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AH500 **Programming Manual**

AH500 **Programming Manual**

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AH500 Programming Manual

Revision History

Version	Revision	Date
1st	The first version is published.	2012/11/09
2nd	1. Chapter 1: updated the model description in section 1.1.2 2. Chapter 2: updated device list in section 2.1.1, latched areas in the device range in section 2.1.4, strings in section 2.2.3, special auxiliary relays in section 2.2.7, refresh time of special data registers in section 2.2.8, special data registers in section 2.2.14, refresh time of special data registers in section 2.2.15, additional remarks on special auxiliary relays and special data registers in section 2.2.16. 3. Chapter 3: added new instructions of API0117, API0118, API0708 and API1812. 4. Chapter 4: updated restrictions on the use of the instructions in section 4.2. 5. Chapter 6: added new instructions of API0114, API0204, API0205, API0212, API0217, API0218, API0219, API0310, API0702, API0703, API0705, API0707, API1000, API1002, API1003, API1004, API1301, API1510, API1516, API1701, API1702, API1703, API1704, API1800, API1803, API1806, API1807, API1809, API1810, API1811, API2100, API2103, API2108, API2110, API2200, API2201, API2202, API2203, API2204, API2205, and API2300. 6. Chapter 7: updated contents of 7.1.1, 7.1.2, 7.1.3, 7.1.4, 7.1.8, 7.1.9, and 7.1.10.	2016/08/15
3rd	1. Chapter 1: updated contents in section 1.1.1 and added information for new models including AH15SCM-5A, AHRTU-ETHN-5A, AH15EN-5A, AHCPU501-RS2, AHCPU521-RS2, AHCPU531-RS2, AHCPU501-EN. Revise the wiring model name. 2. Chapter 2: updated ASCII table in section 2.2.3 and added information for new models including AHCPU560-EN2, AHCPU501-RS2, AHCPU521-RS2, AHCPU531-RS2, and AHCPU501-EN. Added and update information concerning SM/SR in section 2.2.8, 2.2.14, 2.2.15 and 2.2.16. 3. Chapter 3: Added new API2900 and API2901 in the instruction table and updated INV symbol in section 3.3. 4. Chapter 6: Updated the following APIs 0702, 0904, 1111, 1503-1505, 1701, 1702, 1800, 1812, 2116, 2200, 2300-2302, 2900 and 2901. 5. Chapter 7: Updated contents in section 7.1.1 and added information for new models AH15SCM-5A and AH15EN-5A.	2018/06/05

Version	Revision	Date
4th	1. Chapter 2: added new product information for AHAHCPU521-DNP3 in section 2.2.7. Added new flag information for SM454-SM457, SM2304-SM2319, and updated flag information for SM2048-SM2303. Added new product information for AHCPU521-DNP3 in section 2.2.14. Added new flag information for SR418-SR430, SR900-SR902, SR2046-SR2047and updated flag information for SR2048-SR2559. Updated item 15 “Setting the TCP/UDP Socket”, updated item 19 “The flags related to power module”, updated item 20 “The connection status of the redundant extension backplane” and updated item 22 “The flags related to EtherNet/IP” in section 2.2.16. 2. Chapter 3: Added new API1607 and API2208 in section 3.1.2. Added 64-bit instructions in section 3.4. Added new contents for API1607 and API2208. 3. Chapter 6: Updated API0104: adding item 2 in the explanation section; API1103: updating examples; API1401: adding explanation on the application of AH Redundancy System; API1500-1516: adding 64-bit instruction related explanation; API1607, API1808: adding explanation on 0x05 and 0x06. Added new API2208 and updated API2901: explanation on operands D and S. 4. Chapter 7: Added new error codes, 16#0068, 16#212A, 16#6013, 16#E206-16#E28B, 16#E2A0-16#E2AB, and updated error codes, 16#2026, 16#2029, 16#6010, 16#6011, 16#6212-16#6214, 16#6218-16#621A, 16#6400-16#6405.	2020/12/08
5th	1. Added a copyright notice. 2. Updated description of AH500 Hardware and Operation Manual in section 1.1.1. Added new products including, AHCPU521-DNP, AHCPU560-EN2, AHBP04MR1-5A, AHBP06MR1-5A, AHBP08MR1-5A, AHBP06ER1-5A, AHBP08ER1-5A, AHACAB50-5A, AHACABA0-5A, AHACABA5-5A, AHACABB0-5A, AHACABC0-5A, AHACABD0-5A, AHACABE0-5A, AHACABF0-5A, AHACABG0-5A, AHACABH0-5A, AHACABJ0-5A and AHACABK0-5A in Chapter 1. 3. Updated the flags SM108, SM109, SM700-SM955, SM1392-SM1583, SM1599-SM1944, SM2304-SM2319, SR1129-SR1130, SR1142-SR1143, SR1155-SR1156, SR1168-SR1169, SR1181-SR1182, SR1194-SR1195, SR1207-SR1208, SR1220-SR1221, SR1232-SR1233, SR1244-SR1245, SR1256-SR1257, SR1268-SR1269, SR1280-SR1281, SR1292-SR1293, SR1304-SR1305, SR1316-SR1317, SR1336, SR1339-SR1787and updated PLC LINK related parameters as well as EtherNet/IP related flags in	2022/02/25

Version	Revision	Date
	Chapter 2. 4. Updated the descriptions of PID_MODE in API API0707 and 0708. Updated the maximum transmission length for API1800 and added a new error code 16#6406 for API2205 in Chapter 6. 5. Updated the descriptions of error codes 16#005B, 16#0069, 16#1001, 16#1003, 16#6406, 16#2023, 16#2025, 16#2026, 16#9A01-16#9A60 and 16#9B21-16#9B60 in Chapter 7.	

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Chapter 1 Introduction

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1.1 Overview

This manual introduces the programming of the AH500 series programmable logic controllers, the basic instructions, and the applied instructions.

1.1.1 Related Manuals

The related manuals of the AH500 series programmable logic controllers are composed of the following.

- AH500 Quick Start
  It guides users to use the system before they read the related manuals.
- AH500 Programming Manual
  It introduces the programming of the AH500 series programmable logic controllers, the basic instructions, and the applied instructions.
- ISPSoft User Manual
  It introduces the use of ISPSoft, the programming languages (ladder diagrams, instruction lists, sequential function charts, function block diagrams, and structured texts), the concept of POUs, and the concept of tasks.
- AH500 Hardware and Operation Manual
  It introduces electrical specifications, appearances, dimensions and functions of CPUs, devices, module tables, troubleshooting, and etc.
- AH500 Module Manual
  It introduces the use of special I/O modules. For example, network modules, analog I/O modules, temperature measurement modules, and etc.
- AH500 Motion Control Module Manual
  It introduces the specifications for the motion control modules, the wiring, the instructions, and the functions.
- PMSoft User Manual
- It introduces the use of PMSoft, including the editing mode, the connection, and the password setting.
- AH500 Redundancy System Operation Manual
  It introduces the AH500 redundancy structures, establishments, programming designs, and operations.

1.1.2 Model Description

Classification	Model Name	Description
Power supply module	AHPS05-5A	100~240 V AC 50/60 Hz
	AHPS15-5A	24 V DC
CPU module	AHCPU500-RS2	It is a basic CPU module with two built-in RS-485 ports, one built-in USB port, and one built-in SD interface. It supports 768 inputs/outputs. The program capacity is 32K steps.
	AHCPU500-EN	It is a basic CPU module with one built-in Ethernet port, one built-in RS-485 port, one built-in USB port, and one built-in SD interface. It supports 768 inputs/outputs. The program capacity is 32K steps.
	AHCPU501-RS2	It is an advanced CPU module with two built-in RS-485 ports, one built-in USB port, and one built-in SD interface. It supports 768 inputs/outputs. The program capacity is 48K steps.
	AHCPU501-EN	It is an advanced CPU module with one built-in Ethernet port, one built-in RS-485 port, one built-in USB port, and one built-in SD interface. It supports 768 inputs/outputs. The program capacity is 48K steps.
	AHCPU510-RS2	It is a basic CPU module with two built-in RS-485 ports, one built-in USB port, and one built-in SD interface. It supports 1280 inputs/outputs. The program capacity is 64K steps.
	AHCPU510-EN	It is a basic CPU module with one built-in Ethernet port, one built-in RS-485 port, one built-in USB port, and one built-in SD interface. It supports 1280 inputs/outputs. The program capacity is 64K steps.
	AHCPU511-RS2	It is an advanced CPU module with two built-in RS-485 ports, one built-in USB port, and one built-in SD interface. It supports 1280 inputs/outputs. The program capacity is 96K steps.
	AHCPU511-EN	It is an advanced CPU module with one built-in Ethernet port, one built-in RS-485 port, one built-in USB port, and one built-in SD interface. It supports 1280 inputs/outputs. The program capacity is 96K steps.
	AHCPU520-RS2	It is a basic CPU module with two built-in RS-485 ports, one built-in USB port, and one built-in SD interface. It supports 2304 inputs/outputs. The program capacity is 128K steps.
	AHCPU520-EN	It is a basic CPU module with one built-in Ethernet port, one built-in RS-485 port, one built-in USB port, and one built-in SD interface. It supports 2304 inputs/outputs. The program capacity is 128K steps.
	AHCPU521-RS2	It is an advanced CPU module with two built-in RS-485 ports, one built-in USB port, and one built-in SD interface. It supports 2304 inputs/outputs. The program capacity is 192K steps.
	AHCPU521-EN	It is an advanced CPU module with one built-in Ethernet port, one built-in RS-485 port, one built-in USB port, and one built-in SD interface. It supports 2304 inputs/outputs. The program capacity is 192K steps.

Classification	Model Name	Description
	AHCPU530-RS2	It is a basic CPU module with two built-in RS-485 ports, one built-in USB port, and one built-in SD interface. It supports 4352 inputs/outputs. The program capacity is 256K steps.
	AHCPU530-EN	It is a basic CPU module with one built-in Ethernet port, one built-in RS-485 port, one built-in USB port, and one built-in SD interface. It supports 4352 inputs/outputs. The program capacity is 256K steps.
	AHCPU531-RS2	It is an advanced CPU module with two built-in RS-485 ports, one built-in USB port, and one built-in SD interface. It supports 4352 inputs/outputs. The program capacity is 384K steps.
	AHCPU531-EN	It is an advanced CPU module with one built-in Ethernet port, one built-in RS-485 port, one built-in USB port, and one built-in SD interface. It supports 4352 inputs/outputs. The program capacity is 384K steps.
	AHCPU521-DNP	It is an advanced CPU module with one built-in Ethernet port, one built-in RS-485 port, one built-in USB port, and one built-in SD interface. It supports DNP3, 2304 inputs/outputs. The program capacity is 192K steps.
	AHCPU560-EN2	It is a redundant CPU module with one built-in Ethernet port, one built-in RS-485/RS-232 port, one built-in USB port, and one built-in SD interface. It supports 65536 inputs/outputs. The program capacity is 1M steps.
Main backplane	AHBP04M1-5A	Four-slot main backplane for a CPU/RTU rack
	AHBP06M1-5A	Six-slot main backplane for a CPU/RTU rack
	AHBP08M1-5A	Eight-slot main backplane for a CPU/RTU rack
	AHBP12M1-5A	Twelve-slot main backplane for a CPU/RTU rack
Redundant backplane	AHBP04MR1-5A	Four-slot redundant backplane for a CPU/RTU rack
	AHBP06MR1-5A	Six-slot redundant backplane for a CPU/RTU rack
	AHBP08MR1-5A	Eight-slot redundant backplane for a CPU/RTU rack
Extension backplane	AHBP06E1-5A	Six-slot extension backplane for a CPU/RTU extension rack
	AHBP08E1-5A	Eight-slot extension backplane for a CPU/RTU extension rack
Redundant extension backplane	AHBP06ER1-5A	Six-slot extension backplane with power redundancy for a CPU/RTU redundant extension rack
	AHBP08ER1-5A	Eight-slot extension backplane with power redundancy for a CPU/RTU redundant extension rack
Digital input/output module	AH16AM10N-5A	24 V DC 5 mA 16 inputs Terminal block
	AH32AM10N-5A	24 V DC 5 mA 32 inputs Terminal block
	AH32AM10N-5B	24 V DC 5 mA 32 inputs DB37 connector
	AH32AM10N-5C	24 V DC 5 mA 32 inputs Latch connector

Classification	Model Name	Description
	AH64AM10N-5C	24 V DC 3.2 mA 64 inputs Latch connector
	AH16AM30N-5A	100~240 V AC 4.5 mA~9 mA (100 V, 50 Hz) 16 inputs Terminal block
	AH16AR10N-5A	24 V DC 5 mA 16 inputs Terminal block (I/O interrupts are supported.)
	AH16AN01R-5A	240 V AC/24 V DC 2 A 16 outputs Relay Terminal block
	AH16AN01T-5A	12~24 V DC 0.5 A 16 outputs Sinking output Terminal block
Digital input/output module	AH16AN01P-5A	12~24 V DC 0.5 A 16 outputs Sourcing output Terminal block
	AH32AN02T-5A	12~24 V DC 0.1 A 32 outputs Sinking output Terminal block
	AH32AN02T-5B	12~24 V DC 0.1 A 32 outputs Sinking output DB37 connector
	AH32AN02T-5C	12~24 V DC 0.1 A 32 outputs Sinking output Latch connector
	AH32AN02P-5A	12~24 V DC 0.1 A 32 outputs Sourcing output Terminal block
	AH32AN02P-5B	12~24 V DC 0.1 A 32 outputs Sourcing output DB37 connector
	AH32AN02P-5C	12~24 V DC 0.1 A

Classification	Model Name	Description
		32 outputs Sourcing output Latch connector
	AH64AN02T-5C	12~24 V DC 0.1 A 64 outputs Sinking output Latch connector
	AH64AN02P-5C	12~24 V DC 0.1 A 64 outputs Sourcing output Latch connector
	AH16AN01S-5A	100~240 V AC 0.5 A 16 outputs TRIAC Terminal block
Digital input/output module	AH16AP11R-5A	24 V DC 5 mA 8 inputs 240 V AC/24 V DC 2 A 8 outputs Relay Terminal block
	AH16AP11T-5A	24 V DC 5 mA 8 inputs 12~24 V DC 0.5 A 8 outputs Sinking output Terminal block
	AH16AP11P-5A	24 V DC 5 mA 8 inputs 12~24 V DC 0.5 A 8 outputs Sourcing output Terminal block
Analog input/output module	AH04AD-5A	Four-channel analog input module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, 0/4 mA~20 mA, and -20 mA~20 mA Conversion time: 150 us/channel
	AH08AD-5A	Eight-channel analog input module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, 0/4 mA~20 mA, and -20 mA~20 mA Conversion time: 150 us/channel
	AH08AD-5B	Eight-channel analog input module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, and -10 V~10 V

Classification	Model Name	Description
		Conversion time: 150 us/channel
	AH08AD-5C	Eight-channel analog input module Hardware resolution: 16 bits 0/4 mA~20 mA, and -20 mA~20 mA Conversion time: 150 us/channel
	AH04DA-5A	Four-channel analog output module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, and 0/4 mA~20 mA Conversion time: 150 us/channel
	AH08DA-5A	Eight-channel analog input module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, 0/4 mA~20 mA Conversion time: 150 us/channel
	AH08DA-5B	Eight-channel analog output module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, and -10 V~10 V Conversion time: 150 us/channel
	AH08DA-5C	Eight-channel analog output module Hardware resolution: 16 bits 0/4 mA~20 mA Conversion time: 150 us/channel
Analog input/output module	AH06XA-5A	Four-channel analog input module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, 0/4 mA~20 mA, and -20 mA~20 mA Conversion time: 150 us/channel Two-channel analog output module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, and 0/4 mA~20 mA Conversion time: 150 us/channel
Temperature measurement module	AH04PT-5A	Four-channel four-wire/three-wire RTD Sensor type: Pt100/Pt1000/Ni100/Ni1000 sensor, and 0~300 Ω input impedance Resolution: 0.1°C/0.1°F (16 bits) Four-wire conversion time: 150 ms/channel Three-wire conversion time: 300 ms/channel
	AH08PTG-5A	Eight-channel four-wire/three-wire/two-wire RTD Sensor type: Pt100/Pt1000/Ni100/Ni1000, and 0~300 Ω input impedance Resolution: 0.1°C/0.1°F (16 bits) Conversion time: 20 ms/4 channels and 200 ms/8 channels
	AH04TC-5A	Four-channel thermocouple Sensor type: J, K, R, S, T, E, N, and -150~+150 mV Resolution: 0.1°C/0.1°F Conversion time: 200 ms/channel
	AH08TC-5A	Eight-channel thermocouple Sensor type: J, K, R, S, T, E, N, and -150~+150 mV Resolution: 0.1°C/0.1°F Conversion time: 200 ms/channel
Motion control module	AH02HC-5A	Two-channel high-speed counter module (200 kHz)
	AH04HC-5A	Four-channel high-speed counter module (200 kHz)

Classification	Model Name	Description
	AH05PM-5A	Two-axis pulse train motion control module (1 MHz)
	AH10PM-5A	Six-axis pulse train motion control module (Four axes: 1 MHz; Two axes: 200 kHz)
	AH15PM-5A	Four-axis pulse train motion control module (1 MHz)
	AH20MC-5A	Twelve-axis DMCNET (Delta Motion Control Network) motion control module (10 Mbps)
Network module	AH10EN-5A	It is an Ethernet communication module. It can function as a mater or a slave. It is equipped with two Ethernet ports, and supports a Modbus TCP master and EtherNet/IP (V2.0).
	AH15EN-5A	It is an Ethernet communication module. It can function as a mater or a slave. It is equipped with two Ethernet ports, and supports a Modbus TCP master and IEC60870-5-104.
	AH10SCM-5A	It is a serial communication module with two RS-485/RS-422 ports, and supports Modbus and UD Link protocols. One part of communication is isolated from the other part of the communication, and one part of power is isolated from the other part of the power.
	AH15SCM-5A	It is a serial communication module with two RS-232 ports, and supports Modbus and UD Link protocols. One part of communication is isolated from the other part of the communication, and one part of power is isolated from the other part of the power.
	AH10DNET-5A	It is a DeviceNet communication module. It can function as a master or a slave. The maximum communication speed is 1 Mbps.
	AH10PFBM-5A	PROFIBUS-DP master module
	AH10PFBS-5A	PROFIBUS-DP slave module
	AH10COPM-5A	It is a CANopen communication module. It can function as a master or a slave.
Remote I/O module	AHRTU-DNET-5A	DeviceNet remote I/O module
	AHRTU-PFBS-5A	PROFIBUS-DP remote I/O module
	AHRTU-ETHN-5A	Ethernet remote I/O module
Extension cable	AHACAB06-5A	0.6 meter extension cable for connecting an extension backplane
	AHACAB10-5A	1.0 meter extension cable for connecting an extension backplane
	AHACAB15-5A	1.5 meter extension cable for connecting an extension backplane
	AHACAB30-5A	3.0 meter extension cable for connecting an extension backplane
	AHACAB50-5A	5.0 meter extension cable for connecting an extension backplane
	AHACABA0-5A	10.0 meter extension cable for connecting an extension backplane
	AHACABA5-5A	15.0 meter extension cable for connecting an extension backplane
	AHACABB0-5A	20.0 meter extension cable for connecting an extension backplane

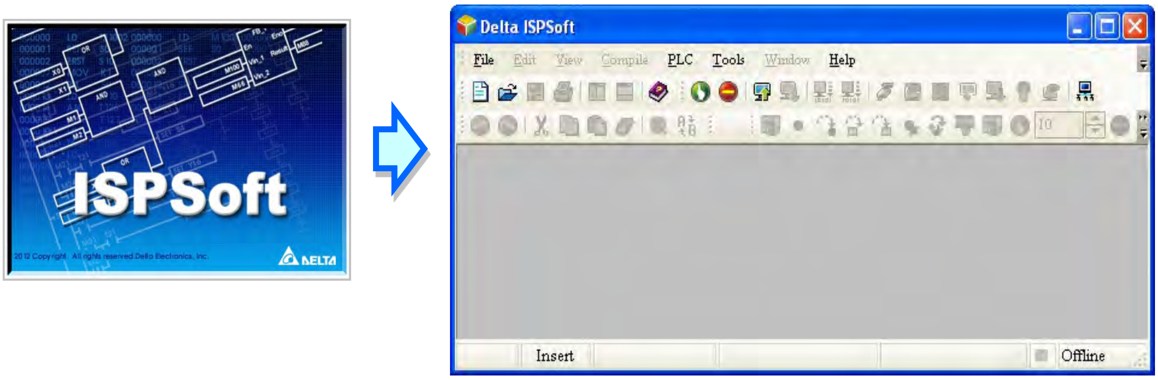
Classification	Model Name	Description
	AHACABC0-5A	30.0 meter extension cable for connecting an extension backplane
	AHACABD0-5A	40.0 meter extension cable for connecting an extension backplane
	AHACABE0-5A	50.0 meter extension cable for connecting an extension backplane
	AHACABF0-5A	60.0 meter extension cable for connecting an extension backplane
	AHACABG0-5A	70.0 meter extension cable for connecting an extension backplane
	AHACABH0-5A	80.0 meter extension cable for connecting an extension backplane
	AHACABJ0-5A	90.0 meter extension cable for connecting an extension backplane
	AHACABK0-5A	100.0 meter extension cable for connecting an extension backplane
	AHAADP01EF-5A/ AHAADP02EF-5A	Fiber optics modules for extension backplanes
I/O extension cable	UC-ET010-24A	1.0 meter I/O extension cable (latch connector) for AH32AM10N-5C and AH64AM10N-5C
	UC-ET010-24C	1.0 meter I/O extension cable (latch connector) for AH32AN02T-5C, AH32AN02P-5C, AH64AN02T-5C and AH64AN02P-5C
	UC-ET010-33B	1.0 meter I/O extension cable (DB37 connector) for AH32AM10N-5B, AH32AN02T-5B, and AH32AN02P-5B
	UC-ET010-13B	1.0 meter I/O extension cable for AH04HC-5A and AH20MC-5A
	UC-ET010-15B	1.0 meter I/O extension cable for AH10PM-5A and AH15PM-5A
External terminal module	UB-10-ID32A	I/O external terminal module for AH32AM10N-5C and AH64AM10N-5C 32 inputs
	UB-10-OR16A	I/O external terminal module for AH32AN02T-5C and AH64AN02T-5C 16 relay outputs
	UB-10-OR16B	I/O external terminal module for AH32AN02P-5C and AH64AN02P-5C 16 relay outputs
	UB-10-ID32B	I/O external terminal module for AH32AM10N-5B 32 inputs
	UB-10-OR32A	I/O external terminal module for AH32AN02T-5B 32 relay outputs
	UB-10-OR32B	I/O external terminal module for AH32AN02P-5B 32 relay outputs
	UB-10-OT32A	I/O external terminal module for AH32AN02T-5C, AH32AN02P-5C, AH64AN02T-5C, and AH64AN02P-5C 32 transistor outputs

Classification	Model Name	Description
	UB-10-OT32B	I/O external terminal module for AH32AN02T-5B and AH32AN02P-5B 32 transistor outputs
	UB-10-IO16C	I/O external terminal module for AH04HC-5A and AH20MC-5A
	UB-10-IO24C	I/O external terminal module for AH10PM-5A
	UB-10-IO34C	I/O external terminal module for AH15PM-5A
Space module	AHASP01-5A	Space module used for an empty I/O slot

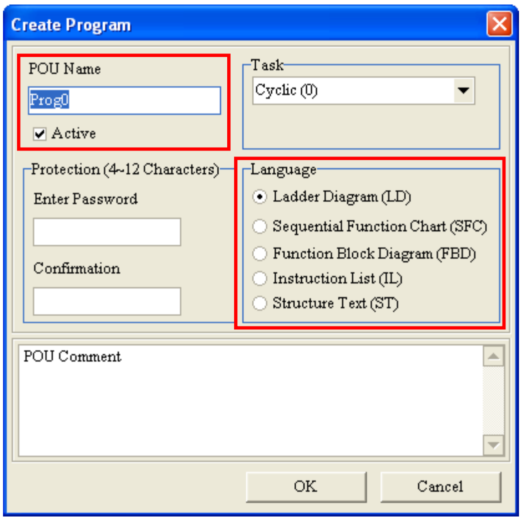
1.2 Software

1.2.1 Program Editor

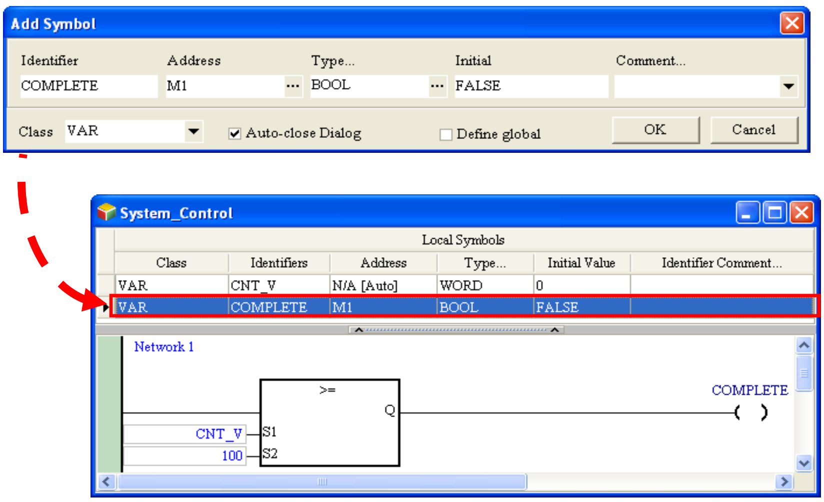
The outline of program editor ISPSoft:



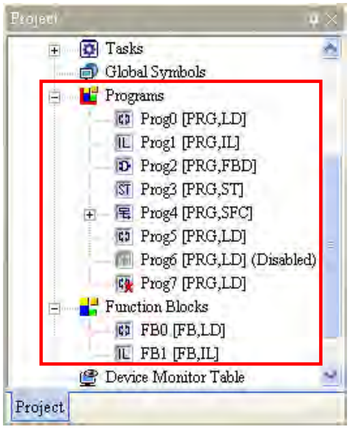
- There are five types of programming languages, including the instruction list, the structure text, the ladder diagram, the sequential function chart, and the function block diagram.

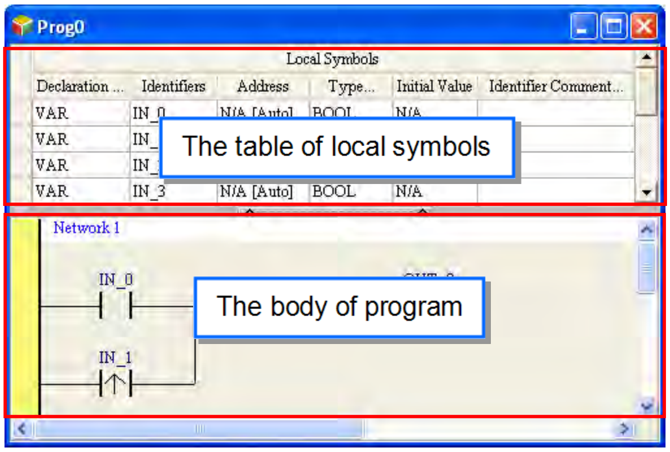


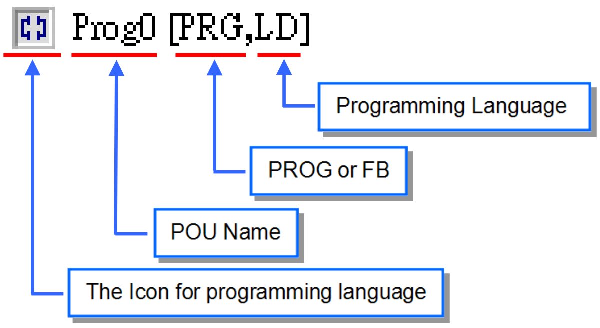
- The use of variables which allows the user to define the variable symbol to replace the device name of the PLC not only enhances the readability of the program, but also saves the user a lot of time to allocate the address of the device.



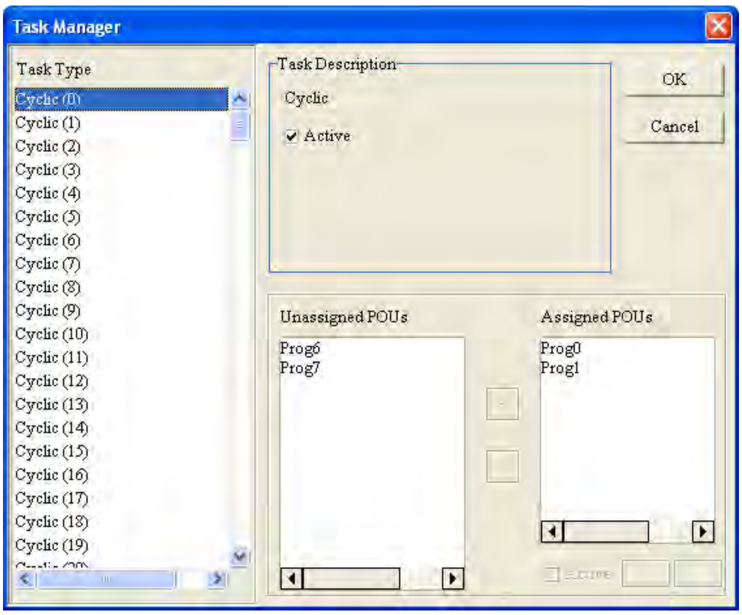
- The introduction of the POU (Program Organization Unit) framework not only divides the main program into several program units, but also replaces the traditional subroutines with functions and function blocks. The framework of the program becomes more modular, and is easier to be managed.







- The concept of tasks which is used to manage the execution order of the programs advances the program development to the level of project management. The large-scale program development becomes easier to be managed.



1.2.2 Program Organization Units and Tasks

The POUs (Program Organization Units) are the basic elements which constitute the PLC program. Differing from the traditional PLC program, the character of the program framework introduced by IEC 61131-3 lies in the fact that the large program is divided into several small units. These small units are called POUs. The POUs can be classified into three types.

1. Program (PROG): The POU of the program type plays the role of the primary program in the PLC program. The designer can define the execution of the POU of the program type as the cyclic scan or the interrupt, and arrange the scan order in the task list for the POUs of the program type.
2. Function block (FB): The meaning of the function block (FB) in itself is similar to the subroutine. The program defined within the function block is executed after the function block is called by the POU of the program type and the related parameters are entered.
3. Function (FC): The meaning of the function (FC) in itself is close to the macro instruction. That is, users can write many operation instructions or functions into the function POU, and then call them into use in the POU of the program type or the function block.

The task is a function which stipulates that programs are executed in certain order or according to certain interrupt condition. The meaning of the task lies in the fact that it provides each POU of the program type with a specific execution task, and specifies the execution order for the POUs of the program type or the way to enable them.

Basically, not all of the POUs of the program type in a project will take part in the practical execution. Whether to execute the POU of the program type or not, and how to execute it depend on the assignment of the task. If the POU of the program type is not assigned the task, it will be saved as an ordinary source code with the project instead of being compiled as an execution code of the PLC. In addition, only the POU of the program type needs to be assigned the task. The execution of the function blocks or functions depends on the superior POU of the program type which calls them. There are three types of tasks.

1. Cyclic task: The POUs of the program type assigned to the cyclic task will be scanned cyclically, and executed in order.
2. Timed interrupt task: If the time of interrupting is reached, all POUs of the program type assigned to the timed interrupt task will be executed in order.
3. Conditional interrupt task: Conditional Interrupts can be divided into several types. For example, the external interrupts, the I/O interrupts, and etc. Users have to make sure of the interrupts supported by the PLC before they create a project. If the POU of the program type is assigned to the conditional interrupt task, the function of the POU of the program type is similar to the interrupt subroutine. If the interrupt condition is satisfied, e.g. the contact of the external interrupt is triggered, all POUs of the program type assigned to the task will be executed in order.

MEMO

Chapter 2 Devices

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2.1 Introduction of Devices

This section gives an account of values/strings processed by the PLC. It also describes the functions of devices which include input/output/auxiliary relays, timers, counters, and data registers.

2.1.1 Devise List

2.1.1.1 AH500 Basic CPU Modules (AHCPU500/510/520/530)

Type	Device name		Number of devices	Range
Bit device	Input relay	X	1024 (AHCPU500)	X0.0~X63.15
			2048 (AHCPU510)	X0.0~X127.15
			4096 (AHCPU520)	X0.0~X255.15
			8192 (AHCPU530)	X0.0~X511.15
	Output relay	Y	1024 (AHCPU500)	Y0.0~Y63.15
			2048 (AHCPU510)	Y0.0~Y127.15
			4096 (AHCPU520)	Y0.0~Y255.15
			8192 (AHCPU530)	Y0.0~Y511.15
	Data register	D	262144 (AHCPU500)	D0.0~D16383.15
			524288 (AHCPU510)	D0.0~D32767.15
			1048576(AHCPU520/530)	D0.0~D65535.15
	Link register	L	262144 (AHCPU500)	L0.0~ L16383.15
			524288 (AHCPU510)	L0.0~ L32767.15
			1048576 (AHCPU520/530)	L0.0~ L65535.15
	Auxiliary relay	M	8192	M0~M8191
	Special auxiliary relay	SM	2048	SM0~SM2047
	Stepping relay	S	2048	S0~S2047
	Timer	T	2048	T0~T2047
	Counter	C	2048	C0~C2047
	32-bit counter	HC	64	HC0~HC63
Word device	Input relay	X	64 (AHCPU500)	X0~X63
			128 (AHCPU510)	X0~X127
			256 (AHCPU520)	X0~X255
			512 (AHCPU530)	X0~X511
	Output relay	Y	64 (AHCPU500)	Y0~Y63
			128 (AHCPU510)	Y0~Y127
			256 (AHCPU520)	Y0~Y255
			512 (AHCPU530)	Y0~Y511
	Data register	D	16384 (AHCPU500)	D0~D16383
			32768 (AHCPU510)	D0~D32767
			65536 (AHCPU520/530)	D0~D65535
	Special data register	SR	2048	SR0~SR2047
	Link register	L	16384 (AHCPU500)	L0~L16383
			32768 (AHCPU510)	L0~L32767
			65536 (AHCPU520/530)	L0~L65535
	Timer	T	2048	T0~T2047
	Counter	C	2048	C0~C2047
	32-bit counter	HC	64 (128 words)	HC0~HC63
	Index register	E	32	E0~E31
Constant*	Decimal system	K	16 bits: -32768~32767 32 bits: -2147483648~2147483647	
	Hexadecimal system	16#	16 bits: 16#0~16#FFFF 32 bits: 16#0~16#FFFFFFFF	

Type	Device name		Number of devices	Range
	Single-precision floating-point number	F	32 bits: $\pm1.17549435^{-38}$~$\pm3.40282347^{+38}$	
	Double-precision floating-point number	DF	64 bits: $\pm2.2250738585072014^{-308}$~ $\pm1.7976931348623157^{+308}$	
String*	String	“$”	1~31 characters	

*1: The decimal forms are notated by K in the device lists in chapters 5 and 6, whereas they are entered directly in ISPSoft, for example, for K50, simply input 50.

*2: The floating-point numbers are notated by F/DF in the device lists in chapters 5 and, whereas they are represented by decimal points in ISPSoft, for example, for F500, simply input 500.0.

*3: The strings are notated by “$” in chapters 5 and 6, whereas they are represented by “ ” in ISPSoft, for example, for “1234”, simply input 1234.

2.1.1.2 AH500 Advanced CPU Modules (AHCPU501/511/521/531)

Type	Device name		Number of devices	Range
Bit device	Input relay	X	2048 (AHCPU501)	X0.0~X127.15
			4096 (AHCPU511)	X0.0~X255.15
			8192 (AHCPU521)	X0.0~X511.15
			16384 (AHCPU531)	X0.0~X1023.15
	Output relay	Y	2048 (AHCPU501)	Y0.0~Y127.15
			4096 (AHCPU511)	Y0.0~Y255.15
			8192 (AHCPU521)	Y0.0~Y511.15
			16384 (AHCPU531)	Y0.0~Y1023.15
	Data register	D	393216 (AHCPU501)	D0.0~D24575.15
			786432 (AHCPU511)	D0.0~D49151.15
			1572864 (AHCPU521)	D0.0~D98303.15
			2097152 (AHCPU531)	D0.0~D131071.15
	Link register	L	393216 (AHCPU501)	L0.0~L24575.15
			786432 (AHCPU511)	L0.0~L49151.15
			1572864 (AHCPU521)	L0.0~L98303.15
			2097152 (AHCPU531)	L0.0~L131071.15
	Auxiliary relay	M	8192	M0~M8191
	Special auxiliary relay	SM	4096	SM0~SM4095
	Stepping relay	S	2048	S0~S2047
	Timer	T	2048	T0~T2047
	Counter	C	2048	C0~C2047
	32-bit counter	HC	64	HC0~HC63
Word device	Input relay	X	128 (AHCPU501)	X0~X127
			256 (AHCPU511)	X0~X255
			512 (AHCPU521)	X0~X511
			1024 (AHCPU531)	X0~X1023
	Output relay	Y	128 (AHCPU501)	Y0~Y127
			256 (AHCPU511)	Y0~Y255
			512 (AHCPU521)	Y0~Y511
			1024 (AHCPU531)	Y0~Y1023
	Data register	D	24576 (AHCPU501)	D0~D24575
			49152 (AHCPU511)	D0~D49151
			98304 (AHCPU521)	D0~D98303
			131072 (AHCPU531)	D0~D131071
	Special data register	SR	4096	SR0~SR4095
	Link register	L	24576 (AHCPU501)	L0~L24575
			49152 (AHCPU511)	L0~L49151
			98304 (AHCPU521)	L0~L98303
			131072 (AHCPU531)	L0~L131071
	Timer	T	2048	T0~T2047

Type	Device name		Number of devices	Range
	Counter	C	2048	C0~C2047
	32-bit counter	HC	64 (128 words)	HC0~HC63
	Index register	E	32	E0~E31
Constant*	Decimal system	K	16 bits: -32768~32767 32 bits: -2147483648~2147483647	
	Hexadecimal system	16#	16 bits: 16#0~16#FFFF 32 bits: 16#0~16#FFFFFFFF	
	Single-precision floating-point number	F	32 bits: $\pm 1.17549435^{-38}$~$\pm 3.40282347^{+38}$	
	Double-precision floating-point number	DF	64 bits: $\pm 2.2250738585072014^{-308}$~ $\pm 1.7976931348623157^{+308}$	
String*	String	“$”	1~31 characters	

*1: The decimal forms are notated by K in the device lists in chapters 5 and 6, whereas they are entered directly in ISPSoft, for example, for K50, simply input 50.
*2: The floating-point numbers are notated by F/DF in the device lists in chapters 5 and, whereas they are represented by decimal points in ISPSoft, for example, for F500, simply input 500.0.
*3: The strings are notated by “$” in chapters 5 and 6, whereas they are represented by “ ” in ISPSoft, for example, for ″1234″, simply input 1234.

2.1.2 Basic Structure of I/O Storages

Device	Function	Access of bits	Access of words	Modification by ISPSoft	Forcing the bit ON/OFF
X	Input relay	OK	OK	OK	OK
Y	Output relay	OK	OK	OK	OK
M	Auxiliary relay	OK	-	OK	-
SM	Special auxiliary relay	OK	-	OK	-
S	stepping relay	OK	-	OK	-
T	Timer	OK	OK	OK	-
C	Counter	OK	OK	OK	-
HC	32-bit counter	OK	OK	OK	-
D	Data register	OK	OK	OK	-
SR	Special data register	-	OK	OK	-
L	Link register	OK	OK	OK	-
E	Index register	-	OK	OK	-

2.1.3 Relation between the PLC Action and the Device Type

PLC action \ Device type		Non-latched area	Latched area	Output relay
Power: OFF→ON		Cleared	Retained	Cleared
STOP ↓ RUN	The output relay is cleared.	Retained	Retained	Cleared
	The state of the output relay is retained.	Retained	Retained	Retained
	The state of the output relay returns to that before the PLC’s stopping.	Retained	Retained	The state of the output relay returns to that before the PLC’s stopping.
	The non-latched area is cleared.	Cleared	Retained	Cleared

PLC action \ Device type		Non-latched area	Latched area	Output relay
	The state of the latched area is retained.	Retained	Retained	Retained
RUN→STOP		Retained	Retained	Retained
SM204 is ON. (All non-latched areas are cleared.)		Cleared	Retained	Cleared
SM205 is ON. (All latched areas are cleared.)		Retained	Cleared	Retained
Default value		0	0	0

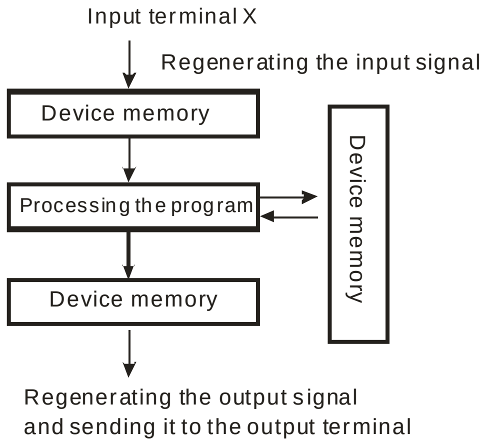
2.1.4 Latched Areas in the Device Range

Device	Function	Latched area
X	Input relay	All devices are non-latched.
Y	Output relay	All devices are non-latched.
M*	Auxiliary relay	The default range is M0~M8191.
SM	Special auxiliary relay	Some devices are latched, and cannot be changed. Please refer to the list of special auxiliary relays for more information.
S	Stepping relay	All devices are non-latched.
T*	Timer	The default range is T0~T2047.
C*	Counter	The default range is C0~C2047.
HC*	32-bit counter	The default range is HC0~HC63.
D*	Data register	AH500-EN/RS2: The default range is D0~D16383. AH501-EN/RS2: The default range is D0~D24575.
		The default range is D0~D32767. At most 32768 devices can be latched areas.
SR	Special data register	Some are latched, and can not be changed. Please refer to the list of special data registers for more information.
L	Link register	All devices are non-latched.
E	Index register	All devices are non-latched.

*: * indicates that users can set the range of latched areas, and that the device can be set to Non-latched Area. The range of latched areas can not exceed the device range. Above all, only 32768 data registers at most can be non-latched areas. For example, users can set D50~D32817 or D32768~D65535 to Latched Areas although the default range of latched areas is D0~D32767.

2.2 Functions of Devices

The procedure for processing the program in the PLC:

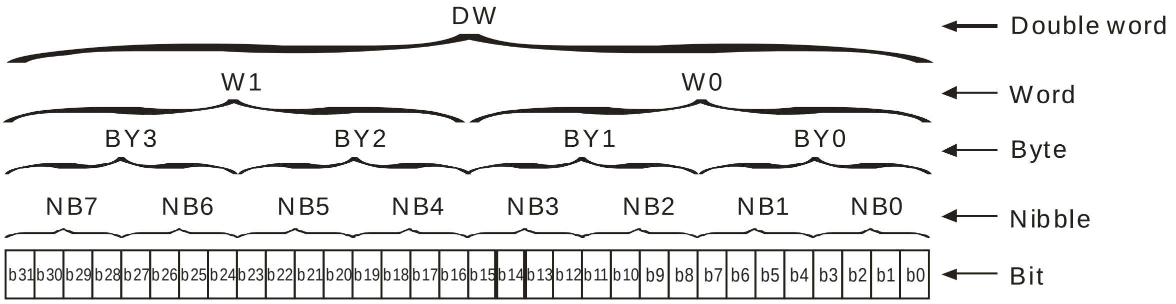


- Regenerating the input signal:
  1. Before the program is executed, the state of the external input signal is read into the memory of the input signal.
  2. When program is executed, the state in the memory of the input signal does not change even if the input signal changes from ON to OFF or from OFF to ON. Not until the next scan begins will the input signal be refreshed.
- Processing the program:
  After the input signal is refreshed, the instructions in the program are executed in order from the start address of the program, and the results are stored in the device memories.
- Regenerating the state of the output:
  After the instruction END is executed, the state in the device memory is sent to the specified output terminal.

2.2.1 Values and Constants

Name	Description
Bit	A bit is the basic unit in the binary system. Its state is either 1 or 0.
Nibble	A nibble is composed of four consecutive bits (e.g. b3~b0). Nibbles can be used to represent 0~9 in the decimal system, or 0~F in the hexadecimal system.
Byte	A byte is composed of two consecutive nibbles (i.e. 8 bits, b7~b0). Bytes can be used to represent 00~FF in the hexadecimal system.
Word	A word is composed of two consecutive bytes (i.e. 16 bits, b15~b0). Words can be used to represent 0000~FFFF in the hexadecimal system.
Double word	A double word is composed of two consecutive words (i.e. 32 bits, b31~b0). Double words can be used to represent 00000000~FFFFFFFF in the hexadecimal system.
Quadruple word	A quadruple word is composed of four consecutive words (i.e. 64 bits, b63~b0). Quadruple words can be used to represent 0000000000000000 – FFFFFFFFFFFFFFFF in the hexadecimal system.

The relation among bits, nibbles, bytes, words, and double words in the binary system is as follows.



The PLC uses four types of values to execute the operation according to different control purposes. The functions of these values are illustrated as follows:

1. Binary number (BIN)
   The PLC adopts the binary system to operate the values.
2. Decimal number (DEC)

The decimal number in the PLC is used as

- the setting value of the timer (T) or the setting value of the counter (C/HC). For example, TMR C0 50 (constant K).
- the device number. For example, M10 and T30 (device number)
- as the number before or after the decimal point. For example, X0.0, Y0.11, and D10.0 (device number).
- the constant K: It is used as the operand in the applied instruction. For example, MOV 123 D0 (constant K).

3. Binary-coded decimal (BCD)

   A decimal value is represented by a nibble or four bits, and therefore sixteen consecutive bits can represent a four-digit decimal value.

4. Hexadecimal number (HEX)

   The hexadecimal number in the PLC is used as

   - the constant 16#: It is used as the operand in the applied instruction. For example, MOV 16#1A2B D0 (hexadecimal constant).

The following is the reference table:

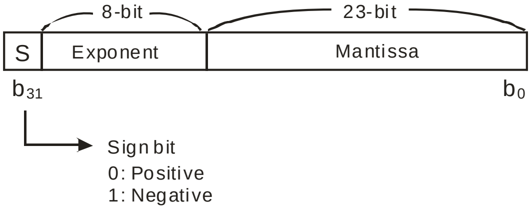
Binary number (BIN)	**Decimal number (DEC)**	**Binary-coded decimal number (BCD)**	**Hexadecimal number (HEX)**
Internal operation in the PLC	Decimal constant, device number	Instruction related to the binary-code decimal number	Hexadecimal constant, device number
0000	0	0000	0
0001	1	0001	1
0010	2	0010	2
0011	3	0011	3
0100	4	0100	4
0101	5	0101	5
0110	6	0110	6
0111	7	0111	7
1000	8	1000	8
1001	9	1001	9
1010	10	-	A
1011	11	-	B
1100	12	-	C
1101	13	-	D
1110	14	-	E
1111	15	-	F
10000	16	0001 0000	10
10001	17	0001 0001	11

2.2.2 Floating-point Numbers

The floating-point numbers are represented by decimal points in ISPSoft. For example, the floating-point number of 500 is 500.0.

2.2.2.1 Single-precision Floating-point Numbers

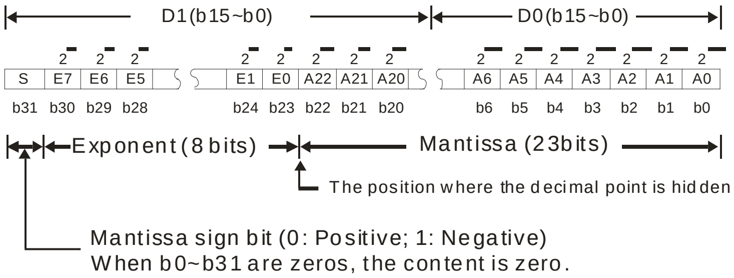
The floating-point number is represented by the 32-bit register. The representation adopts the IEEE754 standard, and the format is as follows.



Equation: $(-1)^S \times 2^{E-B} \times 1.M; B=127$

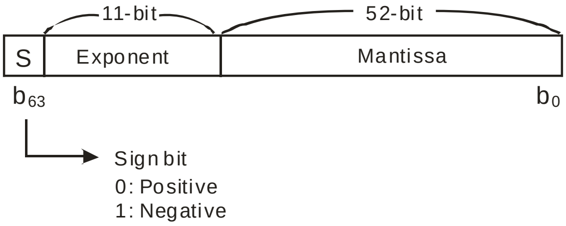
The single-precision floating-point numbers range from $\pm 2^{-126}$ to $\pm 2^{+128}$, and correspond to the range from $\pm 1.1755 \times 10^{-38}$ to $\pm 3.4028 \times 10^{+38}$.

The AH500 series PLC uses two consecutive registers to form a 32-bit floating-point number. Take (D1, D0) for example.



2.2.2.2 Double-precision Floating-point Numbers

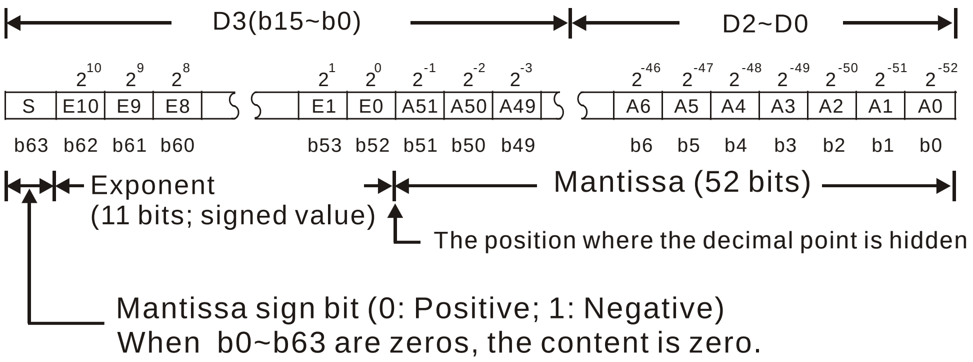
The floating-point number is represented by the 64-bit register. The representation adopts the IEEE754 standard, and the format is as follows.



Equation: $(-1)^S \times 2^{E-B} \times 1.M; B=1023$

The double-precision floating-point numbers range from $\pm 2^{-1022}$ to $\pm 2^{+1024}$, and correspond to the range from $\pm 2.2250 \times 10^{-308}$ to $\pm 1.7976 \times 10^{+308}$.

The AH500 series PLC uses four consecutive registers to form a 64-bit floating-point number. Take (D3, D2, D1, D0) for example.



Example 1:

23 is represented by the single-precision floating-point number.

Step 1: Convert 23 into the binary number, i.e. 23.0=10111.

Step 2: Normalize the binary number, i.e. 10111=1.0111 ×2^4 (0111 is the mantissa, and 4 is the exponent.).

Step 3: Get the value of the exponent.

$\because$E-B=4→E-127=4 $\therefore$E=131=10000011$_2$

Step 4: Combine the sign bit, the exponent, and the mantissa to form the floating-point number.

0 100**0001**1 011**1000**0000**0000**0000**0000**$_2$=41B80000$_{16}$

23 is represented by the double-precision floating-point number.

Step 1: Convert 23 into the binary number, i.e. 23.0=10111.

Step 2: Normalize the binary number, i.e. 10111=1.0111 ×2^4 (0111 is the mantissa, and 4 is the exponent.).

Step 3: Get the value of the exponent.

$\because$E-B=4→E-1023=4 $\therefore$E=1027=10000000011$_2$

Step 4: Combine the sign bit, the exponent, and the mantissa to form the floating-point number.

0 10000000011 01110000**0000**0000**0000**0000**0000**0000**0000**0000**0000**0000**0000**$_2$

=4037000000000000$_{16}$

Example 2:

-23 is represented by the single-precision floating-point number.

The steps of converting -23.0 into the floating-point number are the same as those of converting 23.0 into the floating-point number, except that the sign bit is 1.

1 100**0001**1 011**1000**0000**0000**0000**0000**$_2$=C1B80000$_{16}$

-23 is represented by the double-precision floating-point number.

The steps of converting -23.0 into the floating-point number are the same as those of converting 23.0 into the floating-point number, except that the sign bit is 1.

1 10000000011 01110000**0000**0000**0000**0000**0000**0000**0000**0000**0000**0000**0000**$_2$

=C037000000000000$_{16}$

2.2.2.3 Decimal Floating-point Numbers

- Since single-precision floating-point numbers and double-precision floating-point numbers are not widely accepted by people, they can be converted into decimal floating-point numbers for people to make judgement. However, as to the operation of the decimal point, the PLC still uses single-precision floating-point numbers and double-precision floating-point numbers.
- A 32-bibt decimal floating-point number is represented by two consecutive registers. The constant is stored in the register whose number is smaller while the exponent is stored in the register whose number is bigger. Take (D1, D0) for example.

$$\text{Decimal floating-point number}=[\text{Constant D0}]*10^{[\text{Exponent D1}]}$$

Base number D0=±1,000~±9,999

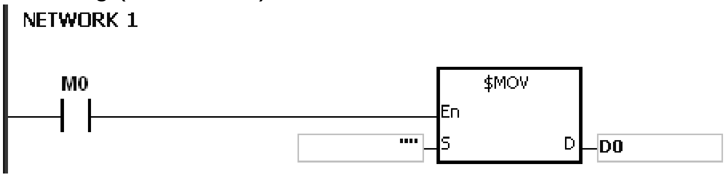
Exponent D1=-41~+35

The base number 100 does not exist in D0 because 100 is represented by 1,000×10^{-1}. In addition, 32-bit decimal floating-point numbers range from ±1175×10^{-41} to ±402×10^{+35}.

2.2.3 Strings

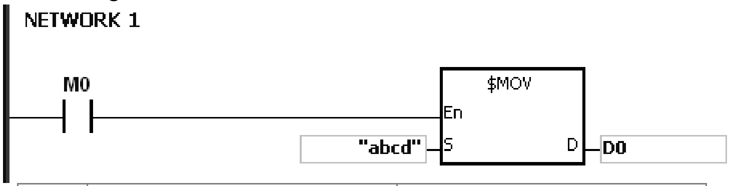
What strings can process are ASCII codes (*1). A complete string begins with a start character, and ends with an ending character (NULL code). If what users enter is a string, they can enter 31 characters at most, and the ending character 16#00 will be added automatically in ISPSoft.

1. No string (NULL code) is moved.



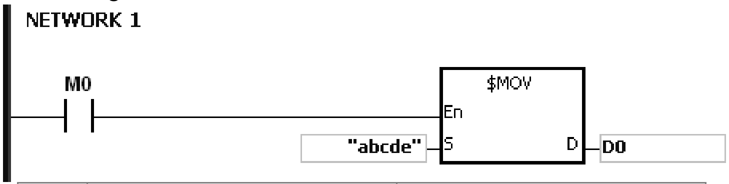
D0=0 (NULL)

2. The string is an even number.



D0	16#62 (b)	16#61 (a)
D1	16#64 (d)	16#63 (c)
D2	0 (NULL)	

3. The string is an odd number.



D0	16#62 (b)	16#61 (a)
D1	16#64 (d)	16#63 (c)
D2	0 (NULL)	16#65 (e)

*1: ASCII code chart

Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
ASCII	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
Hex	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
ASCII	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
Hex	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
ASCII	SP	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
Hex	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
ASCII	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
Hex	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
ASCII	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Hex	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F
ASCII	P	Q	R	S	T	U	V	W	X	Y	Z	☒	☒	☒	☒	☒
Hex	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F
ASCII	`	a	b	C	d	e	f	g	h	i	j	k	l	m	n	o

Hex	70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F
ASCII	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	☒

Note: ☒ represents an invisible character. Please do not use it.

2.2.4 Input Relays

- The function of the input

  The input is connected to the input device (e.g. external devices such as button switches, rotary switches, number switches, and etc.), and the input signal is read into the PLC. Besides, contact A or contact B of the input can be used several times in the program, and the ON/OFF state of the input varies with the ON/OFF state of the input device.
- The input number (the decimal number):

  For the PLC, the input numbers start from X0.0. The number of inputs varies with the number of inputs on the digital input/output modules, and the inputs are numbered according to the order in which the digital input/output modules are connected to the CPU module. The maximum number of inputs on the PLC can reach up to 8192, and the range is between X0.0 and X511.15.
- The input type

  The inputs are classified into two types.

  1. Regenerated input: Before the program is executed, the data is fed into the PLC according to the states of the inputs which are regenerated. For example, LD X0.0.
  2. Direct input: During the execution of the instructions, the data is fed into the PLC according to the states of the inputs. For example, LD DX0.0.

2.2.5 Output Relays

- The function of the output

  The task of the output is sending the ON/OFF signal to drive the load connected to the output. The load can be an external signal lamp, a digital display, or an electromagnetic valve. There are three types of outputs. They are relays, transistors, and TRIACs (AC thyristors). Contact A or contact B of the output can be used several times in the program, but the output should be used only once in the program. Otherwise, according the program-scanning principle of the PLC, the state of the output depends on the circuit connected to the last output in the program.
- The output number (the decimal number)

  For the PLC, the input numbers start from X0.0. The number of outputs varies with the number of outputs on the digital input/output modules, and the outputs are numbered according to the order in which the digital input/output modules are connected to the PLC. The maximum number of outputs on the PLC can reach up to 8192, and the range is between Y0.0 and Y511.15.

  The output which is not practically put to use can be used as a general device.
- The output type

  The outputs are classified into two types.

  1. Regenerated output: Not until the program executes the instruction END is the information fed out according to the states of the outputs. For example, OUT Y0.0.
  2. Direct output: When the instructions are executed, the information is fed out according to the states of the outputs. For example, OUT DY0.0.

2.2.6 Auxiliary Relays

The auxiliary relay has contact A and contact B. It can be used several times in the program. Users can combine the control loops by means of the auxiliary relay, but can not drive the external load by means of the auxiliary relay. The auxiliary relays can be divided into two types according to their attributes.

1. For general use: If an electric power cut occurs when the PLC is running, the auxiliary relay for general use will be reset to OFF. When the power supply is restored, the auxiliary relay for general use is still OFF.
2. For latched use: If an electric power cut occurs when the PLC is running, the state of the auxiliary relay for latched use will be retained. When the power supply is restored, the state remains the same as that before the power electric cut.

2.2.7 Special Auxiliary Relays

Every special auxiliary relay has its specific function. Please do not use the special auxiliary relays which are not defined.

The special auxiliary relays and their functions are listed as follows. As to the SM numbers marked “*”, users can refer to the additional remarks on special auxiliary relays/special data registers. “R” in the attribute column indicates that the special auxiliary relay can read the data, whereas “R/W” in the attribute column indicates that it can read and write the data. In addition, the mark “–” indicates that the status of the special auxiliary relay does not make any change. The mark “#” indicates that the system will be set according to the status of the PLC, and users can read the setting value and refer to the related manual for more information.

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM0	Operation error	O	O	O	O	O	O	OFF	OFF	–	R	OFF
SM1	The operation error is locked.	O	O	O	O	O	O	OFF	OFF	–	R	OFF
SM5	Instruction/Operand inspection error	O	O	O	O	O	O	OFF	OFF	–	R	OFF
*SM8	Watchdog timer error	O	O	O	O	O	O	OFF	–	–	R	OFF
SM9	System error	O	O	O	O	O	O	OFF	–	–	R	OFF
SM10	I/O bus error	O	O	O	O	O	O	OFF	–	–	R	OFF
*SM20	Power supply error log	O	O	O	O	O	O	OFF	–	–	R	OFF
*SM22	Clearing the error log	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM23	Clearing the download log	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM24	Clearing the state-changing log of the PLC	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM25	The online-editing processing flag is on when the online-editing mode starts.	O	O	O	O	O	O	OFF	–	–	R	OFF
SM26	The debugging mode processing flag is on when the debugging mode starts.	O	O	O	O	O	O	OFF	–	–	R	OFF
*SM96	The data is sent through COM1.	O	O	O	O	O	O	OFF	OFF	–	R/W	OFF
*SM97	The data is sent through COM2.	O	X	O	X	X	X	OFF	OFF	–	R/W	OFF
*SM98	Waiting to receive the reply through COM1	O	O	O	O	O	O	OFF	OFF	–	R	OFF
*SM99	Waiting to receive the reply through COM2	O	X	O	X	X	X	OFF	OFF	–	R	OFF
*SM100	Reception through COM1 is complete.	O	O	O	O	O	O	OFF	OFF	–	R/W	OFF
*SM101	Reception through COM2 is complete.	O	X	O	X	X	X	OFF	OFF	–	R/W	OFF
*SM102	An error occurs during the reception of the data through COM1 by using the instruction MODRW or the instruction RS.	O	O	O	O	O	O	OFF	OFF	–	R	OFF
*SM103	An error occurs during the reception of the data through COM2 by using the instruction MODRW or the instruction RS.	O	X	O	X	X	X	OFF	OFF	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SM104	No data is received through COM1 after a specified period of time.	O	O	O	O	O	O	OFF	OFF	–	R/W	OFF
*SM105	No data is received through COM2 after a specified period of time.	O	X	O	X	X	X	OFF	OFF	–	R/W	OFF
*SM106	Choice made by COM1 between the 8-bit processing mode and the 16-bit processing mode ON: The 8-bit processing mode OFF: The 16-bit processing mode	O	O	O	O	O	O	OFF	–	–	R/W	OFF
*SM107	Choice made by COM2 between the 8-bit processing mode and the 16-bit processing mode ON: The 8-bit processing mode OFF: The 16-bit processing mode	O	X	O	X	X	X	OFF	–	–	R/W	OFF
SM108	The receiving of data through COM1 is complete.	V1.01	V1.01	O	O	O	O	OFF	–	–	R/W	OFF
SM109	The receiving of data through COM2 is complete.	V1.01	X	O	X	X	X	OFF	–	–	R/W	OFF
*SM204	All non-latched areas are cleared.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
*SM205	All latched areas are cleared.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM206	Inhibiting all output	O	O	O	O	O	O	OFF	–	–	R/W	OFF
*SM209	The communication protocol of COM1 changes (in accordance with SM210, SR201, SR209, and SR215).	O	O	O	O	O	O	OFF	–	–	R/W	OFF
*SM210	Choice made by COM1 between the ASCII mode and the RTU mode ON: The RTU mode	O	O	O	O	O	O	OFF	–	–	R/W	OFF
*SM211	The communication protocol of COM2 changes (in accordance with SM212, SR202, SR212, and SR216).	O	X	O	X	X	X	OFF	–	–	R/W	OFF
*SM212	Choice made by COM2 between the ASCII mode and the RTU mode ON: The RTU mode	O	X	O	X	X	X	OFF	–	–	R/W	OFF
SM215	Running state of the PLC	O	O	O	O	O	O	OFF	ON	OFF	R/W	OFF
SM220	Calibrating the real-time clock within ±30 seconds	O	O	O	O	O	O	OFF	OFF	–	R/W	OFF
*SM400	The flag is always ON when CPU runs.	O	O	O	O	O	O	ON	ON	ON	R	ON
*SM401	The flag is always OFF when CPU runs.	O	O	O	O	O	O	OFF	OFF	OFF	R	OFF
*SM402	The flag is ON only at the first scan.	O	O	O	O	O	O	OFF	ON	OFF	R	OFF
*SM403	The flag is OFF only at the first scan.	O	O	O	O	O	O	ON	OFF	ON	R	ON
*SM404	10 millisecond clock pulse during which the pulse is ON for 5 milliseconds and is OFF for 5 milliseconds	O	O	O	O	O	O	OFF	–	–	R	OFF
*SM405	100 millisecond clock pulse during which the pulse is ON for 50 milliseconds and is OFF for 50 milliseconds	O	O	O	O	O	O	OFF	–	–	R	OFF
*SM406	200 millisecond clock pulse during which the pulse is ON for 100 milliseconds and is OFF for 100 milliseconds	O	O	O	O	O	O	OFF	–	–	R	OFF
*SM407	One second clock pulse during which the pulse is ON for 500 milliseconds and is OFF for 500 milliseconds	O	O	O	O	O	O	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SM408	Two second clock pulse during which the pulse is ON for one second and is OFF for one second	O	O	O	O	O	O	OFF	–	–	R	OFF
*SM409	2n second clock pulse during which the pulse is ON for n seconds and is OFF for n seconds The interval n is specified by SR409.	O	O	O	O	O	O	OFF	–	–	R	OFF
*SM410	2n millisecond clock pulse during which the pulse is ON for n milliseconds and is OFF for n milliseconds The interval n is specified by SR410.	O	O	O	O	O	O	OFF	–	–	R	OFF
*SM418	Port 2 connection status of backplane 1 (main backplane)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM420	Port 2 connection status of backplane 2 (1st redundant extension backplane)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM421	Port 4 connection status of backplane 2 (1st redundant extension backplane)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM422	Port 2 connection status of backplane 3 (2nd redundant extension backplane)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM423	Port 4 connection status of backplane 3 (2nd redundant extension backplane)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM424	Port 2 connection status of backplane 4 (3rd redundant extension backplane)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM425	Port 4 connection status of backplane 4 (3rd redundant extension backplane)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM426	Port 2 connection status of backplane 5 (4th redundant extension backplane)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM427	Port 4 connection status of backplane 5 (4th redundant extension backplane)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM428	Port 2 connection status of backplane 6 (5th redundant extension backplane)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM429	Port 4 connection status of backplane 6 (5th redundant extension backplane)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM430	Port 2 connection status of backplane 7 (6th redundant extension backplane)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM431	Port 4 connection status of backplane 7 (6th redundant extension backplane)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM450	Whether the memory card exists ON: The memory card exists. OFF: The memory card does not exist.	O	O	O	O	O	O	OFF	–	–	R	OFF
*SM451	Write protection switch on the memory card ON: The memory card is write protected. OFF: The memory card is not write protected.	O	O	O	O	O	O	OFF	–	–	R	OFF
*SM452	The data in the memory card is being accessed. ON: The data in the memory card is being accessed. OFF: The data in the memory card is not accessed.	O	O	O	O	O	O	OFF	–	–	R	OFF
*SM453	An error occurs during the operation of the memory card. ON: An error occurs.	O	O	O	O	O	O	OFF	–	–	R	OFF
SM454	Enabling data logger (ON: enabled; OFF: Disabled)	X	X	V2.01	V2.01	V1.01	O	OFF	–	–	R/W	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM455	Data logger sampling state (ON: buffer overflow or block cycling)	X	X	V2.01	V2.01	V1.01	O	OFF	–	–	R	OFF
SM456	Enabling data logger to be saved in the SD card (in accordance with SR902)	X	X	V2.01	V2.01	V1.01	O	OFF	–	–	R/W	OFF
SM457	Setting state of data logger (ON: data logger is set)	X	X	V2.01	V2.01	V1.01	O	OFF	–	–	R	OFF
SM600	Zero flag	O	O	O	O	O	O	OFF	–	–	R	OFF
SM601	Borrow flag	O	O	O	O	O	O	OFF	–	–	R	OFF
SM602	Carry flag	O	O	O	O	O	O	OFF	–	–	R	OFF
SM604	Setting the working mode of the instruction SORT. ON: The descending order OFF: The ascending order	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM605	Designating the working mode of the instruction SMOV	O	O	O	O	O	O	OFF	-	-	R/W	OFF
SM606	8-bit or 16-bit working mode	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM607	It is the matrix comparison flag. ON: Comparing the equivalent values OFF: Comparing the different values	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM608	The matrix comparison comes to an end. When the last bits are compared, SM608 is ON.	O	O	O	O	O	O	OFF	–	–	R	OFF
SM609	When SM609 is ON, the comparison starts from bit 0.	O	O	O	O	O	O	OFF	–	–	R	OFF
SM610	It is the matrix bit search flag. When the matching bits are compared, the comparison stops immediately, and SM610 is ON.	O	O	O	O	O	O	OFF	–	–	R	OFF
SM611	It is the matrix pointer error flag. When the value of the pointer exceeds the comparison range, SM611 is ON.	O	O	O	O	O	O	OFF	–	–	R	OFF
SM612	It is the matrix pointer increasing flag. The current value of the pointer increases by one.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM613	It is the matrix pointer clearing flag. The current value of the pointer is cleared to zero.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM614	It is the carry flag for the matrix rotation/shift/output.	O	O	O	O	O	O	OFF	–	–	R	OFF
SM615	It is the borrow flag for the matrix shift/output.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM616	It is the direction flag for the matrix rotation/shift. The bits are shifted leftward when SM616 is OFF, whereas the bits are shifted rightward when SM616 is ON.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM617	The bits with the value 0 or 1 are counted.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM618	It is ON when the matrix counting result is 0.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM619	It is ON when the instruction EI is executed.	O	O	O	O	O	O	OFF	OFF	-	R	OFF
SM620	When the results gotten from the comparison by using the instruction CMPT# are that all devices are ON, SM620 is ON.	O	O	O	O	O	O	OFF	–	–	R	OFF
SM621	It sets the counting mode of HC0. (HC0 counts down when SM621 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM622	It sets the counting mode of HC. (HC1 counts down when SM622 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM623	It sets the counting mode of HC2. (HC2 counts down when SM623 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM624	It sets the counting mode of HC3. (HC3 counts down when SM624 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM625	It sets the counting mode of HC4. (HC4 counts down when SM625 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM626	It sets the counting mode of HC5. (HC5 counts down when SM626 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM627	It sets the counting mode of HC6. (HC6 counts down when SM627 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM628	It sets the counting mode of HC7. (HC7 counts down when SM628 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM629	It sets the counting mode of HC8. (HC8 counts down when SM629 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM630	It sets the counting mode of HC9. (HC9 counts down when SM630 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM631	It sets the counting mode of HC10. (HC10 counts down when SM631 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM632	It sets the counting mode of HC11. (HC11 counts down when SM632 is ON.)	O	O	O	O	O	O	OFF	–	-	R/W	OFF
SM633	It sets the counting mode of HC12. (HC12 counts down when SM633 is ON.)	O	O	O	O	O	O	OFF	–	-	R/W	OFF
SM634	It sets the counting mode of HC13. (HC13 counts down when SM634 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM635	It sets the counting mode of HC14. (HC14 counts down when SM635 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM636	It sets the counting mode of HC15. (HC15 counts down when SM636 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM637	It sets the counting mode of HC16. (HC16 counts down when SM637 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM638	It sets the counting mode of HC17. (HC17 counts down when SM638 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM639	It sets the counting mode of HC18. (HC18 counts down when SM639 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM640	It sets the counting mode of HC19. (HC19 counts down when SM640 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM641	It sets the counting mode of HC20. (HC20 counts down when SM641 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM642	It sets the counting mode of HC21. (HC21 counts down when SM642 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM643	It sets the counting mode of HC22. (HC22 counts down when SM643 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM644	It sets the counting mode of HC23. (HC23 counts down when SM644 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM645	It sets the counting mode of HC24. (HC24 counts down when SM645 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM646	It sets the counting mode of HC25. (HC25 counts down when SM646 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM647	It sets the counting mode of HC26. (HC26 counts down when SM647 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM648	It sets the counting mode of HC27.	O	O	O	O	O	O	OFF	–	–	R/W	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
	(HC27 counts down when SM648 is ON.)											
SM649	It sets the counting mode of HC28. (HC28 counts down when SM649 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM650	It sets the counting mode of HC29. (HC29 counts down when SM650 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM651	It sets the counting mode of HC30. (HC30 counts down when SM651 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM652	It sets the counting mode of HC31. (HC31 counts down when SM652 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM653	It sets the counting mode of HC32. (HC32 counts down when SM653 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM654	It sets the counting mode of HC33. (HC33 counts down when SM653 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM655	It sets the counting mode of HC34. (HC34 counts down when SM655 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM656	It sets the counting mode of HC35. (HC35 counts down when SM656 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM657	It sets the counting mode of HC36. (HC36 counts down when SM657 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM658	It sets the counting mode of HC37. (HC37 counts down when SM658 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM659	It sets the counting mode of HC38. (HC38 counts down when SM659 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM660	It sets the counting mode of HC39. (HC39 counts down when SM660 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM661	It sets the counting mode of HC40. (HC40 counts down when SM661 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM662	It sets the counting mode of HC41. (HC41 counts down when SM662 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM663	It sets the counting mode of HC42. (HC42 counts down when SM663 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM664	It sets the counting mode of HC43. (HC43 counts down when SM664 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM665	It sets the counting mode of HC44. (HC44 counts down when SM665 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM666	It sets the counting mode of HC45. (HC45 counts down when SM666 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM667	It sets the counting mode of HC46. (HC46 counts down when SM667 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM668	It sets the counting mode of HC47. (HC47 counts down when SM668 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM669	It sets the counting mode of HC48. (HC48 counts down when SM669 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM670	It sets the counting mode of HC49. (HC49 counts down when SM670 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM671	It sets the counting mode of HC50. (HC50 counts down when SM671 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM672	It sets the counting mode of HC51. (HC51 counts down when SM672 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM673	It sets the counting mode of HC52. (HC52 counts down when SM673 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM674	It sets the counting mode of HC53. (HC53 counts down when SM674 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM675	It sets the counting mode of HC54. (HC54 counts down when SM675 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM676	It sets the counting mode of HC55. (HC55 counts down when SM676 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM677	It sets the counting mode of HC56. (HC56 counts down when SM677 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM678	It sets the counting mode of HC57. (HC57 counts down when SM678 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM679	It sets the counting mode of HC58. (HC58 counts down when SM679 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM680	It sets the counting mode of HC59. (HC59 counts down when SM680 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM681	It sets the counting mode of HC60. (HC60 counts down when SM681 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM682	It sets the counting mode of HC61. (HC61 counts down when SM682 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM683	It sets the counting mode of HC62. (HC62 counts down when SM683 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM684	It sets the counting mode of HC63. (HC63 counts down when SM684 is ON.)	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM685	The instruction DSCLP uses the floating-point operation.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM686	Execute the instruction RAMP unceasingly	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM687	The execution of the instruction RAMP is complete.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM688	The execution of the instruction INCD is complete.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM690	String control mode	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM691	The input mode of the instruction HKY is the 16-bit mode. The input is the hexadecimal input if SM691 is ON, whereas A~F are function keys if it is OFF.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM692	After the execution of the instruction HKY is complete, SM692 is ON for a scan cycle.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM693	After the execution of the instruction SEGL is complete, SM693 is ON for a scan cycle.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM694	After the execution of the instruction DSW is complete, SM694 is ON for a scan cycle.	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM695	It is the radian/degree flag. ON: The degree	O	O	O	O	O	O	OFF	–	–	R/W	OFF
SM699	An error occurs when MODBUS TCP is initialized.	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM700	To enable data exchange for connection 1 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM701	To enable data exchange for connection 2 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM702	To enable data exchange for connection 3 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM703	To enable data exchange for connection 4 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM704	To enable data exchange for connection 5 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM705	To enable data exchange for connection 6 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM706	To enable data exchange for connection 7 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM707	To enable data exchange for connection 8 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM708	To enable data exchange for connection 9 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM709	To enable data exchange for connection 10 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM710	To enable data exchange for connection 11 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM711	To enable data exchange for connection 12 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM712	To enable data exchange for connection 13 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM713	To enable data exchange for connection 14 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM714	To enable data exchange for connection 15 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM715	To enable data exchange for connection 16 via Modbus TCP.	X	V1.01	X	O	O	O	OFF	–	–	R/W	OFF
SM716	To enable data exchange for connection 17 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM717	To enable data exchange for connection 18 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM718	To enable data exchange for connection 19 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM719	To enable data exchange for connection 20 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM720	To enable data exchange for connection 21 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM721	To enable data exchange for connection 22 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM722	To enable data exchange for connection 23 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM723	To enable data exchange for connection 24 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM724	To enable data exchange for connection 25 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM725	To enable data exchange for connection 26 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM726	To enable data exchange for connection 27 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM727	To enable data exchange for connection 28 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM728	To enable data exchange for connection 29 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM729	To enable data exchange for connection 30 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM730	To enable data exchange for connection 31 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM731	To enable data exchange for connection 32 via Modbus TCP.	X	O*1	X	O*6	O	O	OFF	–	–	R/W	OFF
SM732	To enable data exchange for connection 33 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM733	To enable data exchange for connection 34 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM734	To enable data exchange for connection 35 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM735	To enable data exchange for connection 36 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM736	To enable data exchange for connection 37 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM737	To enable data exchange for connection 38 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM738	To enable data exchange for connection 39 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM739	To enable data exchange for connection 40 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM740	To enable data exchange for connection 41 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM741	To enable data exchange for connection 42 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM742	To enable data exchange for connection 43 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM743	To enable data exchange for connection 44 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM744	To enable data exchange for connection 45 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM745	To enable data exchange for connection 46 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM746	To enable data exchange for connection 47 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM747	To enable data exchange for connection 48 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM748	To enable data exchange for connection 49 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM749	To enable data exchange for connection 50 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM750	To enable data exchange for connection 51 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM751	To enable data exchange for connection 52 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM752	To enable data exchange for connection 53 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM753	To enable data exchange for connection 54 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM754	To enable data exchange for connection 55 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM755	To enable data exchange for connection 56 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM756	To enable data exchange for connection 57 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM757	To enable data exchange for connection 58 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM758	To enable data exchange for connection 59 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM759	To enable data exchange for connection 60 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM760	To enable data exchange for connection 61 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM761	To enable data exchange for connection 62 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM762	To enable data exchange for connection 63 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM763	To enable data exchange for connection 64 via Modbus TCP.	X	O*2	X	O*4	O	O	OFF	–	–	R/W	OFF
SM764	To enable data exchange for connection 65 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM765	To enable data exchange for connection 66 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM766	To enable data exchange for connection 67 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM767	To enable data exchange for connection 68 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM768	To enable data exchange for connection 69 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM769	To enable data exchange for connection 70 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM770	To enable data exchange for connection 71 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM771	To enable data exchange for connection 72 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM772	To enable data exchange for connection 73 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM773	To enable data exchange for connection 74 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM774	To enable data exchange for connection 75 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM775	To enable data exchange for connection 76 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM776	To enable data exchange for connection 77 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM777	To enable data exchange for connection 78 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM778	To enable data exchange for connection 79 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM779	To enable data exchange for connection 80 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM780	To enable data exchange for connection 81 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM781	To enable data exchange for connection 82 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM782	To enable data exchange for connection 83 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM783	To enable data exchange for connection 84 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM784	To enable data exchange for connection 85 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM785	To enable data exchange for connection 86 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM786	To enable data exchange for connection 87 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM787	To enable data exchange for connection 88 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM788	To enable data exchange for connection 89 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM789	To enable data exchange for connection 90 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM790	To enable data exchange for connection 91 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM791	To enable data exchange for connection 92 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM792	To enable data exchange for connection 93 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM793	To enable data exchange for connection 94 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM794	To enable data exchange for connection 95 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM795	To enable data exchange for connection 96 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM796	To enable data exchange for connection 97 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM797	To enable data exchange for connection 98 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM798	To enable data exchange for connection 99 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM799	To enable data exchange for connection 100 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM800	To enable data exchange for connection 101 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM801	To enable data exchange for connection 102 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM802	To enable data exchange for connection 103 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM803	To enable data exchange for connection 104 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM804	To enable data exchange for connection 105 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM805	To enable data exchange for connection 106 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM806	To enable data exchange for connection 107 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM807	To enable data exchange for connection 108 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM808	To enable data exchange for connection 109 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM809	To enable data exchange for connection 110 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM810	To enable data exchange for connection 111 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM811	To enable data exchange for connection 112 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM812	To enable data exchange for connection 113 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM813	To enable data exchange for connection 114 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM814	To enable data exchange for connection 115 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM815	To enable data exchange for connection 116 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM816	To enable data exchange for connection 117 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM817	To enable data exchange for connection 118 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM818	To enable data exchange for connection 119 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM819	To enable data exchange for connection 120 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM820	To enable data exchange for connection 121 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM821	To enable data exchange for connection 122 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM822	To enable data exchange for connection 123 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM823	To enable data exchange for connection 124 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM824	To enable data exchange for connection 125 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM825	To enable data exchange for connection 126 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM826	To enable data exchange for connection 127 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM827	To enable data exchange for connection 128 via Modbus TCP.	X	O*3	X	O*5	O	X	OFF	–	–	R/W	OFF
SM828	An error occurs in data exchange connection 1 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM829	An error occurs in data exchange connection 2 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM830	An error occurs in data exchange connection 3 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM831	An error occurs in data exchange connection 4 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM832	An error occurs in data exchange connection 5 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM833	An error occurs in data exchange connection 6 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM834	An error occurs in data exchange connection 7 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM835	An error occurs in data exchange connection 8 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM836	An error occurs in data exchange connection 9 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM837	An error occurs in data exchange connection 10 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM838	An error occurs in data exchange connection 11 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM839	An error occurs in data exchange connection 12 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM840	An error occurs in data exchange connection 13 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM841	An error occurs in data exchange connection 14 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM842	An error occurs in data exchange connection 15 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM843	An error occurs in data exchange connection 16 via Modbus TCP	X	V1.01	X	O	O	O	OFF	–	–	R	OFF
SM844	An error occurs in data exchange connection 17 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM845	An error occurs in data exchange connection 18 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM846	An error occurs in data exchange connection 19 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM847	An error occurs in data exchange connection 20 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM848	An error occurs in data exchange connection 21 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM849	An error occurs in data exchange connection 22 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM850	An error occurs in data exchange connection 23 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM851	An error occurs in data exchange connection 24 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM852	An error occurs in data exchange connection 25 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM853	An error occurs in data exchange connection 26 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM854	An error occurs in data exchange connection 27 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM855	An error occurs in data exchange connection 28 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM856	An error occurs in data exchange connection 29 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM857	An error occurs in data exchange connection 30 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM858	An error occurs in data exchange connection 31 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM859	An error occurs in data exchange connection 32 via Modbus TCP	X	O*1	X	O*6	O	O	OFF	–	–	R	OFF
SM860	An error occurs in data exchange connection 33 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM861	An error occurs in data exchange connection 34 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM862	An error occurs in data exchange connection 35 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM863	An error occurs in data exchange connection 36 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM864	An error occurs in data exchange connection 37 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM865	An error occurs in data exchange connection 38 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM866	An error occurs in data exchange connection 39 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM867	An error occurs in data exchange connection 40 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM868	An error occurs in data exchange connection 41 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM869	An error occurs in data exchange connection 42 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM870	An error occurs in data exchange connection 43 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM871	An error occurs in data exchange connection 44 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM872	An error occurs in data exchange connection 45 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM873	An error occurs in data exchange connection 46 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM874	An error occurs in data exchange connection 47 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM875	An error occurs in data exchange connection 48 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM876	An error occurs in data exchange connection 49 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM877	An error occurs in data exchange connection 50 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM878	An error occurs in data exchange connection 51 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM879	An error occurs in data exchange connection 52 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM880	An error occurs in data exchange connection 53 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM881	An error occurs in data exchange connection 54 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM882	An error occurs in data exchange connection 55 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM883	An error occurs in data exchange connection 56 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM884	An error occurs in data exchange connection 57 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM885	An error occurs in data exchange connection 58 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM886	An error occurs in data exchange connection 59 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM887	An error occurs in data exchange connection 60 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM888	An error occurs in data exchange connection 61 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM889	An error occurs in data exchange connection 62 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM890	An error occurs in data exchange connection 63 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM891	An error occurs in data exchange connection 64 via Modbus TCP	X	O*2	X	O*4	O	O	OFF	–	–	R	OFF
SM892	An error occurs in data exchange connection 65 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM893	An error occurs in data exchange connection 66 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM894	An error occurs in data exchange connection 67 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM895	An error occurs in data exchange connection 68 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM896	An error occurs in data exchange connection 69 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM897	An error occurs in data exchange connection 70 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM898	An error occurs in data exchange connection 71 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM899	An error occurs in data exchange connection 72 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM900	An error occurs in data exchange connection 73 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM901	An error occurs in data exchange connection 74 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM902	An error occurs in data exchange connection 75 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM903	An error occurs in data exchange connection 76 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM904	An error occurs in data exchange connection 77 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM905	An error occurs in data exchange connection 78 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM906	An error occurs in data exchange connection 79 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM907	An error occurs in data exchange connection 80 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM908	An error occurs in data exchange connection 81 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM909	An error occurs in data exchange connection 82 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM910	An error occurs in data exchange connection 83 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM911	An error occurs in data exchange connection 84 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM912	An error occurs in data exchange connection 85 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM913	An error occurs in data exchange connection 86 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM914	An error occurs in data exchange connection 87 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM915	An error occurs in data exchange connection 88 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM916	An error occurs in data exchange connection 89 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM917	An error occurs in data exchange connection 90 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM918	An error occurs in data exchange connection 91 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM919	An error occurs in data exchange connection 92 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM920	An error occurs in data exchange connection 93 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM921	An error occurs in data exchange connection 94 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM922	An error occurs in data exchange connection 95 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM923	An error occurs in data exchange connection 96 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM924	An error occurs in data exchange connection 97 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM925	An error occurs in data exchange connection 98 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM926	An error occurs in data exchange connection 99 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM927	An error occurs in data exchange connection 100 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM928	An error occurs in data exchange connection 101 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM929	An error occurs in data exchange connection 102 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM930	An error occurs in data exchange connection 103 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM931	An error occurs in data exchange connection 104 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM932	An error occurs in data exchange connection 105 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM933	An error occurs in data exchange connection 106 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM934	An error occurs in data exchange connection 107 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM935	An error occurs in data exchange connection 108 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM936	An error occurs in data exchange connection 109 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM937	An error occurs in data exchange connection 110 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM938	An error occurs in data exchange connection 111 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM939	An error occurs in data exchange connection 112 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM940	An error occurs in data exchange connection 113 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM941	An error occurs in data exchange connection 114 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM942	An error occurs in data exchange connection 115 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM943	An error occurs in data exchange connection 116 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM944	An error occurs in data exchange connection 117 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM945	An error occurs in data exchange connection 118 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM946	An error occurs in data exchange connection 119 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM947	An error occurs in data exchange connection 120 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM948	An error occurs in data exchange connection 121 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM949	An error occurs in data exchange connection 122 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM950	An error occurs in data exchange connection 123 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM951	An error occurs in data exchange connection 124 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM952	An error occurs in data exchange connection 125 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM953	An error occurs in data exchange connection 126 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM954	An error occurs in data exchange connection 127 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM955	An error occurs in data exchange connection 128 via Modbus TCP	X	O*3	X	O*5	O	X	OFF	–	–	R	OFF
SM1000	It is the Ethernet setting flag. When SM1000 is ON, the data in SR1000~SR1006 is written into the flash memory.	X	O	X	O	O	O	-	–	–	R/W	OFF
*SM1001	Port1 Ethernet connection status	X	X	X	O	O	O	–	–	–	R	OFF
*SM1002	Port2 Ethernet connection status	X	X	X	X	O	X	–	–	–	R	OFF
*SM1003	Fiber for synchronization connection status	X	X	X	X	O	X	–	–	–	R	OFF
*SM1089	MODBUS TCP connection has reached its limit	X	V1.06.	X	V2.00	O	O	OFF	–	–	R	OFF
SM1090	The TCP connection is busy.	X	O	X	O	O	O	OFF	–	–	R	OFF
SM1091	The UDP connection is busy.	X	O	X	O	O	O	OFF	–	–	R	OFF
SM1100	The network cable is not connected	X	O	X	O	O	O	OFF	–	–	R	OFF
SM1106	Ethernet connection error	X	O	X	O	O	O	OFF	–	–	R	OFF
SM1107	HWCONFIG Ethernet–Basic setting, parameters setting error	X	O	X	O	O	O	OFF	–	–	R	OFF
SM1108	HWCONFIG Ethernet–Advanced setting, filter setting error	X	O	X	O	O	O	OFF	–	–	R	OFF
SM1109	HWCONFIG Ethernet–Advanced setting, TCP/UDP socket–the local port is already used.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1112	Email setting error	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1113	Email service error	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1116	It is the switch of trigger 1 in the email.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1117	Trigger 1 in the email	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1118	When trigger 1 is triggered but the email cannot be sent due to the Ethernet connection failure; SM1118 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1119	When trigger 1 is triggered and the email has been sent successfully; SM1119 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1120	When trigger 1 is triggered but the email cannot be sent due to email content error; SM1120 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1121	When trigger 1 is triggered and the email is being sent; SM1121 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1122	When trigger 1 is triggered and there is an SMTP server response timeout, SM1122 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1123	When trigger 1 is triggered and there is an SMTP server response error, SM1123 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1124	When trigger 1 is triggered and the size of the attachment exceeds the limit, SM1124 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1125	When trigger 1 is triggered and the attachment is not found, SM1125 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1126	It is the switch of trigger 2 in the email.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1127	Trigger 2 in the email	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1128	When trigger 2 is triggered but the email cannot be sent due to the Ethernet connection failure; SM1128 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1129	When trigger 2 is triggered and the email has been sent successfully; SM1129 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SM1130	When trigger 2 is triggered but the email cannot be sent due to email content error; SM1130 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1131	When trigger 2 is triggered and the email is being sent; SM1131 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1132	When trigger 2 is triggered and there is an SMTP server response timeout, SM1132 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1133	When trigger 2 is triggered and there is an SMTP server response error, SM1133 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1134	When trigger 2 is triggered and the size of the attachment exceeds the limit, SM1134 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1135	When trigger 2 is triggered and the attachment is not found, SM1135 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1136	It is the switch of trigger 3 in the email.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1137	Trigger 3 in the email	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1138	When trigger 3 is triggered but the email cannot be sent due to the Ethernet connection failure; SM1138 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1139	When trigger 3 is triggered and the email has been sent successfully; SM1139 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1140	When trigger 3 is triggered but the email cannot be sent due to email content error; SM1140 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1141	When trigger 3 is triggered and the email is being sent; SM1141 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1142	When trigger 3 is triggered and there is an SMTP server response timeout, SM1142 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1143	When trigger 3 is triggered and there is an SMTP server response error, SM1143 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1144	When trigger 3 is triggered and the size of the attachment exceeds the limit, SM1144 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1145	When trigger 3 is triggered and the attachment is not found, SM1145 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1146	It is the switch of trigger 4 in the email.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1147	Trigger 4 in the email	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1148	When trigger 4 is triggered but the email cannot be sent due to the Ethernet connection failure; SM1148 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1149	When trigger 4 is triggered and the email has been sent successfully; SM1149 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1150	When trigger 4 is triggered but the email cannot be sent due to email content error; SM1150 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1151	When trigger 4 is triggered and the email is being sent; SM1151 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1152	When trigger 4 is triggered and there is an SMTP server response timeout, SM1152 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1153	When trigger 4 is triggered and there is an SMTP server response error, SM1153 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1154	When trigger 4 is triggered and the size of the attachment exceeds the limit, SM1154 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SM1155	When trigger 4 is triggered and the attachment is not found, SM1155 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1156	It is the switch of trigger 5 in the email.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1157	Trigger 5 in the email	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1158	When trigger 5 is triggered but the email cannot be sent due to the Ethernet connection failure; SM1158 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1159	When trigger 5 is triggered and the email has been sent successfully; SM1159 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1160	When trigger 5 is triggered but the email cannot be sent due to email content error; SM1160 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1161	When trigger 5 is triggered and the email is being sent; SM1161 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1162	When trigger 5 is triggered and there is an SMTP server response timeout, SM1162 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1163	When trigger 5 is triggered and there is an SMTP server response error, SM1163 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1164	When trigger 5 is triggered and the size of the attachment exceeds the limit, SM1164 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1165	When trigger 5 is triggered and the attachment is not found, SM1165 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1166	It is the switch of trigger 6 in the email.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1167	Trigger 6 in the email	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1168	When trigger 6 is triggered but the email cannot be sent due to the Ethernet connection failure; SM1168 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1169	When trigger 6 is triggered and the email has been sent successfully; SM1169 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1170	When trigger 6 is triggered but the email cannot be sent due to email content error; SM1170 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1171	When trigger 6 is triggered and the email is being sent; SM1171 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1172	When trigger 6 is triggered and there is an SMTP server response timeout, SM1172 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1173	When trigger 6 is triggered and there is an SMTP server response error, SM1173 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1174	When trigger 6 is triggered and the size of the attachment exceeds the limit, SM1174 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1175	When trigger 6 is triggered and the attachment is not found, SM1175 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1176	It is the switch of trigger 7 in the email.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1177	Trigger 7 in the email	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1178	When trigger 7 is triggered but the email cannot be sent due to the Ethernet connection failure; SM1178 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1179	When trigger 7 is triggered and the email has been sent successfully; SM1179 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SM1180	When trigger 7 is triggered but the email cannot be sent due to email content error; SM1180 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1181	When trigger 7 is triggered and the email is being sent; SM1181 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1182	When trigger 7 is triggered and there is an SMTP server response timeout, SM1182 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1183	When trigger 7 is triggered and there is an SMTP server response error, SM1183 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1184	When trigger 7 is triggered and the size of the attachment exceeds the limit, SM1184 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1185	When trigger 7 is triggered and the attachment is not found, SM1185 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1186	It is the switch of trigger 8 in the email.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1187	Trigger 8 in the email	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1188	When trigger 8 is triggered but the email cannot be sent due to the Ethernet connection failure; SM1188 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1189	When trigger 8 is triggered and the email has been sent successfully; SM1189 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1190	When trigger 8 is triggered but the email cannot be sent due to email content error; SM1190 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1191	When trigger 8 is triggered and the email is being sent; SM1191 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1192	When trigger 8 is triggered and there is an SMTP server response timeout, SM1192 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1193	When trigger 8 is triggered and there is an SMTP server response error, SM1193 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1194	When trigger 8 is triggered and the size of the attachment exceeds the limit, SM1194 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1195	When trigger 8 is triggered and the attachment is not found, SM1195 is ON.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1196	Socket configuration error	X	O	X	O	O	O	OFF	–	–	R/W	OFF
*SM1270	TCP socket 1—The connection is successful.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1271	TCP socket 1—The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1272	TCP socket 1—The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1273	TCP socket 1—The connection is being started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1274	TCP socket 1—The connection is being closed.	X	O	X	O	O	O	ON	–	–	R	ON
*SM1275	TCP socket 1—The data is being sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1276	TCP socket 1—The data is being received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1277	TCP socket 1—Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1278	TCP socket 2—The connection is successful.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1279	TCP socket 2—The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1280	TCP socket 2—The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1281	TCP socket 2—The connection is being started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1282	TCP socket 2—The connection is being closed.	X	O	X	O	O	O	ON	–	–	R	ON
*SM1283	TCP socket 2—The data is being sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1284	TCP socket 2—The data is being received.	X	O	X	O	O	O	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SM1285	TCP socket 2–Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1286	TCP socket 3–The connection is successful.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1287	TCP socket 3–The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1288	TCP socket3–The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1289	TCP socket 3–The connection is being started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1290	TCP socket 3–The connection is being closed.	X	O	X	O	O	O	ON	–	–	R	ON
*SM1291	TCP socket 3–The data is being sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1292	TCP socket 3–The data is being received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1293	TCP socket 3–Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1294	TCP socket 4–The connection is successful.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1295	TCP socket 4–The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1296	TCP socket 4–The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1297	TCP socket 4–The connection is being started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1298	TCP socket 4–The connection is being closed.	X	O	X	O	O	O	ON	–	–	R	ON
*SM1299	TCP socket 4–The data is being sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1300	TCP socket 4–The data is being received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1301	TCP socket 4–Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1302	TCP socket 5–The connection is successful.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1303	TCP socket 5–The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1304	TCP socket 5–The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1305	TCP socket 5–The connection is being started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1306	TCP socket 5–The connection is being closed.	X	O	X	O	O	O	ON	–	–	R	ON
*SM1307	TCP socket 5–The data is being sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1308	TCP socket 5–The data is being received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1309	TCP socket 5–Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1310	TCP socket 6–The connection is successful.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1311	TCP socket 6–The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1312	TCP socket 6–The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1313	TCP socket 6–The connection is being started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1314	TCP socket 6–The connection is being closed.	X	O	X	O	O	O	ON	–	–	R	ON
*SM1315	TCP socket 6–The data is being sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1316	TCP socket 6–The data is being received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1317	TCP socket 6–Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1318	TCP socket 7–The connection is successful.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1319	TCP socket 7–The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1320	TCP socket 7–The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1321	TCP socket 7–The connection is being started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1322	TCP socket 7–The connection is being closed.	X	O	X	O	O	O	ON	–	–	R	ON
*SM1323	TCP socket 7–The data is being sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1324	TCP socket 7–The data is being received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1325	TCP socket7–Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1326	TCP socket 8–The connection is successful.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1327	TCP socket 8–The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1328	TCP socket 8–The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SM1329	TCP socket 8—The connection is being started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1330	TCP socket 8—The connection is being closed.	X	O	X	O	O	O	ON	–	–	R	ON
*SM1331	TCP socket 8—The data is being sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1332	TCP socket 8—The data is being received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1333	TCP socket 1—Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1334	UDP socket 1—The connection has been started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1335	UDP socket 1—The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1336	UDP socket 1—The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1337	UDP socket 1—The data is being received.	X	O	X	O	O	O	ON	–	–	R	OFF
*SM1338	UDP socket 1—Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1339	UDP socket 2—The data is being received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1340	UDP socket 2—The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1341	UDP socket 2—The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1342	UDP socket 2—The connection has been closed.	X	O	X	O	O	O	ON	–	–	R	OFF
*SM1343	UDP socket 2—Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1344	UDP socket 3—The connection has been started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1345	UDP socket 3—The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1346	UDP socket 3—The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1347	UDP socket 3—The data is being received.	X	O	X	O	O	O	ON	–	–	R	OFF
*SM1348	UDP socket 3—Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1349	UDP socket 4—The connection has been started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1350	UDP socket 4—The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1351	UDP socket 4—The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1352	UDP socket 4—The data is being received.	X	O	X	O	O	O	ON	–	–	R	OFF
*SM1353	UDP socket 4—Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1354	UDP socket 5—The connection has been started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1355	UDP socket 5—The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1356	UDP socket 5—The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1357	UDP socket 5—The data is being received.	X	O	X	O	O	O	ON	–	–	R	OFF
*SM1358	UDP socket 5—Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1359	UDP socket 6—The connection has been started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1360	UDP socket 6—The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1361	UDP socket 6—The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1362	UDP socket 6—The data is being received.	X	O	X	O	O	O	ON	–	–	R	OFF
*SM1363	UDP socket 6—Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1364	UDP socket 7—The connection has been started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1365	UDP socket 7—The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1366	UDP socket 7—The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1367	UDP socket 7—The data is being received.	X	O	X	O	O	O	ON	–	–	R	OFF
*SM1368	UDP socket 7—Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1369	UDP socket 8—The connection has been started.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1370	UDP socket 8—The data has been received.	X	O	X	O	O	O	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SM1371	UDP socket 8—The data has been sent.	X	O	X	O	O	O	OFF	–	–	R	OFF
*SM1372	UDP socket 8—The data is being received.	X	O	X	O	O	O	ON	–	–	R	OFF
*SM1373	UDP socket 8—Error flag	X	O	X	O	O	O	OFF	–	–	R	OFF
SM1374	Web setting error	X	O	X	O	O	O	OFF	–	–	R	OFF
SM1375	TCP socket 1—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1376	TCP socket 2—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1377	TCP socket 3—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1378	TCP socket 4—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1379	TCP socket 5—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-		R/W	OFF
SM1380	TCP socket 6—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1381	TCP socket 7—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1382	TCP socket 8—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1383	UDP socket 1—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1384	UDP socket 2—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1385	UDP socket 3—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1386	UDP socket 4—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1387	UDP socket 5—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1388	UDP socket 6—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1389	UDP socket 7—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
SM1390	UDP socket 8—Start to send an odd number of bytes	X	V1.05	X	O	O	O	OFF	-	-	R/W	OFF
*SM1392 ↓ SM1423	To start data exchange for connection 1 via PLC Link. (Data exchange connection 1) ↓ To start data exchange for connection 32 via PLC Link. (Data exchange connection 32)	O	O	X	X	X	X	OFF	–	–	R/W	OFF
	To start Modbus data exchange for connection 1 via COM1. (Data exchange connection 1) ↓ To start Modbus data exchange for connection 32 via COM1. (Data exchange connection 32)	X	X	O	O	O	O	OFF	OFF	–	R/W	OFF
*SM1424 ↓ SM1455	Data exchange connection 1 via PLC Link is executing. (Data exchange connection 1) ↓ Data exchange connection 32 via PLC Link is executing. (Data exchange connection 32)	O	O	X	X	X	X	OFF	–	–	R	OFF
	Modbus data exchange connection 1 via COM1 is executing. (Data exchange connection 1) ↓	X	X	O	O	O	O	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
	Modbus data exchange connection 32 via COM1 is executing. (Data exchange connection 32)											
*SM1456 ↓ SM1487	An error occurs while reading data via PLC Link. (Data exchange connection 1) ↓ An error occurs while reading data via PLC Link. (Data exchange connection 32)	O	O	X	X	X	X	OFF	–	–	R	OFF
	A Modbus error occurs while reading data via COM1. (Data exchange connection 1) ↓ A Modbus error occurs while reading data via COM1. (Data exchange connection 32)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM1488 ↓ SM1519	An error occurs while writing data via PLC Link. (Data exchange connection 1) ↓ An error occurs while writing data via PLC Link. (Data exchange connection 32)	O	O	X	X	X	X	OFF	–	–	R	OFF
	A Modbus error occurs while writing data via COM1. (Data exchange connection 1) ↓ A Modbus error occurs while writing data via COM1. (Data exchange connection 32)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM1520 ↓ SM1551	Data reading via PLC Link is complete. (Data exchange connection 1) ↓ Data reading via PLC Link is complete. (Data exchange connection 32)	O	O	X	X	X	X	OFF	–	–	R	OFF
	Modbus data reading via COM1 is complete. (Data exchange connection 1) ↓ Modbus data reading via COM1 is complete. (Data exchange connection 32)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM1552 ↓ SM1583	Data writing via PLC Link is complete. (Data exchange connection 1) ↓ Data writing via PLC Link is complete. (Data exchange connection 32)	O	O	X	X	X	X	OFF	–	–	R	OFF
	Modbus data writing via COM1 is complete. (Data exchange connection 1) ↓ Modbus data writing via COM1 is complete. (Data exchange connection 32)	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM1584	Starting a connection in the PLC Link	O	O	X	X	X	X	OFF	–	–	R/W	OFF
	Enabling the Modbus connection of COM1	X	X	O	O	O	O	OFF	–	–	R/W	OFF
*SM1585	Assignment of the slaves by users in the PLC Link	O	O	X	X	X	X	–	–	–	R/W	OFF
	Assignment of slaves by users for the Modbus connection of COM1	X	X	O	O	O	O	OFF	–	–	R/W	OFF
*SM1586	Automatic mode of the PLC Link	O	O	X	X	X	X	–	–	–	R/W	OFF
	Automatic mode of the Modbus connection of COM1	X	X	O	O	O	O	OFF	–	–	R/W	OFF
*SM1587	Manual mode of the PLC Link	O	O	X	X	X	X	–	–	–	R/W	OFF
*SM1588	Detection of the slaves in the PLC Link	O	O	X	X	X	X	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
	Detection of slaves for the Modbus connection of COM1	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM1589	PLC Link flag error	O	O	X	X	X	X	OFF	–	–	R	OFF
*SM1590	Device address error in the PLC Link	O	O	X	X	X	X	OFF	–	–	R	OFF
	A device address error occurs in the Modbus connection of COM1	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM1591	PLC Link timeout	O	O	X	X	X	X	OFF	–	–	R	OFF
	A timeout occurs in the Modbus connection of COM1.	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM1592	The number of polling cycles in the PLC Link is incorrect.	O	O	X	X	X	X	OFF	–	–	R	OFF
*SM1593	Standard Modbus communication protocol is used in the PLC Link when SM1593 is OFF, whereas AH communication protocol is used in the PLC Link when SM1593 is ON.	O	O	X	X	X	X	–	–	–	R/W	OFF
*SM1594	The slaves are automatically detected in the PLC Link in the current environment. Only when the PLC Link is in the stop mode can SM1594 be used. OFF: (default) The detection is complete or the PLC is waiting to detect the slaves. ON: The PLC is detecting the slaves.	O	O	X	X	X	X	OFF	–	–	R/W	OFF
	Automatically detecting slaves for the Modbus connection of COM1 in the current environment: Only when the Modbus connection of COM1 stops can SM1594 be used. OFF: The detection of slaves is complete or the PLC is waiting to detect slaves. (default value) ON: The PLC is detecting slaves.	X	X	O	O	O	O	OFF	–	–	R/W	OFF
*SM1595	The slave IDs are assigned by users when SM1595 is ON, whereas they are assigned automatically when SM1595 is OFF.	O	O	X	X	X	X	–	–	–	R/W	OFF
*SM1596	There is an operation error in the PLC Link.	O	O	X	X	X	X	OFF	–	–	R	OFF
	An operation error occurs in the Modbus connection of COM1.	X	X	O	O	O	O	OFF	–	–	R	OFF
*SM1597	When SM1597 is ON, the extension port is used in the PLC Link.	O	O	X	X	X	X	–	–	–	R/W	OFF
*SM1598	When SM1598 is ON, the function of reading/writing synchronously in the PLC Link is enabled.	O	O	X	X	X	X	–	–	–	R/W	OFF
	ON: COM1 reads data and writes data simultaneously by Modbus.	X	X	O	O	O	O	–	–	–	R/W	OFF
SM1599 ↓ SM1630	To enable Modbus data exchange for connection 1 via COM1. (Data exchange connection 1) ↓ To enable Modbus data exchange for connection 32 via COM1. (Data exchange connection 32)	X	X	O	O	O	O	OFF	–	–	R/W	OFF
SM1720 ↓ SM1751	To change the to-read function code used for PLC Link to 0x04. (Data exchange connection 1) ↓	O	O	X	X	X	X	OFF	OFF	–	R/W	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
	To change the to-read function code used for PLC Link to 0x04. (Data exchange connection 32)											
SM1752 ↓ SM1768	Modbus data exchange connection 1 via COM2 is executing. (Data exchange connection 1) ↓ Modbus data exchange connection 17 via COM2 is executing. (Data exchange connection 17)	X	X	O	X	X	X	OFF	–	–	R	OFF
SM1769	Status of the Ether Link	O	O	X	X	X	X	OFF	–	–	R	OFF
	Modbus data exchange connection 18 via COM2 is executing. (Data exchange connection 18)	X	X	O	X	X	X	OFF	–	–	R	OFF
*SM1770	Starting the Ether Link (CPU)	O	O	X	X	X	X	OFF	–	–	R/W	OFF
	Modbus data exchange connection 19 via COM2 is executing. (Data exchange connection 19)	X	X	O	X	X	X	OFF	–	–	R	OFF
*SM1771	Modbus data exchange connection 20 via COM2 is executing. (Data exchange connection 20)	X	X	O	X	X	X	OFF	–	–	R	OFF
*SM1772 ↓ SM1783	Starting the Ether Link (port 0) ↓ Starting the Ether Link (port 11)	O	O	X	X	X	X	OFF	–	–	R/W	OFF
	Modbus data exchange connection 21 via COM2 is executing. (Data exchange connection 21) ↓ Modbus data exchange connection 32 via COM2 is executing. (Data exchange connection 32)	X	X	O	X	X	X	OFF	–	–	R	OFF
*SM1784 ↓ SM1787	Starting the Ether Link (port 12) ↓ Starting the Ether Link (port 15)	O	O	X	X	X	X	OFF	–	–	R/W	OFF
	A Modbus error occurs while reading data via COM2. (Data exchange connection 1) ↓ A Modbus error occurs while reading data via COM2. (Data exchange connection 4)	X	X	O	X	X	X	OFF	–	–	R	OFF
*SM1788	Ether Link error flag (CPU)	O	O	X	X	X	X	OFF	–	–	R	OFF
	A Modbus error occurs while reading data via COM2. (Data exchange connection 5)	X	X	O	X	X	X	OFF	–	–	R	OFF
*SM1789	A Modbus error occurs while reading data via COM2. (Data exchange connection 6)	X	X	O	X	X	X	OFF	–	–	R	OFF
*SM1790 ↓ SM1805	Ether Link error flag (port 0) ↓ Ether Link error flag (port 15)	O	O	X	X	X	X	OFF	–	–	R	OFF
	A Modbus error occurs while reading data via COM2. (Data exchange connection 7) ↓ A Modbus error occurs while reading data via COM2. (Data exchange connection 22)	X	X	O	X	X	X	OFF	–	–	R	OFF
*SM1806	Status of the Ether Link (CPU)	O	O	X	X	X	X	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
	A Modbus error occurs while reading data via COM2. (Data exchange connection 23)	X	X	O	X	X	X	OFF	–	–	R	OFF
*SM1807	A Modbus error occurs while reading data via COM2. (Data exchange connection 24)	X	X	O	X	X	X	OFF	–	–	R	OFF
*SM1808 ↓ SM1815	Status of the Ether Link (port 0) ↓ Status of the Ether Link (port 7)	O	O	X	X	X	X	OFF	–	–	R	OFF
*SM1808 ↓ SM1815	A Modbus error occurs while reading data via COM2. (Data exchange connection 25) ↓ A Modbus error occurs while reading data via COM2. (Data exchange connection 32)	X	X	O	X	X	X	OFF	–	–	R	OFF
*SM1816 ↓ SM1823	Status of an Ether link (port 8) ↓ Status of an Ether link (port 15)	O	O	X	X	X	X	OFF	–	–	R	OFF
*SM1816 ↓ SM1823	A Modbus error occurs while writing data via COM2. (Data exchange connection 1) ↓ A Modbus error occurs while writing data via COM2. (Data exchange connection 8)	X	X	O	X	X	X	OFF	–	–	R	OFF
SM1824 ↓ SM1847	Block 1 for an Ether link is active. ↓ Block 24 for an Ether link is active.	O	O	X	X	X	X	OFF	–	–	R	OFF
SM1824 ↓ SM1847	A Modbus error occurs while writing data via COM2. (Data exchange connection 9) ↓ A Modbus error occurs while writing data via COM2. (Data exchange connection 32)	X	X	O	X	X	X	OFF	–	–	R	OFF
SM1848 ↓ SM1879	Block 25 for an Ether link is active. ↓ Block 56 for an Ether link is active.	O	O	X	X	X	X	OFF	–	–	R	OFF
SM1848 ↓ SM1879	Modbus data reading via COM2 is complete. (Data exchange connection 1) ↓ Modbus data reading via COM2 is complete. (Data exchange connection 32)	X	X	O	X	X	X	OFF	–	–	R	OFF
SM1880 ↓ SM1911	Block 57 for an Ether link is active. ↓ Block 88 for an Ether link is active.	O	O	X	X	X	X	OFF	–	–	R	OFF
SM1880 ↓ SM1911	Modbus data writing via COM2 is complete. (Data exchange connection 1) ↓ Modbus data writing via COM2 is complete. (Data exchange connection 32)	X	X	O	X	X	X	OFF	–	–	R	OFF
SM1912	Block 89 for an Ether link is active.	O	O	X	X	X	X	OFF	–	–	R	OFF
SM1912	COM2 reads data and writes data simultaneously by Modbus.	X	X	O	X	X	X	OFF	–	–	R/W	OFF
SM1913 ↓ SM1944	Block 90 for an Ether link is active. ↓ Block 121 for an Ether link is active.	O	O	X	X	X	X	OFF	–	–	R	OFF
SM1913 ↓ SM1944	To enable Modbus data exchange for connection 1 via COM2. (Data exchange connection 1) ↓	X	X	O	X	X	X	OFF	–	–	R/W	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
	To enable Modbus data exchange for connection 32 via COM2. (Data exchange connection 32)											
SM1945 ↓ SM1951	Block 122 for an Ether link is active. ↓ Block 128 for an Ether link is active.	O	O	X	X	X	X	OFF	–	–	R	OFF
*SM2000	The data is sent by using the instruction EMDRW 1.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2001	The PLC waits for the data after the instruction EMDRW 1 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2002	The data is received by using the instruction EMDRW 1.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2003	An error occurs when the instruction EMDRW 1 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2004	There is a timeout after the instruction EMDRW 1 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2005	The connection is closed after the instruction EMDRW 1 is used.	X	O	X	O	O	O	ON	ON	ON	R	ON
*SM2006	The data is sent by using the instruction EMDRW 2.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2007	The PLC waits for the data after the instruction EMDRW 2 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2008	The data is received by using the instruction EMDRW 2.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2009	An error occurs when the instruction EMDRW 2 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2010	There is a timeout after the instruction EMDRW 2 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2011	The connection is closed after the instruction EMDRW 2 is used.	X	O	X	O	O	O	ON	ON	ON	R	ON
*SM2012	The data is sent by using the instruction EMDRW 3.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2013	The PLC waits for the data after the instruction EMDRW 3 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2014	The data is received by using the instruction EMDRW 3.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2015	An error occurs when the instruction EMDRW 3 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2016	There is a timeout after the instruction EMDRW 3 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2017	The connection is closed after the instruction EMDRW 3 is used.	X	O	X	O	O	O	ON	ON	ON	R	ON
*SM2018	The data is sent by using the instruction EMDRW 4.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2019	The PLC waits for the data after the instruction EMDRW 4 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2020	The data is received by using the instruction EMDRW 4.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2021	An error occurs when the instruction EMDRW 4 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2022	There is a timeout after the instruction EMDRW 4 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2023	The connection is closed after the instruction EMDRW 4 is used.	X	O	X	O	O	O	ON	ON	ON	R	ON

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SM2024	The data is sent by using the instruction EMDRW 5.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2025	The PLC waits for the data after the instruction EMDRW 5 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2026	The data is received by using the instruction EMDRW 5.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2027	An error occurs when the instruction EMDRW 5 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2028	There is a timeout after the instruction EMDRW 5 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2029	The connection is closed after the instruction EMDRW 5 is used.	X	O	X	O	O	O	ON	ON	ON	R	ON
*SM2030	The data is sent by using the instruction EMDRW 6.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2031	The PLC waits for the data after the instruction EMDRW 6 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2032	The data is received by using the instruction EMDRW 6.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2033	An error occurs when the instruction EMDRW 6 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2034	There is a timeout after the instruction EMDRW 6 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2035	The connection is closed after the instruction EMDRW 6 is used.	X	O	X	O	O	O	ON	ON	ON	R	ON
*SM2036	The data is sent by using the instruction EMDRW 7.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2037	The PLC waits for the data after the instruction EMDRW 7 is use.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2038	The data is received by using the instruction EMDRW 7.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2039	An error occurs when the instruction EMDRW 7 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2040	There is a timeout after the instruction EMDRW 7 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2041	The connection is closed after the instruction EMDRW 7 is used.	X	O	X	O	O	O	ON	ON	ON	R	ON
*SM2042	The data is sent by using the instruction EMDRW 8.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2043	The PLC waits for the data after the instruction EMDRW 8 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2044	The data is received by using the instruction EMDRW 8.	X	O	X	O	O	O	OFF	OFF	OFF	R/W	OFF
*SM2045	An error occurs when the instruction EMDRW 8 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2046	There is a timeout after the instruction EMDRW 8 is used.	X	O	X	O	O	O	OFF	OFF	OFF	R	OFF
*SM2047	The connection is closed after the instruction EMDRW 8 is used.	X	O	X	O	O	O	ON	ON	ON	R	ON
SM2048 ↓ SM2079	Enable data mapping for Connection 1 via EtherNet/IP (scanner) ↓ Enable data mapping for Connection 32 via EtherNet/IP (scanner)	X	X	X	V2.00	O	X	OFF	–	–	R	OFF

SM	Function	CPU5X0-RS2	CPU5X0-EN	CPU5X1-RS2	CPU5X1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SM2080 ↓ SM2111	Enable data mapping for Connection 33 via EtherNet/IP (scanner) ↓ Enable data mapping for Connection 64 via EtherNet/IP (scanner)	X	X	X	V2. 00 *6	O	X	OFF	–	–	R	OFF
SM2112 ↓ SM2175	Enable data mapping for Connection 65 via EtherNet/IP (scanner) ↓ Enable data mapping for Connection 128 via EtherNet/IP (scanner)	X	X	X	V2. 00 *4	O	X	OFF	–	–	R	OFF
SM2176 ↓ SM2303	Enable data mapping for Connection 129 via EtherNet/IP (scanner) ↓ Enable data mapping for Connection 256 via EtherNet/IP (scanner)	X	X	X	V2. 00 *5	O	X	OFF	–	–	R	OFF
SM2304 ↓ SM2311	Error flag of EtherNet/IP I/O Connection 1 (adapter) ↓ Error flag of EtherNet/IP I/O Connection 8 (adapter)	X	X	X	V2. 04	V1. 10	X	OFF	–	–	R	OFF
SM2312 ↓ SM2319	Enable EtherNet/IP I/O Connection 1 (adapter) ↓ Enable EtherNet/IP I/O Connection 8 (adapter)	X	X	X	V2. 04	V1. 10	X	OFF	–	–	R	OFF

Note: As to the SM numbers marked “*”, users can refer to the additional remarks on special auxiliary relays/special data registers.

*1：Only available for AHCPU530-EN, AHCPU520-EN and AHCPU510-EN

*2：Only available for AHCPU530-EN and AHCPU520-EN

*3：Only available for AHCPU530-EN

*4：Only available for AHCPU531-EN and AHCPU521-EN

*5：Only available for AHCPU531-EN

*6：Only available for AHCPU531-EN, AHCPU521-EN and AHCPU511-EN

2.2.8 Refresh Time of Special Auxiliary Relays

Limited to	Special auxiliary relay	Refresh time
	SM0~SM1	The system automatically sets the flag to ON and resets it to OFF. The flag is automatically set to ON when there is an operation error.
	SM5	The system automatically sets SM5 to ON and resets it to OFF. (1) SM5 is refreshed when the program is rewritten in the PLC. (2) SM5 is refreshed when the PLC is supplied with power and starts to run for the first time.
	SM8	The system automatically sets SM8 to ON and resets it to OFF. SM8 is automatically set to ON when there is a watchdog timer error.
	SM9	The system automatically sets SM9 to ON and resets it to OFF. SM9 is automatically set to ON when there is a system error.
	SM10	The system automatically sets SM10 to ON and resets it to OFF. SM10 is automatically set to ON when there is an I/O bus error.
	SM20	Power supply is back to normal after a short break of insufficient internal power supply.
	SM22, SM23, SM24	Users set the flag to ON, and the system automatically resets it to OFF. The log is cleared when the flag is ON.
	SM25~SM26	The system automatically sets the flag to ON and resets it to OFF. The flag is refreshed every scan cycle.
	SM96~SM97	Users set the flag to ON. After the data is sent, the system automatically resets the flag to OFF.
	SM98~SM99	The system automatically sets the flag to ON and resets it to OFF. The flag is automatically set to ON when the command is sent.
	SM100~SM101	The system automatically sets the flag to ON, and users reset it to OFF. The flag is set to ON when the command is received.
	SM102~SM103	The system automatically sets the flag to ON, and users reset it to OFF. The flag is automatically set to ON when the command received is wrong.
	SM104~SM105	The system automatically sets the flag to ON, and users reset it to OFF. The flag is set to ON when there is a receive timeout.
	SM106~SM107	Users set the flag to ON and reset it to OFF. ON: The 8-bit mode OFF: The 16-bit mode
	SM108, SM109	Users set the flag to ON and reset it to OFF.
	SM204~SM205	Users set the flag to ON, and the system automatically resets it to OFF. ON: Clearing the non-latched/latched areas
	SM206	Users set SM206 to ON and reset it to OFF. ON: Inhibiting all output
	SM209	Users set SM209 to ON, and the system automatically resets it to OFF. ON: The communication protocol of COM1 changes.
	SM210	Users set SM210 to ON and reset it to OFF. ON: The RTU mode

Limited to	Special auxiliary relay	Refresh time
	SM211	Users set SM211 to ON, and the system automatically resets it to OFF. ON: The communication protocol of COM2 changes.
	SM212	Users set SM212 to ON and reset it to OFF. ON: The RTU mode
	SM215	Users set SM215 to ON and reset it to OFF. ON: The PLC runs.
	SM220	Users set SM220 to ON and reset it to OFF. ON: Calibrating the real-time clock within ±30 seconds
	SM400~SM401	The system automatically sets the flag to ON and resets it to OFF when CPU runs. The flag is refreshed every scan cycle.
	SM402~SM403	The system automatically sets the flag to ON and resets it to OFF when CPU runs. The flag is refreshed whenever the instruction END is executed.
	SM404	The system automatically sets the flag to ON and resets it to OFF. SM404 is refreshed every 5 milliseconds.
	SM405	The system automatically sets SM405 to ON and resets it to OFF. SM405 is refreshed every 50 milliseconds.
	SM406	The system automatically sets SM406 to ON and resets it to OFF. SM406 is refreshed every 100 milliseconds.
	SM407	The system automatically sets SM407 to ON and resets it to OFF. SM407 is refreshed every 500 seconds.
	SM408	The system automatically sets SM408 to ON and resets it to OFF. SM408 is refreshed every second.
	SM409	The system automatically sets SM409 to ON and resets it to OFF. SM409 is refreshed every n seconds, n is specified by SR409.
	SM410	The system automatically sets SM410 to ON and resets it to OFF. SM410 is refreshed every n seconds, and n is specified by SR410.
	SM418	The system automatically sets the flag to ON and resets it to OFF.
	SM420-SM431	The system automatically sets the flag to ON and resets it to OFF.
	SM450	The system automatically sets SM450 to ON and resets it to OFF. ON: The memory card is inserted into the PLC.
	SM451	Users set SM451 to ON and reset it to OFF. ON: The memory card is write protected.
	SM452	The system automatically sets SM452 to ON and resets it to OFF. ON: The data in the memory card is being accessed.
	SM453	The system automatically sets SM453 to ON and resets it to OFF. ON: An error occurs during the operation of the memory card.
	SM454	Users set the flag to ON and resets it to OFF.
	SM455	The system automatically sets the flag to ON and resets it to OFF.
	SM456	Users setss the flag to ON to save and then the system automatically resets it to OFF.
	SM457	The system automatically sets the flag to ON and resets it to OFF.
	SM600~SM602	The system automatically sets the flag to ON and resets it to OFF. The flag is refreshed when the instruction is executed.
	SM604	Users set SM604 to ON and reset it to OFF. SM604 is refreshed when the instruction SORT whose mode is the descending order is executed.
	SM605	Users set SM605 to ON and reset it to OFF.

Limited to	Special auxiliary relay	Refresh time
	SM606	Users set SM606 to ON and reset it to OFF. ON: The 8-bit mode
	SM607	Users set SM607 to ON or OFF.
	SM608	SM608 is refreshed when the instruction is executed.
	SM609	Users set the flag to ON or OFF.
	SM610~SM611	The flag is refreshed when the instruction is executed.
	SM612~SM613	Users set the flag to ON or OFF.
	SM614	SM614 is refreshed when the instruction is executed.
	SM615~SM617	Users set the flag to ON or OFF.
	SM618	SM618 is refreshed when the instruction is executed.
	SM619	SM619 is refreshed when EI or DI is executed.
	SM620	SM620 is refreshed when the instruction CMPT is executed.
	SM621~SM686	Users set the flag to ON or OFF.
	SM687	SM687 is refreshed when the instruction RAMP is executed.
	SM688	SM688 is refreshed when the instruction INCD is executed.
	SM690~SM691	Users set the flag to ON or OFF.
	SM692	SM692 is refreshed when the instruction HKY is executed.
	SM693	SM693 is refreshed when the instruction SEGL is executed.
	SM694	SM694 is refreshed when the instruction DSW is executed.
	SM695	Users set the flag to ON or OFF.
AH5×0	SM699	1. The flag is refreshed after the Ether link parameters/data exchange parameters are downloaded. 2. The flag is refreshed after the system restoration is executed.
AH5×1		1. The flag is refreshed after the Modbus TCP data exchange table is downloaded. 2. The flag is refreshed after the system restoration is executed.
AH5×0	SM700-SM827	1. The flag is refreshed after the data exchange parameters are downloaded. 2. The flag is refreshed every scan cycle.
AH5×1		Users set the flag to ON or OFF.
	SM828-SM955	1. The flag is refreshed after the data exchange parameters are downloaded. 2. The flag is refreshed every scan cycle.
	SM1000~1003	Users set the flag to ON or OFF.
	SM1089	The flag is refreshed every scan cycle.
	SM1090	SM1090 is ON when the TCP connection is busy.
	SM1091	SM1091 is ON when the UDP connection is busy.
	SM1100	The flag is refreshed when API 2200/API 2201/API 2202/API 2203/API 2204/API 2205 is executed or the network cable is reconnected.
	SM1106	SM1106 is ON when the PHY initialization fails.
	SM1107	SM1107 is ON when the IP address, the netmask address, and the gateway address are set incorrectly.
	SM1108	SM1108 is ON when there is a filter setting error.
	SM1109	SM1109 is ON when the function of the socket is enabled and the same port is used.
	SM1112	SM1112 is ON when there is a setting error.
	SM1113	SM1113 is ON when there is a server error.
	SM1116	SM1116 is ON when the trigger of the PLC parameter is enabled.
	SM1117	SM1117 is ON when the trigger of the PLC parameter is triggered.
	SM1118	SM1118 is ON when the trigger is enabled and no mail has been sent.

Limited to	Special auxiliary relay	Refresh time
	SM1119	SM1119 is ON when the trigger is enabled and the last mail has been sent successfully.
	SM1120	SM1120 is ON when the trigger is enabled and the last mail has been sent in error.
	SM1121	SM1121 is ON when the trigger is enabled and the mail has been sent.
	SM1122	SM1122 is ON when the trigger is enabled and there is an SMTP server response timeout.
	SM1123	SM1123 is ON when the trigger is enabled and there is an SMTP server response error.
	SM1124	SM1124 is ON when the trigger is enabled and the size of the attachment exceeds the limit.
	SM1125	SM1125 is ON when the trigger is enabled and the attachment is not found.
	SM1126	SM1126 is ON when the trigger of the PLC parameter is enabled.
	SM1127	SM1127 is ON when the trigger of the PLC parameter is triggered.
	SM1128	SM1128 is ON when the trigger is enabled and no mail has been sent.
	SM1129	SM1129 is ON when the trigger is enabled and the last mail has been sent successfully.
	SM1130	SM1130 is ON when the trigger is enabled and the last mail has been sent in error.
	SM1131	SM1131 is ON when the trigger is enabled and the mail has been sent.
	SM1132	SM1132 is ON when the trigger is enabled and there is an SMTP server response timeout.
	SM1133	SM1133 is ON when the trigger is enabled and there is an SMTP server response error.
	SM1134	SM1134 is ON when the trigger is enabled and the size of the attachment exceeds the limit.
	SM1135	SM1135 is ON when the trigger is enabled and the attachment is not found.
	SM1136	SM1136 is ON when the trigger of the PLC parameter is enabled.
	SM1137	SM1137 is ON when the trigger of the PLC parameter is triggered.
	SM1138	SM1138 is ON when the trigger is enabled and no mail has been sent.
	SM1139	SM1139 is ON when the trigger is enabled and the last mail has been sent successfully.
	SM1140	SM1140 is ON when the trigger is enabled and the last mail has been sent in error.
	SM1141	SM1141 is ON when the trigger is enabled and the mail has been sent.
	SM1142	SM1142 is ON when the trigger is enabled and there is an SMTP server response timeout.
	SM1143	SM1143 is ON when the trigger is enabled and there is an SMTP server response error.
	SM1144	SM1144 is ON when the trigger is enabled and the size of the attachment exceeds the limit.
	SM1145	SM1145 is ON when the trigger is enabled and the attachment is not found.
	SM1146	SM1146 is ON when the trigger of the PLC parameter is enabled.
	SM1147	SM1147 is ON when the trigger of the PLC parameter is triggered.

Limited to	Special auxiliary relay	Refresh time
	SM1148	SM1148 is ON when the trigger is enabled and no mail has been sent.
	SM1149	SM1149 is ON when the trigger is enabled and the last mail has been sent successfully.
	SM1150	SM1150 is ON when the trigger is enabled and the last mail has been sent in error.
	SM1151	SM1151 is ON when the trigger is enabled and the mail has been sent.
	SM1152	SM1152 is ON when the trigger is enabled and there is an SMTP server response timeout.
	SM1153	SM1153 is ON when the trigger is enabled and there is an SMTP server response error.
	SM1154	SM1154 is ON when the trigger is enabled and the size of the attachment exceeds the limit.
	SM1155	SM1155 is ON when the trigger is enabled and the attachment is not found.
	SM1156	SM1156 is ON when the trigger of the PLC parameter is enabled.
	SM1157	SM1157 is ON when the trigger of the PLC parameter is triggered.
	SM1158	SM1158 is ON when the trigger is enabled and no mail has been sent.
	SM1159	SM1159 is ON when the trigger is enabled and the last mail has been sent successfully.
	SM1160	SM1160 is ON when the trigger is enabled and the last mail has been sent in error.
	SM1161	SM1161 is ON when the trigger is enabled and the mail has been sent.
	SM1162	SM1162 is ON when the trigger is enabled and there is an SMTP server response timeout.
	SM1163	SM1163 is ON when the trigger is enabled and there is an SMTP server response error.
	SM1164	SM1164 is ON when the trigger is enabled and the size of the attachment exceeds the limit.
	SM1165	SM1165 is ON when the trigger is enabled and the attachment is not found.
	SM1166	SM1166 is ON when the trigger of the PLC parameter is enabled.
	SM1167	SM1167 is ON when the trigger of the PLC parameter is triggered.
	SM1168	SM1168 is ON when the trigger is enabled and no mail has been sent.
	SM1169	SM1169 is ON when the trigger is enabled and the last mail has been sent successfully.
	SM1170	SM1170 is ON when the trigger is enabled and the last mail has been sent in error.
	SM1171	SM1171 is ON when the trigger is enabled and the mail has been sent.
	SM1172	SM1172 is ON when the trigger is enabled and there is an SMTP server response timeout.
	SM1173	SM1173 is ON when the trigger is enabled and there is an SMTP server response error.
	SM1174	SM1174 is ON when the trigger is enabled and the size of the attachment exceeds the limit.
	SM1175	SM1175 is ON when the trigger is enabled and the attachment is not found.

Limited to	Special auxiliary relay	Refresh time
	SM1176	SM1176 is ON when the trigger of the PLC parameter is enabled.
	SM1177	SM1177 is ON when the trigger of the PLC parameter is triggered.
	SM1178	SM1178 is ON when the trigger is enabled and no mail has been sent.
	SM1179	SM1179 is ON when the trigger is enabled and the last mail has been sent successfully.
	SM1180	SM1180 is ON when the trigger is enabled and the last mail has been sent in error.
	SM1181	SM1181 is ON when the trigger is enabled and the mail has been sent.
	SM1182	SM1182 is ON when the trigger is enabled and there is an SMTP server response timeout.
	SM1183	SM1183 is ON when the trigger is enabled and there is an SMTP server response error.
	SM1184	SM1184 is ON when the trigger is enabled and the size of the attachment exceeds the limit.
	SM1185	SM1185 is ON when the trigger is enabled and the attachment is not found.
	SM1186	SM1186 is ON when the trigger of the PLC parameter is enabled.
	SM1187	SM1187 is ON when the trigger of the PLC parameter is triggered.
	SM1188	SM1188 is ON when the trigger is enabled and no mail has been sent.
	SM1189	SM1189 is ON when the trigger is enabled and the last mail has been sent successfully.
	SM1190	SM1190 is ON when the trigger is enabled and the last mail has been sent in error.
	SM1191	SM1191 is ON when the trigger is enabled and the mail has been sent.
	SM1192	SM1192 is ON when the trigger is enabled and there is an SMTP server response timeout.
	SM1193	SM1193 is ON when the trigger is enabled and there is an SMTP server response error.
	SM1194	SM1194 is ON when the trigger is enabled and the size of the attachment exceeds the limit.
	SM1195	SM1195 is ON when the trigger is enabled and the attachment is not found.
	SM1196	SM1196 is ON when there is a socket configuration error.
	SM1270 ↓ SM1373	The flag is refreshed when the socket function is executed.
	SM1374 ↓ SM1390	Users set the flag to ON and reset it to OFF.
AH5×0	SM1392 ↓ SM1423	Users set the flag to ON and reset it to OFF.
AH5×1		Users set the flag to ON and reset it to OFF.
AH5×0	SM1424 ↓ SM1455	Data exchange connection 1 via PLC Link is executing. (Data exchange connection 1) ↓ Data exchange connection 1 via PLC Link is executing. (Data exchange connection 32)

Limited to	Special auxiliary relay	Refresh time
AH5×1		Modbus data exchange connection 1 via COM1 is executing. (Data exchange connection 1) ↓ Modbus data exchange connection 1 via COM1 is executing. (Data exchange connection 32)
AH5×0	SM1456 ↓ SM1487	A Modbus error occurs while reading data via PLC Link. (Data exchange connection 1) ↓ A Modbus error occurs while reading data via PLC Link. (Data exchange connection 32)
AH5×1		A Modbus error occurs while reading data via COM1. (Data exchange connection 1) ↓ A Modbus error occurs while reading data via COM1. (Data exchange connection 32)
AH5×0	SM1488 ↓ SM1519	An error occurs while writing data via PLC Link. (Data exchange connection 1) ↓ An error occurs while writing data via PLC Link. (Data exchange connection 32)
AH5×1		A Modbus error occurs while writing data via COM1. (Data exchange connection 1) ↓ A Modbus error occurs while writing data via COM1. (Data exchange connection 32)
AH5×0	SM1520 ↓ SM1551	Data reading via PLC Link is complete. (Data exchange connection 1) ↓ Data reading via PLC Link is complete. (Data exchange connection 32)
AH5×1		Modbus data reading via COM1 is complete. (Data exchange connection 1) ↓ Modbus data reading via COM1 is complete. (Data exchange connection 32)
AH5×0	SM1552 ↓ SM1583	Data writing via PLC Link is complete. (Data exchange connection 1) ↓ Data writing via PLC Link is complete. (Data exchange connection 32)
AH5×1		Modbus data writing via COM1 is complete. (Data exchange connection 1) ↓ Modbus data writing via COM1 is complete. (Data exchange connection 32)
	SM1584~SM1587	Users set the flag ON and reset it OFF.
	SM1588	SM1588 is ON when the master detects the slaves.
	SM1589	SM1589 is ON when an error occurs.
	SM1590	SM1590 is ON when there is a device address error.
	SM1591	SM1591 is ON when there is a timeout.
	SM1592	SM1592 is ON when the number of polling cycles is incorrect.
	SM1593~SM1595	Users set the flag to ON and reset it to OFF.

Limited to	Special auxiliary relay	Refresh time
AH5×0	SM1596	SM1596 is ON when there is an operation error in the PLC Link
AH5×1		SM1596 is ON when the COM1-Modbus connection is enabled and an error occurs.
	SM1597~SM11630	Users set the flag to ON and reset it to OFF.
	SM1720~SM1751	Users set the flag to ON and reset it to OFF.
AH5×0	SM1769	SM1769 is ON when there is an error in the Ether Link.
AH5×1		The flag is refreshed every scan cycle.
AH5×0	SM1770	Users set the flag ON and reset it OFF.
AH5×1		The flag is refreshed every scan cycle.
	SM1771	Users set the flag to ON and reset it to OFF.
AH5×0	SM1772~SM1788	Users set the flag ON and reset it OFF.
AH5×1		The flag is refreshed every scan cycle.
	SM1789	The flag is refreshed every scan cycle.
AH5×0	SM1790~SM1805	The flag is ON when an error occurs in the corresponding communication port.
AH5×1		The flag is refreshed every scan cycle.
AH5×0	SM1806	The flag is ON when the Ether Link function of the corresponding communication port is enabled.
AH5×1		The flag is refreshed every scan cycle.
	SM1807	The flag is refreshed every scan cycle.
AH5×0	SM1808~SM1823	The flag is ON when the Ether Link function of the corresponding communication port is enabled.
AH5×1		The flag is refreshed every scan cycle.
	SM1824~SM1911	The flag is refreshed every scan cycle.
AH5×0	SM1912	The flag is refreshed every scan cycle.
AH5×1		Users set the flag ON and reset it OFF.
	SM1913~SM1951	The flag is refreshed every scan cycle.
	SM2000	User define. The flag is refreshed, after the transmission is done.
	SM2001	The flag is refreshed when the instruction EMDRW is executed.
	SM2002	The flag is refreshed when the instruction EMDRW is executed.
	SM2003	The flag is refreshed when the instruction EMDRW is executed and an error occurs.
	SM2004	The flag is refreshed when the instruction EMDRW is executed and there is a response timeout.
	SM2005	The flag is refreshed when the instruction EMDRW is executed.
	SM2006	User define. The flag is refreshed, after the transmission is done.
	SM2007	The flag is refreshed when the instruction EMDRW is executed.
	SM2008	The flag is refreshed when the instruction EMDRW is executed.
	SM2009	The flag is refreshed when the instruction EMDRW is executed and an error occurs.
	SM2010	The flag is refreshed when the instruction EMDRW is executed and there is a response timeout.
	SM2011	The flag is refreshed when the instruction EMDRW is executed.
	SM2012	User define. The flag is refreshed, after the transmission is done.
	SM2013	The flag is refreshed when the instruction EMDRW is executed.
	SM2014	The flag is refreshed when the instruction EMDRW is executed.
	SM2015	The flag is refreshed when the instruction EMDRW is executed and an error occurs.
	SM2016	The flag is refreshed when the instruction EMDRW is executed and there is a response timeout.

Limited to	Special auxiliary relay	Refresh time
	SM2017	The flag is refreshed when the instruction EMDRW is executed.
	SM2018	User define. The flag is refreshed, after the transmission is done.
	SM2019	The flag is refreshed when the instruction EMDRW is executed.
	SM2020	The flag is refreshed when the instruction EMDRW is executed.
	SM2021	The flag is refreshed when the instruction EMDRW is executed and an error occurs.
	SM2022	The flag is refreshed when the instruction EMDRW is executed and there is a response timeout.
	SM2023	The flag is refreshed when the instruction EMDRW is executed.
	SM2024	User define. The flag is refreshed, after the transmission is done.
	SM2025	The flag is refreshed when the instruction EMDRW is executed.
	SM2026	The flag is refreshed when the instruction EMDRW is executed.
	SM2027	The flag is refreshed when the instruction EMDRW is executed and an error occurs.
	SM2028	The flag is refreshed when the instruction EMDRW is executed and there is a response timeout.
	SM2029	The flag is refreshed when the instruction EMDRW is executed.
	SM2030	User define. The flag is refreshed, after the transmission is done.
	SM2031~SM2032	The flag is refreshed when the instruction EMDRW is executed.
	SM2033	SM2033 is refreshed when the instruction EMDRW is executed and an error occurs.
	SM2034	SM2034 is refreshed when the instruction EMDRW is executed and there is a response timeout.
	SM2035	The flag is refreshed when the instruction EMDRW is executed.
	SM2036	User define. The flag is refreshed, after the transmission is done.
	SM2037	The flag is refreshed when the instruction EMDRW is executed.
	SM2038	The flag is refreshed when the instruction EMDRW is executed.
	SM2039	The flag is refreshed when the instruction EMDRW is executed and an error occurs.
	SM2040	The flag is refreshed when the instruction EMDRW is executed and there is a response timeout.
	SM2041	The flag is refreshed when the instruction EMDRW is executed.
	SM2042	User define. The flag is refreshed, after the transmission is done.
	SM2043	The flag is refreshed when the instruction EMDRW is executed.
	SM2044	The flag is refreshed when the instruction EMDRW is executed.
	SM2045	The flag is refreshed when the instruction EMDRW is executed and an error occurs.
	SM2046	The flag is refreshed when the instruction EMDRW is executed and there is a response timeout.
	SM2047	The flag is refreshed when the instruction EMDRW is executed.
	SM2048 ↓ SM2319	The flag is refreshed every scan cycle.

Note: The models AH5×0 and AH5×1 shown in the column of “Limited to” refer to AHCPU500/510/520/530 and AHCPU501/511/521/531 respectively.

2.2.9 Stepping Relays

The function of the stepping relay:

The stepping relay can be easily used in the industrial automation to set the procedure. It is the most basic device in the sequential function chart (SFC). Please refer to ISPSoft User Manual for more information related to sequential function charts.

There are 2048 stepping relays, i.e. S0~S2047. Every stepping relay is like an output relay in that it has an output coil, contact A, and contact B. It can be used several times in the program, but it can not directly drive the external load. Besides, the stepping relay can be used as a general auxiliary relay when it is not used in the sequential function chart.

2.2.10 Timers

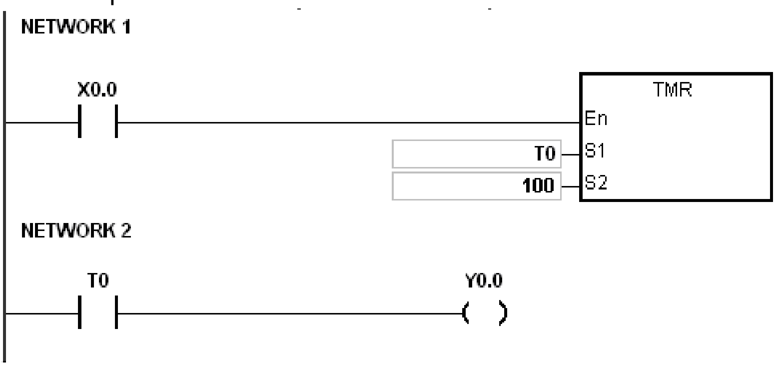
1. 100 millisecond timer: The timer specified by the instruction TMR takes 100 milliseconds as the timing unit.
2. 1 millisecond timer: The timer specified by the instruction TMRH takes 1 millisecond as the timing unit.
3. The timers for the subroutine's exclusive use are T1920~T2047.
4. The accumulative timers are ST0~ST2047. If users want to use the device-monitoring function, they can monitor T0~T2047.
5. If the same timer is used repeatedly in the program, including in different instructions TMR and TMRH, the setting value is the one that the value of the timer matches first.
6. If the same timer is used repeatedly in the program, it is OFF when one of the conditional contacts is OFF.
7. If the same timer is used repeatedly in the program as the timer for the subroutine's exclusive use and the accumulative timer in the program, it is OFF when one of the conditional contacts is OFF.
8. When the timer is switched from ON to OFF and the conditional contact is ON, the timer is reset and counts again.
9. When the instruction TMR is executed, the specified timer coil is ON and the timer begins to count. As the value of the timer matches the setting value, the state of the contact is as follows.

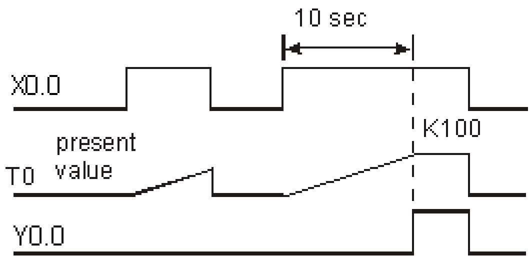
Normally open (NO) contact	ON
Normally closed (NC) contact	OFF

A. The general-purpose timer

When the instruction TMR is executed, the general-purpose timer begins to count. As the value of the timer matches the setting value, the output coil is ON.

- When X0.0 is ON, the timer T0 takes 100 milliseconds as the timing unit and counts up. As the current value of the timer matches the setting value 100, the output coil of T0 is ON.
- When X0.0 is OFF or there is a power cut, the current value of the timer is reset to 0 and the output coil is switched OFF.

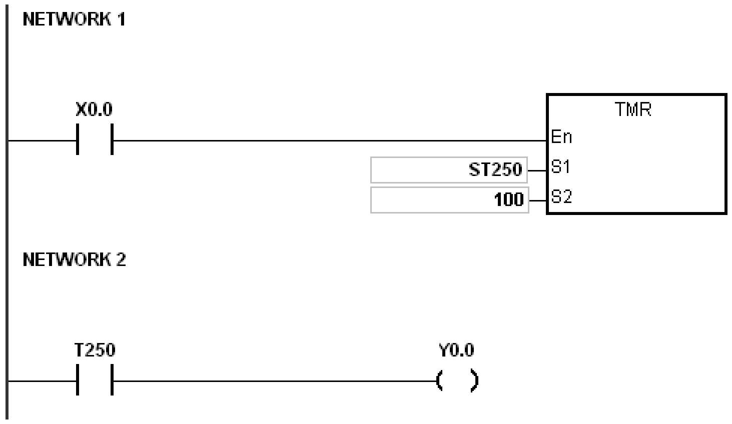


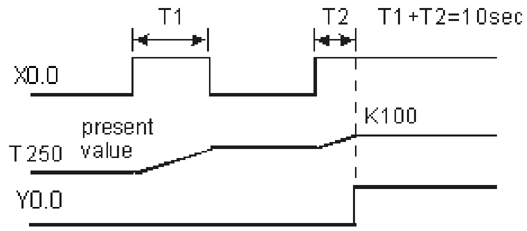


B. The accumulative timer

When the instruction TMR is executed, the accumulative timer begins to count. As the value of the timer matches the setting value, the output coil is ON. As long as users add the letter S in front of the letter T, the timer becomes the accumulative timer. When the conditional contact is OFF, the value of the accumulative timer is not reset. When the conditional contact is ON, the timer counts from the current value.

- When X0.0 is ON, the timer T250 takes 100 milliseconds as the timing unit and counts up. As the current value of the timer matches the setting value 100, the output coil of T250 is ON.
- When X0.0 is OFF, the timer T250 stops counting and the current value of the timer remains unchanged. Not until X0.0 is switched ON will the timer counts again. When the timer counts up from the current value to the setting value 100, the output coil of T250 is ON.





C. The timer used in the function block

T1920~T2047 are the timers which users can use in the functional block or the interrupt. When the instruction TMR or END is executed, the timer used in the functional block begins to count. As the value of the timer matches the setting value, the output coil is ON.

If the general-purpose timer is used in the functional block or the interrupt, and the functional is not executed, the timer can not count correctly.

2.2.11 Counters

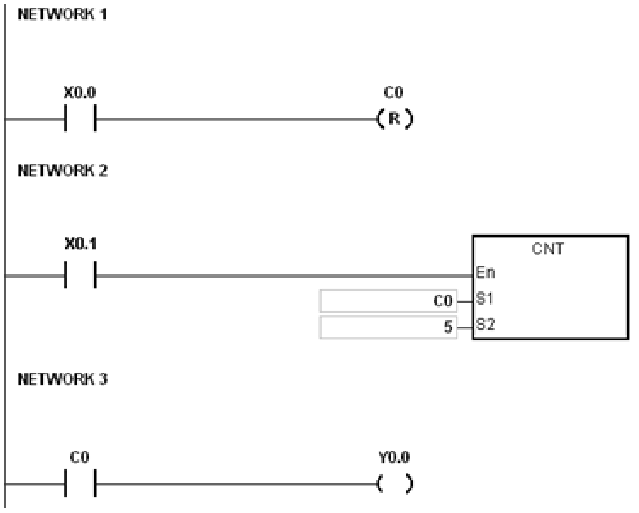
The characteristics of the 16-bit counter:

Item	16-bit counter
Type	General type
Number	C0~C2047
Direction	Counting up
Setting value	0~32,767
Specification of the setting value	The setting value can be either the constant or the value in the data register.
Change of the current value	The counter stops counting when the value of the counter matches the setting value.
Output contact	The contact is ON when the value of the counter matches the setting value.
Reset	When the instruction RST is executed, the current value is cleared to zero, and the contact is reset of OFF.
Action of the contact	After the scan is complete, the contact acts.

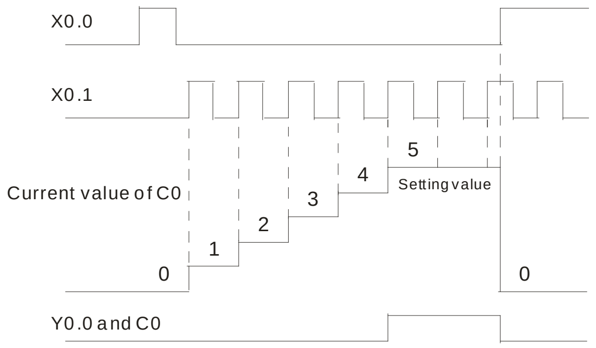
The function of the counter:
Each time the input switches from OFF to ON, the value of the counter increases by one increment. When the value of the counter matches the setting value, the output coil is ON. Users can use either the decimal constant or the value in the data register as the setting value.
The 16-bit counter:

1. Setting range: 0~32,767 (The setting values 0 and 1 mean the same thing in that the output contact is ON when the counter counts for the first time.)
2. For the general-purpose counter, the current value of the counter is cleared when there is a power cut. If the counter is the latched one, the current value of the counter and the state of the contact before the power cut will be retained. The latched counter counts from the current value when the power supply is restored.
3. If users use the instruction MOV or ISPSoft to transmit a value bigger than the setting value to the current value register C0, the contact of the counter C0 will be ON and the current value will become the same as the setting value next time ×0.1 is switched from OFF to ON.
4. Users can use either the constant or the value in the register as the setting value of the counter.
5. The setting value of the counter can be a positive or a negative. If the counter counts up from 32,767, the next current value becomes -32,768.

Example:



1. When X0.0 is ON, the instruction RST is executed, the current value of the counter C0 is cleared to zero, and the output contact is reset to OFF.
2. If ×0.1 is switched from OFF to ON, the counter will count up, i.e. the current value will increase by one.
3. When the current value of the counter C0 matches the setting value 5, the contact of C0 is ON. Even if ×0.1 is still triggered, C0 does not accept the trigger signal, and the current value remains 5.



2.2.12 32-bit Counters

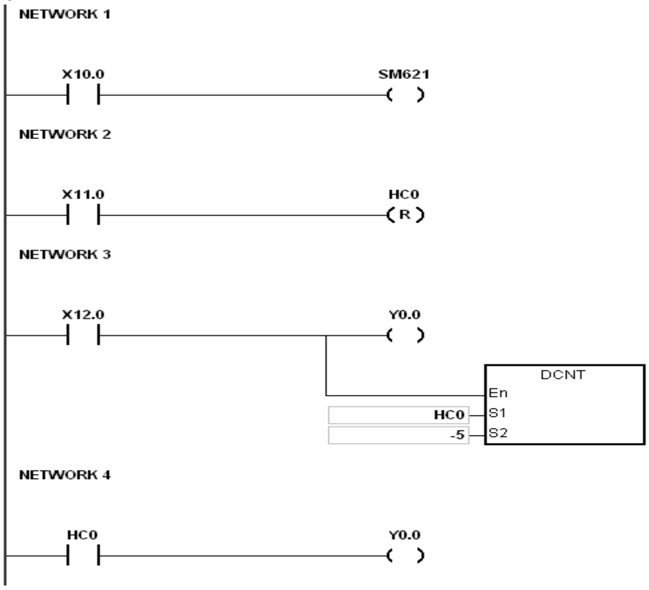
The characteristics of the 32-bit counter:

Item	32-bit counter
Type	General type
Number	HC0~HC63
Direction	Counting up/down
setting value	-2,147,483,648~+2,147,483,647
Specification of the setting value	The setting value can be either the constant or the value occupying two data registers.
Change of the current value	The counter keeps counting after the value of the counter matches the setting value.
Output contact	The contact is ON when the value of the addition counter matches the setting value. The contact is reset to OFF when the value of the subtraction counter matches the setting value.
Reset	When the instruction RST is executed, the current value is cleared to zero, and the contact is reset of OFF.
Action of the contact	After the scan is complete, the contact acts.

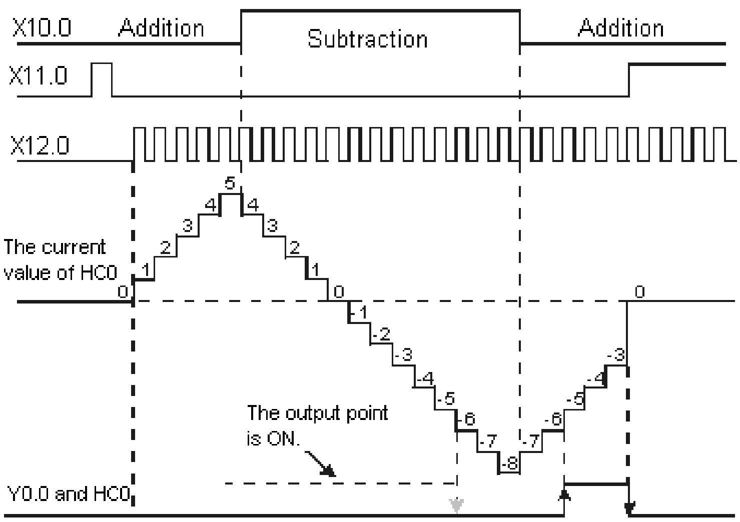
The 32-bit general-purpose addition/subtraction counter:

1. Setting range: -2,147,483,648~2,147,483,647
2. The switch between the 32-bit general-purpose addition counters and the 32-bit general-purpose subtraction counters depends on the states of the special auxiliary relays SM621~SM684. For example, the counter HC0 is the addition counter when SM621 is OFF, whereas HC0 is the subtraction counter when SM621 is ON.
3. Users can use either the constant or the value in the data registers as the setting value of the counter, and the setting value can be a positive or a negative. If users use the value in the data registers as the setting value of the counter, the setting value occupies two consecutive registers.
4. For the general-purpose counter, the current value of the counter is cleared when there is a power cut. If the counter is the latched one, the current value of the counter and the state of the contact before the power cut will be retained. The latched counter counts from the current value when the power supply is restored.
5. If the counter counts up from 2,147,483,647, the next current value becomes -2,147,483,648. If the counter counts down from -2,147,483,648, the next current value becomes 2,147,483,647.

Example:



1. ×10.0 drives S621 to determine whether the counter HC0 is the addition counter or the subtraction counter.
2. When ×11.0 is switched from OFF to ON, the instruction RST is executed, the current value of the counter HC0 is cleared to zero, and the contact is switched OFF.
3. When ×12.0 is switched from OFF to ON, the current value of the counter increases or decreases by one.
4. When the current value of the counter HC0 changes from -6 to -5, the contact of HC0 is switched from OFF to ON. When the current value of the counter HC0 changes from -5 to -6, the contact of HC0 is switched from ON to OFF.
5. If users use the instruction MOV or ISPSoft to transmit a value bigger than the setting value to the current value register HC0, the contact of the counter HC0 will be ON and the current value will become the same as the setting value next time ×12.0 is switched from OFF to ON.



2.2.13 Data Registers

The data register stores the 16-bit data. The highest bit represents either a positive sign or a negative sign, and the values which can be stored in the data registers range from -32,768 to +32,767. Two 16-bit registers can be combined into a 32-bit register, i.e. (D+1, D) in which the register whose number is smaller represents the low 16 bits. The highest bit represents either a positive sign or a negative sign, and the values which can be stored in the data registers range from -2,147,483,648 to +2,147,483,647. Besides, four 16-bit registers can be combined into a 64-bit register, i.e. (D+3, D+2, D+1, D) in which the register whose number is smaller represents the lower 16 bits. The highest bit represents either a positive sign or a negative sign, and the values which can be stored in the data registers range from -9,223,372,036,854,776 to +9,223,372,036,854,775,807. The data registers also can be used to refresh the values in the control registers in the modules other than digital I/O modules. Please refer to ISPSoft User Manual for more information regarding refreshing the values in the control registers.

The registers can be classified into two types according to their properties:

1. General-purpose register: If the PLC begins to run, or is disconnected, the value in the register will be cleared to zero. If users want to retain the data when the PLC begins to RUN, they can refer to ISPSoft User Manual for more information. Please notice that the value will still be cleared to zero if the PLC is disconnected.
2. Latched register: If the PLC is disconnected, the data in the latched register will not be cleared. In other words, the value before the disconnection is still retained. If users want to clear the data in the latched area, they can use RST or ZRST.

2.2.14 Special Data Registers

Every special data register has its definition and specific function. The system statuses and the error messages are stored in the special data registers. Besides, the special data registers can be used to monitor the system statuses. The special data registers and their functions are listed as follows. As to the SR numbers marked "*", users can refer to the additional remarks on special auxiliary relays/special data registers. The "R" in the attribute column indicates that the special data register can read the data, whereas the "R/W" in the attribute column indicates that it can read and write the data. In addition, the mark "–" indicates that the status of the special data register does not make any change. The mark "#" indicates that the system will be set according to the status of the PLC, and users can read the setting value and refer to the related manual for more information.

SR	Function	CPU5x0-RS2	CPU5x0-EN	CPU5x1-RS2	CPU5x1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SR0	Error-detecting code of the PLC operation error	○	○	○	○	○	○	0	0	–	R	0
SR1 ↓ SR2	The address of the operation error is locked.	○	○	○	○	○	○	0	0	–	R	0
SR4	Error-detecting code of the grammar check error	○	○	○	○	○	○	0	0	–	R	0
SR5	Address of the instruction/operand check error	○	○	○	○	○	○	0	0	–	R	0
SR6	Step address at which the watchdog timer is ON	○	○	○	○	○	○	0	0	–	R	0
SR8		○	○	○	○	○	○	0	–	–	R	0
SR24 ↓ SR25	Data amount from the last cyclic synchronization (Kbyte)	×	×	×	×	○	×	0	–	–	R	0
SR26 ↓ SR27	Maximum synchronized data amount (Kbyte)	×	×	×	×	○	×	0	–	–	R	0
SR28 ↓ SR29	Noncyclic synchronization time (ms)	×	×	×	×	○	×	0	–	–	R	0
SR30 ↓ SR31	Cyclic synchronization time (ms)	×	×	×	×	○	×	0	–	–	R	0
*SR32	Status of the master power module	V1 .08	V1 .08	○	○	○	○	–	–	–	R	0
*SR33	Status of the standby power module	V1 .08	V1 .08	○	○	○	○	–	–	–	R	0
*SR40	Number of error logs	○	○	○	○	○	○	–	–	–	R	0
*SR41	Error log pointer	○	○	○	○	○	○	–	–	–	R	0
*SR42	Error log 1: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR43	Error log 1: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR44	Error log 1: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR45	Error log 1: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR46	Error log 1: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR47	Error log 1: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR48	Error log 2: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR49	Error log 2: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR50	Error log 2: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR51	Error log 2: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR52	Error log 2: The day and the hour	○	○	○	○	○	○	–	–	–	R	0

SR	Function	CPU5x0-RS2	CPU5x0-EN	CPU5x1-RS2	CPU5x1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR53	Error log 2: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR54	Error log 3: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR55	Error log 3: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR56	Error log 3: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR57	Error log 3: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR58	Error log 3: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR59	Error log 3: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR60	Error log 4: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR61	Error log 4: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR62	Error log 4: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR63	Error log 4: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR64	Error log 4: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR65	Error log 4: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR66	Error log 4: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
SR67	Error log 5: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
SR68	Error log 5: The module ID	○	○	○	○	○	○	–	–	–	R	0
SR69	Error log 5: The error code	○	○	○	○	○	○	–	–	–	R	0
SR70	Error log 5: The year and the month	○	○	○	○	○	○	–	–	–	R	0
SR71	Error log 5: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
SR72	Error log 6: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR73	Error log 6: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR74	Error log 6: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR75	Error log 6: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR76	Error log 6: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR77	Error log 6: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR78	Error log 7: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR79	Error log 7: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR80	Error log 7: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR81	Error log 7: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR82	Error log 7: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR83	Error log 7: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR84	Error log 8: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR85	Error log 8: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR86	Error log 8: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR87	Error log 8: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR88	Error log 8: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR89	Error log 8: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR90	Error log 9: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR91	Error log 9: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR92	Error log 9: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR93	Error log 9: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR94	Error log 9: The day and the hour	○	○	○	○	○	○	–	–	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR95	Error log 9: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR96	Error log 10: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR97	Error log 10: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR98	Error log 10: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR99	Error log 10: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR100	Error log 10: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR101	Error log 10: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR102	Error log 11: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR103	Error log 11: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR104	Error log 11: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR105	Error log 11: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR106	Error log 11: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR107	Error log 11: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR108	Error log 12: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR109	Error log 12: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR110	Error log 12: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR111	Error log 12: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR112	Error log 12: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR113	Error log 12: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR114	Error log 13: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR115	Error log 13: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR116	Error log 13: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR117	Error log 13: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR118	Error log 13: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR119	Error log 13: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR120	Error log 13: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR121	Error log 14: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR122	Error log 14: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR123	Error log 14: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR124	Error log 14: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR125	Error log 14: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR126	Error log 15: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR127	Error log 15: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR128	Error log 15: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR129	Error log 15: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR130	Error log 15: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR131	Error log 15: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR132	Error log 16: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR133	Error log 16: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR134	Error log 16: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR135	Error log 16: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR136	Error log 16: The day and the hour	○	○	○	○	○	○	–	–	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR137	Error log 16: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR138	Error log 17: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR139	Error log 17: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR140	Error log 17: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR141	Error log 17: The year and the month	○	○	○	○	○	○	–	–	–	R	0
SR142	Error log 17: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR143	Error log 17: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR144	Error log 18: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR145	Error log 18: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR146	Error log 18: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR147	Error log 18: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR148	Error log 18: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR149	Error log 18: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR150	Error log 19: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR151	Error log 19: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR152	Error log 19: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR153	Error log 19: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR154	Error log 19: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR155	Error log 19: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR156	Error log 20: The rack number and the slot number	○	○	○	○	○	○	–	–	–	R	0
*SR157	Error log 20: The module ID	○	○	○	○	○	○	–	–	–	R	0
*SR158	Error log 20: The error code	○	○	○	○	○	○	–	–	–	R	0
*SR159	Error log 20: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR160	Error log 20: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR161	Error log 20: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR201	Communication address of COM1	○	○	○	○	○	○	–	–	–	R/W	1
*SR202	Communication address of COM2	○	×	○	×	○	×	–	–	–	R/W	3
*SR209	Communication protocol of COM1	○	○	○	○	○	○	–	–	–	R/W	16#0024
*SR210	COM1 communication timeout	○	○	○	○	○	○	3000 ms	–	–	R/W	3000 ms
*SR211	Number of times the command is resent through COM1	○	○	○	○	○	○	–	–	–	R/W	3
*SR212	Communication protocol of COM2	○	×	○	×	○	×	–	–	–	R/W	16#0024
*SR213	COM2 communication timeout	○	×	○	×	○	×	3000 ms	–	–	R/W	3000 ms
*SR214	Number of times the command is resent through COM2	○	○	○	○	×	○	–	–	–	R/W	3
*SR215	Interface code of COM1	○	○	○	○	○	○	–	–	–	R/W	0
*SR216	Interface code of COM2	○	×	○	×	○	×	–	–	–	R/W	0
*SR220	Value of the year in the real-time clock (RTC): 00~99 (A.D.)	○	○	○	○	○	○	–	–	–	R	0
*SR221	Value of the month in the real-time clock (RTC): 01~12	○	○	○	○	×	○	–	–	–	R	1
*SR222	Value of the day in the real-time clock (RTC): 1~31	○	○	○	○	×	○	–	–	–	R	1

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR223	Value of the hour in the real-time clock (RTC): 00~23	○	○	○	○	×	○	–	–	–	R	0
*SR224	Value of the minute in the real-time clock (RTC): 00~59	○	○	○	○	○	○	–	–	–	R	0
*SR225	Value of the second in the real-time clock (RTC): 00~59	○	○	○	○	×	○	–	–	–	R	0
*SR226	Value of the week in the real-time clock (RTC): 1~7	○	○	○	○	○	○	–	–	–	R	1
*SR227	Number of download logs (The maximum number is 20.)	○	○	○	○	○	○	–	–	–	R	0
*SR228	Download log pointer	○	○	○	○	○	○	–	–	–	R	0
*SR229	Download log 1: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR230	Download log 1: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR231	Download log 1: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR232	Download log 1: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR233	Download log 2: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR234	Download log 2: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR235	Download log 2: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR236	Download log 2: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR237	Download log 3: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR238	Download log 3: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR239	Download log 3: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR240	Download log 3: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR241	Download log 4: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR242	Download log 4: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR243	Download log 4: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR244	Download log 4: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR245	Download log 5: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR246	Download log 5: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR247	Download log 5: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR248	Download log 5: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR249	Download log 6: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR250	Download log 6: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR251	Download log 6: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR252	Download log 6: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR253	Download log 7: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR254	Download log 7: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR255	Download log 7: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR256	Download log 7: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR257	Download log 8: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR258	Download log 8: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR259	Download log 8: The day and the hour	○	○	○	○	○	○	–	–	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR260	Download log 8: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR261	Download log 9: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR262	Download log 9: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR263	Download log 9: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR264	Download log 9: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR265	Download log 10: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR266	Download log 10: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR267	Download log 10: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR268	Download log 10: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR269	Download log 11: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR270	Download log 11: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR271	Download log 11: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR272	Download log 11: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR273	Download log 12: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR274	Download log 12: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR275	Download log 12: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR276	Download log 12: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR277	Download log 13: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR278	Download log 13: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR279	Download log 13: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR280	Download log 13: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR281	Download log 14: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR282	Download log 14: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR283	Download log 14: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR284	Download log 14: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR285	Download log 15: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR286	Download log 15: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR287	Download log 15: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR288	Download log 15: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR289	Download log 16: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR290	Download log 16: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR291	Download log 16: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR292	Download log 16: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR293	Download log 17: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR294	Download log 17: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR295	Download log 17: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR296	Download log 17: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR297	Download log 18: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR298	Download log 18: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR299	Download log 18: The day and the hour	○	○	○	○	○	○	–	–	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR300	Download log 18: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR301	Download log 19: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR302	Download log 19: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR303	Download log 19: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR304	Download log 19: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR305	Download log 20: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR306	Download log 20: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR307	Download log 20: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR308	Download log 20: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR309	Number of PLC status change logs (The maximum number is 20.)	○	○	○	○	○	○	–	–	–	R	0
*SR310	PLC status change log pointer	○	○	○	○	○	○	–	–	–	R	0
*SR311	PLC status change log 1: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR312	PLC status change log 1: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR313	PLC status change log 1: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR314	PLC status change log 1: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR315	PLC status change log 2: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR316	PLC status change log 2: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR317	PLC status change log 2: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR318	PLC status change log 2: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR319	PLC status change log 3: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR320	PLC status change log 3: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR321	PLC status change log 3: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR322	PLC status change log 3: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR323	PLC status change log 4: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR324	PLC status change log 4: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR325	PLC status change log 4: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR326	PLC status change log 4: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR327	PLC status change log 5: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR328	PLC status change log 5: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR329	PLC status change log 5: The day and the hour	○	○	○	○	○	○	–	–	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR330	PLC status change log 5: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR331	PLC status change log 6: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR332	PLC status change log 6: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR333	PLC status change log 6: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR334	PLC status change log 6: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR335	PLC status change log 7: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR336	PLC status change log 7: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR337	PLC status change log 7: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR338	PLC status change log 7: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR339	PLC status change log 8: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR340	PLC status change log 8: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR341	PLC status change log 8: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR342	PLC status change log 8: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR343	PLC status change log 9: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR344	PLC status change log 9: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR345	PLC status change log 9: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR346	PLC status change log 9: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR347	PLC status change log 10: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR348	PLC status change log 10: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR349	PLC status change log 10: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR350	PLC status change log 10: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR351	PLC status change log 11: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR352	PLC status change log 11: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR353	PLC status change log 11: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR354	PLC status change log 11: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR355	PLC status change log 12: The action number	○	○	○	○	○	○	–	–	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR356	PLC status change log 12: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR357	PLC status change log 12: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR358	PLC status change log 12: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR359	PLC status change log 13: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR360	PLC status change log 13: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR361	PLC status change log 13: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR362	PLC status change log 13: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR363	PLC status change log 14: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR364	PLC status change log 14: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR365	PLC status change log 14: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR366	PLC status change log 14: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR367	PLC status change log 15: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR368	PLC status change log 15: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR369	PLC status change log 15: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR370	PLC status change log 15: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR371	PLC status change log 16: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR372	PLC status change log 16: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR373	PLC status change log 16: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR374	PLC status change log 16: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR375	PLC status change log 17: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR376	PLC status change log 17: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR377	PLC status change log 17: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR378	PLC status change log 17: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR379	PLC status change log 18: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR380	PLC status change log 18: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR381	PLC status change log 18: The day and the hour	○	○	○	○	○	○	–	–	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR382	PLC status change log 18: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR383	PLC status change log 19: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR384	PLC status change log 19: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR385	PLC status change log 19: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR386	PLC status change log 19: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
*SR387	PLC status change log 20: The action number	○	○	○	○	○	○	–	–	–	R	0
*SR388	PLC status change log 20: The year and the month	○	○	○	○	○	○	–	–	–	R	0
*SR389	PLC status change log 20: The day and the hour	○	○	○	○	○	○	–	–	–	R	0
*SR390	PLC status change log 20: The minute and the second	○	○	○	○	○	○	–	–	–	R	0
SR391	Value of the year in the real-time clock (RTC): 00~99 (A.D.)	○	○	○	○	○	○	–	–	–	R	0
SR392	Value of the month in the real-time clock (RTC): 01~12	○	○	○	○	○	○	–	–	–	R	1
SR393	Value of the day in the real-time clock (RTC): 1~31	○	○	○	○	○	○	–	–	–	R	1
SR394	Value of the hour in the real-time clock (RTC): 00~23	○	○	○	○	○	○	–	–	–	R	0
SR395	Value of the minute in the real-time clock (RTC): 00~59	○	○	○	○	○	○	–	–	–	R	0
SR396	Value of the second in the real-time clock (RTC): 00~59	○	○	○	○	○	○	–	–	–	R	0
SR397	Value of the week in the real-time clock (RTC): 1~7	○	○	○	○	○	○	–	–	–	R	1
SR402	After operation, it increments every 100μs from 0 to 32767 and then from -32768 to 0.	×	×	V1.01	V1.01	○	V1.01	0	–	–	R	0
SR404	After operation, it increments every 1ms from 0 to 32767 and then from -32768 to 0.	×	×	V1.01	V1.01	○	V1.01	0	–	–	R	0
SR407	When the PLC runs, the value in SR407 increases by one every second. SR407 counts from 0 to 32767, and then from -32768 to 0.	○	○	○	○	○	○	0	0	–	R/W	0
SR408	When the PLC runs, the value in SR408 increases by one every scan cycle. SR408 counts from 0 to 32767, and then from -32768 to 0.	○	○	○	○	○	○	0	0	–	R/W	0
*SR409	The pulse is ON for n seconds and is OFF for n seconds during the 2n second clock pulse. The interval n is stored in SR409, and the setting range is 1~32767.	○	○	○	○	○	○	–	–	–	R/W	30
*SR410	The pulse is ON for n milliseconds and is OFF for n milliseconds during the 2n millisecond clock pulse. The interval n is stored in SR410.	○	○	○	○	○	○	–	–	–	R/W	30

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SR411	The current scan time is stored in SR411 and SR412, and the unit of measurement is 100 microseconds. The value of the millisecond is stored in SR411. (The range is 0~65535.) The value of the microsecond is stored in SR421. (The range is 0~900.). For example, 12 is stored in SR411 and 300 is stored in SR412 when the current scan time is 12.3 milliseconds.	○	○	○	○	○	○	0	–	–	R	0
SR412		○	○	○	○	○	○	0	–	–	R	0
SR413	The maximum scan time is stored in SR413 and SR414, and the unit of measurement is 100 microseconds. The value of the millisecond is stored in SR413.	○	○	○	○	○	○	0	–	–	R	0
SR414		○	○	○	○	○	○	0	–	–	R	0
SR415	The maximum scan time is stored in SR415 and SR416, and the unit of measurement is 100 microseconds. The value of the millisecond is stored in SR415.	○	○	○	○	○	○	0	–	–	R	0
SR416		○	○	○	○	○	○	0	–	–	R	0
SR418	Here records which port is being used for communication between the main backplane and the redundant extension backplane	×	×	○	○	○	○	0	–	–	R	0
SR420	Here records which port is being used for communication between the 1st redundant extension backplane and the 2nd redundant extension backplane	×	×	○	○	○	○	0	–	–	R	0
SR422	Here records which port is being used for communication between the 2nd redundant extension backplane and the 3rd redundant extension backplane	×	×	○	○	○	○	0	–	–	R	0
SR424	Here records which port is being used for communication between the 3rd redundant extension backplane and the 4th redundant extension backplane	×	×	○	○	○	○	0	–	–	R	0
SR426	Here records which port is being used for communication between the 4th redundant extension backplane and the 5th redundant extension backplane	×	×	○	○	○	○	0	–	–	R	0
SR428	Here records which port is being used for communication between the 5th redundant extension backplane and the 6th redundant extension backplane	×	×	○	○	○	○	0	–	–	R	0
SR430	Here records which port is being used for communication between the 6th redundant extension backplane and the 7th redundant extension backplane	×	×	○	○	○	○	0	–	–	R	0
*SR440 ↓ *SR442	PLC MAC address	○	○	○	○	○	○	MAC add.	–	–	R	MAC add.
*SR443 ↓ *SR451	PLC serial number	○	○	○	○	○	○	SN	–	–	R	SN

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR453	If an error occurs during the operation of the memory card, the error code will be recorded.	○	○	○	○	○	○	–	–	–	R	0
SR621	Interrupt character used in the instruction RS (COM1)	○	○	○	○	○	○	–	–	–	R/W	0
SR622	Interrupt character used in the instruction RS (COM2)	○	×	○	×	○	○	–	–	–	R/W	0
SR623	Bit 0~bit 15: The conditions of the interrupt programs I0~I15 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR624	Bit 0~bit 15: The conditions of the interrupt programs I16~I31 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR625	Bit 0~bit 15: The conditions of the interrupt programs I32~I47 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR626	Bit 0~bit 15: The conditions of the interrupt programs I48~I63 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR627	Bit 0~bit 15: The conditions of the interrupt programs I64~I79 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR628	Bit 0~bit 15: The conditions of the interrupt programs I80~I95 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR629	Bit 0~bit 15: The conditions of the interrupt programs I96~I111 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR630	Bit 0~bit 15: The conditions of the interrupt programs I112~I127 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR631	Bit 0~bit 15: The conditions of the interrupt programs I128~I143 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR632	Bit 0~bit 15: The conditions of the interrupt programs I144~I159 are set by the instruction IMASK.	○	○	○	○	×	○	FFFF	–	–	R	FFFF
SR633	Bit 0~bit 15: The conditions of the interrupt programs I160~I175 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR634	Bit 0~bit 15: The conditions of the interrupt programs I176~I191 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR635	Bit 0~bit 15: The conditions of the interrupt programs I192~I207 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR636	Bit 0~bit 15: The conditions of the interrupt programs I208~I213 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR637	Bit 0~bit 15: The conditions of the interrupt programs I214~I229 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF
SR638	Bit 0~bit 15: The conditions of the interrupt programs I230~I255 are set by the instruction IMASK.	○	○	○	○	○	○	FFFF	–	–	R	FFFF

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR655 ↓ SR662	Recording the mapping error occurring in the module table for rack 1 or the error occurring in the I/○ module of rack 1 ↓ Recording the mapping error occurring in the module table for rack 8 or the error occurring in the I/○ module of rack 8	○	○	○	○	○	○	0	–	–	R	0
*SR663 ↓ SR674	Recording the mapping error code occurring in the module table for rack 1 whose slot number is 0 ↓ Recording the mapping error code occurring in the module table for rack 1 whose slot number is 11	○	○	○	○	○	○	0	–	–	R	0
*SR675 ↓ SR682	Recording the mapping error code occurring in the module table for rack 2 whose slot number is 0 ↓ Recording the mapping error code occurring in the module table for rack 2 whose slot number is 7	○	○	○	○	○	○	0	–	–	R	0
*SR683 ↓ SR690	Recording the mapping error code occurring in the module table for rack 3 whose slot number is 0 ↓ Recording the mapping error code occurring in the module table for rack 3 whose slot number is 7	○	○	○	○	○	○	0	–	–	R	0
*SR691 ↓ SR698	Recording the mapping error code occurring in the module table for rack 4 whose slot number is 0 ↓ Recording the mapping error code occurring in the module table for rack 4 whose slot number is 7	○	○	○	○	○	○	0	–	–	R	0
*SR699 ↓ SR706	Recording the mapping error code occurring in the module table for rack 5 whose slot number is 0 ↓ Recording the mapping error code occurring in the module table for rack 5 whose slot number is 7	○	○	○	○	○	○	0	–	–	R	0
*SR707 ↓ SR714	Recording the mapping error code occurring in the module table for rack 6 whose slot number is 0 ↓ Recording the mapping error code occurring in the module table for rack 6 whose slot number is 7	○	○	○	○	○	○	0	–	–	R	0
*SR715 ↓ SR722	Recording the mapping error code occurring in the module table for rack 7 whose slot number is 0 ↓	○	○	○	○	○	○	0	–	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
	Recording the mapping error code occurring in the module table for rack 7 whose slot number is 7											
*SR723 ↓ SR730	Recording the mapping error code occurring in the module table for rack 8 whose slot number is 0 ↓ Recording the mapping error code occurring in the module table for rack 8 whose slot number is 7	○	○	○	○	○	○	0	–	–	R	0
*SR731	External 24V low-voltage detected on the master power module	V1.08	V1.08	○	○	○	○	0	–	–	R	0
*SR732	External 24V low-voltage detected on the standby power module	V1.08	V1.08	○	○	○	○	0	–	–	R	0
SR900	The total sampled number of data logger (high word)	×	×	V2.01	V2.01	×	○	0	–	–	R	0
SR901	The total sampled number of data logger (low word)	×	×	V2.01	V2.01	×	○	0	–	–	R	0
SR902	Set the setting value as 16#5AA5 and set SM456 to ON to save data logger data in SD card.	×	×	V2.01	V2.01	×	○	0	–	–	R/W	0
*SR1000	High word in the Ethernet IP address	×	○	×	○	○	○	–	–	–	R/W	C0A8
*SR1001	Low word in the Ethernet IP address	×	○	×	○	○	○	–	–	–	R/W	0101
*SR1002	High word in the Ethernet netmask address	×	○	×	○	○	○	–	–	–	R/W	FFFF
*SR1003	Low word in the Ethernet netmask address	×	○	×	○	○	○	–	–	–	R/W	0000
*SR1004	High word in the Ethernet gateway address	×	○	×	○	○	○	–	–	–	R/W	C0A8
*SR1005	Low word in the Ethernet gateway address	×	○	×	○	○	○	–	–	–	R/W	0101
*SR1006	Time for which the TCP connection has been persistent	×	○	×	○	○	○	–	–	–	R/W	0060
SR1007	Ethernet transmission speed	×	○	×	○	○	○	0	–	–	R	0
SR1008	Ethernet transmission mode	×	○	×	○	○	○	0	–	–	R	0
SR1100	High word in the value of the input packet counter	×	○	×	○	○	○	0	–	–	R	0
SR1101	Low word in the value of the input packet counter	×	○	×	○	○	○	0	–	–	R	0
SR1102	High word in the value of the input octet counter	×	○	×	○	○	○	0	–	–	R	0
SR1103	Low word in the value of the input octet counter	×	○	×	○	○	○	0	–	–	R	0
SR1104	High word in the value of the output packet counter	×	○	×	○	○	○	0	–	–	R	0
SR1105	Low word in value of the output packet counter	×	○	×	○	○	○	0	–	–	R	0
SR1106	High word in the value of the output octet counter	×	○	×	○	○	○	0	–	–	R	0
SR1107	Low word in the value of the output octet counter	×	○	×	○	○	○	0	–	–	R	0
*SR1116	Email counter	×	○	×	○	○	○	0	–	–	R	0
*SR1117	Email error counter	×	○	×	○	○	○	0	–	–	R	0
*SR1118	TCP Socket 1—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR1119	TCP Socket 1—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1120	TCP Socket 1—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1121	TCP Socket 1—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1122	TCP Socket 1—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1123	TCP Socket 1—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1124	TCP Socket 1—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1125	TCP Socket 1—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1126	TCP Socket 1—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1127	TCP Socket 1—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1128	TCP Socket 1—The time for which the connection has been persistent	×	○	×	○	○	○	–	–	–	R/W	1000
*SR1129	TCP Socket 1—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1130	TCP Socket 1—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1131	TCP Socket 2—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1132	TCP Socket 2—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1133	TCP Socket 2—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1134	TCP Socket 2—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1135	TCP Socket 2—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1136	TCP Socket 2—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1137	TCP Socket 2—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1138	TCP Socket 2—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1139	TCP Socket 2—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1140	TCP Socket 2—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1141	TCP Socket 2—The time for which the connection has been persistent	×	○	×	○	○	○	–	–	–	R/W	1000
*SR1142	TCP Socket 2—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1143	TCP Socket 2—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1144	TCP Socket 3—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1145	TCP Socket 3—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR1146	TCP Socket 3—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1147	TCP Socket 3—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1148	TCP Socket 3—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1149	TCP Socket 3—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1150	TCP Socket 3—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1151	TCP Socket 3—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1152	TCP Socket 3—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1153	TCP Socket 3—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1154	TCP Socket 3—The time for which the connection has been persistent	×	○	×	○	○	○	–	–	–	R/W	1000
*SR1155	TCP Socket 3—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1156	TCP Socket 3—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1157	TCP Socket 4—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1158	TCP Socket 4—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1159	TCP Socket 4—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1160	TCP Socket 4—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1161	TCP Socket 4—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1162	TCP Socket 4—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1163	TCP Socket 4—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1164	TCP Socket 4—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1165	TCP Socket 4—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1166	TCP Socket 4—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1167	TCP Socket 4—The time for which the connection has been persistent	×	○	×	○	○	○	–	–	–	R/W	1000
*SR1168	TCP Socket 4—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1169	TCP Socket 4—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1170	TCP Socket 5—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1171	TCP Socket 5—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1172	TCP Socket 5—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR1173	TCP Socket 5—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1174	TCP Socket 5—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1175	TCP Socket 5—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1176	TCP Socket 5—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1177	TCP Socket 5—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1178	TCP Socket 5—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1179	TCP Socket 5—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1180	TCP Socket 5—The time for which the connection has been persistent	×	○	×	○	○	○	–	–	–	R/W	1000
*SR1181	TCP Socket 5—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1182	TCP Socket 5—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1183	TCP Socket 6—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1184	TCP Socket 6—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1185	TCP Socket 6—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1186	TCP Socket 6—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1187	TCP Socket 6—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1188	TCP Socket 6—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1189	TCP Socket 6—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1190	TCP Socket 6—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1191	TCP Socket 6—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1192	TCP Socket 6—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1193	TCP Socket 6—The time for which the connection has been persistent	×	○	×	○	○	○	–	–	–	R/W	1000
*SR1194	TCP Socket 6—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1195	TCP Socket 6—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1196	TCP Socket 7—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1197	TCP Socket 7—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1198	TCP Socket 7—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1199	TCP Socket 7—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR1200	TCP Socket 7—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1201	TCP Socket 7—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1202	TCP Socket 7—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1203	TCP Socket 7—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1204	TCP Socket 7—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1205	TCP Socket 7—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1206	TCP Socket 7—The time for which the connection has been persistent	×	○	×	○	○	○	–	–	–	R/W	1000
*SR1207	TCP Socket 7—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1208	TCP Socket 7—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1209	TCP Socket 8—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1210	TCP Socket 8—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1211	TCP Socket 8—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1212	TCP Socket 8—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1213	TCP Socket 8—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1214	TCP Socket 8—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1215	TCP Socket 8—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1216	TCP Socket 8—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1217	TCP Socket 8—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1218	TCP Socket 8—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1219	TCP Socket 8—The time for which the connection has been persistent	×	○	×	○	○	○	–	–	–	R/W	1000
*SR1220	TCP Socket 8—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1221	TCP Socket 8—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1222	UDP Socket 1—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1223	UDP Socket 1—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1224	UDP Socket 1—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1225	UDP Socket 1—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1226	UDP Socket 1—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR1227	UDP Socket 1—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1228	UDP Socket 1—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1229	UDP Socket 1—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1230	UDP Socket 1—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1231	UDP Socket 1—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1232	UDP Socket 1—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1233	UDP Socket 1—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1234	UDP Socket 2—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1235	UDP Socket 2—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1236	UDP Socket 2—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1237	UDP Socket 2—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1238	UDP Socket 2—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1239	UDP Socket 2—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1240	UDP Socket 2—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1241	UDP Socket 2—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1242	UDP Socket 2—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1243	UDP Socket 2—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1244	UDP Socket 2—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1245	UDP Socket 2—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1246	UDP Socket 3—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1247	UDP Socket 3—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1248	UDP Socket 3—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1249	UDP Socket 3—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1250	UDP Socket 3—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1251	UDP Socket 3—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1252	UDP Socket 3—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1253	UDP Socket 3—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR1254	UDP Socket 3—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1255	UDP Socket 3—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1256	UDP Socket 3—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1257	UDP Socket 3—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1258	UDP Socket 4—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1259	UDP Socket 4—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1260	UDP Socket 4—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1261	UDP Socket 4—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1262	UDP Socket 4—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1263	UDP Socket 4—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1264	UDP Socket 4—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1265	UDP Socket 4—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1266	UDP Socket 4—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1267	UDP Socket 4—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1268	UDP Socket 4—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1269	UDP Socket 4—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1270	UDP Socket 5—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1271	UDP Socket 5—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1272	UDP Socket 5—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1273	UDP Socket 5—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1274	UDP Socket 5—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1275	UDP Socket 5—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1276	UDP Socket 5—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1277	UDP Socket 5—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1278	UDP Socket 5—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1279	UDP Socket 5—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1280	UDP Socket 5—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1281	UDP Socket 5—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR1282	UDP Socket 6—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1283	UDP Socket 6—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1284	UDP Socket 6—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1285	UDP Socket 6—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1286	UDP Socket 6—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1287	UDP Socket 6—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1288	UDP Socket 6—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1289	UDP Socket 6—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1290	UDP Socket 6—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1291	UDP Socket 6—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1292	UDP Socket 6—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1293	UDP Socket 6—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1294	UDP Socket 7—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1295	UDP Socket 7—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1296	UDP Socket 7—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1297	UDP Socket 7—The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1298	UDP Socket 7—The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1299	UDP Socket 7—The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1300	UDP Socket 7—The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1301	UDP Socket 7—The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1302	UDP Socket 7—The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1303	UDP Socket 7—The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1304	UDP Socket 7—The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1305	UDP Socket 7—The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1306	UDP Socket 8—The local communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1307	UDP Socket 8—The high word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0
*SR1308	UDP Socket 8—The low word in the remote IP address	×	○	×	○	○	○	–	–	–	R/W	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
*SR1309	UDP Socket 8–The remote communication port	×	○	×	○	○	○	–	–	–	R/W	0
*SR1310	UDP Socket 8–The length of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1311	UDP Socket 8–The high word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1312	UDP Socket 8–The low word in the address of the data transmitted	×	○	×	○	○	○	–	–	–	R/W	0
*SR1313	UDP Socket 8–The length of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1314	UDP Socket 8–The high word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1315	UDP Socket 8–The low word in the address of the data received	×	○	×	○	○	○	–	–	–	R/W	0
*SR1316	UDP Socket 8–The received data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1317	UDP Socket 8–The transmitted data counter	×	○	×	○	○	○	0	0	–	R	0
*SR1318	Socket input counter	×	○	×	○	○	○	0	–	–	R	0
*SR1319	Socket output counter	×	○	×	○	○	○	0	–	–	R	0
*SR1320	Socket error counter	×	○	×	○	○	○	0	–	–	R	0
*SR1329	Main backplane ID	○	○	×	×	×	×	–	–	–	R/W	0
*SR1330	Main slot ID	○	○	×	×	×	×	–	–	–	R/W	0
*SR1331	RTU number	○	○	×	×	×	×	–	–	–	R/W	0
*SR1332	Extension backplane ID	○	○	×	×	×	×	–	–	–	R/W	0
*SR1333	Extension slot number	○	○	×	×	×	×	–	–	–	R/W	0
*SR1334	Port number	○	○	×	×	×	×	–	–	–	R/W	0
*SR1335	PLC Link cycle	○	○	×	×	○	×	–	–	–	R	0
	Modbus connection cycle of COM1	×	×	○	○	○	○	–	–	–	R	0
*SR1336	Number of data exchange connections via PLC Link.	○	○	×	×	○	×	–	–	–	R	0
	Number of Modbus data exchange connections via COM1	×	×	○	○	○	○	–	–	–	R	0
*SR1337	Time for which the data has been exchanged in the PLC Link	○	○	×	×	○	×	–	–	–	R/W	0
	Number of times COM1 exchanges data with a slave by Modbus	×	×	○	○	○	○	–	–	–	R/W	0
*SR1338	Restricted time of the PLC Link which is defined by users	○	○	×	×	×	×	–	–	–	R/W	0
*SR1339	Interval of sending the command in the PLC Link	○	○	×	×	○	×	–	–	–	R/W	1
	Interval of COM1's sending a command by means of Modbus	×	×	○	○	○	○	–	–	–	R/W	1
*SR1340 ↓ SR1371	Device types to be read for data exchange connection 1 via PLC Link. (0: register; 1: output coil; others: not supported) ↓ Device types to be read for data exchange connection 32 via PLC Link.	○	○	×	×	○	×	–	–	–	R/W	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
	(0: register; 1: output coil; others: not supported)											
	Device types to be read for Modbus data exchange connection 1 via COM1. (0: register; 1: output coil; others: not supported) ↓ Device types to be read for Modbus data exchange connection 32 via COM1. (0: register; 1: output coil; others: not supported)	×	×	○	○	○	○	–	–	–	R/W	0
*SR1372 ↓ SR1403	Device types to be written for data exchange connection 1 via PLC Link. (0: register; 1: output coil; others: not supported) ↓ Device types to be written for data exchange connection 32 via PLC Link. (0: register; 1: output coil; others: not supported)	○	○	×	×	○	×	–	–	–	R/W	0
	Device types to be written for Modbus data exchange connection 1 via COM1. (0: register; 1: output coil; others: not supported) ↓ Device types to be written for Modbus data exchange connection 32 via COM1. (0: register; 1: output coil; others: not supported)	×	×	○	○	○	○	–	–	–	R/W	0
*SR1404 ↓ SR1467	The device starting address of the master where the data exchange connection 1 reads from via PLC Link. ↓ The device starting address of the master where the data exchange connection 32 reads from via PLC Link.	○	○	×	×	×	×	–	–	–	R/W	0
	The device starting address of the master where the Modbus data exchange connection 1 reads from via COM1. ↓ The device starting address of the master where the Modbus data exchange connection 32 reads from via COM32.	×	×	○	○	○	○	–	–	–	R/W	0
*SR1468 ↓ SR1531	The device starting address of the master where the data exchange connection 1 writes from via PLC Link. ↓ The device starting address of the master where the data exchange connection 32 writes from via PLC Link.	○	○	×	×	×	×	–	–	–	R/W	0
	The device starting address of the master where the Modbus data exchange connection 1 writes from via COM1. ↓	×	×	○	○	○	○	–	–	–	R/W	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
	The device starting address of the master where the Modbus data exchange connection 32 writes from via COM1.											
*SR1532 ↓ SR1595	The device starting address of the slave where the data exchange connection 1 reads from via PLC Link. ↓ The device starting address of the slave where the data exchange connection 32 reads from via PLC Link.	○	○	×	×	×	×	–	–	–	R/W	0
	The device starting address of the slave where the Modbus data exchange connection 1 reads from via COM1. ↓ The device starting address of the slave where the Modbus data exchange connection 32 reads from via COM1.	×	×	○	○	○	○	–	–	–	R/W	0
*SR1596 ↓ SR1659	The device starting address of the slave where the data exchange connection 1 writes from via PLC Link. ↓ The device starting address of the slave where the data exchange connection 32 writes from via PLC Link.	○	○	×	×	×	×	–	–	–	R/W	0
	The device starting address of the slave where the Modbus data exchange connection 1 writes from via COM1. ↓ The device starting address of the slave where the Modbus data exchange connection 32 writes from via COM1.	×	×	○	○	○	○	–	–	–	R/W	0
*SR1660 ↓ SR1691	The data length for data exchange connection 1 to be read via PLC Link. ↓ The data length for data exchange connection 32 to be read via PLC Link.	○	○	×	×	×	×	–	–	–	R/W	0
	The Modbus data length for data exchange connection 1 to be read via COM1. ↓ The Modbus data length for data exchange connection 32 to be read via COM1.	×	×	○	○	○	○	–	–	–	R/W	0
*SR1692 ↓ SR1723	The data length for data exchange connection 1 to be written via PLC Link. ↓ The data length for data exchange connection 32 to be written via PLC Link.	○	○	×	×	×	×	–	–	–	R/W	0
	The Modbus data length for data exchange connection 1 to be written via COM1. ↓ The Modbus data length for data exchange connection 32 to be written via COM1.	×	×	○	○	○	○	–	–	–	R/W	0
*SR1724 ↓ SR1755	Type of data exchange connection 1 in the PLC Link. ↓	○	○	×	×	×	×	–	–	–	R/W	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
	Type of data exchange connection 32 in the PLC Link.											
*SR1756 ↓ SR1787	The slave ID of data exchange connection 1 via PLC Link. ↓ The slave ID of data exchange connection 32 via PLC Link.	○	○	×	×	×	×	–	–	–	R/W	1 ↓ 32
	The remote ID of Modbus data exchange connection 1 via COM1. ↓ The remote ID of Modbus data exchange connection 32 via COM1.	×	×	○	○	○	○	–	–	–	R/W	1 ↓ 32
*SR1792 ↓ SR1823	IP address of block 1 in the Ether Link (SR1792 and SR1793) ↓ IP address of block 16 in the Ether Link (SR1822 and SR1823)	○	○	×	×	×	×	–	–	–	R	0
*SR1824 ↓ SR1855	IP address of block 17 in the Ether Link (SR1824 and SR1825) ↓ IP address of block 32 in the Ether Link (SR1854 and SR1855)	○*1	○*1	×	×	×	×	–	–	–	R	0
*SR1856 ↓ SR1919	IP address of block 33 in the Ether Link (SR1856 and SR1857) ↓ IP address of block 64 in the Ether Link (SR1918 and SR1919)	○*2	○*2	×	×	×	×	–	–	–	R	0
*SR1920 ↓ SR2047	IP address of block 65 in the Ether Link (SR1920 and SR1921) ↓ IP address of block 128 in the Ether Link (SR2046 and SR2047)	○*3	○*3	×	×	×	×	–	–	–	R	0
SR2046	Connection number of EtherNet/IP Adapter	×	×	×	V2. 04	V1. 10	×	–	–	–	R	0
SR2047	Connection number of EtherNet/IP Scanner	×	×	×	V2. 04	V1. 10	×	–	–	–	R	0
SR2048 ↓ SR2079	Error code of Connection 1 via EtherNet/IP Scanner ↓ Error code of Connection 32 via EtherNet/IP Scanner	×	×	○	○	○	×	–	–	–	R	0
SR2080 ↓ SR2111	Error code of Connection 33 via EtherNet/IP Scanner ↓ Error code of Connection 64 via EtherNet/IP Scanner	×	×	○	○*6	○	×	–	–	–	R	0
SR2112 ↓ SR2175	Error code of Connection 65 via EtherNet/IP Scanner ↓ Error code of Connection 128 via EtherNet/IP Scanner	×	×	○	○*4	○	×	–	–	–	R	0
SR2176 ↓ SR2303	Error code of Connection 129 via EtherNet/IP Scanner ↓	×	×	○	○*5	○	×	–	–	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
	Error code of Connection 256 via EtherNet/IP Scanner											
SR2304 ↓ SR2335	Status of Connection 1 via EtherNet/IP Scanner ↓ Status of Connection 32 via EtherNet/IP Scanner	×	×	○	○	○	×	–	–	–	R	0
SR2336 ↓ SR2367	Status of Connection 33 via EtherNet/IP Scanner ↓ Status of Connection 64 via EtherNet/IP Scanner	×	×	○	○*6	○	×	–	–	–	R	0
SR2368 ↓ SR2431	Status of Connection 65 via EtherNet/IP Scanner ↓ Status of Connection 128 via EtherNet/IP Scanner	×	×	○	○*4	○	×	–	–	–	R	0
SR2432 ↓ SR2559	Status of Connection 129 via EtherNet/IP Scanner ↓ Status of Connection 256 via EtherNet/IP Scanner	×	×	○	○*5	○	×	–	–	–	R	0
SR2560	High byte of RTU IP or ID from the 1st error log	×	×	○	○	○	○	–	–	–	R	0
SR2561	Low byte of RTU IP or ID from the 1st error log	×	×	○	○	○	○	–	–	–	R	0
SR2562	RTU backplane ID and slot ID from the 1st error log	×	×	○	○	○	○	–	–	–	R	0
SR2563 ↓ SR2564	Position of the 1st execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2565	High byte of RTU IP or ID from the 2nd error log	×	×	○	○	○	○	–	–	–	R	0
SR2566	Low byte of RTU IP or ID from the 2nd error log	×	×	○	○	○	○	–	–	–	R	0
SR2567	RTU backplane ID and slot ID from the 2nd error log	×	×	○	○	○	○	–	–	–	R	0
SR2568 ↓ SR2569	Position of the 2nd execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2570	High byte of RTU IP or ID from the 3rd error log	×	×	○	○	○	○	–	–	–	R	0
SR2571	Low byte of RTU IP or ID from the 3rd error log	×	×	○	○	○	○	–	–	–	R	0
SR2572	RTU backplane ID and slot ID from the 3rd error log	×	×	○	○	○	○	–	–	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SR2573 ↓ SR2574	Position of the 3rd execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2575	High byte of RTU IP or ID from the 4th error log	×	×	○	○	○	○	–	–	–	R	0
SR2576	Low byte of RTU IP or ID from the 4th error log	×	×	○	○	○	○	–	–	–	R	0
SR2577	RTU backplane ID and slot ID from the 4th error log	×	×	○	○	○	○	–	–	–	R	0
SR2578 ↓ SR2579	Position of the 4th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2580	High byte of RTU IP or ID from the 5th error log	×	×	○	○	○	○	–	–	–	R	0
SR2581	Low byte of RTU IP or ID from the 5th error log	×	×	○	○	○	○	–	–	–	R	0
SR2582	RTU backplane ID and slot ID from the 5th error log	×	×	○	○	○	○	–	–	–	R	0
SR2583 ↓ SR2584	Position of the 5th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2585	High byte of RTU IP or ID from the 6th error log	×	×	○	○	○	○	–	–	–	R	0
SR2586	Low byte of RTU IP or ID from the 6th error log	×	×	○	○	○	○	–	–	–	R	0
SR2587	RTU backplane ID and slot ID from the 6th error log	×	×	○	○	○	○	–	–	–	R	0
SR2588 ↓ SR2589	Position of the 6th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2590	High byte of RTU IP or ID from the 7th error log	×	×	○	○	○	○	–	–	–	R	0
SR2591	Low byte of RTU IP or ID from the 7th error log	×	×	○	○	○	○	–	–	–	R	0
SR2592	RTU backplane ID and slot ID from the 7th error log	×	×	○	○	○	○	–	–	–	R	0
SR2593 ↓ SR2594	Position of the 7th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2595	High byte of RTU IP or ID from the 8th error log	×	×	○	○	○	○	–	–	–	R	0
SR2596	Low byte of RTU IP or ID from the 8th error log	×	×	○	○	○	○	–	–	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SR2597	RTU backplane ID and slot ID from the 8th error log	×	×	○	○	○	○	–	–	–	R	0
SR2598 ↓ SR2599	Position of the 8th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2600	High byte of RTU IP or ID from the 9th error log	×	×	○	○	○	○	–	–	–	R	0
SR2601	Low byte of RTU IP or ID from the 9th error log	×	×	○	○	○	○	–	–	–	R	0
SR2602	RTU backplane ID and slot ID from the 9th error log	×	×	○	○	○	○	–	–	–	R	0
SR2603 ↓ SR2604	Position of the 9th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2605	High byte of RTU IP or ID from the 10th error log	×	×	○	○	○	○	–	–	–	R	0
SR2606	Low byte of RTU IP or ID from the 10th error log	×	×	○	○	○	○	–	–	–	R	0
SR2607	RTU backplane ID and slot ID from the 10th error log	×	×	○	○	○	○	–	–	–	R	0
SR2608 ↓ SR2609	Position of the 10th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2610	High byte of RTU IP or ID from the 11th error log	×	×	○	○	○	○	–	–	–	R	0
SR2611	Low byte of RTU IP or ID from the 11th error log	×	×	○	○	○	○	–	–	–	R	0
SR2612	RTU backplane ID and slot ID from the 11th error log	×	×	○	○	○	○	–	–	–	R	0
SR2613 ↓ SR2614	Position of the 11th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2615	High byte of RTU IP or ID from the 12th error log	×	×	○	○	○	○	–	–	–	R	0
SR2616	Low byte of RTU IP or ID from the 12th error log	×	×	○	○	○	○	–	–	–	R	0
SR2617	RTU backplane ID and slot ID from the 12th error log	×	×	○	○	○	○	–	–	–	R	0
SR2618 ↓ SR2619	Position of the 12th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2620	High byte of RTU IP or ID from the 13th error log	×	×	○	○	○	○	–	–	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SR2621	Low byte of RTU IP or ID from the 13th error log	×	×	○	○	○	○	–	–	–	R	0
SR2622	RTU backplane ID and slot ID from the 13th error log	×	×	○	○	○	○	–	–	–	R	0
SR2623 ↓ SR2624	Position of the 13th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2625	High byte of RTU IP or ID from the 14th error log	×	×	○	○	○	○	–	–	–	R	0
SR2626	Low byte of RTU IP or ID from the 14th error log	×	×	○	○	○	○	–	–	–	R	0
SR2627	RTU backplane ID and slot ID from the 14th error log	×	×	○	○	○	○	–	–	–	R	0
SR2628 ↓ SR2629	Position of the 14th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2630	High byte of RTU IP or ID from the 15th error log	×	×	○	○	○	○	–	–	–	R	0
SR2631	Low byte of RTU IP or ID from the 15th error log	×	×	○	○	○	○	–	–	–	R	0
SR2632	RTU backplane ID and slot ID from the 15th error log	×	×	○	○	○	○	–	–	–	R	0
SR2633 ↓ SR2634	Position of the 15th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2635	High byte of RTU IP or ID from the 16th error log	×	×	○	○	○	○	–	–	–	R	0
SR2636	Low byte of RTU IP or ID from the 16th error log	×	×	○	○	○	○	–	–	–	R	0
SR2637	RTU backplane ID and slot ID from the 16th error log	×	×	○	○	○	○	–	–	–	R	0
SR2638 ↓ SR2639	Position of the 16th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2640	High byte of RTU IP or ID from the 17th error log	×	×	○	○	○	○	–	–	–	R	0
SR2641	Low byte of RTU IP or ID from the 17th error log	×	×	○	○	○	○	–	–	–	R	0
SR2642	RTU backplane ID and slot ID from the 17th error log	×	×	○	○	○	○	–	–	–	R	0
SR2643 ↓ SR2644	Position of the 17th execution error in the program	×	×	○	○	○	○	–	–	–	R	0

SR	Function	CPU5×0-RS2	CPU5×0-EN	CPU5×1-RS2	CPU5×1-EN	CPU560-EN2	CPU521-DNP3	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Attribute	Default
SR2645	High byte of RTU IP or ID from the 18th error log	×	×	○	○	○	○	–	–	–	R	0
SR2646	Low byte of RTU IP or ID from the 18th error log	×	×	○	○	○	○	–	–	–	R	0
SR2647	RTU backplane ID and slot ID from the 18th error log	×	×	○	○	○	○	–	–	–	R	0
SR2648 ↓ SR2649	Position of the 18th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2650	High byte of RTU IP or ID from the 19th error log	×	×	○	○	○	○	–	–	–	R	0
SR2651	Low byte of RTU IP or ID from the 19th error log	×	×	○	○	○	○	–	–	–	R	0
SR2652	RTU backplane ID and slot ID from the 19th error log	×	×	○	○	○	○	–	–	–	R	0
SR2653 ↓ SR2654	Position of the 19th execution error in the program	×	×	○	○	○	○	–	–	–	R	0
SR2655	High byte of RTU IP or ID from the 20th error log	×	×	○	○	○	○	–	–	–	R	0
SR2656	Low byte of RTU IP or ID from the 20th error log	×	×	○	○	○	○	–	–	–	R	0
SR2657	RTU backplane ID and slot ID from the 20th error log	×	×	○	○	○	○	–	–	–	R	0
SR2658 ↓ SR2659	Position of the 20th execution error in the program	×	×	○	○	○	○	–	–	–	R	0

Note: As to the SR numbers marked "*", users can refer to the additional remarks on special auxiliary relays/special data registers.

*1：Only available for AHCPU530-EN, AHCPU520-EN, AHCPU510-EN, AHCPU530-RS2, AHCPU520-RS2, and AHCPU510-RS2

*2：Only available for AHCPU530-EN, AHCPU520-EN, AHCPU530-RS2, and AHCPU520-RS2

*3：Only available for AHCPU530-EN and AHCPU530-RS2

*4：Only available for AHCPU531-EN and AHCPU521-EN

*5：Only available for AHCPU531-EN

*6：Only available for AHCPU531-EN, AHCPU521-EN and AHCPU511-EN.

2.2.15 Refresh Time of Special Data Registers

Limited to	Special data register	Refresh time
	SR0~SR2	The register is refreshed when the program is executed in error.
	SR4	The register is refreshed when there is a grammar check error
	SR5~SR6	The register is refreshed when the program is downloaded to the PLC, or when the PLC is suppied with power and starts to run for the first time.
	SR8	The register is refreshed when there is a watchdog timer error.
	SR24~SR31	The register is refreshed when the synchronization is done.
	SR32	The register is refreshed when an error occurs in the master power module.
	SR33	The register is refreshed when an error occurs in the standby power module.
	SR40~SR161	The register is refreshed when an error occurs.
	SR201~SR216	Users set the value and clear it.
	SR220~SR226	The register is refreshed every scan cycle.
	SR227~SR308	The register is refreshed when the program is downloaded to the PLC.
	SR309~SR390	The register is refreshed when the status of the PLC changes.
	SR391~SR397	The register is refreshed every scan cycle.
	SR402	The register is refreshed every 100μs.
	SR404	The register is refreshed every 1 millie second.
	SR407	The register is refreshed every second.
	SR408	The register is refreshed whenever the instruction END is executed.
	SR409~SR410	Users set the value and clear it.
	SR411~SR416	The register is refreshed whenever the instruction END is executed.
	SR440~SR451	The register is refreshed once the power is supplied.
	SR453	The register is refreshed when an error occurs.
	SR621~SR622	Users set the value and clear it.
	SR623~SR638	The register is refreshed when the instruction IMASK is executed.
	SR655~SR730	The register is refreshed when an error occurs in the I/O module.
	SR731	Once a low 24V voltage is detected, the status of the master power module changes and the register will also be refreshed.
	SR732	Once a low 24V voltage is detected, the status of the standby power module changes and the register will also be refreshed.
	SR900	When the value in data logger is updated, the register is refreshed.
	SR901	When the value in data logger is updated, the register is refreshed.
	SR902	Users set the value and clear it.
	SR1000~SR1006	Users set the value and clear it.
	SR1007	When powered on and network cable is connected.
	SR1008	When powered on and network cable is connected.
	SR1100~SR1117	The register is refreshed every scan cycle.
	SR1118~SR1128	The register is refreshed when the parameter is downloaded to the PLC.
	SR1129~SR1130	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.

Limited to	Special data register	Refresh time
	SR1131~SR1141	The register is refreshed when the parameter is downloaded to the PLC.
	SR1142~SR1143	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1144~SR1154	The register is refreshed when the parameter is downloaded to the PLC.
	SR1155~SR1156	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1157~SR1167	The register is refreshed when the parameter is downloaded to the PLC.
	SR1168~SR1169	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1170~SR1180	The register is refreshed when the parameter is downloaded to the PLC.
	SR1181~SR1182	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1183~SR1193	The register is refreshed when the parameter is downloaded to the PLC.
	SR1194~SR1195	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1196~SR1206	The register is refreshed when the parameter is downloaded to the PLC.
	SR1207~SR1208	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1209~SR1219	The register is refreshed when the parameter is downloaded to the PLC.
	SR1220~SR1221	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1222~SR1231	The register is refreshed when the parameter is downloaded to the PLC.
	SR1232~SR1233	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1234~SR1243	The register is refreshed when the parameter is downloaded to the PLC.
	SR1244~SR1245	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1246~SR1255	The register is refreshed when the parameter is downloaded to the PLC.
	SR1256~SR1257	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1258~SR1267	The register is refreshed when the parameter is downloaded to the PLC.
	SR1268~SR1269	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1270~SR1279	The register is refreshed when the parameter is downloaded to the PLC.
	SR1280~SR1281	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1282~SR1291	The register is refreshed when the parameter is downloaded to the PLC.
	SR1292~SR1293	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.

Limited to	Special data register	Refresh time
	SR1294~SR1303	The register is refreshed when the parameter is downloaded to the PLC.
	SR1304~SR1305	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1306~SR1315	The register is refreshed when the parameter is downloaded to the PLC.
	SR1316~SR1320	The register is refreshed when the parameter is downloaded to the PLC, or when the PLC is supplied with power.
	SR1329~SR1334	Users set the value and clear it.
AH5×0	SR1335~SR1336	The register is refreshed every scan cycle when the PLC Link is enabled.
AH5×1		Modbus connection cycle of COM1
	SR1337~SR1787	Users set the value and clear it.
	SR1792~SR2559	The register is refreshed every scan cycle.
	SR2560~SR2659	The register is refreshed whenever an error occurs.

Note: The models AH5×0 and AH5×1 shown in the column of “Limited to” refer to AHCPU500/510/520/530 and AHCPU501/511/521/531 respectively.

2.2.16 Additional Remarks on Special Auxiliary Relays and Special Data Registers

1. **The scan timeout timer**

- SM8/SR8

  When a scan timeout occurs during the execution of the program, the error LED indicator on the PLC is ON all the time, and SM8 is ON.

  The content of SR8 is the step address at which the watchdog timer is ON.

2. **Clearing the warning light**

- SM22

  If SM22 is ON, the error log and the warning light will be cleared.

3. **The real-time clock**

- SM220, SR220~SR226, and SR391~SR397

  SM220: Calibrating the real-time clock within ±30 seconds

  When SM220 is switched from OFF to ON, the real-time clock is calibrated.

  If the value of the second in the real-time clock is within the range between 0 and 29, the value of the minute is fixed, and the value of the second is cleared to zero.

  If the value of the second in the real-time clock is within the range between 30 and 59, the value of the minute increases by one, and the value of the second is cleared to zero.

  The corresponding functions and values of SR220~SR226 and SR391~SR397 are as follows.

Device		Function	Value
Binary-coded decimal system	Decimal system		
SR220	SR391	Year	00~99 (A.D.)
SR221	SR392	Month	1~12
SR222	SR393	Day	1~31
SR223	SR394	Hour	0~23
SR224	SR395	Minute	0~59
SR225	SR396	Second	0~59
SR226	SR397	Week	1~7

  SR391~SR397 correspond to SR220~ SR226. The difference between SR220~ SR226 and SR391~SR397 lies in the fact that the former adopts the binary-coded decimal while the latter adopts the decimal system. For example, December is represented as 12 in SR392 while it is represented as 12 in the binary-coded decimal.

  Please refer to section 6.17 for more information related to the real-time clock.

4. **The functions related to communication**

- SM96~SM107, SM209~SM212, SR201~SR202, and SR209~SR216

  SR215 and SR216 are used to record the interface code of the communication port on the PLC. The functions represented by the interface codes are as follows.

Code	0	1	2
Function	RS-232	RS-485	RS-422

  When the interface of the communication port on the PLC is RS-485, RS-232, or RS-422, SR209 records the communication format of COM1 on the PLC, and SR212 records the communication format of COM2 on the PLC. The setting values of the communication protocols are shown in the following table. Please refer to section 6.19 for more information related to the communication instructions.

b0	Data length	7 (value=0)		8 (value=1)
b1 **b2**	Parity bits	00	:	None
		01	:	Odd parity bits

		10 :	Even parity bits
b3	Stop bit	1 bit (value=0)	2 bits (value=1)
b4 **b5** **b6** **b7**	0001 (16#1) :	4800	
	0010 (16#2) :	9600	
	0011 (16#3) :	19200	
	0100 (16#4) :	38400	
	0101 (16#5) :	57600	
	0110 (16#6) :	115200	
	0111 (16#7) :	230400	RS-232 does not support the baud rate.
	1000 (16#8) :	460800	RS-232 does not support the baud rate.
	1001 (16#9) :	921600	RS-232 does not support the baud rate.
b8~b15	Undefined (reserved)		

5. **Clearing the contents of the device**

- SM204/SM205

Device number	Device which is cleared
SM204 All non-latched areas are cleared.	The non-latched areas in the input relays, the output relays, the stepping relays, the auxiliary relays, and the link registers are cleared. The non-latched areas in the timers, the counters, and the 32-bit counters are cleared. The non-latched areas in the data registers and the index registers are cleared. It takes 530 milliseconds to clear the device. The watchdog timer does not act during this period of time.
SM205 All latched areas are cleared.	The latched areas in the timers, counters, and 32-bit counters are cleared. The latched auxiliary relays are cleared. The latched data registers are cleared. It takes 30 milliseconds to clear the device. The watchdog timer does not act during this period of time.

Please refer to section 2.1.4 for more information related to the latched areas in the device range.

6. **The error log in the PLC**

- SR40~SR161

SR40: The maximum number of error logs which are stored in SR40 is 20. Every error log occupies 6 registers.

SR41: The error log pointer points to the latest error log. When an error occurs, the value of the error log pointer increases by one. The range of pointer values is 0~19. For example, the error log pointer points to the fourth error log when the value in SR41 is 3.

The time when the errors occur and the positions where the errors occur are recorded in SR42~SR161. The corresponding functions of these data registers are as follows.

Number	Rack	Slot	Module ID	Error code	Time when the error occurs					
					Year	Month	Day	Hour	Minute	Second
1	SR42 High byte	SR42 Low byte	SR43	SR44	SR45 High byte	SR45 Low byte	SR46 High byte	SR46 Low byte	SR47 High byte	SR47 Low byte
2	SR48 High byte	SR48 Low byte	SR49	SR50	SR51 High byte	SR51 Low byte	SR52 High byte	SR52 Low byte	SR53 High byte	SR53 Low byte

Number	Rack	Slot	Module ID	Error code	Time when the error occurs					
					Year	Month	Day	Hour	Minute	Second
3	SR54 High byte	SR54 Low byte	SR55	SR56	SR57 High byte	SR57 Low byte	SR58 High byte	SR58 Low byte	SR59 High byte	SR59 Low byte
4	SR60 High byte	SR60 Low byte	SR61	SR62	SR63 High byte	SR63 Low byte	SR64 High byte	SR64 Low byte	SR65 High byte	SR65 Low byte
5	SR66 High byte	SR66 Low byte	SR67	SR68	SR69 High byte	SR69 Low byte	SR70 High byte	SR70 Low byte	SR71 High byte	SR71 Low byte
6	SR72 High byte	SR72 Low byte	SR73	SR74	SR75 High byte	SR75 Low byte	SR76 High byte	SR76 Low byte	SR77 High byte	SR77 Low byte
7	SR78 High byte	SR78 Low byte	SR79	SR80	SR81 High byte	SR81 Low byte	SR82 High byte	SR82 Low byte	SR83 High byte	SR83 Low byte
8	SR84 High byte	SR84 Low byte	SR85	SR86	SR87 High byte	SR87 Low byte	SR88 High byte	SR88 Low byte	SR89 High byte	SR89 Low byte
9	SR90 High byte	SR90 Low byte	SR91	SR92	SR93 High byte	SR93 Low byte	SR94 High byte	SR94 Low byte	SR95 High byte	SR95 Low byte
10	SR96 High byte	SR96 Low byte	SR97	SR98	SR99 High byte	SR99 Low byte	SR100 High byte	SR100 Low byte	SR101 High byte	SR101 Low byte
11	SR102 High byte	SR102 Low byte	SR103	SR104	SR105 High byte	SR105 Low byte	SR106 High byte	SR106 Low byte	SR107 High byte	SR107 Low byte
12	SR108 High byte	SR108 Low byte	SR109	SR110	SR111 High byte	SR111 Low byte	SR112 High byte	SR112 Low byte	SR113 High byte	SR113 Low byte
13	SR114 High byte	SR114 Low byte	SR115	SR116	SR117 High byte	SR117 Low byte	SR118 High byte	SR118 Low byte	SR119 High byte	SR119 Low byte
14	SR120 High byte	SR120 Low byte	SR121	SR122	SR123 High byte	SR123 Low byte	SR124 High byte	SR124 Low byte	SR125 High byte	SR125 Low byte
15	SR126 High byte	SR126 Low byte	SR127	SR128	SR129 High byte	SR129 Low byte	SR130 High byte	SR130 Low byte	SR131 High byte	SR131 Low byte
16	SR132 High byte	SR132 Low byte	SR133	SR134	SR135 High byte	SR135 Low byte	SR136 High byte	SR136 Low byte	SR137 High byte	SR137 Low byte
17	SR138 High byte	SR138 Low byte	SR139	SR140	SR141 High byte	SR141 Low byte	SR142 High byte	SR142 Low byte	SR143 High byte	SR143 Low byte
18	SR144 High byte	SR144 Low byte	SR145	SR146	SR147 High byte	SR147 Low byte	SR148 High byte	SR148 Low byte	SR149 High byte	SR149 Low byte
19	SR150 High byte	SR150 Low byte	SR151	SR152	SR153 High byte	SR153 Low byte	SR154 High byte	SR154 Low byte	SR155 High byte	SR155 Low byte
20	SR156 High byte	SR156 Low byte	SR157	SR158	SR159 High byte	SR159 Low byte	SR160 High byte	SR160 Low byte	SR161 High byte	SR161 Low byte

7. **The download log in the PLC**

- SR227~SR308

SR227: The maximum number of download logs which are stored in SR227 is 20. Every download log occupies 4 registers. The download actions which are recorded are numbered, as shown in the following table.

Download action	Number
Downloading the program	1
Downloading the setting of the PLC	2
Downloading the module table	3

SR228: The download log pointer points to the latest download log. When a download action is executed, the value of the download log pointer increases by one. The range of pointer values is 0~19. For example, the download log pointer points to the fourth download log when the value in SR228 is 3.

The time when the downloading actions occur and the action numbers are recorded in SR229~SR30. The corresponding functions of these data registers are as follows.

Number	Action number	*Time when the download action occurs					
		Year	Month	Day	Hour	Minute	Second
1	SR229	SR230 High byte	SR230 Low byte	SR231 High byte	SR231 Low byte	SR232 High byte	SR232 Low byte
2	SR233	SR234	SR234	SR235	SR235	SR236	SR236

Number	Action number	*Time when the download action occurs					
		Year	Month	Day	Hour	Minute	Second
		High byte	Low byte	High byte	Low byte	High byte	Low byte
3	SR237	SR238 High byte	SR238 Low byte	SR239 High byte	SR239 Low byte	SR240 High byte	SR240 Low byte
4	SR241	SR242 High byte	SR242 Low byte	SR243 High byte	SR243 Low byte	SR244 High byte	SR244 Low byte
5	SR245	SR246 High byte	SR246 Low byte	SR247 High byte	SR247 Low byte	SR248 High byte	SR248 Low byte
6	SR249	SR250 High byte	SR250 Low byte	SR251 High byte	SR251 Low byte	SR252 High byte	SR252 Low byte
7	SR253	SR254 High byte	SR254 Low byte	SR255 High byte	SR255 Low byte	SR256 High byte	SR256 Low byte
8	SR257	SR258 High byte	SR258 Low byte	SR259 High byte	SR259 Low byte	SR260 High byte	SR260 Low byte
9	SR261	SR262 High byte	SR262 Low byte	SR263 High byte	SR263 Low byte	SR264 High byte	SR264 Low byte
10	SR265	SR266 High byte	SR266 Low byte	SR267 High byte	SR267 Low byte	SR268 High byte	SR268 Low byte
11	SR269	SR270 High byte	SR270 Low byte	SR271 High byte	SR271 Low byte	SR272 High byte	SR272 Low byte
12	SR273	SR274 High byte	SR274 Low byte	SR275 High byte	SR275 Low byte	SR276 High byte	SR276 Low byte
13	SR277	SR278 High byte	SR278 Low byte	SR279 High byte	SR279 Low byte	SR280 High byte	SR280 Low byte
14	SR281	SR282 High byte	SR282 Low byte	SR283 High byte	SR283 Low byte	SR284 High byte	SR284 Low byte
15	SR285	SR286 High byte	SR286 Low byte	SR287 High byte	SR287 Low byte	SR288 High byte	SR288 Low byte
16	SR289	SR290 High byte	SR290 Low byte	SR291 High byte	SR291 Low byte	SR292 High byte	SR292 Low byte
17	SR293	SR294 High byte	SR294 Low byte	SR295 High byte	SR295 Low byte	SR296 High byte	SR296 Low byte
18	SR297	SR298 High byte	SR298 Low byte	SR299 High byte	SR299 Low byte	SR300 High byte	SR300 Low byte
19	SR301	SR302 High byte	SR302 Low byte	SR303 High byte	SR303 Low byte	SR304 High byte	SR304 Low byte
20	SR305	SR306 High byte	SR306 Low byte	SR307 High byte	SR307 Low byte	SR308 High byte	SR308 Low byte

*Time when the download action occurs: The data is stored as the values in the binary-coded decimal. The range of values is as follows.

Function	Value
Year	00~99 (A.D.)
Month	01~12
Day	01~31
Hour	00~23
Minute	00~59
Second	00~59

8. **The PLC status change log**

- SR309~SR390

SR309: The maximum number of PLC status change logs which are stored in SR309 is 20. Every PLC status change log occupies 4 registers. The PLC status change actions which are recorded are numbered, as shown in the following table.

PLC status change	Number
The PLC is supplied with power.	1
The PLC is disconnected.	2
The PLC starts to run.	3
The PLC stops running.	4
Default setting of the PLC (1. RST button; 2. Communication command)	5
Pressing the CLR button on the PLC (Clearing the data in the latched device)	6

SR310: The PLC status change log pointer points to the latest PLC status change log. When the PLC status is changed once, the value of the PLC status change log pointer increases by one. The range of pointer values is 0~19. For example, the PLC status change log pointer points to the fourth PLC status change log when the value in SR310 is 3.

The time when the PLC status change actions occur is recorded in SR311~SR390. The corresponding functions of these data registers are as follows.

Number	Action number	*Time when the PLC status change action occurs					
		Year	Month	Day	Hour	Minute	Second
1	SR311	SR312 High byte	SR312 Low byte	SR313 High byte	SR313 Low byte	SR314 High byte	SR314 Low byte
2	SR315	SR316 High byte	SR316 Low byte	SR317 High byte	SR317 Low byte	SR318 High byte	SR318 Low byte
3	SR319	SR320 High byte	SR320 Low byte	SR321 High byte	SR321 Low byte	SR322 High byte	SR322 Low byte
4	SR323	SR324 High byte	SR324 Low byte	SR325 High byte	SR325 Low byte	SR326 High byte	SR326 Low byte
5	SR327	SR328 High byte	SR328 Low byte	SR329 High byte	SR329 Low byte	SR330 High byte	SR330 Low byte
6	SR331	SR332 High byte	SR332 Low byte	SR333 High byte	SR333 Low byte	SR334 High byte	SR334 Low byte
7	SR335	SR336 High byte	SR336 Low byte	SR337 High byte	SR337 Low byte	SR338 High byte	SR338 Low byte
8	SR339	SR340 High byte	SR340 Low byte	SR341 High byte	SR341 Low byte	SR342 High byte	SR342 Low byte
9	SR343	SR344 High byte	SR344 Low byte	SR345 High byte	SR345 Low byte	SR346 High byte	SR346 Low byte
10	SR347	SR348 High byte	SR348 Low byte	SR349 High byte	SR349 Low byte	SR350 High byte	SR350 Low byte
11	SR351	SR352 High byte	SR352 Low byte	SR353 High byte	SR353 Low byte	SR354 High byte	SR354 Low byte
12	SR355	SR356 High byte	SR356 Low byte	SR357 High byte	SR357 Low byte	SR358 High byte	SR358 Low byte
13	SR359	SR360 High byte	SR360 Low byte	SR361 High byte	SR361 Low byte	SR362 High byte	SR362 Low byte
14	SR363	SR364 High byte	SR364 Low byte	SR365 High byte	SR365 Low byte	SR366 High byte	SR366 Low byte
15	SR367	SR368 High byte	SR368 Low byte	SR369 High byte	SR369 Low byte	SR370 High byte	SR370 Low byte
16	SR371	SR372 High byte	SR372 Low byte	SR373 High byte	SR373 Low byte	SR374 High byte	SR374 Low byte
17	SR375	SR376 High byte	SR376 Low byte	SR377 High byte	SR377 Low byte	SR378 High byte	SR378 Low byte
18	SR379	SR380 High byte	SR380 Low byte	SR381 High byte	SR381 Low byte	SR382 High byte	SR382 Low byte
19	SR383	SR384	SR384	SR385	SR385	SR386	SR386

Number	Action number	*Time when the PLC status change action occurs					
		Year	Month	Day	Hour	Minute	Second
		High byte	Low byte	High byte	Low byte	High byte	Low byte
20	SR387	SR388 High byte	SR388 Low byte	SR389 High byte	SR389 Low byte	SR390 High byte	SR390 Low byte

*Time when the PLC status change action occurs: The data is stored as the values in the binary-coded decimal. The range of values is as follows.

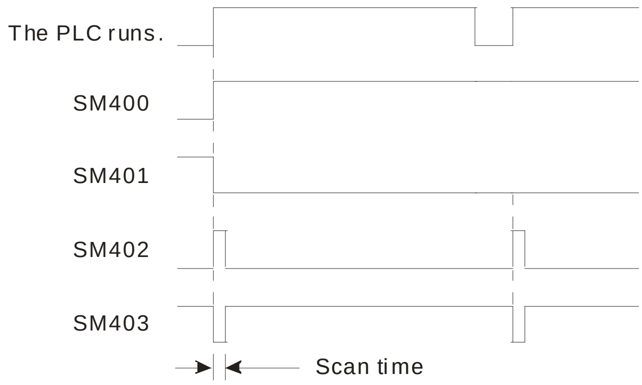
Function	Value
Year	00~99 (A.D.)
Month	01~12
Day	01~31
Hour	00~23
Minute	00~59
Second	00~59

9. **The PLC operation flag**

- SM400~SM403

  SM400: The flag is always ON when CPU runs.

SM401: The flag is always OFF when CPU runs.
SM402: The flag is ON only at the first scan. The pulse width equals one scan time. Users can use this contact to do the initial setting.
SM403: The flag is OFF only at the first scan. That is, the negative pulse is generated the moment the PLC runs.



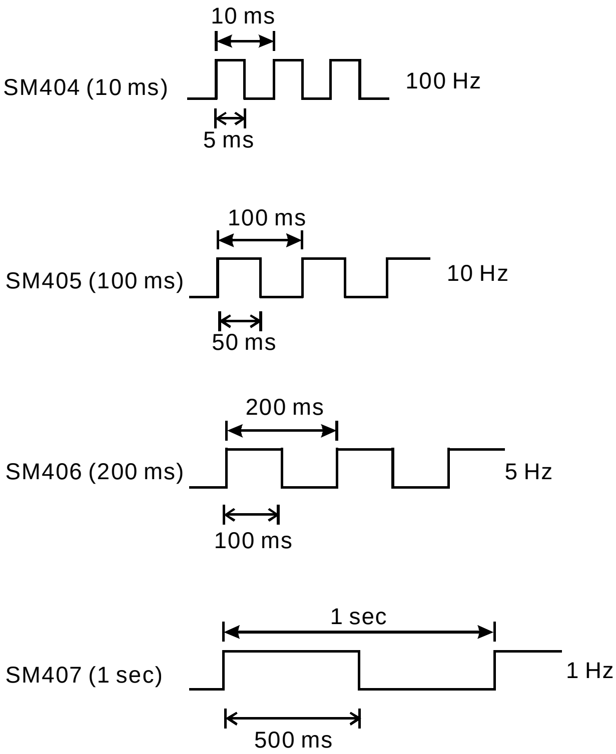
10. **The initial clock pulse**

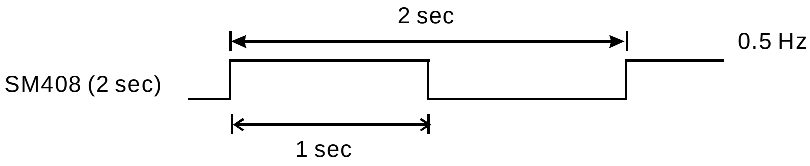
- SM404~SM410, and SR409~SR410

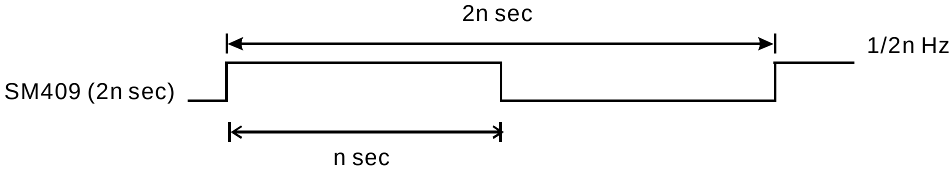
  The PLC provides seven types of clock pulses. When the PLC is supplied with power, the seven types of clock pulses act automatically. Users can set the interval of the clock pulse in SM409 and SM410.

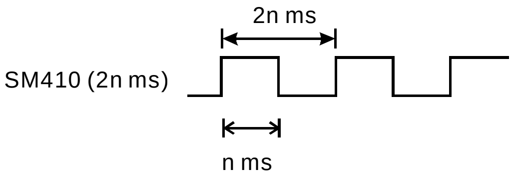
Device	Function
SM404	10 millisecond clock pulse during which the pulse is ON for 5 milliseconds and is OFF for 5 milliseconds
SM405	100 millisecond clock pulse during which the pulse is ON for 50 milliseconds and is OFF for 50 milliseconds
SM406	200 millisecond clock pulse during which the pulse is ON for 100 milliseconds and is OFF for 100 milliseconds
SM407	One second clock pulse during which the pulse is ON for 500 milliseconds and is OFF for 500 milliseconds
SM408	Two second clock pulse during which the pulse is ON for one second and is OFF for one second
SM409	2n second clock pulse during which the pulse is ON for n seconds and is OFF for n seconds The interval n is specified by SR409.
SM410	2n millisecond clock pulse during which the pulse is ON for n milliseconds and is OFF for n milliseconds The interval n is specified by SR410.

The clock pulses are illustrated as follows.









11. **The flags related to the memory card**
    - SM450~SM453, and SR453

      The memory card is used to backup the data in the PLC. The corresponding functions of these special auxiliary relays and the corresponding function of SR453 are as follows.

Device	Function
SM450	Whether the memory card exists ON: The memory card exists. OFF: The memory card does not exist.
SM451	Write protection switch on the memory card ON: The memory card is write protected. OFF: The memory card is not write protected.
SM452	The data in the memory card is being accessed. ON: The data in the memory card is being accessed. OFF: The data in the memory card is not accessed.
SM453	An error occurs during the operation of the memory card. ON: An error occurs.
SR453	If an error occurs during the operation of the memory card, the error code will be recorded.

12. **The flags related to the I/O module**
    - SR655~SR730 record the mapping error occurring in the module table or the error occurring in the I/O module.

      SR655~SR730 record the mapping error occurring in the module table.

      If the mapping error occurs in the module table, the corresponding bit in the special data register belonging to this module will be ON. Users can read the value in the special data register to get the information about the position where the error occurs. For example, when bit 5 in SR655 is ON, users can get the information that the error occurs at slot 5 in backplane 1.

Description	Main backplane	Extension backplane						
	Backplane 1	Backplane 2	Backplane 3	Backplane 4	Backplane 5	Backplane 6	Backplane 7	Backplane 8
Device	SR655	SR656	SR657	SR658	SR659	SR660	SR661	SR662
Slot 0	Bit0	Bit0	Bit0	Bit0	Bit0	Bit0	Bit0	Bit0
Slot 1	Bit1	Bit1	Bit1	Bit1	Bit1	Bit1	Bit1	Bit1
Slot 2	Bit2	Bit2	Bit2	Bit2	Bit2	Bit2	Bit2	Bit2
Slot 3	Bit3	Bit3	Bit3	Bit3	Bit3	Bit3	Bit3	Bit3
Slot 4	Bit4	Bit4	Bit4	Bit4	Bit4	Bit4	Bit4	Bit4
Slot 5	Bit5	Bit5	Bit5	Bit5	Bit5	Bit5	Bit5	Bit5
Slot 6	Bit6	Bit6	Bit6	Bit6	Bit6	Bit6	Bit6	Bit6
Slot 7	Bit7	Bit7	Bit7	Bit7	Bit7	Bit7	Bit7	Bit7
Slot 8	Bit8	-	-	-	-	-	-	-
Slot 9	Bit9	-	-	-	-	-	-	-
Slot 10	Bit10	-	-	-	-	-	-	-
Slot 11	Bit11	-	-	-	-	-	-	-

SR663~SR730 record the mapping error code occurring in the module table.
If the mapping error occurs in the module table, the special data register belonging to this module will record the error code. Users can read the error code in the special data register to get the information about the error.

Description	Main backplane	Extension backplane						
Backplane / Slot	Backplane 1	Backplane 2	Backplane 3	Backplane 4	Backplane 5	Backplane 6	Backplane 7	Backplane 8
Slot 0	SR663	SR675	SR683	SR691	SR699	SR707	SR715	SR723
Slot 1	SR664	SR676	SR684	SR692	SR700	SR708	SR716	SR724
Slot 2	SR665	SR677	SR685	SR693	SR701	SR709	SR717	SR725
Slot 3	SR666	SR678	SR686	SR694	SR702	SR710	SR718	SR726
Slot 4	SR667	SR679	SR687	SR695	SR703	SR711	SR719	SR727
Slot 5	SR668	SR680	SR688	SR696	SR704	SR712	SR720	SR728
Slot 6	SR669	SR681	SR689	SR697	SR705	SR713	SR721	SR729
Slot 7	SR670	SR682	SR690	SR698	SR706	SR714	SR722	SR730
Slot 8	SR671	-	-	-	-	-	-	-
Slot 9	SR672	-	-	-	-	-	-	-
Slot 10	SR673	-	-	-	-	-	-	-
Slot 11	SR674	-	-	-	-	-	-	-

13. **The flags related to the Ethernet**

- SM1001~SM1003, SM1089, SM1090, SM1091, and SM1106~SM1109

SM number	Description	Function
SM1001	Connection status of Ethernet Port 1	OFF：Ethernet Port 1 is not connected. ON：Ethernet Port 1 is connected.
SM1002	Connection status of Ethernet Port 2	OFF：Ethernet Port 2 is not connected. ON：Ethernet Port 2 is connected.
SM1003	Connection status of synchronization fiber cable	OFF：Synchronization fiber cable is not connected. ON：Synchronization fiber cable is connected.
SM1089	Maximum MODBUS TCP connetion number has been reached.	ON：Maximum MODBUS TCP connetion number has been reached.
SM1090	The TCP connection is busy.	ON: TCP connection timeout
SM1091	The UDP connection is busy.	ON: UDP connection timeout
SM1106	Ethernet connection error	OFF: The Ethernet auto-negotiation succeeds. ON: The Ethernet auto-negotiation fails.
SM1107	Basic setting error	OFF: The basic setting is correct. ON: The basic setting is incorrect.
SM1108	Filter setting error	OFF: The filter setting is correct. ON: The filter setting is incorrect.
SM1109	Basic management of the TCP/UDP socket—The local port is already used.	The flag is ON when the same port is used.

Please refer to section 12.2 in AH500 Operation Manual for more information about the LED indicators and the error codes.

14. **The setting of the email sending**

- SM1112~SM1113, and SM1116~SM1195

Before sending the email, users have to set the related parameters in the email. If the setting fails, SM1112 will be set to ON. Besides, SM1113 will be set to ON if the sending of the email fails.

The triggers (trigger1~trigger8) and the flags (SM1116~SM1195) are described below.

Item / Function	Trigger 1	Trigger 2	Trigger 3	Trigger 4	Trigger 5	Trigger 6	Trigger 7	Trigger 8
Email trigger switch	SM1116	SM1126	SM1136	SM1146	SM1156	SM1166	SM1176	SM1186
	When the basic setting is incorrect, the flag is set to ON.							
Email trigger	SM1117	SM1127	SM1137	SM1147	SM1157	SM1167	SM1177	SM1187
	When the filter setting is incorrect, the flag is set to ON.							
Email trigger status 0	SM1118	SM1128	SM1138	SM1148	SM1158	SM1168	SM1178	SM1188
	When the trigger is enabled and no mail has been sent, the flag is ON.							
Email trigger status 1	SM1119	SM1129	SM1139	SM1149	SM1159	SM1169	SM1179	SM1189
	When the trigger is enabled and the last mail has been sent successfully, the flag is ON.							
Email trigger status 2	SM1120	SM1130	SM1140	SM1150	SM1160	SM1170	SM1180	SM1190
	When the trigger is enabled and the last mail has been sent in error, the flag is ON.							
Email	SM1121	SM1131	SM1141	SM1151	SM1161	SM1171	SM1181	SM1191

Function \ Item	Trigger 1	Trigger 2	Trigger 3	Trigger 4	Trigger 5	Trigger 6	Trigger 7	Trigger 8
trigger status 3	When the trigger is enabled and the mail has been sent, the flag is ON.							
SMTP server response timeout	SM1122	SM1132	SM1142	SM1152	SM1162	SM1172	SM1182	SM1192
	When the trigger is enabled and there is an SMTP server response timeout, the flag is ON.							
SMTP server response error	SM1123	SM1133	SM1143	SM1153	SM1163	SM1173	SM1183	SM1193
	When the trigger is enabled and there is an SMTP server response error, the flag is ON.							
Attachment size error	SM1124	SM1134	SM1144	SM1154	SM1164	SM1174	SM1184	SM1194
	When the trigger is enabled and the size of the attachment exceeds the limit, the flag is ON.							
Nonexistent attachment	SM1125	SM1135	SM1145	SM1155	SM1165	SM1175	SM1185	SM1195
	When the trigger is enabled and the attachment is not found, the flag is ON.							

Please refer to section 12.2 in AH500 Operation Manual for more information about the LED indicators and the error codes.

15. **Setting the TCP/UDP socket**

- SR1118-SR1320

  The TCP/UDP sockets are set in SR1118-SR1320, and eight TCP/UDP sockets at most can be set. Users can set the sockets which uses the TCP protocol to execute the data exchange in SR1118~SR1221. And sers can set the sockets which uses the UDP protocol to execute the data exchange in SR1222~SR1317. Please refer to section 6.22 for more information related to the Ethernet control instructions.

16. **The functions related to the PLC Link**

- SM1392~SM1598, and SR1335~SR1787

  The PLC Link supports COM1 on the PLC. At most 32 slaves can be connected. When the master connects to the AH500 series programmable logic controllers, at most 450 words or 7200 bits can be read from the AH500 series programmable logic controllers and written into them. When the master connects to other models which support the standard Modbus, at most 100 words or 1600 bits can be read from these models and written into them.

	Master station						
	Data exchange connection 1		Data exchange connection 2		...	Data exchange connection 32	
	Read	Write	Read	Write	...	Read	Write
Latched area	The device starting address of the master from where the data exchange connection 1 reads. (SR1404 and SR1405)	The device starting address of the master from where the data exchange connection 1 writes. (SR1468 and SR1469)	The device starting address of the master from where the data exchange connection 2 reads. (SR1406 and SR1407)	The device starting address of the master from where the data exchange connection 1 writes. (SR1470 and SR1471)	...	The device starting address of the master from where the data exchange connection 32 reads. (SR1466 and SR1467)	The device starting address of the master from where the data exchange connection 32 writes. (SR1530 and SR1531)

	Master station						
	Data exchange connection 1		Data exchange connection 2		…	Data exchange connection 32	
	Read	Write	Read	Write	…	Read	Write
	The device starting address of the slave from where the data exchange connection 1 reads. (SR1532 and SR1533)	The device starting address of the slave from where the data exchange connection 1 writes (SR1596 and SR1597)	The device starting address of the slave from where the data exchange connection 2 reads. (SR1534 and SR1535)	The device starting address of the slave from where the data exchange connection 2 writes. (SR1598 and SR1599)	…	The device starting address of the slave from where the data exchange connection 32 reads. (SR1594 and SR1595)	The device starting address of the slave from where the data exchange connection 32 writes. (SR1658 and SR1659)
	The data length for data exchange connection 1 to be read. (SR1660)	The data length for data exchange connection 1 to be written. (SR1692)	The data length for data exchange connection 2 to be read (SR1661)	The data length for data exchange connection 2 to be written. (SR1693)	…	The data length for data exchange connection 32 to be read (SR1691)	The data length for data exchange connection 32 to be written. (SR1723)
	Device types to be read for data exchange connection 1 (SR1340)	Device types to be wtrite for data exchange connection 1 (SR1372)	Device types to be read for data exchange connection 2 (SR1341)	Device types to be wtrite for data exchange connection 2 (SR1373)	…	Device types to be read for data exchange connection 32 (SR1371)	Device types to be wtrite for data exchange connection 32 (SR1403)
	Type of data exchange connection 1 (SR1724)		Type of data exchange connection 2 (SR1725)		…	Type of data exchange connection 32 (SR1755)	
	The slave ID of data exchange connection 1 (SR1756)		The slave ID of data exchange connection 2 (SR1757)		…	The slave ID of data exchange connection 32 (SR1787)	
Non-latched area	To start data exchange for connection 1 (SM1392)		To start data exchange for connection 1 (SM1393)		…	To start data exchange for connection 1 (SM1423)	
	Data exchange execution flag (SM1424)		Data exchange execution flag (SM1425)		…	Data exchange execution flag (SM1455)	
	An error occurs while reading data from data exchange connection 1 (SM1456)	An error occurs while writing data in data exchange connection 1 (SM1488)	An error occurs while reading data from data exchange connection 2 (SM1457)	An error occurs while writing data in data exchange connection 2 (SM1489)	…	An error occurs while reading data from data exchange connection 32 (SM1487)	An error occurs while writing data in data exchange connection 32 (SM1519)
	The data reading from data exchange connection 1 is complete. (ON->OFF) (SM1520)		The data reading from data exchange connection 2 is complete. (ON->OFF) (SM1521)		…	The data reading from data exchange connection 32 is complete. (ON->OFF) (SM1551)	
	The data writing in data exchange 1 is complete. (ON->OFF) (SM1552)		The data writing in data exchange 2 is complete. (ON->OFF) (SM1553)		…	The data writing in data exchange 32 is complete. (ON->OFF) (SM1583)	

***. SM1424~SM1583 are read-only devices.**

Please refer to section 11.1 in AH500 Operation Manual for more information related to the PLC Link.

17. **The functions related to the Ether Link**

Port	Starting the Ether Link OFF: Stop ON: Start	Ether Link error flag OFF: Incorrect ON: Correct	Status of the Ether Link OFF: Stop ON: Run
CPU	SM1770	SM1788	SM1806
Port 0	SM1772	SM1790	SM1808
Port 1	SM1773	SM1791	SM1809
Port 2	SM1774	SM1792	SM1810
Port 3	SM1775	SM1793	SM1811
Port 4	SM1776	SM1794	SM1812
Port 5	SM1777	SM1795	SM1813
Port 6	SM1778	SM1796	SM1814
Port 7	SM1779	SM1797	SM1815
Port 8	SM1780	SM1798	SM1816
Port 9	SM1781	SM1799	SM1817
Port 10	SM1782	SM1800	SM1818
Port 11	SM1783	SM1801	SM1819
Port 12	SM1784	SM1802	SM1820
Port 13	SM1785	SM1803	SM1821
Port 14	SM1786	SM1804	SM1822
Port 15	SM1787	SM1805	SM1823

Please refer to section 11.2 in AH500 Operation Manual for more information related to the Ether Link.

18. **Setting the IP address**

- SR1792~SR2047

Device	Function	Description
SR1792	IP address of block 1	High eight bits in the IP address of block 1 Example: If the remote IP address is 192.168.1.100, the value in the register is 16#C0A8.
SR1793	IP address of block 1	Low eight bits in the IP address of block 1 Example: If the remote IP address is 192.168.1.100, the value in the register is 16#0164.
⋮		
SR2046	IP address of block 128	High eight bits in the IP address of block 128 Example: If the remote IP address is 192.168.1.100, the value in the register is 16#C0A8.
SR2047	IP address of block 128	Low eight bits in the IP address of block 128 Example: If the remote IP address is 192.168.1.100, the value in the register is 16#0164.

Please refer to section 11.2 in AH500 Operation Manual for more information related to the Ether Link.

19. **The flags related to power module**

- SM20, SR32-SR33, SR731, SR732

Device	Function	Description
SM20	Power supply error log	Power supply is back to normal after a short break of insufficient internal power supply.
SR32	Status of the left-side power module	ON: Something went wrong in the left-side power module OFF: Nothing went wrong in the left-side power module
SR33	Status of the right-side power module	ON: Something went wrong in the right-side power module OFF: Nothing went wrong in the right-side power module
SR731	External 24V low-voltage detected on the left-side power module	ON: Something wrong is detected in the external 24V input of the left-side power module OFF: Nothing wrong is detected in the external 24V input of the left-side r power module
SR732	External 24V low-voltage detected on the right-side power module	ON: Something wrong is detected in the external 24V input of the right-side power module OFF: Nothing wrong is detected in the external 24V input of the right-side power module

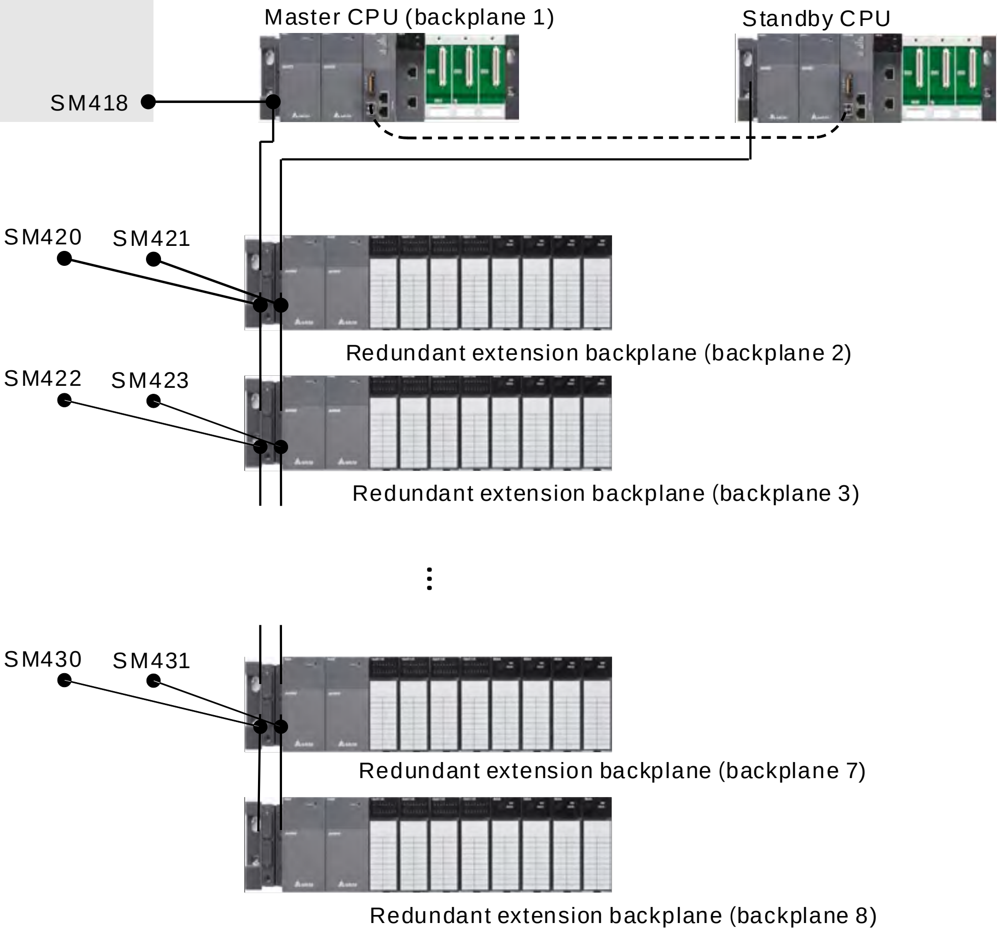
Description		Power module status		External 24V low-voltage detection	
		Left-side power module	Right-side Power module	Left-side power module	Right-side Power module
Device		SR32	SR33	SR731	SR732
Main backplane	Backplane 1	Bit0	Bit0	Bit0	Bit0
Redundant backplane	Backplane 2	Bit1	Bit1	Bit1	Bit1
	Backplane 3	Bit2	Bit2	Bit2	Bit2
	Backplane 4	Bit3	Bit3	Bit3	Bit3
	Backplane 5	Bit4	Bit4	Bit4	Bit4
	Backplane 6	Bit5	Bit5	Bit5	Bit5
	Backplane 7	Bit6	Bit6	Bit6	Bit6
	Backplane 8	Bit7	Bit7	Bit7	Bit7

20. **The connection status of the redundant extension backplane**

- SM418~431: communication port status of the redundant extension backplane (ON: normal ; OFF: abnormal)

Description		Communication port status	
		Port2	Port4
Main backplane in the redundancy system	Backplane 1	SM418	-
Redundant extension backplane	Backplane 2	SM420	SM421
	Backplane 3	SM422	SM423

Description		Communication port status	
		Port2	Port4
	Backplane 4	SM424	SM425
	Backplane 5	SM426	SM427
	Backplane 6	SM428	SM429
	Backplane 7	SM430	SM431



21. **The flags related to PLC informaiton**

- SR440~SR442, SR443~SR451
  SR440~SR442: PLC MAC address
  SR443~SR451: PLC serial number

PLC MAC address 00:18:23:10:F5:1A		PLC serial number CPU52120W15480004	
Device	**Value**	**Device**	**Value**
SR440	0018	SR443	PC
SR441	2310	SR444	5U
SR442	F51A	SR445	12
		SR446	02

PLC MAC address 00:18:23:10:F5:1A		PLC serial number CPU52120W15480004	
Device	**Value**	**Device**	**Value**
		SR447	1W
		SR448	45
		SR449	08
		SR450	00
		SR451	40

AHCPU automatically writes the MAC address and the serial number in ASCII format in the corresponding SR devices.

22. **The flags related to EtherNet/IP**

- SM2048 ~ SM2303: flags to enable data mapping for connection 1~256 via EtherNet/IP Scanner. You can use the flags to enable or disable the connection between AH Series PLC CPU and its adapters.
  ON: Enable data mapping for the connection.
  OFF: Disable data mapping for the connection.
- SM2304~ SM2311: flags to show the error status of EtherNet/IP Adapter connection 1~8. You can use the flas to check if the connection between AH Series PLC CPU and its scanner is working.
  ON: The connection is NOT working.
  OFF: The connection is working.
- SM2312~ SM2319: flags to show the connection status of EtherNet/IP Adapter connection 1~8. You can use the flags to check the connection status between AH Series PLC CPU and its scanner.
  ON: The connection is established.
  OFF: The connection is NOT established.
- SR2046: Number of the EtherNet/IP adapter connections
  You can use the flag to see the number of connections between AH Series PLC CPU (adapter) and its scanners.
- SR2047: Number of the EtherNet/IP scanner connections
  You can use the flag to see the number of connections between AH Series PLC CPU (scanner) and its adapters.
- SR2048~SR2303: Erroor codes of data mapping for connection 1~256 via EtherNet/IP Scanner. Refer to Chapter 6 Troubleshooting from EtherNet/IP Operation Manual.
- SR2304~SR2559: The operation status of the connection 1~256 for data mapping via EtherNet/IP Scanner.
  The values 0 and 1 in this SR indicates:
  0: This connection is abnormal or not established. Refer to the corresponding register SR2048~SR2303 to learn more about the error.
  1: The connection is working.

2.2.17 Link Registers

The link register is mainly used in the PLC Link or the Ether Link. When the data exchange occurs between the AH500 series programmable logic controllers, the link register can be used as the buffer. Please refer to chapter 12 in AH500 Operation Manual for more information.

The link registers L0~L65535 add up to 65536 words. Besides, the link register can be used as the general auxiliary register.

2.2.18 Index Registers

The index register is the 16-bit data register. It is like the general register in that the data can be read from it and written into it. However, it is mainly used as the index register. The range of index registers is E0~E13. Please refer to section 4.3 for more information related to the index register.

Chapter 3 Instruction Tables

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3.1 Instructions

Instructions used in the AH500 series PLC include basic instructions and applied instructions.

3.1.1 Basic Instructions

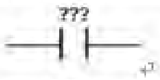
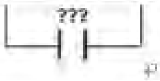
Classification	Description
Contact instructions	Loading the contact, connecting the contact in series, connecting the contact in parallel, and etc.
Connection instructions	Storing and reading the operation result
Output instructions	Bit device output; pulse output
Master control Instructions	Setting and resetting the master control
Rising-edge/Falling-edge detection contact instructions	Triggering the instructions that load the contact, connect the contacts in series, and connect the contacts in parallel
Rising-edge/Falling-edge output instructions	Bit device output
Other instructions	Other instructions

3.1.2 Applied Instructions

API	Classification	Description
0000~0065	Comparison instructions	Comparisons such as =, <>, >, >=, <, <=, and etc.
0100~0118	Arithmetic instructions	Using binary numbers or binary-coded decimal numbers to add, subtract, multiply, or divide.
0200~0219	Data conversion instructions	Converting the binary-coded decimal number into the binary number, and converting the binary number into the binary-coded decimal number
0300~0310	Data transfer instructions	Transfer the specified data
0400~0402	Jump instructions	The program jumps.
0500~0502	Program execution instructions	Enabling or disabling the interrupt
0600	I/O refreshing instructions	Refreshing the I/O.
0700~0708	Miscellaneous instructions	Instructions which are applied to the counters, the teach mode timers, the special timers, and etc.
0800~0817	Logic instructions	Logical operations such as logical addition, logical multiplication, and etc.
0900~0904	Rotation instructions	Rotating/Shifting the specified data
1000~1004	Timer and counter instructions	Timer instructions and counter instructions
1100~1115	Shift instructions	Shifting the specified data
1200~1223	Data processing instructions	16-bit data processing such as decoding and encoding.
1300~1302	Structure creation instructions	Nested loops
1400~1401	Module instructions	Reading the data from the special module and writing the data into the special module
1500~1524	Floating-point number instructions	Floating-point number operations
1600~1607	Real-time clock instructions	Reading/Writing, adding/subtracting and comparing the time
1700~1704	Peripheral instructions	I/O points connected to the peripheral
1800~1812	Communication instructions	Controlling the peripheral though communication
1900~1905	Other instructions	Instructions which are different from those mentioned above
2100~2121	String processing instructions	Conversion between binary/binary-coded decimal numbers and ASCII codes; conversion between binary numbers and strings; conversion between floating-point numbers and strings; string processing
2200~2208	Ethernet instructions	Controlling the Ethernet data exchange
2300~2302	Memory card instructions	Reading the data from the memory card and writing the data into the memory card
2400~2401	Task control instructions	Controlling the task in the program
2500~2502	Sequential function charts (SFC) instructions	Controlling the SFC instructions
2900~2901	Redundant instructions	Controlling the redundancy system

3.2 Instruction Tables

3.2.1 Basic Instructions

Instruction code	Symbol	Function	Operand
LD		Loading the contact A/Connecting the contact A in series/Connecting the contact A in parallel	DX X Y M S T C HC D L SM PR
AND			
OR			

① ② ③ ④

The descriptions:

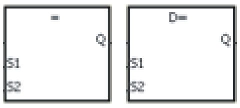
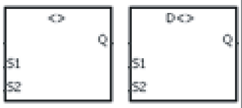
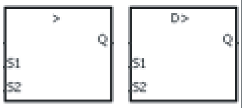
①: The instruction name

②: The symbol used in the ladder diagram in ISPSoft

③: The function

④: The operands supported by the instruction

3.2.2 Applied Instructions

API	Instruction code		Pulse Instruction	Symbol	Function
	16-bit	32-bit			
0000	LD=	DLD=	–		Comparing the contact types ON: S1 = S2 OFF: S1≠S2
0001	LD<>	DLD<>	–		Comparing the contact types ON: S1≠S2 OFF: S1 = S2
0002	LD>	DLD>	–		Comparing the contact types ON: S1 > S2 OFF: S1≦S2

① ② ③ ④ ⑤ ⑥

API	Instruction code		Pulse Instruction	Symbol	Function
	32-bit	64-bit			
0018	FLD=	DFLD=	–		Comparing the floating-point number contact types ON: S1 = S2 OFF: S1≠S2

⑦

The descriptions:

①: The applied instruction number

②: The instruction name

③: If the 16-bit instruction can be used as the 32-bit instruction, a D is added in front of the 16-bit instruction to form the 32-bit instruction.

④: ✓ indicates that the instruction can be used as the pulse instruction, whereas – indicates that it can not.
If users want to use the pulse instruction, they only need to add a P in back of the instruction.

⑤: The symbol used in the ladder diagram in ISPSoft

⑥: The function

⑦: If the 32-bit floating-point number instruction can be used as the 64-bit floating-point number instruction, a D is added in front of the 32-bit floating-point number instruction to form the 64-bit floating-point number instruction.

3.2.3 Applied Instructions (Sorted Alphabetically)

Classification	API	Instruction code			Pulse instruction	Function
		16-bit	32-bit	64-bit		
G	0209	GBIN	DGBIN	–	✓	Converting the Gray code into the binary number
	0402	GOEND	–	–	–	Jumping to the end of the program
	1902	GPWM	–	–	–	General pulse width modulation
	0208	GRY	DGRY	–	✓	Converting the binary number into the Gray code
H	2104	HABIN	DHABIN	–	✓	Converting the hexadecimal ASCII code into the hexadecimal binary number
	1701	HKY	DHKY	–	–	Hexadecimal key input
	1604	HOUR	DHOUR	–	–	Running-time meter

① ② ③ ④ ⑤ ⑥ ⑦

The descriptions:

①: The initial of the instruction name

②: The applied instruction number

③～⑤: The instruction names

If the 16-bit instruction can be used as the 32-bit instruction, a D is added in front of the 16-bit instruction to form the 32-bit instruction.

If the 32-bit floating-point number instruction can be used as the 64-bit floating-point number instruction, a D is added in front of the 32-bit floating-point number instruction to form the 64-bit floating-point number instruction.

⑥: ✓ indicates that the instruction can be used as the pulse instruction, whereas – indicates that it can not.

If users want to use the pulse instruction, they only need to add a P in back of the instruction name.

⑦: The function

3.2.4 Device Tables

① ② ③ ④

API	Instruction code			Operand	Function
0100	D	+	P	S_1、S_2、D	Binary number addition

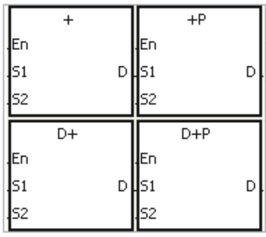
⑤

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	●	●		
S_2	●	●			●	●	●	●	●		●	○	●	●	●		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH	AH	AH

⑧

Symbol:



S_1	:	Augend	Word/Double Word
S_2	:	Addend	Word/Double Word
D	:	Sum	Word/Double Word

⑦

⑥

The descriptions:

①: The applied instruction number

②: The instruction name

If the 16-bit instruction can be used as the 32-bit instruction, a D is added in front of the 16-bit instruction to form the 32-bit instruction.

If the 32-bit floating-point number instruction can be used as the 64-bit floating-point number instruction, a D is added in front of the 32-bit floating-point number instruction to form the 64-bit floating-point number instruction.

If the instruction can be used as the pulse instruction, a P is added in back of the instruction.

③: The operand

④: The function

⑤: The devices which are supported by the operand

The decimal forms are notated by K, but they are entered directly in ISPSoft. For example, the decimal number 30 is entered directly in ISPSoft.

The hexadecimal forms are notated by 16#. For example, the decimal number 30 is represented by 16#1E in the hexadecimal system.

The floating-point numbers are notated by F/DF, but they are represented by decimal points in ISPSoft. For example, the floating-point number F500 is represented by 500.0 in ISPSoft.

The strings are notated by "$", but they are represented by " " in ISPSoft. For example, the string 1234 is represented by "1234" in ISPSoft.

○: The hollow circle

The device can not be modified by an index register.

●: The solid circle

The device can not be modified by an index register.

⑥: The ladder diagram

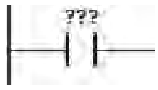
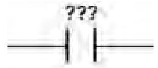
⑦: The unit of the operand

⑧: The format of the instruction

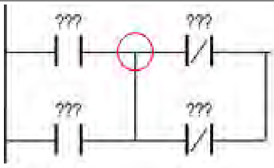
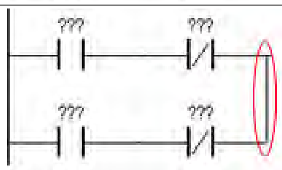
It indicates whether the instruction can be used as the pulse instruction, the 16-bit instruction, the 32-bit instruction, or the 64-bit instruction, and the number of steps.

3.3 Lists of Basic Instructions

- **Contact instructions**

Instruction code	Symbol	Function	Operand
LD		Loading contact A/Connecting contact A in series/Connecting contact A in parallel	DX, X, Y, M, S, T, C, HC, D, L, SM, and PR
AND			
OR			
LDI		Loading contact B/Connecting contact B in series/Connecting contact B in parallel	DX, X, Y, M, S, T, C, HC, D, L, SM, and PR
ANI			
ORI			

- **Connection instructions**

Instruction code	Symbol	Function	Operand
ANB		Connecting the loop blocks in series	–
ORB		Connecting the loop blocks in parallel	–
MPS	–	Storing the data in the stack	–
MRD	–	Reading the data from the stack	–
MPP	–	Popping the data from the stack	–

- **Output instructions**

Instruction code	Symbol	Function	Execution condition	Operand
OUT	??? ( )	Driving the coil		DY, X, Y, M, S, T, C, HC, D, L, SM, and PR
SET	??? (S)	Keeping the device on		DY, X, Y, M, S, T, C, HC, D, L, SM, and PR

- **Master control instructions**

Instruction code	Symbol	Function	Operand
MC	MC En N	Setting the master control	N
MCR	MCR N	Resetting the master control	N

- **Rising-edge/Falling-edge detection contact instructions**

Instruction code	Symbol	Function	Execution condition	Operand
LDP	??? ↑	Starting the rising-edge detection/Connecting the rising-edge detection in series/Connecting the rising-edge detection in parallel		DX, X, Y, M, S, T, C, HC, D, L, SM, and PR
PED				
ANDP	??? ↑			
APED				
ORP	??? ↑			
OPED				
LDF	??? ↓	Starting the falling-edge detection/Connecting the falling-edge detection in series/Connecting the falling-edge detection in parallel		DX, X, Y, M, S, T, C, HC, D, W, L, SM, and PR
NED				
ANDF	??? ↓			
ANED				
ORF	??? ↓			
ONED				

- **Rising-edge/Falling-edge output instructions**

Instruction code	Symbol	Function	Execution condition	Operand
PLS	PLS En D	Rising-edge output		DY, X, Y, M, S, T, C, HC, D, L, SM, and PR
PLF	PLF En D	Falling-edge output		DY, X, Y, M, S, T, C, HC, D, L, SM, and PR

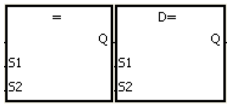
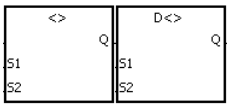
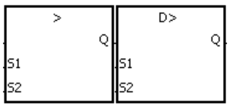
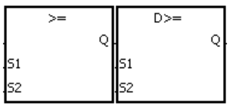
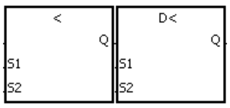
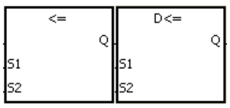
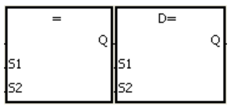
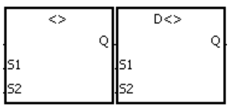
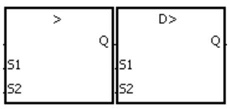
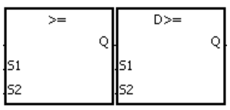
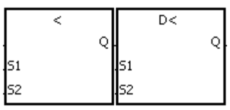
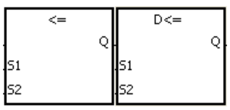
- **Other instructions**

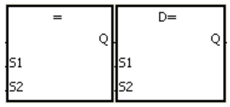
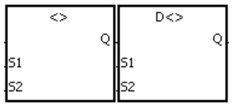
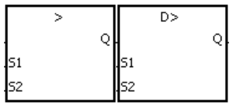
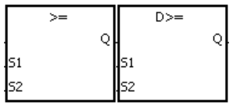
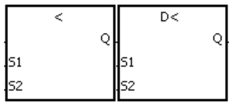
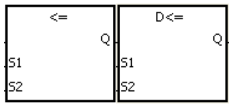
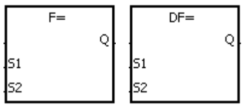
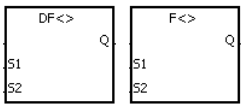
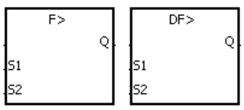
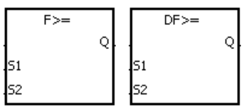
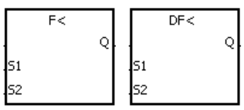
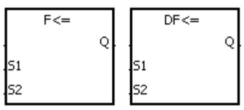
Instruction code	Symbol	Function	Operand
INV		Inverting the logical operation result	–
NOP	–	No operation	–
PSTOP	PSTOP	Stopping executing the PLC program	–
NP		The circuit is rising edge-triggered.	–
PN		The circuit is falling edge-triggered.	–
FB_NP	???	The circuit is rising edge-triggered.	S
FB_PN	???	The circuit is falling edge-triggered.	S

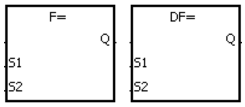
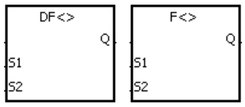
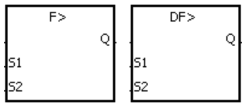
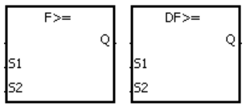
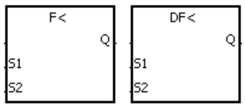
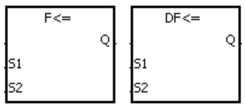
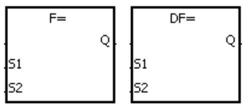
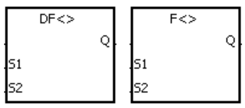
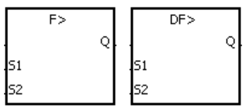
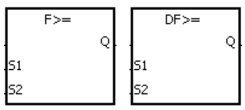
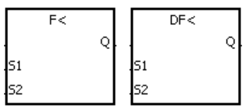
3.4 Lists of Applied Instructions

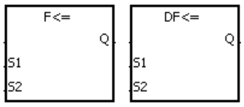
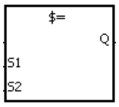
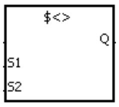
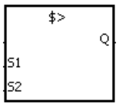
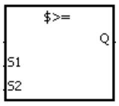
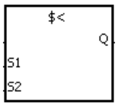
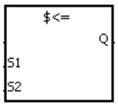
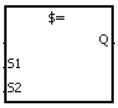
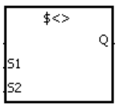
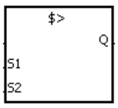
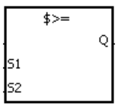
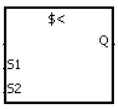
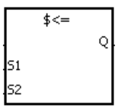
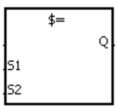
3.4.1 Applied Instructions

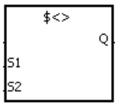
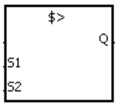
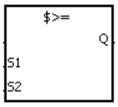
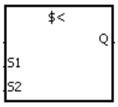
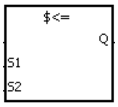
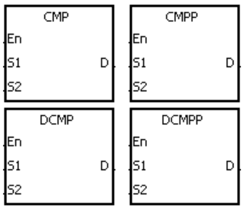
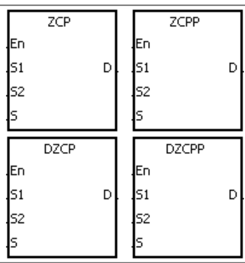
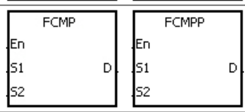
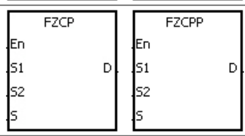
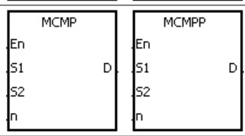
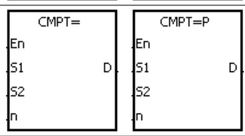
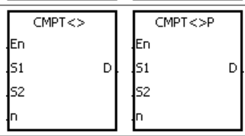
- **Comparison instructions**

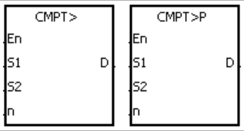
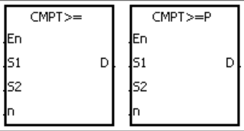
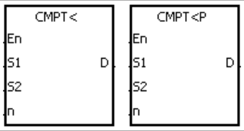
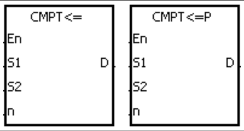
API	Instruction code		Pulse Instruction	Symbol	Function
	16-bit	32-bit			
0000	LD=	DLD=	–		Comparing the values ON: $S_1 = S_2$ OFF: $S_1 \neq S_2$
0001	LD<>	DLD<>	–		Comparing the values ON: $S_1 \neq S_2$ OFF: $S_1 = S_2$
0002	LD>	DLD>	–		Comparing the values ON: $S_1 > S_2$ OFF: $S_1 \leqq S_2$
0003	LD>=	DLD>=	–		Comparing the values ON: $S_1 \geqq S_2$ OFF: $S_1 < S_2$
0004	LD<	DLD<	–		Comparing the values ON: $S_1 < S_2$ OFF: $S_1 \geqq S_2$
0005	LD<=	DLD<=	–		Comparing the values ON: $S_1 \leqq S_2$ OFF: $S_1 > S_2$
0006	AND=	DAND=	–		Comparing the values ON: $S_1 = S_2$ OFF: $S_1 \neq S_2$
0007	AND<>	DAND<>	–		Comparing the values ON: $S_1 \neq S_2$ OFF: $S_1 = S_2$
0008	AND>	DAND>	–		Comparing the values ON: $S_1 > S_2$ OFF: $S_1 \leqq S_2$
0009	AND>=	DAND>=	–		Comparing the values ON: $S_1 \geqq S_2$ OFF: $S_1 < S_2$
0010	AND<	DAND<	–		Comparing the values ON: $S_1 < S_2$ OFF: $S_1 \geqq S_2$
0011	AND<=	DAND<=	–		Comparing the values ON: $S_1 \leqq S_2$ OFF: $S_1 > S_2$

API	Instruction code		Pulse Instruction	Symbol	Function
	16-bit	32-bit			
0012	OR=	DOR=	–		Comparing the values ON: $S_1 = S_2$ OFF: $S_1 \neq S_2$
0013	OR<>	DOR<>	–		Comparing the values ON: $S_1 \neq S_2$ OFF: $S_1 = S_2$
0014	OR>	DOR>	–		Comparing the values ON: $S_1 > S_2$ OFF: $S_1 \leqq S_2$
0015	OR>=	DOR>=	–		Comparing the values ON: $S_1 \geqq S_2$ OFF: $S_1 < S_2$
0016	OR<	DOR<	–		Comparing the values ON: $S_1 < S_2$ OFF: $S_1 \geqq S_2$
0017	OR<=	DOR<=	–		Comparing the values ON: $S_1 \leqq S_2$ OFF: $S_1 > S_2$
0018	FLD=	DFLD=	–		Comparing the floating-point numbers ON: $S_1 = S_2$ OFF: $S_1 \neq S_2$
0019	FLD<>	DFLD<>	–		Comparing the floating-point numbers ON: $S_1 1 \neq S_2$ OFF: $S_1 = S_2$
0020	FLD>	DFLD>	–		Comparing the floating-point numbers ON: $S_1 > S_2$ OFF: $S_1 \leqq S_2$
0021	FLD>=	DFLD>=	–		Comparing the floating-point numbers ON: $S_1 \geqq S_2$ OFF: $S_1 < S_2$
0022	FLD<	DFLD<	–		Comparing the floating-point numbers ON: $S_1 < S_2$ OFF: $S_1 \geqq S_2$
0023	FLD<=	DFLD<=	–		Comparing the floating-point numbers ON: $S_1 \leqq S_2$ OFF: $S_1 > S_2$

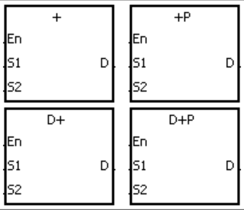
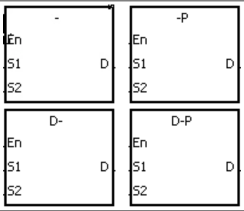
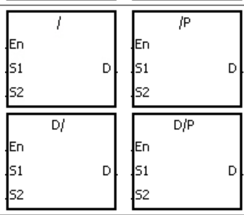
API	Instruction code		Pulse Instruction	Symbol	Function
	16-bit	32-bit			
0024	FAND=	DFAND=	–		Comparing the floating-point numbers ON: $\mathbf{S_1} = \mathbf{S_2}$ OFF: $\mathbf{S_1} \neq \mathbf{S_2}$
0025	FAND<>	DFAND<>	–		Comparing the floating-point numbers ON: $\mathbf{S_1} \neq \mathbf{S_2}$ OFF: $\mathbf{S_1} = \mathbf{S_2}$
0026	FAND>	DFAND>	–		Comparing the floating-point numbers ON: $\mathbf{S_1} > \mathbf{S_2}$ OFF: $\mathbf{S_1} \leqq \mathbf{S_2}$
0027	FAND>=	DFAND>=	–		Comparing the floating-point numbers ON: $\mathbf{S_1} \geqq \mathbf{S_2}$ OFF: $\mathbf{S_1} < \mathbf{S_2}$
0028	FAND<	DFAND<	–		Comparing the floating-point numbers ON: $\mathbf{S_1} < \mathbf{S_2}$ OFF: $\mathbf{S_1} \geqq \mathbf{S_2}$
0029	FAND<=	DFAND<=	–		Comparing the floating-point numbers ON: $\mathbf{S_1} \leqq \mathbf{S_2}$ OFF: $\mathbf{S_1} > \mathbf{S_2}$
0030	FOR=	DFOR=	–		Comparing the floating-point numbers ON: $\mathbf{S_1} = \mathbf{S_2}$ OFF: $\mathbf{S_1} \neq \mathbf{S_2}$
0031	FOR<>	DFOR<>	–		Comparing the floating-point numbers ON: $\mathbf{S_1} \neq \mathbf{S_2}$ OFF: $\mathbf{S_1} = \mathbf{S_2}$
0032	FOR>	DFOR>	–		Comparing the floating-point numbers ON: $\mathbf{S_1} > \mathbf{S_2}$ OFF: $\mathbf{S_1} \leqq \mathbf{S_2}$
0033	FOR>=	DFOR>=	–		Comparing the floating-point numbers ON: $\mathbf{S_1} \geqq \mathbf{S_2}$ OFF: $\mathbf{S_1} < \mathbf{S_2}$
0034	FOR<	DFOR<	–		Comparing the floating-point numbers ON: $\mathbf{S_1} < \mathbf{S_2}$ OFF: $\mathbf{S_1} \geqq \mathbf{S_2}$

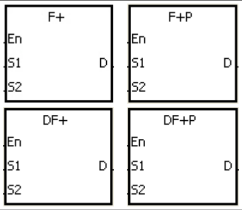
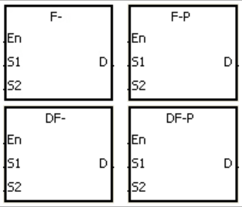
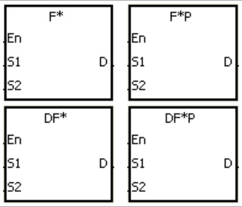
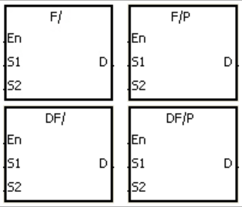
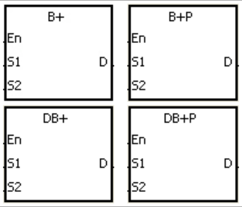
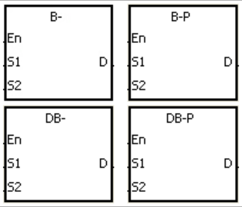
API	Instruction code		Pulse Instruction	Symbol	Function
	16-bit	32-bit			
0035	FOR<=	DFOR<=	–		Comparing the floating-point numbers ON: $S_1 \leqq S_2$ OFF: $S_1 > S_2$
0036	LD$=	–	–		Comparing the strings ON: $S_1 = S_2$ ON: $S_1 \neq S_2$
0037	LD$<>	–	–		Comparing the strings ON: $S_1 \neq S_2$ OFF: $S_1 = S_2$
0038	LD$>	–	–		Comparing the strings ON: $S_1 > S_2$ OFF: $S_1 \leqq S_2$
0039	LD$>=	–	–		Comparing the strings ON: $S_1 \geqq S_2$ OFF: $S_1 < S_2$
0040	LD$<	–	–		Comparing the strings ON: $S_1 < S_2$ OFF: $S_1 \geqq S_2$
0041	LD$<=	–	–		Comparing the strings ON: $S_1 \leqq S_2$ OFF: $S_1 > S_2$
0042	AND$=	–	–		Comparing the strings ON: $S_1 = S_2$ OFF $S_1 \neq S_2$
0043	AND$<>	–	–		Comparing the strings ON: $S_1 \neq S_2$ OFF: $S_1 = S_2$
0044	AND$>	–	–		Comparing the strings ON: $S_1 > S_2$ OFF: $S_1 \leqq S_2$
0045	AND$>=	–	–		Comparing the strings ON: $S_1 \geqq S_2$ OFF: $S_1 < S_2$
0046	AND$<	–	–		Comparing the strings ON: $S_1 < S_2$ OFF: $S_1 \geqq S_2$
0047	AND$<=	–	–		Comparing the strings ON: $S_1 \leqq S_2$ OFF: $S_1 > S_2$
0048	OR$=	–	–		Comparing the strings ON: $S_1 = S_2$ OFF: $S_1 \neq S_2$

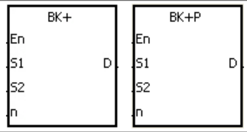
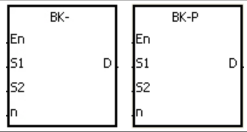
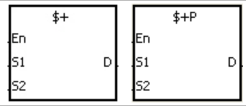
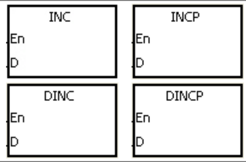
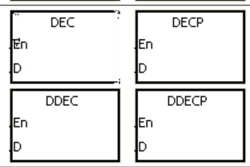
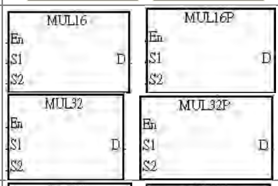
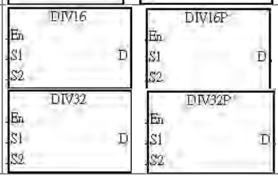
API	Instruction code		Pulse Instruction	Symbol	Function
	16-bit	32-bit			
0049	OR$<>	–	–		Comparing the strings ON: $S_1 \neq S_2$ OFF: $S_1 = S_2$
0050	OR$>	–	–		Comparing the strings ON: $S_1 > S_2$ OFF: $S_1 \leqq S_2$
0051	OR$>=	–	–		Comparing the strings ON: $S_1 \geqq S_2$ OFF: $S_1 < S_2$
0052	OR$<	–	–		Comparing the strings ON: $S_1 < S_2$ OFF: $S_1 \geqq S_2$
0053	OR$<=	–	–		Comparing the strings ON: $S_1 \leqq S_2$ OFF: $S_1 > S_2$
0054	CMP	DCMP	✓		Comparing the values
0055	ZCP	DZCP	✓		Zone comparison
0056	–	FCMP	✓		Comparing the floating-point numbers
0057	–	FZCP	✓		Floating-point zone comparison
0058	MCMP	–	✓		Matrix comparison
0059	CMPT=	–	✓		Comparing the tables ON: =
0060	CMPT<>	–	✓		Comparing the tables ON: ≠

API	Instruction code 16-bit	Instruction code 32-bit	Pulse Instruction	Symbol	Function
0061	CMPT>	–	✓		Comparing the tables ON: >
0062	CMPT>=	–	✓		Comparing the tables ON: ≧
0063	CMPT<	–	✓		Comparing the tables ON: <
0064	CMPT<=	–	✓		Comparing the tables ON: ≦
0065	CHKADR	–	–		Checking the address of the contact type of pointer register

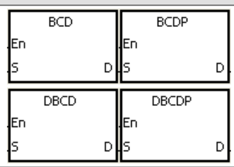
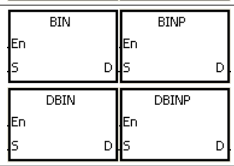
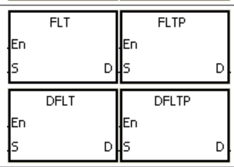
- **Arithmetic instructions**

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
0100	+	D+	✓		Addition of binary numbers $\mathbf{S_1}+\mathbf{S_2}$=D
0101	-	D-	✓		Subtraction of binary numbers $\mathbf{S_1}-\mathbf{S_2}$=D
0102	*	D*	✓		Multiplication of binary numbers $\mathbf{S_1}*\mathbf{S_2}$=D
0103	/	D/	✓		Division of binary numbers $\mathbf{S_1}/\mathbf{S_2}$=D

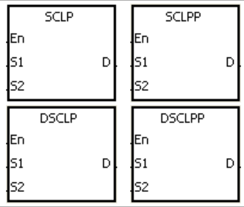
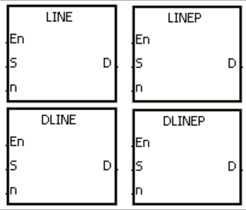
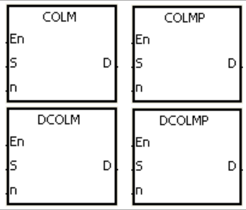
API	Instruction code 32-bit	Instruction code 64-bit	Pulse instruction	Symbol	Function
0104	F+	DF+	✓		Addition of floating-point numbers **S**$_1$+**S**$_2$=D
0105	F-	DF-	✓		Subtraction of floating-point numbers **S**$_1$-**S**$_2$=D
0106	F*	DF*	✓		Multiplication of floating-point numbers **S**$_1$****S**$_2$=D
0107	F/	DF/	✓		Division of floating-point numbers **S**$_1$/**S**$_2$=D
0108	B+	DB+	✓		Addition of binary-coded decimal numbers **S**$_1$+**S**$_2$=D
0109	B-	DB-	✓		Subtraction of binary-coded decimal numbers **S**$_1$-**S**$_2$=D
0110	B*	DB*	✓		Multiplication of binary-coded decimal numbers **S**$_1$****S**$_2$=D
0111	B/	DB/	✓		Division of binary-coded decimal numbers **S**$_1$/**S**$_2$=D

API	Instruction code		Pulse instruction	Symbol	Function
	32-bit	64-bit			
0112	BK+	–	✓		Addition of binary numbers in blocks
0113	BK-	–	✓		Subtraction of binary numbers in blocks
0114	\$+	–	✓		Linking the strings
0115	INC	DINC	✓		Adding one to the binary number
0116	DEC	DDEC	✓		Subtracting one from the binary number
0117	MUL16	MUL32	✓		Multiplication of binary numbers for 16-bit Multiplication of binary numbers for 32-bit
0118	DIV16	DIV32	✓		Division of binary numbers for 16-bit Division of binary numbers for 32-bit

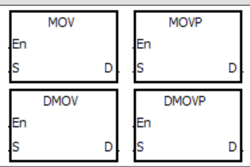
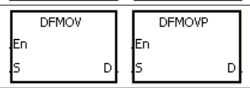
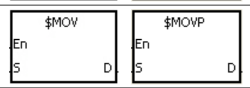
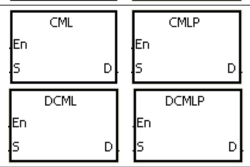
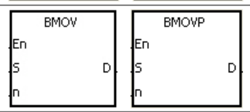
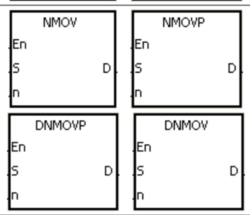
- **Data conversion instructions**

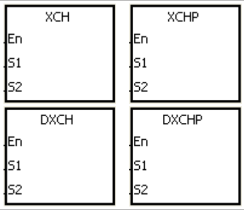
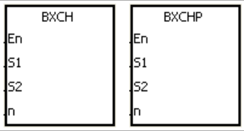
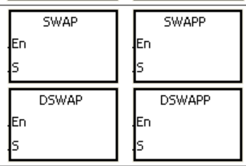
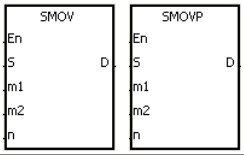
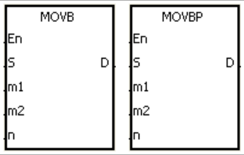
API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
0200	BCD	DBCD	✓		Converting the binary number into the binary-coded decimal number
0201	BIN	DBIN	✓		Converting the binary-coded decimal number into the binary number
0202	FLT	DFLT	✓		Converting the binary integer into the binary floating-point number

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
0203	FLTD	DFLTD	✓	FLTD, FLTDP, DFLTD, DFLTDP (En, S, D)	Converting the binary integer into the 64-bit floating-point number
0204	INT	DINT	✓	INT, INTP, DINT, DINTP (En, S, D)	Converting the 32-bit floating-point number into the binary integer
0205	DFINT	DFINT	✓	DFINT, DFINTP, DDFINT, DDFINTP (En, S, D)	Converting the 64-bit floating-point number into the binary integer
0206	MMOV	–	✓	MMOV, MMOVP (En, S, D)	Converting the 16-bit value into the 32-bit value
0207	RMOV	–	✓	RMOV, RMOVP (En, S, D)	Converting the 32-bit value into the 16-bit value
0208	GRY	DGRY	✓	GRY, GRYP, DGRY, DGRYP (En, S, D)	Converting the binary number into the Gray code
0209	GBIN	DGBIN	✓	GBIN, GBINP, DGBIN, DGBINP (En, S, D)	Converting the Gray code into the binary number
0210	NEG	DNEG	✓	NEG, NEGP, DNEG, DNEGP (En, D)	Two's complement
0211	–	FNEG	✓	FNEG, FNEGP (En, D)	Reversing the sign of the 32-bit floating-point number
0212	–	FBCD	✓	FBCD, FBCD (En, S, D)	Converting the binary floating-point number into the decimal floating-point number
0213	–	FBIN	✓	FBIN, FBINP (En, S, D)	Converting the decimal floating-point number into the binary floating-point number
0214	BKBCD	–	✓	BKBCD, BKBCDP (En, S, n, D)	Converting the binary numbers in blocks into the binary-coded decimal numbers in blocks
0215	BKBIN	–	✓	BKBIN, BKBINP (En, S, n, D)	Converting the binary numbers in blocks into the binary-coded decimal numbers in blocks
0216	SCAL	–	✓	SCAL, SCALP (En, S1, S2, S3, D)	Scale value operation

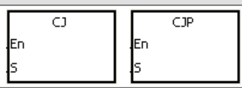
API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
0217	SCLP	DSCLP	✓		Parameter type of scale value operation
0218	LINE	DLINE	✓		Converting a column of data into a line of data
0219	COLM	DCOLM	✓		Converting a line of data into a column of data

- **Data transfer instructions**

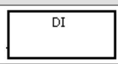
API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
0300	MOV	DMOV	✓		Transferring the data
0301	–	DFMOV	✓		Transferring the 64-bit floating-point number
0302	$MOV	–	✓		Transferring the string
0303	CML	DCML	✓		Inverting the data
0304	BMOV	–	✓		Transferring all data
0305	NMOV	DNMOV	✓		Transferring the data to several devices

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
0306	XCH	DXCH	✓		Exchanging the data
0307	BXCH	–	✓		Exchanging all data
0308	SWAP	DSWAP	✓		Exchange the high byte with the low byte
0309	SMOV	–	✓		Transferring the digits
0310	MOVB	–	✓		Transferring several bits

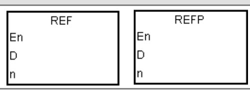
- **Jump instructions**

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
0400	CJ	–	✓		Conditional jump
0401	JMP	–	–		Unconditional jump
0402	GOEND	–	–		Jumping to END

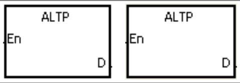
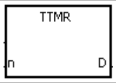
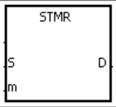
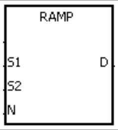
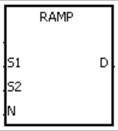
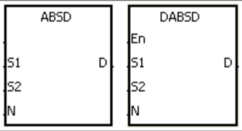
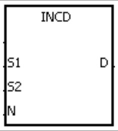
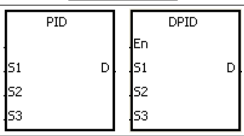
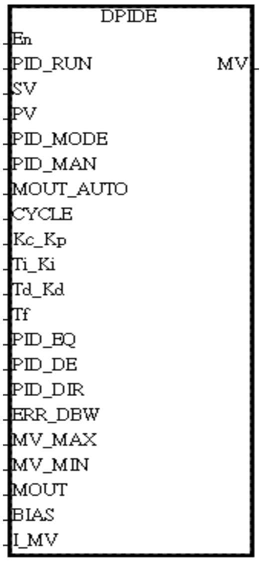
- **Program execution instructions**

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
0500	DI	–	–		Disabling the interrupt
0501	EI	–	–		Enabling the interrupt
0502	IMASK	–	–		Controlling the interrupt

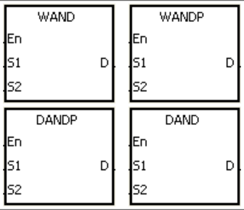
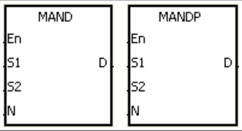
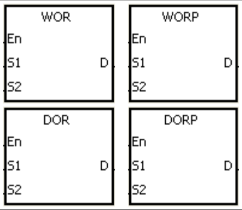
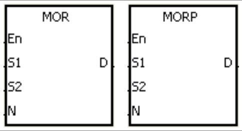
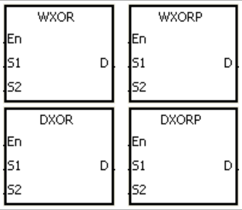
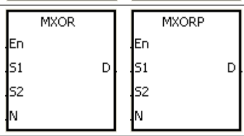
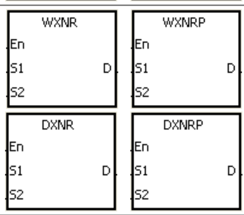
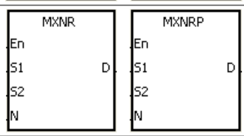
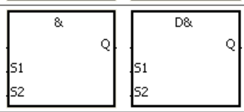
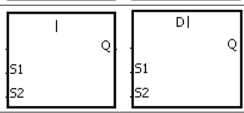
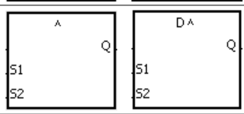
- **I/O refreshing instructions**

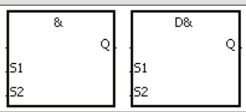
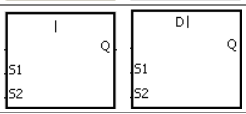
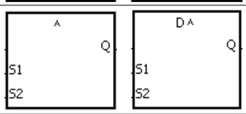
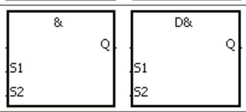
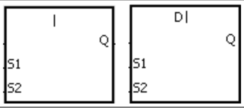
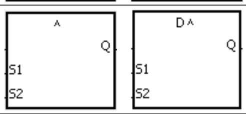
API	Instruction code 16-bit	Instruction code 32-bit	Pulse instructio n	Symbol	Function
0600	REF	–	✓		Refreshing the I/O

- **Miscellaneous instructions**

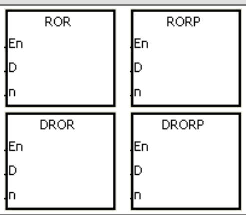
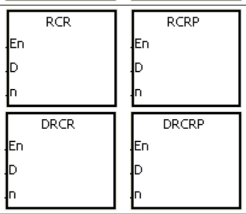
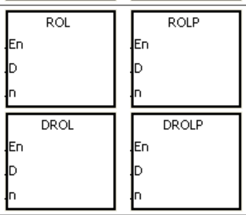
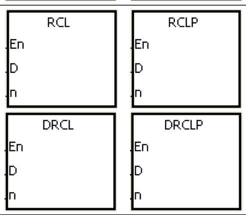
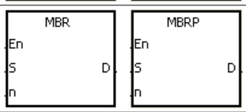
API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
0700	ALT	–	✓		Alternating between ON and OFF
0701	TTMR	–	–		Teach mode timer
0702	STMR	–	–		Special timer
0703	RAMP	–	–		Ramp signal
0704	MTR	–	–		Matrix input
0705	ABSD	DABSD	–		Absolute drum sequencer
0706	INCD	–	–		Incremental drum sequencer
0707	PID	DPID	–		PID algorithm
0708	–	DPIDE	–		PID algorithm

- **Logic instructions**

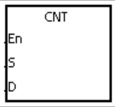
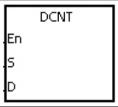
API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
0800	WAND	DAND	✓		Logical AND operation
0801	MAND	–	✓		Matrix AND operation
0802	WOR	DOR	✓		Logical OR operation
0803	MOR	–	✓		Matrix OR operation
0804	WXOR	DXOR	✓		Logical exclusive OR operation
0805	MXOR	–	✓		Matrix exclusive OR operation
0806	WXNR	DXNR	✓		Logical exclusive NOR operation
0807	MXNR	–	✓		Matrix exclusive NOR operation
0809	LD&	DLD&	–		ON: $S_1\&S_2 \neq 0$ OFF: $S_1\&S_2=0$
0810	LD|	DLD|	–		ON: $S_1 \vert S_2 \neq 0$ OFF: $S_1 \vert S_2=0$
0811	LD^	DLD^	–		ON: S_1^$S_2 \neq 0$ OFF: S_1^$S_2=0$

API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
0812	AND&	DAND&	–		ON: S_1&$S_2 \neq 0$ OFF: S_1&S_2=0
0813	AND|	DAND|	–		ON: $S_1 \| S_2 \neq 0$ OFF: $S_1 \| S_2$=0
0814	AND^	DAND^	–		ON: S_1^$S_2 \neq 0$ OFF: S_1^S_2=0
0815	OR&	DOR&	–		ON: S_1&$S_2 \neq 0$ OFF: S_1&S_2=0
0816	OR|	DOR|	–		ON: $S_1 \| S_2 \neq 0$ OFF: $S_1 \| S_2$=0
0817	OR^	DOR^	–		ON: S_1^$S_2 \neq 0$ OFF: S_1^S_2=0

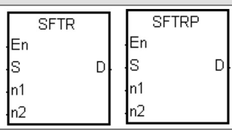
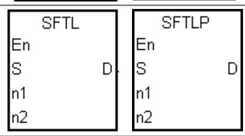
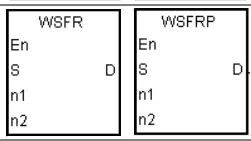
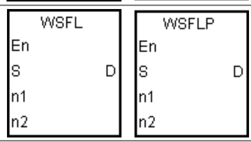
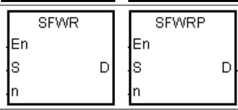
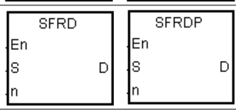
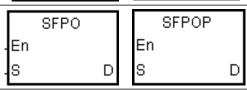
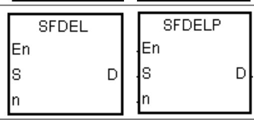
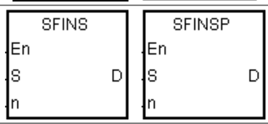
- **Rotation instructions**

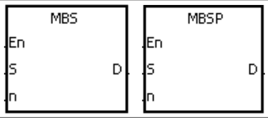
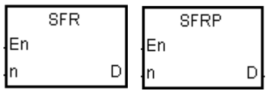
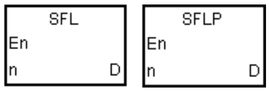
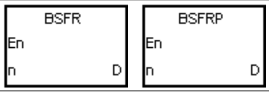
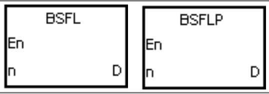
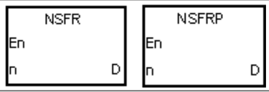
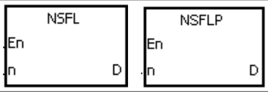
API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
0900	ROR	DROR	✓		Rotating to the right
0901	RCR	DRCR	✓		Rotating to the right with the carry flag
0902	ROL	DROL	✓		Rotating to the left
0903	RCL	DRCL	✓		Rotating to the left with the carry flag
0904	MBR	–	✓		Rotating the matrix bits

- **Timer and counter instructions**

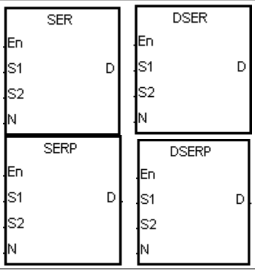
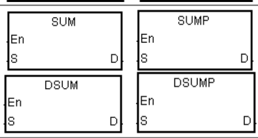
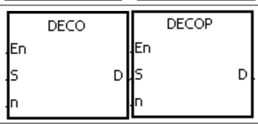
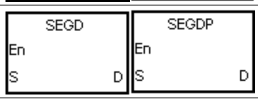
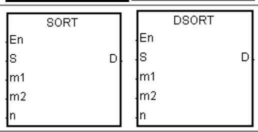
API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
1000	RST	–	–		Resetting the contact or clearing the register
1001	TMR	–	–		16-bit timer
1002	TMRH	–	–		16-bit timer
1003	CNT	–	–		16-bit counter
1004	–	DCNT	–		32-bit counter

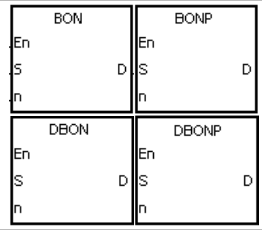
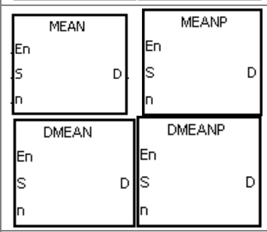
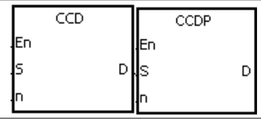
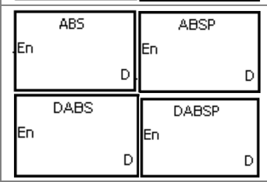
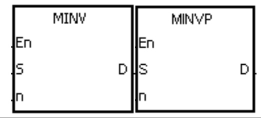
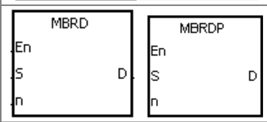
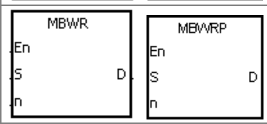
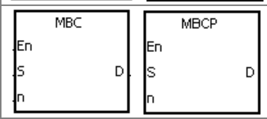
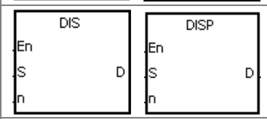
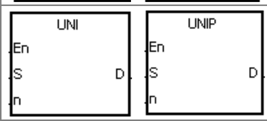
- **Shift instructions**

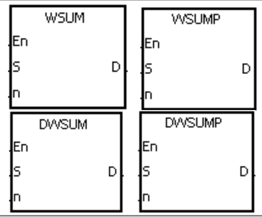
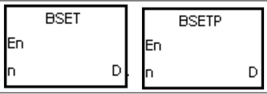
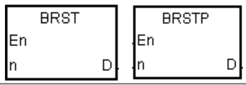
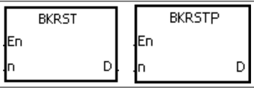
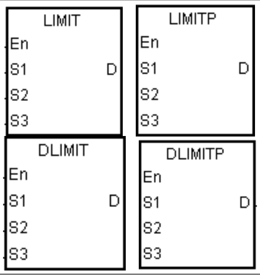
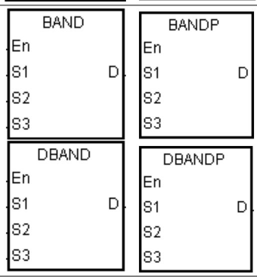
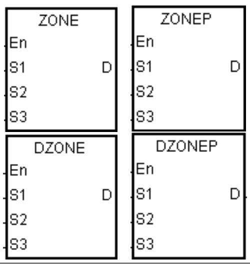
API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
1100	SFTR	–	✓		Shifting the states of the devices to the right
1101	SFTL	–	✓		Shifting the states of the devices to the left
1102	WSFR	–	✓		Shifting the data in the word devices to the right
1103	WSFL	–	✓		Shifting the data in the word devices to the left
1104	SFWR	–	✓		Shifting the data and writing it into the word device
1105	SFRD	–	✓		Shifting the data and reading it from the word device
1106	SFPO	–	✓		Reading the latest data from the data list
1107	SFDEL	–	✓		Deleting the data from the data list
1108	SFINS	–	✓		Inserting the data into the data list

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
1109	MBS	–	✓		Shifting the matrix bits
1110	SFR	–	✓		Shifting the values of the bits in the 16-bit registers by **n** bits to the right
1111	SFL	–	✓		Shifting the values of the bits in the 16-bit registers by **n** bits to the left
1112	BSFR	–	✓		Shifting the states of the **n** bit devices by one bit to the right
1113	BSFL	–	✓		Shifting the states of the **n** bit devices by one bit to the left
1114	NSFR	–	✓		Shifting **n** registers to the right
1115	NSFL	–	✓		Shifting **n** registers to the left

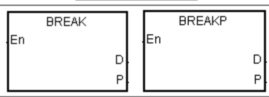
- **Data processing instructions**

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
1200	SER	DSER	✓		Searching the data
1201	SUM	DSUM	✓		Number of bits whose states are ON
1202	DECO	–	✓		Decoder
1203	ENCO	–	✓		Encoder
1204	SEGD	–	✓		Seven-segment decoding
1205	SORT	DSORT	-		Sorting the data

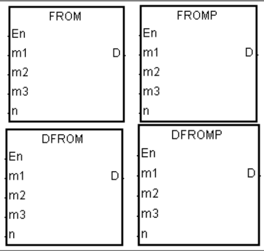
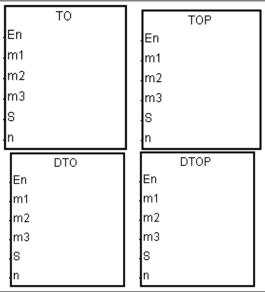
API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
1206	ZRST	–	✓		Resetting the zone
1207	BON	DBON	✓		Checking the state of the bit
1208	MEAN	DMEAN	✓		Mean
1209	CCD	–	✓		Sum check
1210	ABS	DABS	✓		Absolute value
1211	MINV	–	✓		Inverting the matrix bits
1212	MBRD	–	✓		Reading the matrix bit
1213	MBWR	–	✓		Writing the matrix bit
1214	MBC	–	✓		Counting the bits with the value 0 or 1
1215	DIS	–	✓		Disuniting the 16-bit data
1216	UNI	–	✓		Uniting the 16-bit data

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
1217	WSUM	DWSUM	✓		Getting the sum
1218	BSET	–	✓		Setting the bit in the word device to ON
1219	BRST	–	✓		Resetting the bit in the word device
1220	BKRST	–	✓		Resetting the specified zone
1221	LIMIT	DLIMIT	✓		Confining the value within the bounds
1222	BAND	DBAND	✓		Deadband control
1223	ZONE	DZONE	✓		Controlling the zone

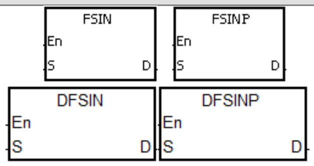
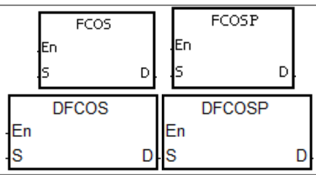
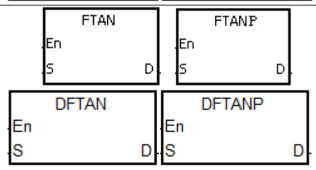
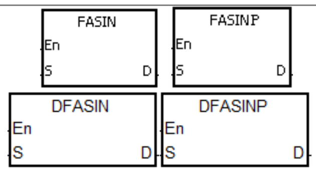
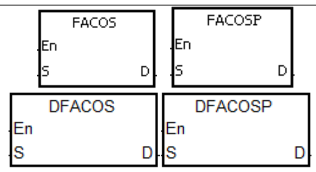
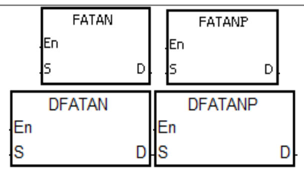
- **Structure creation instructions**

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
1300	FOR	–	–		Start of the nested loop
1301	NEXT	–	–		End of the nested loop
1302	BREAK	–	✓		Terminating the FOR-NEXT loop

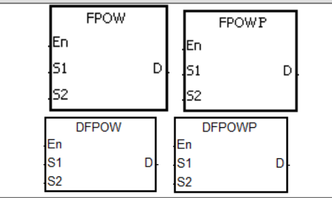
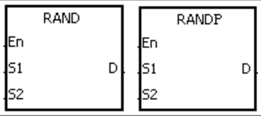
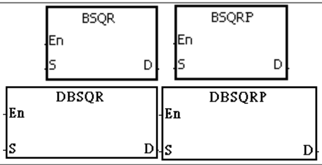
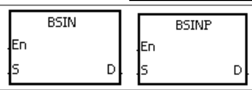
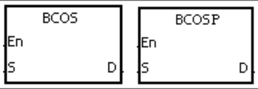
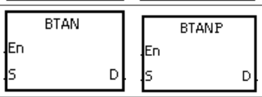
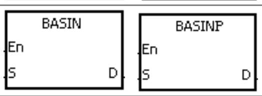
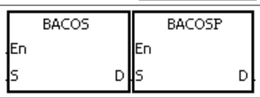
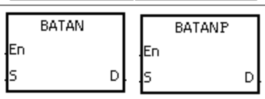
- **Module instructions**

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
1400	FROM	DFROM	✓		Reading the data from the control register in the special module
1401	TO	DTO	✓		Writing the data into the control register in the special module

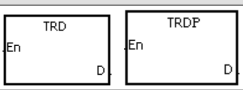
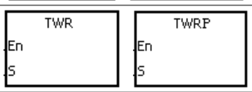
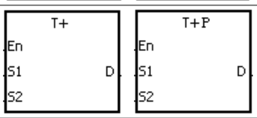
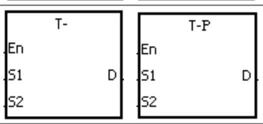
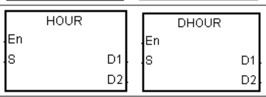
- **Floating-point number instructions**

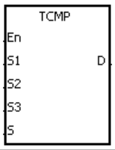
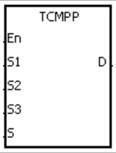
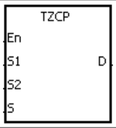
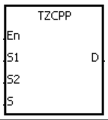
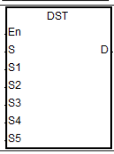
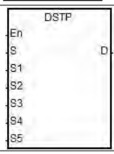
API	Instruction code 16-bit	Instruction code 32-bit	Instruction code 64-bit	Pulse instruction	Symbol	Function
1500	–	FSIN	DFSIN	✓		Sine of the floating-point number
1501	–	FCOS	DFCOS	✓		Cosine of the floating-point number
1502	–	FTAN	DFTAN	✓		Tangent of the floating-point number
1503	–	FASIN	DFASIN	✓		Arcsine of the floating-point number
1504	–	FACOS	DFACOS	✓		Arccosine of the floating-point number
1505	–	FATAN	DFATAN	✓		Arctangent of the floating-point number

API	Instruction code			Pulse instruction	Symbol	Function
	16-bit	32-bit	64-bit			
1506	–	FSINH	DFSINH	✓	FSINH (En, S, D) FSINHP (En, S, D) DFSINH (En, S, D) DFSINHP (En, S, D)	Hyperbolic sine of the floating-point number
1507	–	FCOSH	DFCOSH	✓	FCOSH (En, S, D) FCOSHP (En, S, D) DFCOSH (En, S, D) DFCOSHP (En, S, D)	Hyperbolic cosine of the floating-point number
1508	–	FTANH	DFTANH	✓	FTANH (En, S, D) FTANHP (En, S, D) DFTANH (En, S, D) DFTANHP (En, S, D)	Hyperbolic tangent of the floating-point number
1509	–	FRAD	DFRAD	✓	FRAD (En, S, D) FRADP (En, S, D) DFRAD (En, S, D) DFRADP (En, S, D)	Converting the degree to the radian
1510	–	FDEG	DFDEG	✓	FDEG (En, S, D) FDEGP (En, S, D) DFDEG (En, S, D) DFDEGP (En, S, D)	Converting the radian to the degree
1511	SQR	DSQR	–	✓	SQR (En, S, D) SQRP (En, S, D) DSQR (En, S, D) DSQRP (En, S, D)	Square root of the binary number
1512	–	FSQR	DFSQR	✓	FSQR (En, S, D) FSQRP (En, S, D) DFSQR (En, S, D) DFSQRP (En, S, D)	Square root of the floating-point number
1513	–	FEXP	DFEXP	✓	FEXP (En, S, D) FEXPP (En, S, D) DFEXP (En, S, D) DFEXPP (En, S, D)	An exponent of the floating-point number
1514	–	FLOG	DFLOG	✓	FLOG (En, S1, S2, D) FLOGP (En, S1, S2, D) DFLOG (En, S1, S2, D) DFLOGP (En, S1, S2, D)	Logarithm of the floating-point number
1515	–	FLN	DFLN	✓	FLN (En, S, D) FLNP (En, S, D) DFLN (En, S, D) DFLNP (En, S, D)	Natural logarithm of the binary floating-point number

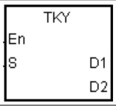
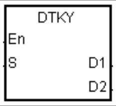
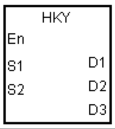
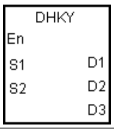
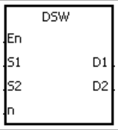
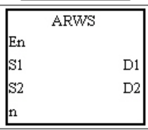
API	Instruction code			Pulse instruction	Symbol	Function
	16-bit	32-bit	64-bit			
1516	–	FPOW	DFPOW	✓		A power of the floating-point number
1517	RAND	–	–	✓		Random number
1518	BSQR	DBSQR	–	✓		Square root of the binary-coded decimal number
1519	–	BSIN	–	✓		Sine of the binary-coded decimal number
1520	–	BCOS	–	✓		Cosine of the binary-coded decimal number
1521	–	BTAN	–	✓		Tangent of the binary-coded decimal number
1522	–	BASIN	–	✓		Arcsine of the binary-coded decimal number
1523	–	BACOS	–	✓		Arccosine of the binary-coded decimal number
1524	–	BATAN	–	✓		Arctangent of the binary-coded decimal number

- **Real-time clock instructions**

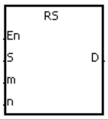
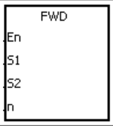
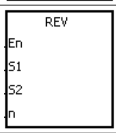
API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
1600	TRD	–	✓		Reading the time
1601	TWR	–	✓		Writing the time
1602	T+	–	✓		Adding the time
1603	T-	–	✓		Subtracting the time
1604	HOUR	DHOUR	–		Running-time meter

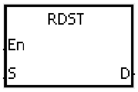
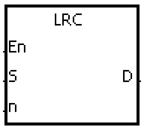
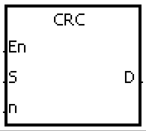
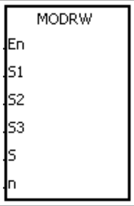
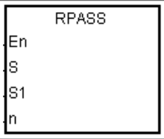
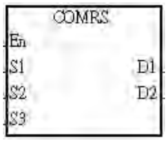
API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
1605	TCMP	–	✓	 	Comparing the time
1606	TZCP	–	✓	 	Time zone comparison
1607	DST	–	✓	 	Daylight saving time

- **Peripheral instructions**

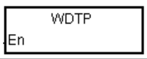
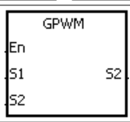
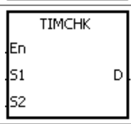
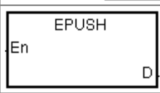
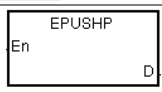
API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
1700	TKY	DTKY	–	 	Ten-key keypad
1701	HKY	DHKY	–	 	Sixteen-key keypad
1702	DSW	–	–		DIP switch
1703	ARWS	–	–		Arrow keys
1704	SEGL	–	–		Seven-segment display with latches

- **Communication instructions**

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
1800	RS	–	–		Transmitting the user-defined communication command
1801	FWD	–	–		The AC motor drive runs clockwise.
1802	REV	–	–		The AC motor drive runs counterclockwise.

API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
1803	STOP	–	–		The AC motor drive stops.
1804	RDST	–	–		Reading the statuses of the AC motor drives
1805	RSTEF	–	–		Resetting the abnormal AC motor drives
1806	LRC	–	✓		Longitudinal parity check
1807	CRC	–	✓		Cyclic Redundancy Check
1808	MODRW	–	–		Reading/Writing the MODBUS data
1811	RPASS	–	–		Passing the packet to the remote device through routing
1812	COMRS	–	–		Transmitting communications and receiving instructions

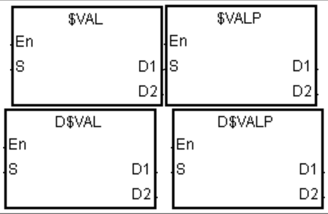
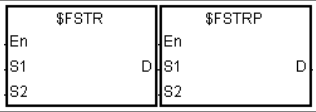
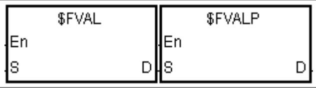
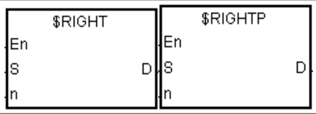
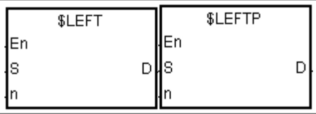
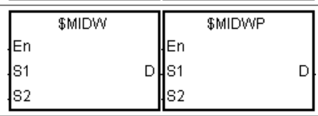
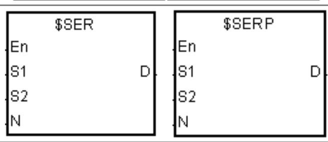
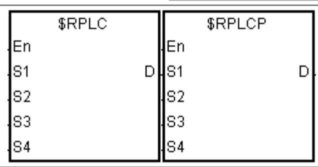
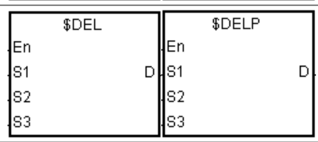
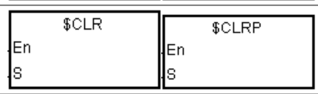
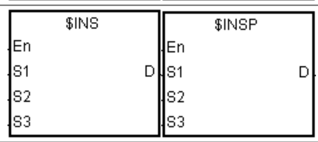
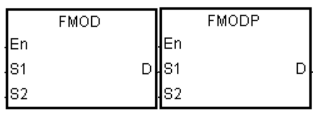
- **Other instructions**

API	Instruction code		Pulse instructio n	Symbol	Function
	16-bit	32-bit			
1900	WDT	–	✓	 	Watchdog timer
1901	DELAY	–	✓	 	Delaying the execution of the program
1902	GPWM	–	–		General pulse width modulation
1903	TIMCHK	–	–		Checking time
1904	EPUSH	–	✓	 	Storing the contents of the index registers

API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
1905	EPOP	–	✓	EPOP En D EPOPP En D	Reading the data into the index registers

- **String processing instructions**

API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
2100	BINDA	DBINDA	✓	BINDA En S D BINDAP En S D DBINDA En S D DBINDAP En S D	Converting the singed decimal number into the ASCII code
2101	BINHA	DBINHA	✓	BINHA En S D BINHAP En S D DBINHA En S D DBINHAP En S D	Converting the binary hexadecimal number into the hexadecimal ASCII code
2102	BCDDA	DBCDDA	✓	BCDDA En S D BCDDAP En S D DBCDDA En S D DBCDDAP En S D	Converting the binary-coded decimal number into the ASCII code
2103	DABIN	DDABIN	✓	DABIN En S D DABINP En S D DDABIN En S D DDABINP En S D	Converting the signed decimal ASCII code into the signed decimal binary number
2104	HABIN	DHABIN	✓	HABIN En S D HABINP En S D DHABIN En S D DHABINP En S D	Converting the hexadecimal ASCII code into the hexadecimal binary number
2105	DABCD	DDABCD	✓	DABCD En S D DABCDP En S D DDABCD En S D DDABCDP En S D	Converting the ASCII code into the binary-coded decimal number
2106	$LEN	–	✓	$LEN En S D $LENP En S D	Calculating the length of the string
2107	$STR	$DSTR	✓	$STR En S1 S2 D $STRP En S1 S2 D D$STR En S1 S2 D D$STRP En S1 S2 D	Converting the binary number into the string

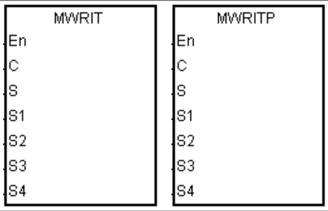
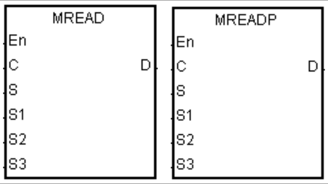
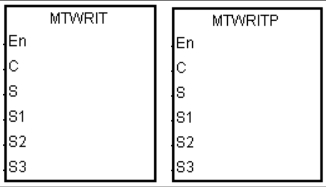
API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
2108	$VAL	$DVAL	✓		Converting the string into the binary number
2109	$FSTR	–	✓		Converting the floating-point number into the string
2110	$FVAL	–	✓		Converting the string into the floating-point number
2111	$RIGHT	–	✓		The retrieve of the characters in the string begins from the right.
2112	$LEFT	–	✓		The retrieve of the characters in the string begins from the left.
2113	$MIDR	–	✓		Retrieving a part of the string
2114	$MIDW	–	✓		Replacing a part of the string
2115	$SER	–	✓		Searching the string
2116	$RPLC	–	✓		Replacing the characters in the string
2117	$DEL	–	✓		Deleting the characters in the string
2118	$CLR	–	✓		Clearing the string
2119	$INS	–	✓		Inserting the string
2120	$FMOD	–	✓		Converting the floating-point number into the binary-coded decimal floating-point number

API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
2121	$FREXP	–	✓	FREXP: En, S1, S2, D FREXPP: En, S1, S2, D	Converting the Binary-coded decimal floating-point number into the floating-point number

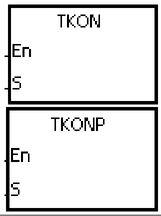
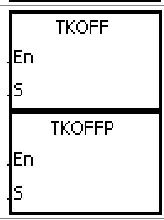
- **Ethernet instructions**

API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
2200	SOPEN	–	✓	SOPEN: En, S1, S2, S3 SOPENP: En, S1, S2, S3	Opening the socket
2201	SSEND	–	✓	SSEND: En, S1, S2 SSENDP: En, S1, S2	Sending the data through the socket
2202	SRCVD	–	✓	SRCVD: En, S1, S2 SRCVDP: En, S1, S2	Receiving the data through the socket
2203	SCLOSE	–	✓	SCLOSE: En, S1, S2 SCLOSEP: En, S1, S2	Closing the socket
2204	MSEND	–	✓	MSEND: En, S1, S2, S3, D MSENDP: En, S1, S2, S3, D	Sending the email
2205	EMDRW	–	✓	EMDRW: En, S1, S2, S3, S, n EMDRWP: En, S1, S2, S3, S, n	Reading/Writing the MODBUS TCP data
2206	–	DINTOA	✓	DINTOA: En, S, D DINTOAP: En, S, D	Converting the IP address of the integer type into the IP address of the string type
2207	–	DIATON	✓	DINTOA: En, S, D DINTOAP: En, S, D	Converting the IP address of the string type into the IP address of the integer type
2208	EIPRW	–	–	EIPRW: En, S1, S2, S3, S4, S5, S6, S7, n, S, D1, D2	Reading and writing EtherNet/IP data

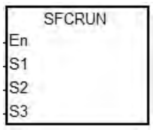
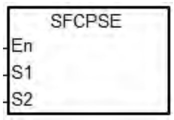
- **Memory card instructions**

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
2300	MWRIT	–	✓		Writing the data from the PLC into the memory card
2301	MREAD	–	✓		Reading the data from the memory card into the PLC
2302	MTWRIT	–	✓		Writing the string into the memory card

- **Task control instructions**

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
2400	TKON	–	✓		Enabling the cyclic task
2401	TKOFF	–	✓		Disabling the cyclic task

- **Sequential function charts (SFC) instructions**

API	Instruction code 16-bit	Instruction code 32-bit	Pulse instruction	Symbol	Function
2500	SFCRUN	–	–		Enabling the SFC
2501	SFCPSE	–	–		Making SFC to pause
2502	SFCSTP	–	–		Stopping the SFC

- **Redundant instructions**

API	Instruction code		Pulse instruction	Symbol	Function
	16-bit	32-bit			
2900	SSO	–	✓	SSOP En D	Switching from Master CPU to Standby CPU
2901	RCS	–	–	RCS En S D	Reading / setting redundant system data

3.4.2 Applied Instructions (Sorted Alphabetically)

Classification	API	Instruction code			Pulse instruction	Function
		16-bit	32-bit	64-bit		
Symbol	0101	-	D-	–	✓	Subtraction of binary numbers
	0114	$+	–	–	✓	Linking the strings
	2118	$CLR	–	–	✓	Clearing the string
	2117	$DEL	–	–	✓	Deleting the characters in the string
	2109	$FSTR	–	–	✓	Converting the floating-point number into the string
	2110	$FVAL	–	–	✓	Converting the string into the floating-point number
	2119	$INS	–	–	✓	Inserting the string
	2112	$LEFT	–	–	✓	The retrieve of the characters in the string begins from the left.
	2106	$LEN	–	–	✓	Calculating the length of the string
	2113	$MIDR	–	–	✓	Retrieving a part of the string
	2114	$MIDW	–	–	✓	Replacing a part of the string
	0302	$MOV	–	–	✓	Transferring the string
	2111	$RIGHT	–	–	✓	The retrieve of the characters in the string begins from the right.
	2116	$RPLC	–	–	✓	Replacing the characters in the string
	2115	$SER	–	–	✓	Searching the string
	2107	$STR	D$STR	–	✓	Converting the binary number into the string
	2108	$VAL	D$VAL	–	✓	Converting the string into the binary number
	0102	*	D*	–	✓	Multiplication of binary numbers
	0103	/	D/	–	✓	Division of binary numbers
	0100	+	D+	–	✓	Addition of binary numbers

<table>
<tr><th rowspan="2">Classification</th><th rowspan="2">API</th><th colspan="3">Instruction code</th><th rowspan="2">Pulse instruction</th><th rowspan="2">Function</th></tr>
<tr><th>16-bit</th><th>32-bit</th><th>64-bit</th></tr>
<tr><td rowspan="19">A</td><td>1210</td><td>ABS</td><td>DABS</td><td>–</td><td>✓</td><td>Absolute value</td></tr>
<tr><td>0705</td><td>ABSD</td><td>DABSD</td><td>–</td><td>–</td><td>Absolute drum sequencer</td></tr>
<tr><td>0700</td><td>ALT</td><td>–</td><td>–</td><td>✓</td><td>Alternating between ON and OFF</td></tr>
<tr><td>0046</td><td>AND$<</td><td>–</td><td>–</td><td>–</td><td>Comparing the strings
ON: $S_1 \lt S_2$
OFF: $S_1 \geqq S_2$</td></tr>
<tr><td>0047</td><td>AND$<=</td><td>–</td><td>–</td><td>–</td><td>Comparing the strings
ON: $S_1 \leqq S_2$
OFF: $S_1 \gt S_2$</td></tr>
<tr><td>0043</td><td>AND$<></td><td>–</td><td>–</td><td>–</td><td>Comparing the strings
ON: $S_1 \neq S_2$
OFF: $S_1 = S_2$</td></tr>
<tr><td>0042</td><td>AND$=</td><td>–</td><td>–</td><td>–</td><td>Comparing the strings
ON: $S_1 = S_2$
OFF $S_1 \neq S_2$</td></tr>
<tr><td>0044</td><td>AND$></td><td>–</td><td>–</td><td>–</td><td>Comparing the strings
ON: $S_1 \gt S_2$
OFF: $S_1 \leqq S_2$</td></tr>
<tr><td>0045</td><td>AND$>=</td><td>–</td><td>–</td><td>–</td><td>Comparing the strings
ON: $S_1 \geqq S_2$
OFF: $S_1 \lt S_2$</td></tr>
<tr><td>0812</td><td>AND&</td><td>DAND&</td><td>–</td><td>–</td><td>ON: $S_1 \& S_2 \neq 0$
OFF: $S_1 \& S_2 = 0$</td></tr>
<tr><td>0814</td><td>AND^</td><td>DAND^</td><td>–</td><td>–</td><td>ON: $S_1 \hat{} S_2 \neq 0$
OFF: $S_1 \hat{} S_2 = 0$</td></tr>
<tr><td>0813</td><td>AND|</td><td>DAND|</td><td>–</td><td>–</td><td>ON: $S_1 \vert S_2 \neq 0$
OFF: $S_1 \vert$S2=0</td></tr>
<tr><td>0010</td><td>AND<</td><td>DAND<</td><td>–</td><td>–</td><td>Comparing the values
ON: $S_1 \lt S_2$
OFF: $S_1 \geqq S_2$</td></tr>
<tr><td>0011</td><td>AND<=</td><td>DAND<=</td><td>–</td><td>–</td><td>Comparing the values
ON: $S_1 \leqq S_2$
OFF: $S_1 \gt S_2$</td></tr>
<tr><td>0007</td><td>AND<></td><td>DAND<></td><td>–</td><td>–</td><td>Comparing the values
ON: $S_1 \neq S_2$
OFF: $S_1 = S_2$</td></tr>
<tr><td>0006</td><td>AND=</td><td>DAND=</td><td>–</td><td>–</td><td>Comparing the values
ON: $S_1 = S_2$
OFF: $S_1 \neq S_2$</td></tr>
<tr><td>0008</td><td>AND></td><td>DAND></td><td>–</td><td>–</td><td>Comparing the values
ON: $S_1 \gt S_2$
OFF: $S_1 \leqq S_2$2</td></tr>
</table>

Classification	API	Instruction code 16-bit	Instruction code 32-bit	Instruction code 64-bit	Pulse instruction	Function
	0009	AND>=	DAND>=	–	–	Comparing the values ON: $S_1 \geq S_2$ OFF: $S_1 < S_2$
	1703	ARWS	–	–	–	Arrow key input
B	0109	B-	DB-	–	✓	Subtraction of binary-coded decimal numbers S_1-S_2=D
	0110	B*	DB*	–	✓	Multiplication of binary-coded decimal numbers S_1*S_2=D
	0111	B/	DB/	–	✓	Division of binary-coded decimal numbers S_1/S_2=D
	0108	B+	DB+	–	✓	Addition of binary-coded decimal numbers S_1+S_2=D
	1523	BACOS	–	–	✓	Arccosine of the binary-coded decimal number
	1222	BAND	DBAND	–	✓	Deadband control
	1522	BASIN	–	–	✓	Arcsine of the binary-coded decimal number
	1524	BATAN	–	–	✓	Arctangent of the binary-coded decimal number
	0200	BCD	DBCD	–	✓	Converting the binary number into the binary-coded decimal number
	2102	BCDDA	DBCDDA	–	✓	Converting the binary-coded decimal number into the ASCII code
	1520	BCOS	–	–	✓	Cosine of the binary-coded decimal number
	0201	BIN	DBIN	–	✓	Converting the binary-coded decimal number into the binary number
	2100	BINDA	DBINDA	–	✓	Converting the singed decimal number into the ASCII code
	2101	BINHA	DBINHA	–	✓	Converting the binary hexadecimal number into the hexadecimal ASCII code
	0113	BK-	–	–	✓	Subtraction of binary numbers in blocks
	0112	BK+	–	–	✓	Addition of binary numbers in blocks
	0214	BKBCD	–	–	✓	Converting the binary numbers in blocks into the binary-coded decimal numbers in blocks
	0215	BKBIN	–	–	✓	Converting the binary numbers in blocks into

Classification	API	Instruction code			Pulse instruction	Function
		16-bit	32-bit	64-bit		
						the binary-coded decimal numbers in blocks
	1220	BKRST	–	–	✓	Resetting the specified zone
	0304	BMOV	–	–	✓	Transferring all data
	1207	BON	DBON	–	✓	Checking the state of the bit
	1302	BREAK	–	–	✓	Terminating the FOR-NEXT loop
	1219	BRST	–	–	✓	Resetting the bit in the word device
	1218	BSET	–	–	✓	Setting the bit in the word device to ON
	1113	BSFL	–	–	✓	Shifting the states of the **n** bit devices by one bit to the left
	1112	BSFR	–	–	✓	Shifting the states of the **n** bit devices by one bit to the right
	1519	BSIN	–	–	✓	Sine of the binary-coded decimal number
	1518	BSQR	DBSQR	–	✓	Square root of the binary-coded decimal number
	1521	BTAN	–	–	✓	Tangent of the binary-coded decimal number
	0307	BXCH	–	–	✓	Exchanging all data
C	1209	CCD	–	–	✓	Sum check
	0065	CHKADR	–	–	–	Checking the address of the contact type of pointer register
	0400	CJ	–	–	✓	Conditional jump
	1812	COMRS	–	–	–	Transmitting communicatons and receiving instrucitons
	0303	CML	DCML	–	✓	Inverting the data
	0054	CMP	DCMP	–	✓	Comparing the values
	0063	CMPT<	–	–	✓	Comparing the tables ON: <
	0064	CMPT<=	–	–	✓	Comparing the tables ON: ≦
	0060	CMPT<>	–	–	✓	Comparing the tables ON: ≠
	0059	CMPT=	–	–	✓	Comparing the tables ON: =
	0061	CMPT>	–	–	✓	Comparing the tables ON: >
	0062	CMPT>=	–	–	✓	Comparing the tables ON: ≧
	1003	CNT	–	–	–	16-bit counter

Classification	API	Instruction code			Pulse instruction	Function
		16-bit	32-bit	64-bit		
	0219	COLM	DCOLM	–	✓	Converting a line of data into a column of data
	1807	CRC	–	–	–	Cyclic Redundancy Check
D	2105	DABCD	DDABCD	–	✓	Converting the ASCII code into the binary-coded decimal number
	2103	DABIN	DDABIN	–	✓	Converting the signed decimal ASCII code into the signed decimal binary number
	1004	DCNT	–	–	–	32-bit counter
	0116	DEC	DDEC	–	✓	Subtracting one from the binary number
	1202	DECO	–	–	✓	Decoder
	1901	DELAY	–	–	✓	Delaying the execution of the program
	0301	–	–	DFMOV	✓	Transferring the 64-bit floating-point number
	0500	DI	–	–	–	Disabling the interrupt
	2207	DIATON	–	–	✓	Converting the IP address of the string type into the IP address of the integer type
	2206	DINTOA	–	–	✓	Converting the IP address of the integer type into the IP address of the string type
	1215	DIS	–	–	✓	Disuniting the 16-bit data
	0118	DIV16	DIV32	–	✓	Division of binary numbers for 16-bit/32-bit
	0708	–	DPIDE	–	–	PID algorithm
	1607	DST	–	–	✓	Daylight saving time
	1702	DSW	–	–	–	Digital switch input
E	0501	EI	–	–	–	Enabling the interrupt
	2205	EMDRW	–	–	✓	Reading/Writing the MODBUS TCP data
	1203	ENCO	–	–	✓	Encoder
	1905	EPOP	–	–	✓	Reading the data into the index registers
	1904	EPUSH	–	–	✓	Storing the contents of the index registers
	2208	EIPRW	–	–	–	Reading and writing EtherNet/IP data
F	0105	–	F-	DF-	✓	Subtraction of floating-point numbers **S_1-S_2**=D
	0106	–	F*	DF*	✓	Multiplication of floating-point numbers **S_1*S_2**=D

Classification	API	Instruction code			Pulse instruction	Function
		16-bit	32-bit	64-bit		
	0107	–	F/	DF/	✓	Division of floating-point numbers S_1/S_2=D
	0104	–	F+	DF+	✓	Addition of floating-point numbers S_1+S_2=D
	1504	–	FACOS	DFACOS	✓	Arccosine of the floating-point number
	0028	–	FAND<	DFAND<	–	Comparing the floating-point numbers ON: $S_1 < S_2$ OFF: $S_1 \geqq S_2$
	0029	–	FAND<=	DFAND<=	–	Comparing the floating-point numbers ON: $S_1 \leqq S_2$ OFF: $S_1 > S_2$
	0025	–	FAND<>	DFAND<>	–	Comparing the floating-point numbers ON: $S_1 \neq S_2$ OFF: $S_1 = S_2$
	0024	–	FAND=	DFAND=	–	Comparing the floating-point numbers ON: $S_1 = S_2$ OFF: $S_1 \neq S_2$
	0026	–	FAND>	DFAND>	–	Comparing the floating-point numbers ON: $S_1 > S_2$ OFF: $S_1 \leqq S_2$
	0027	–	FAND>=	DFAND>=	–	Comparing the floating-point numbers ON: $S_1 \geqq S_2$ OFF: $S_1 < S_2$
	1503	–	FASIN	DFASIN	✓	Arcsine of the floating-point number
	1505	–	FATAN	DFATAN	✓	Arctangent of the floating-point number
	0212	–	FBCD	–	✓	Converting the binary floating-point number into the decimal floating-point number
	0213	–	FBIN	–	✓	Converting the decimal floating-point number into the binary floating-point number
	0056	–	FCMP	–	✓	Comparing the floating-point numbers
	1501	–	FCOS	DFCOS	✓	Cosine of the floating-point number
	1507	–	FCOSH	DFCOSH	✓	Hyperbolic cosine of the floating-point number

Classification	API	Instruction code			Pulse instruction	Function
		16-bit	32-bit	64-bit		
	1510	–	FDEG	DFDEG	✓	Converting the radian to the degree
	1513	–	FEXP	DFEXP	✓	An exponent of the floating-point number
	0205	–	FINT	DFINT	✓	Converting the 64-bit floating-point number into the binary integer
	0022	–	FLD<	DFLD<	–	Comparing the floating-point numbers ON: $\mathbf{S_1} < \mathbf{S_2}$ OFF: $\mathbf{S_1} \geqq \mathbf{S_2}$
	0023	–	FLD<=	DFLD<=	–	Comparing the floating-point numbers ON: $\mathbf{S_1} \leqq \mathbf{S_2}$ OFF: $\mathbf{S_1} > \mathbf{S_2}$
	0019	–	FLD<>	DFLD<>	–	Comparing the floating-point numbers ON: $\mathbf{S_1} \neq \mathbf{S_2}$ OFF: $\mathbf{S_1} = \mathbf{S_2}$
	0018	–	FLD=	DFLD=	–	Comparing the floating-point numbers ON: $\mathbf{S_1} = \mathbf{S_2}$ OFF: $\mathbf{S_1} \neq \mathbf{S_2}$
	0020	–	FLD>	DFLD>	–	Comparing the floating-point numbers ON: $\mathbf{S_1} > \mathbf{S_2}$ OFF: $\mathbf{S_1} \leqq \mathbf{S_2}$
	0021	–	FLD>=	DFLD>=	–	Comparing the floating-point numbers ON: $\mathbf{S_1} \geqq \mathbf{S_2}$ OFF: $\mathbf{S_1} < \mathbf{S_2}$
	1515	–	FLN	DFLN	✓	Natural logarithm of the binary floating-point number
	1514	–	FLOG	DFLOG	✓	Logarithm of the floating-point number
	0202	FLT	DFLT	–	✓	Converting the binary integer into the binary floating-point number
	0203	FLTD	DFLTD	–	✓	Converting the binary integer into the 64-bit floating-point number
	2120	FMOD	–	–	✓	Converting the floating-point number into the binary-coded decimal floating-point number

Classification	API	Instruction code			Pulse instruction	Function
		16-bit	32-bit	64-bit		
	0211	FNEG	—	—	✓	Reversing the sign of the 32-bit floating-point number
	1300	FOR	—	—	—	Start of the nested loop
	0034	—	FOR<	DFOR<	—	Comparing the floating-point numbers ON: $\mathbf{S_1} < \mathbf{S_2}$ OFF: $\mathbf{S_1} \geqq \mathbf{S_2}$
	0035	—	FOR<=	DFOR<=	—	Comparing the floating-point numbers ON: $\mathbf{S_1} \leqq \mathbf{S_2}$ OFF: $\mathbf{S_1} > \mathbf{S_2}$
	0031	—	FOR<>	DFOR<>	—	Comparing the floating-point numbers ON: $\mathbf{S_1} \neq \mathbf{S_2}$ OFF: $\mathbf{S_1} = \mathbf{S_2}$
	0030	—	FOR=	DFOR=	—	Comparing the floating-point numbers ON: $\mathbf{S_1} = \mathbf{S_2}$ OFF: $\mathbf{S_1} \neq \mathbf{S_2}$
	0032	—	FOR>	DFOR>	—	Comparing the floating-point numbers ON: $\mathbf{S_1} > \mathbf{S_2}$ OFF: $\mathbf{S_1} \leqq \mathbf{S_2}$
	0033	—	FOR>=	DFOR>=	—	Comparing the floating-point numbers ON: $\mathbf{S_1} \geqq \mathbf{S_2}$ OFF: $\mathbf{S_1} < \mathbf{S_2}$
	1516	—	FPOW	DFPOW	✓	A power of the floating-point number
	1509	—	FRAD	DFRAD	✓	Converting the degree to the radian
	2121	FREXP	—	—	✓	Converting the Binary-coded decimal floating-point number into the floating-point number
	1400	FROM	DFROM	—	✓	Reading the data from the control register in the special module
	1500	—	FSIN	DFSIN	✓	Sine of the floating-point number
	1506	—	FSINH	DFSINH	✓	Hyperbolic sine of the floating-point number
	1512	—	FSQR	DFSQR	✓	Square root of the floating-point number
	1502	—	FTAN	DFTAN	✓	Tangent of the floating-point number
	1508	—	FTANH	DFTANH	✓	Hyperbolic tangent of the floating-point number

Classification	API	Instruction code			Pulse instruction	Function
		16-bit	32-bit	64-bit		
	1801	FWD	–	–	–	The AC motor drive runs clockwise.
	0057	–	FZCP	–	✓	Floating-point zone comparison
G	0209	GBIN	DGBIN	–	✓	Converting the Gray code into the binary number
	0402	GOEND	–	–	–	Jumping to END
	1902	GPWM	–	–	–	General pulse width modulation
	0208	GRY	DGRY	–	✓	Converting the binary number into the Gray code
H	2104	HABIN	DHABIN	–	✓	Converting the hexadecimal ASCII code into the hexadecimal binary number
	1701	HKY	DHKY	–	–	Hexadecimal key input
	1604	HOUR	DHOUR	–	–	Running-time meter
I	0502	IMASK	–	–	–	Controlling the interrupt
	0115	INC	DINC	–	✓	Adding one to the binary number
	0706	INCD	–	–	–	Incremental drum sequencer
	0204	INT	DINT	–	✓	Converting the 32-bit floating-point number into the binary integer
J	0401	JMP	–	–	–	Unconditional jump
L	0040	LD$<	–	–	–	Comparing the strings ON: $S_1 < S_2$ OFF: $S_1 \geqq S_2$
	0041	LD$<=	–	–	–	Comparing the strings ON: $S_1 \leqq S_2$ OFF: $S_1 > S_2$
	0037	LD$<>	–	–	–	Comparing the strings ON: $S_1 \neq S_2$ OFF: $S_1 = S_2$
	0036	LD$=	–	–	–	Comparing the strings ON: $S_1 = S_2$ ON: $S_1 \neq S_2$
	0038	LD$>	–	–	–	Comparing the strings ON: $S_1 > S_2$ OFF: $S_1 \leqq S_2$
	0039	LD$>=	–	–	–	Comparing the strings ON: $S_1 \geqq S_2$ OFF: $S_1 < S_2$
	0809	LD&	DLD&	–	–	ON: $S_1 \& S_2 \neq 0$ OFF: $S_1 \& S_2 = 0$

Classification	API	Instruction code			Pulse instruction	Function
		16-bit	32-bit	64-bit		
	0811	LD^	DLD^	–	–	ON: $\mathbf{S_1}$^$\mathbf{S_2} \neq 0$ OFF: $\mathbf{S_1}$^$\mathbf{S_2}=0$
	0810	LD$\vert$	DLD$\vert$	–	–	ON: $\mathbf{S_1} \vert \mathbf{S_2} \neq 0$ OFF: $\mathbf{S_1} \vert \mathbf{S_2}=0$
	0004	LD<	DLD<	–	–	Comparing the values ON: $\mathbf{S_1} < \mathbf{S_2}$ OFF: $\mathbf{S_1} \geqq \mathbf{S_2}$
	0005	LD<=	DLD<=	–	–	Comparing the values ON: $\mathbf{S_1} \leqq \mathbf{S_2}$ OFF: $\mathbf{S_1} > \mathbf{S_2}$
	0001	LD<>	DLD<>	–	–	Comparing the values ON: $\mathbf{S_1} \neq \mathbf{S_2}$ OFF: $\mathbf{S_1} = \mathbf{S_2}$
	0000	LD=	DLD=	–	–	Comparing the values ON: $\mathbf{S_1} = \mathbf{S_2}$ OFF: $\mathbf{S_1} \neq \mathbf{S_2}$
	0002	LD>	DLD>	–	–	Comparing the values ON: $\mathbf{S_1} > \mathbf{S_2}$ OFF: $\mathbf{S_1} \leqq \mathbf{S_2}$
	0003	LD>=	DLD>=	–	–	Comparing the values ON: $\mathbf{S_1} \geqq \mathbf{S_2}$ OFF: $\mathbf{S_1} < \mathbf{S_2}$
	1221	LIMIT	DLIMIT	–	✓	Confining the value within the bounds
	0218	LINE	DLINE	–	✓	Converting a column of data into a line of data
	1806	LRC	–	–	–	Longitudinal parity check
M	0801	MAND	–	–	✓	Matrix AND operation
	1214	MBC	–	–	✓	Counting the bits with the value 0 or 1
	0904	MBR	–	–	✓	Rotating the matrix bits
	1212	MBRD	–	–	✓	Reading the matrix bit
	1109	MBS	–	–	✓	Shifting the matrix bits
	1213	MBWR	–	–	✓	Writing the matrix bit
	0058	MCMP	–	–	✓	Matrix comparison
	1208	MEAN	DMEAN	–	✓	Mean
	1211	MINV	–	–	✓	Inverting the matrix bits
	0206	MMOV	–	–	✓	Converting the 16-bit value into the 32-bit value
	1808	MODRW	–	–	–	Reading/Writing the MODBUS data
	0803	MOR	–	–	✓	Matrix OR operation
	0300	MOV	DMOV	–	✓	Transferring the data

Classification	API	Instruction code			Pulse instruction	Function
		16-bit	32-bit	64-bit		
	0310	MOVB	–	–	✓	Transferring several bits
	2301	MREAD	–	–	–	Reading the data from the memory card into the PLC
	2204	MSEND	–	–	✓	Sending the email
	0704	MTR	–	–	–	Matrix input
	2302	MTWRIT	–	–	–	Writing the string into the memory card
	0117	MUL16	MUL32	–	✓	Multiplication of binary numbers for 16-bit/32-bit
	2300	MWRIT	–	–	–	Writing the data from the PLC into the memory card
	0807	MXNR	–	–	✓	Matrix exclusive NOR operation
	0805	MXOR	–	–	✓	Matrix exclusive OR operation
N	0210	NEG	DNEG	–	✓	Two's complement
	1301	NEXT	–	–	–	End of the nested loop
	0305	NMOV	DNMOV	–	✓	Transferring the data to several devices
	1115	NSFL	–	–	✓	Shifting **n** registers to the left
	1114	NSFR	–	–	✓	Shifting **n** registers to the right
O	0052	OR$<	–	–	–	Comparing the strings ON: $S_1 < S_2$ OFF: $S_1 \geqq S_2$
	0053	OR$<=	–	–	–	Comparing the strings ON: $S_1 \leqq S_2$ OFF: $S_1 > S_2$
	0049	OR$<>	–	–	–	Comparing the strings ON: $S_1 \neq S_2$ OFF: $S_1 = S_2$
	0048	OR$=	–	–	–	Comparing the strings ON: $S_1 = S_2$ OFF: $S_1 \neq S_2$
	0050	OR$>	–	–	–	Comparing the strings ON: $S_1 > S_2$ OFF: $S_1 \leqq S_2$
	0051	OR$>=	–	–	–	Comparing the strings ON: $S_1 \geqq S_2$ OFF: $S_1$1 < $S_2$2
	0815	OR&	DOR&	–	–	ON: S_1&$S_2 \neq 0$ OFF: S_1&$S_2$2=0
	0817	OR^	DOR^	–	–	ON: S_1^$S_2 \neq 0$ OFF: S_1^S_2=0

Classification	API	Instruction code			Pulse instruction	Function
		16-bit	32-bit	64-bit		
	0816	OR|	DOR|	–	–	ON: $S_1 \| S_2 \neq 0$ OFF: $S_1 \| S_2 = 0$
	0016	OR<	DOR<	–	–	Comparing the values ON: $S_1 < S_2$ OFF: $S_1 \geqq S_2$
	0017	OR<=	DOR<=	–	–	Comparing the values ON: $S_1 \leqq S_2$ OFF: $S_1 > S_2$
	0013	OR<>	DOR<>	–	–	Comparing the values ON: $S_1 \neq S_2$ OFF: $S_1 = S_2$
	0012	OR=	DOR=	–	–	Comparing the values ON: $S_1 = S_2$ OFF: $S_1 \neq S_2$
	0014	OR>	DOR>	–	–	Comparing the values ON: $S_1 > S_2$ OFF: $S_1 \leqq S_2$
	0015	OR>=	DOR>=	–	–	Comparing the values ON: $S_1 \geqq S_2$ OFF: $S_1 1 < S_2$
P	0707	PID	–	–	–	PID algorithm
R	0703	RAMP	–	–	–	Ramp signal
	1517	RAND	–	–	✓	Random number
	0903	RCL	DRCL	–	✓	Rotating to the left with the carry flag
	0901	RCR	DRCR	–	✓	Rotating to the right with the carry flag
	2901	RCS	–	–	–	Reading / setting redundant system data
	1804	RDST	–	–	–	Reading the statuses of the AC motor drives
	0600	REF	–	–	✓	Refreshing the I/O
	1802	REV	–	–	–	The AC motor drive runs counterclockwise.
	0207	RMOV	–	–	✓	Converting the 32-bit value into the 16-bit value
	0902	ROL	DROL	–	✓	Rotating to the left
	0900	ROR	DROR	–	✓	Rotating to the right
	1811	RPASS	–	–	–	Passing the packet to the remote device through routing
	1800	RS	–	–	–	Transmitting the user-defined communication command

Classification	API	Instruction code			Pulse instruction	Function
		16-bit	32-bit	64-bit		
	1000	RST	–	–	–	Resetting the contact or clearing the register
	1805	RSTEF	–	–	–	Resetting the abnormal AC motor drives
S	0216	SCAL	–	–	✓	Scale value operation
	2203	SCLOSE	–	–	✓	Closing the socket
	0217	SCLP	DSCLP	–	✓	Parameter type of scale value operation
	1204	SEGD	–	–	✓	Seven-segment decoding
	1704	SEGL	–	–	–	Seven-segment display with latches
	1200	SER	DSER	–	✓	Searching the data
	2500	SFCRUN	–	–	–	Enabling the SFC
	2501	SFCPSE	–	–	–	Making SFC to pause
	2502	SFCSTP	–	–	–	Stopping the SFC
	1107	SFDEL	–	–	✓	Deleting the data from the data list
	1108	SFINS	–	–	✓	Inserting the data into the data list
	1111	SFL	–	–	✓	Shifting the values of the bits in the 16-bit registers by **n** bits to the left
	1106	SFPO	–	–	✓	Reading the latest data from the data list
	1110	SFR	–	–	✓	Shifting the values of the bits in the 16-bit registers by **n** bits to the right
	1105	SFRD	–	–	✓	Shifting the data and reading it from the word device
	1101	SFTL	–	–	✓	Shifting the states of the devices to the left
	1100	SFTR	–	–	✓	Shifting the states of the devices to the right
	1104	SFWR	–	–	✓	Shifting the data and writing it into the word device
	0309	SMOV	–	–	✓	Transferring the digits
	2200	SOPEN	–	–	✓	Opening the socket
	1205	SORT	DSORT	–	–	Sorting the data
	1511	SQR	DSQR	–	✓	Square root of the binary number
	2202	SRCVD	–	–	✓	Receiving the data through the socket
	2201	SSEND	–	–	✓	Sending the data through the socket
	2900	SSO	–	–	✓	Switching from Master CPU to Standby CPU
	0702	STMR	–	–	–	Special timer

Classification	API	Instruction code			Pulse instruction	Function
		16-bit	32-bit	64-bit		
	1803	STOP	–	–	–	The AC motor drive stops.
	1201	SUM	DSUM	–	✓	Number of bits whose states are ON
	0308	SWAP	DSWAP	–	✓	Exchange the high byte with the low byte
T	1603	T-	–	–	✓	Subtracting the time
	1602	T+	–	–	✓	Adding the time
	1605	TCMP	–	–	✓	Comparing the time
	1903	TIMCHK	–	–	–	Checking time
	2401	TKOFF	–	–	✓	Disabling the cyclic task
	2400	TKON	–	–	✓	Enabling the cyclic task
	1700	TKY	DTKY	–	–	Ten key input
	1001	TMR	–	–	–	16-bit timer
	1002	TMRH	–	–	–	16-bit timer
	1401	TO	DTO		✓	Writing the data into the control register in the special module
	1600	TRD	–	–	✓	Reading the time
	0701	TTMR	–	–	–	Teach mode timer
	1601	TWR	–	–	✓	Writing the time
	1606	TZCP	–	–	✓	Time zone comparison
U	1216	UNI	–	–	✓	Uniting the 16-bit data
W	0800	WAND	DAND	–	✓	Logical AND operation
	1900	WDT	–	–	✓	Watchdog timer
	0802	WOR	DOR	–	✓	Logical OR operation
	1103	WSFL	–	–	✓	Shifting the data in the word devices to the left
	1102	WSFR	–	–	✓	Shifting the data in the word devices to the right
	1217	WSUM	DWSUM	–	✓	Getting the sum
	0806	WXNR	DXNR	–	✓	Logical exclusive NOR operation
	0804	WXOR	DXOR	–	✓	Logical exclusive OR operation
X	0306	XCH	DXCH	–	✓	Exchanging the data
Z	0055	ZCP	DZCP	–	✓	Zone comparison
	1223	ZONE	DZONE	–	✓	Controlling the zone
	1206	ZRST	–	–	✓	Resetting the zone

MEMO

Chapter 4 Instruction Structure

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4.1 Composition of Applied Instructions

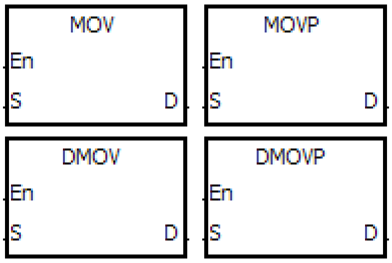
Every instruction has its own instruction code and API number. The API number of the instruction in the following table is 0300, and the instruction code is MOV, whose function is transferring the data.

API	Instruction code			Operand	Function
0300	D	MOV	P	**S, D**	Transferring the data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●	○	●	●	●		○
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Data source — Word/Double word

D : Data destination — Word/Double word

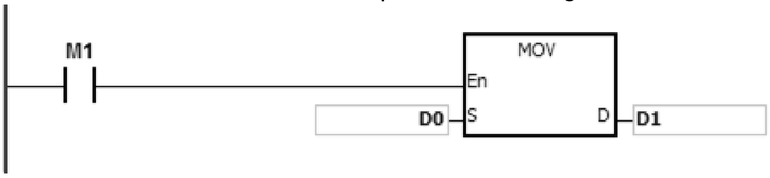
1. The devices used by the instruction are listed in the operand column. **S**, **D**, **n**, and **m** are used as the operands according to their functions. When more than one operand is used, and these operands share the same function, they are suffixed with numbers. For example, $\mathbf{S_1}$, $\mathbf{S_2}$, and etc.
2. If the instruction can be used as the pulse instruction, the letter P is added in back of the instruction. If the 16-bit instruction can be used as the 32-bit instruction, the letter D is added in front of the 16-bit instruction to form the 32-bit instruction. For example, "D***P" in which "***" is an instruction code.
3. Among the operands, the device PR is the pointer register Please refer to ISPSoft User Manual and section 4.4 for more information about the pointer register.
4. If users want to use an instruction in the function block, and the timer, the 16-bit counter, and the 32-bit counter are supported among the operands, users have to use the pointer register of the timer, the pointer register of the 16-bit counter, and the pointer register of the 32-bit counter. Please refer to sections 4.5~4.7 for more information.
5. Among the operands, the 32-bit single-precision floating-point numbers are notated by F, whereas the 64-bit double-precision floating-point numbers are notated by DF.
6. The solid circle ● indicates that the device can be modified by an index register, and the hollow circle ○ indicates that the device can not be modified by an index register. For example, the data register designated by the operand **S** can be modified by an index register.
7. The applicable model is indicated in the table. Users can check whether the instruction can be used as the pulse instruction, the 16-bit instruction, the 32-bit instruction, or the 64-bit instruction according to the information in the table.
8. The description of the symbols representing the instruction MOV in ISPSoft:
   MOV, MOVP, DMOV, and DMOVP: Instruction codes
   En: Enable
   S: The data source (The applicable format of the operand is a word/double word.)
   D: The data destination (The applicable format of the operand is a word/double word.)

The composition of applied instructions:

Some applied instructions are composed of instruction codes. For example, the instructions EI, DI, WDT, and etc. however, most applied instructions consist of instruction codes and several operands.

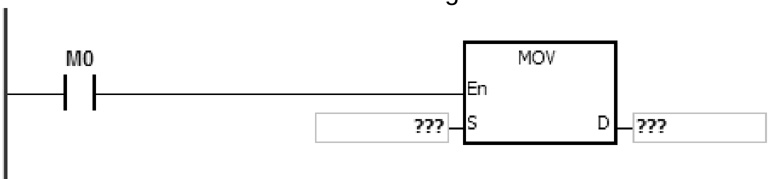
Every applied instruction has its own API number and instruction code. For example, the instruction code of API0300 is MOV (transferring the data).

Entering the instruction directly: Users can enter the instruction by means of ISPSoft. For the instruction MOV, users only need to enter the instruction name and the operands to designate “MOV D0 D1”.



Entering the instruction by dragging: Users can drag the instruction MOV from **APIs** in ISPSoft to the area where the ladder diagram can be edited.

Entering the instruction by the toolbar: Users can click **API/FB Selection** on the toolbar in ISPSoft, and then choose **API**. Finally, they can choose the instruction MOV in **Data Transfer**. The operands are extra designated.



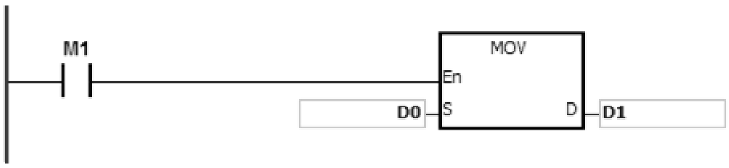
S	Source operand If there is more than one source operand, these source operands are represented by **S_1**, **S_2**, and etc.
D	Destination operand If there is more than one destination operand, these destination operand is represented by **D_1**, **D_2**, and etc.
If the operand only can designate the constant K/H or the register, it is represented by **m**, **m_1**, **m_2**, **n**, **n_1**, or **n_2**.	

The length of the operand (the 16-bit instruction, the 32-bit instruction, or the floating-point number instruction):

The 16-bit instruction or the 32-bit instruction

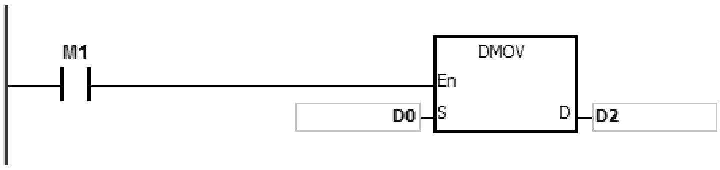
The values of the operands can be divided into the 16-bit values and the 32-bit values. Accordingly, in order to process data of difference lengths, the instructions are divided into the 16-bit instructions and the 32-bit instructions. To separate the 32-bit instruction from the 16-bit one, a D is added in front of the 16-bit instruction.

16-bit instruction MOV



When M1 is ON, the data in D0 is transferred to D1.

32-bit instruction DMOV



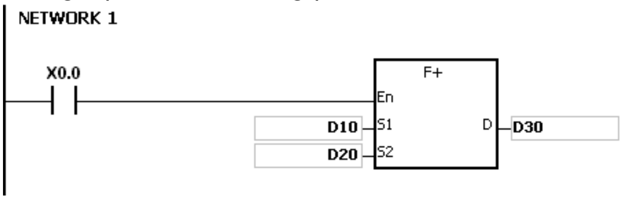
When M1 is ON, the data in (D1, D0) is transferred to (D3, D2).

The floating-point number instruction

The floating-point number instructions can be divided into the 32-bit floating-point number instructions and the 64-bit floating-point number instructions, which correspond to the single-precision floating-point number instructions and the double-precision floating-point number instructions respectively. Users can refer to chapter 2 for more information about the floating-point numbers.

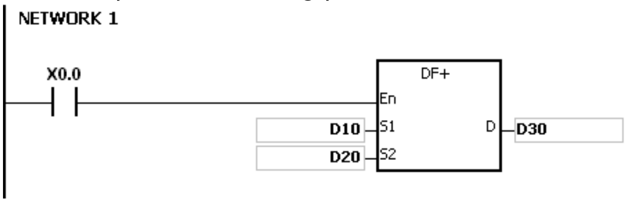
The values of the operands used in the instructions can be divided into the 32-bit values and the 64-bit values. Accordingly, in order to process data of difference lengths, the instructions are divided into the 32-bit instructions and the 64-bit instructions. To separate the 64-bit instruction from the 32-bit one, a D is added in front of the 32-bit instruction.

32-bit single-precision floating-point number instruction F+



When X0.0 is ON, the data in (D11, D10) and (D21, D20) is transferred to (D31, D30).

64-bit double-precision floating-point number instruction DF+

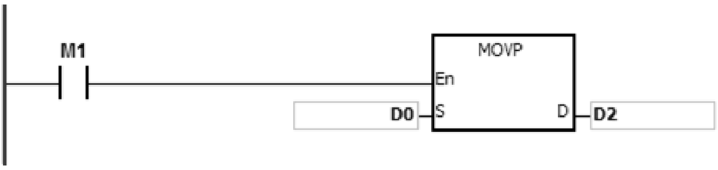


When X0.0 is ON, the data in (D13, D12, D11, D10) and (D23, D22, D21, D20) is transferred to (D33, D32, D31, D30).

The continuous execution of the instruction and the pulse execution of the instruction:

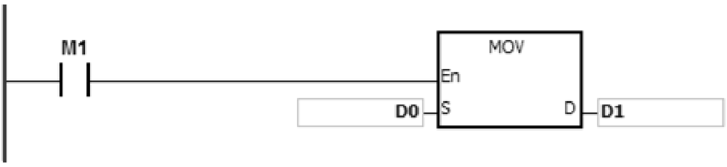
1. The execution of the instructions can be divided into the continuous execution and the pulse execution. When the instruction is not executed, the time needed to execute the program is shorter. Therefore, using the pulse instruction in the program can lessen the scan cycle.
2. The pulse function allows the related instruction to enable the rising edge-triggered control input. The instruction is ON within one scan cycle.
3. If the control input stays ON, and the related instruction is not executed, the control input has to be switched from OFF to ON again in order to execute the instruction.
4. The pulse instruction:

Pulse execution



When M1 is switched from OFF to ON, the instruction MOVP is executed once. The instruction is not executed any more within the scan cycle. Therefore, it is called the pulse instruction.

Continuous execution



Whenever M1 is ON during the scan cycle, the instruction MOV is executed once. Therefore, the instruction is called the continuous instruction.

When the conditonal contact M1 is OFF, the instruction is not executed, and the value in the destination operand D does not change.

The objects that the operands designate:

1. Input relay: X0.0~X511.15 or X0~X511
2. Output relay: Y0.0~Y511.15 or Y0~Y511
3. Internal relay: M0~M8191
4. Stepping relay: S0~S2047
5. Timer: T0~T2047
6. 16-bit counter: C0~C2047
7. 32-bit counter: HC0~HC63
8. Data register: D0~D65535 or D0.0~D65535.15
9. Link register: L0~L65535 or L0.0~D65535.15
10. Special auxiliary flag: SM0~SM2047
11. Special data register: SR0~SR2047

12. Index register: E0~E31
13. Pointer register: PR0~PR15
14. Pointer register of the timer: TR0~TR7
15. Pointer register of the 16-bit counter: CR0~CR7
16. Pointer register of the 32-bit counter: HCR0~HCR7
17. Constant: The decimal constants are notated by K, and the hexadecimal constants are notated by 16#.
18. String: “$”
19. Floating-point number: The single-precision floating-point numbers are notated by F, and the double-precision floating-point numbers are notated by DF.
20. The length of the data in one register is generally 16 bits. If users want to store the 32-bit data in the register, they have to designate two consecutive registers.
21. If the operand used in the 32-bit instruction designates D0, the 32-bit data register composed of (D1, D0) is occupied. D1 represents the higher 16 bits, and D0 represents the lower 16 bits. The same rule applies to the timer and the 16-bit counter.。
22. When the 32-bit counter HC is used as the data register, it is only can be designated by the operand used in the 32-bit instruction.

PS. Please refer to chapter 2 for more information about devices.

4.2 Restrictions on the Use of the Instructions

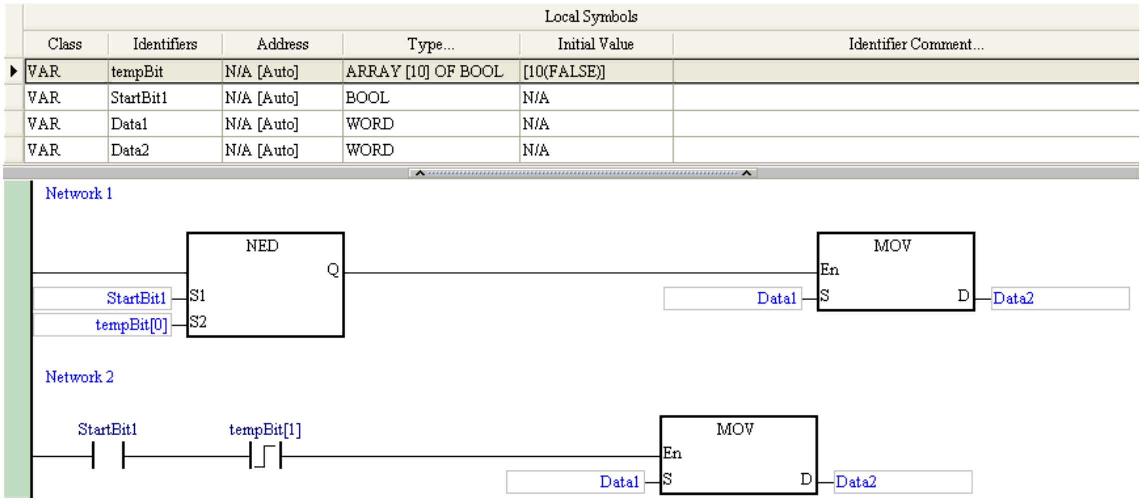
- The instructions which only can be used in the function blocks
  API0065 CHKADR, FB_NP, FB_PN, NED, ANED, ONED, PED, APED, and OPED
- The instructions which can not be used in the interrupt tasks
  GOEND
- The instructions which are not supported in the function blocks
  LDP, ANDP, ORP, LDF, ANDF, ORF, PLS, PLF, NP, PN, MC/MCR, GOEND, and all pulse instructions in applied commands
  If users want to use some of the instructions mentioned above, they can use the substitute instructions.

Instruction which can not be used in the function block	Substitute instruction in the function block
LDP/ANDP/ORP	PED/APED/OPED
LDF/ANDF/ORF	NED/ANED/ONED
PLS	-
PLF	-
NP	FB_NP
PN	FB_PN
MC	-
MCR	-
All pulse instructions in applied commands	Note 1

Note 1: Pulse instructions can not be used in the function blocks. If users want to get the function of the pulse instruction in the function block, they can refer to the following example.

Example:

1. First, declare 10 bit variables tempBit[10] used in the system.
2. When StartBit1 is switched from ON to OFF, network 1 executes the instruction MOV once.
3. When StartBit1 is switched from OFF to ON, network 2 executes the instruction MOV once.
4. The variable tempBit used in the system can not be used repeatedly.



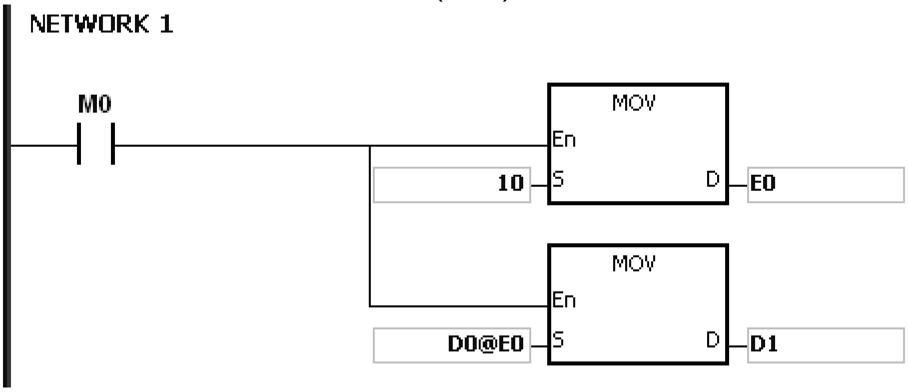
4.3 Index Registers

The index register is the 16-bit data register. It is like the general register in that the data can be read from it and written into it. However, it is mainly used as the index register. The range of index registers is E0~E13.

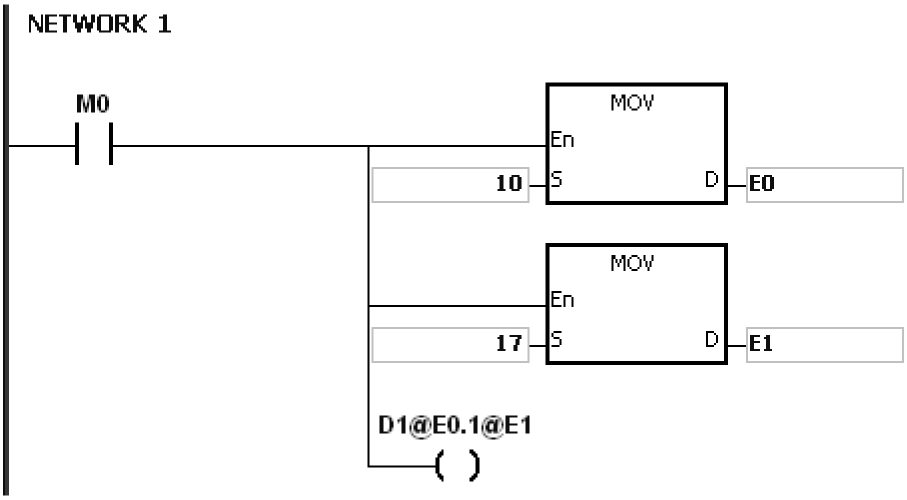
The index register is used as follows.

1. Using the register name to modify the device

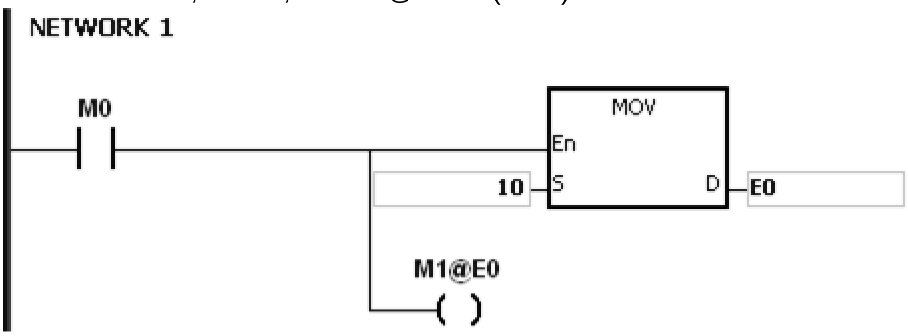
   When M0 is ON, E0=10, D0@E0=D (0+10)=D10, and D1=D10.



   When M0 is ON, E0=10, E1=17, D1@E0=D (1+10)=D11, and the bit part 1@E1=(1+17)=18. However, the maximum bit number is 15. Since m=18/16=1 and n=18%16=2 (getting the remainder), the last modification result is D (11+m).n=D12.2. D12.2 is ON.



   When M0 is ON, E0=10, and M1@E0=M (1+10)=M11. M11 is ON.

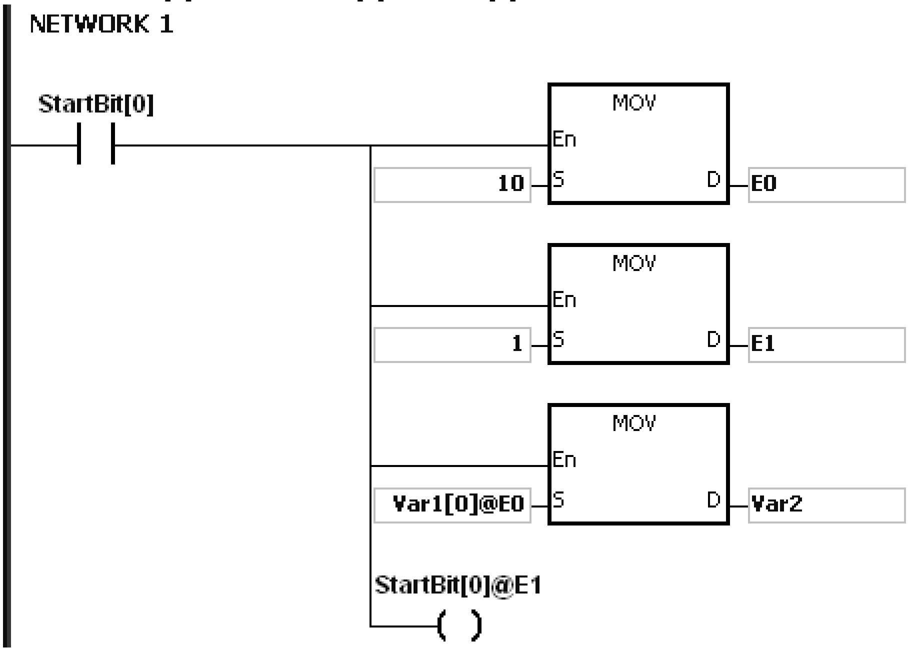


2. Declaring the variables first, and then modifying the device

- Declare the three variables StartBit, Var1, and Var2 in ISPSoft.
  The type of StartBit is the Boolean array, and its size is 2 bits. The range is from StartBit[0] to StartBit[1].
  The type of Var1 is the word array, and its size is 11 words. The range is from Var1[0] to Var1[10].
  The type of Var2 is the word, and its size is one word.

Local Symbols					
Class	Identifiers	Address	Type...	Initial Value	Identifier Comment...
VAR	StartBit	N/A [Auto]	ARRAY [2] OF BOOL	N/A	
VAR	Var1	N/A [Auto]	ARRAY [11] OF WORD	N/A	
VAR	Var2	N/A [Auto]	WORD	N/A	

- When StartBit[0] is ON, E0=10, E1=1, Var1[0]@E0=Var1[10], Var2=Var1[10], and StrartBit[0]@E1=StartBit[1]. StartBit[1] is ON.



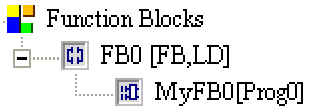
Additional remark: When users declare the variables in ISPSoft, and the variables are added to the contents of the registers to form the addresses to the actual data, users must note the addresses to prevent the program from being executed wrongly.

4.4 Pointer Registers

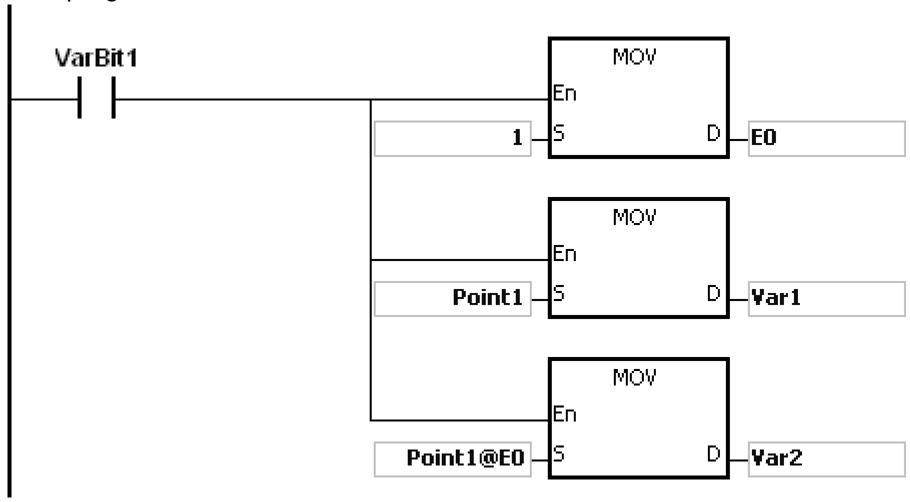
- ISPSoft supports the function blocks. When the variable declaration type is VAR_IN_OUT, and the data type is POINTER, the variable is the pointer register. The value in the pointer register can refer directly to the value stored in the device X, Y, D, or L, and the pointer register can point to the address associated with the variable set automatically in ISPSoft.
- Users can declare 16 pointer registers in every function block. The range is PR0~PR15, or PR0.0~PR15.15.

Example:

1. Establish a program organization unit (POU) in ISPSoft first.
2. Establish a function block which is called FB0.



3. The program in the function block FB0



4. Declare the varaible in the function block FB0.

Choose VAR_IN_OUT as the declaration type, Point1 as the identifier, POINTER as the data type. The variable is the pointer register.

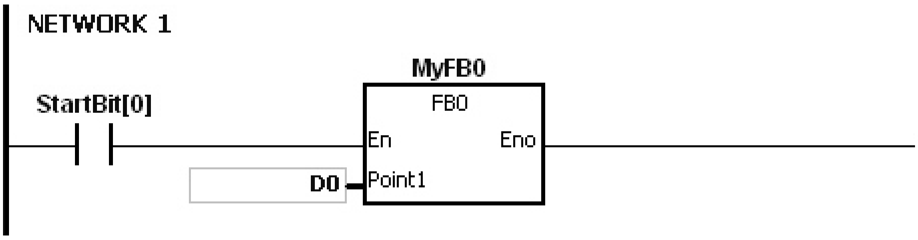
Local Symbols					
Class	Identifiers	Address	Type...	Initial Value	Identifier Comment...
VAR	VarBit1	N/A [Auto]	BOOL	FALSE	
VAR	Var1	N/A [Auto]	WORD	0	
VAR	Var2	N/A [Auto]	WORD	0	
VAR_IN_OUT	Point1	N/A [Auto]	POINTER	N/A	

5. Declare the variable in the program organization unit (POU).

Local Symbols					
Class	Identifiers	Address	Type...	Initial Value	Identifier Comment...
VAR	StartBit	N/A [Auto]	ARRAY [2] OF BOOL	N/A	
VAR	CVar1	N/A [Auto]	ARRAY [2] OF WORD	N/A	
VAR	MyFB0	N/A [Auto]	FB0	N/A	

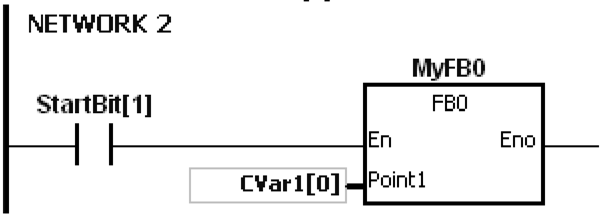
6. Call the function block FB0 in the program organization unit (POU).
7. The program in the program organization unit (POU)

Network 1: When StartBit[0] is ON, the address of D0 is transmitted to Point 1 in FB0.



When VarBit1 in FB0 is ON, E0=1, Var1=D0, Point1@E0=D (0+1)=D1, and Var2=D1.

Network 2: When StartBit[1] is ON, the address of CVar1[0] is transmitted to Point1 in FB0.



When VarBit1 in FB0 is ON, E0=1, Var1=CVar1[0], Point1@E0=CVar1 (0+1)=Cvar1[1], and Var2=CVar1[1].

4.5 Pointer Registers of Timers

- ISPSoft supports the function blocks. If users want to use the timer in the function block, they have to declare a pointer register of the timer in the function block. The address of the timer is transmitted to the pointer register of the timer when the function block is called.
- When the variable declaration type is VAR_IN_OUT, and the data type is T_POINTER, the variable is the pointer register of the timer. The value in the pointer register of the timer can refer directly to the value stored in the device T or in the variable which is the timer in ISPSoft.
- Users can declare 8 pointer registers of the timers in every function block. The range is TR0~TR7.
- If users want to use an instruction in the function block, and the timer is supported among the operands, users have to use the pointer register of the timer.

Example:

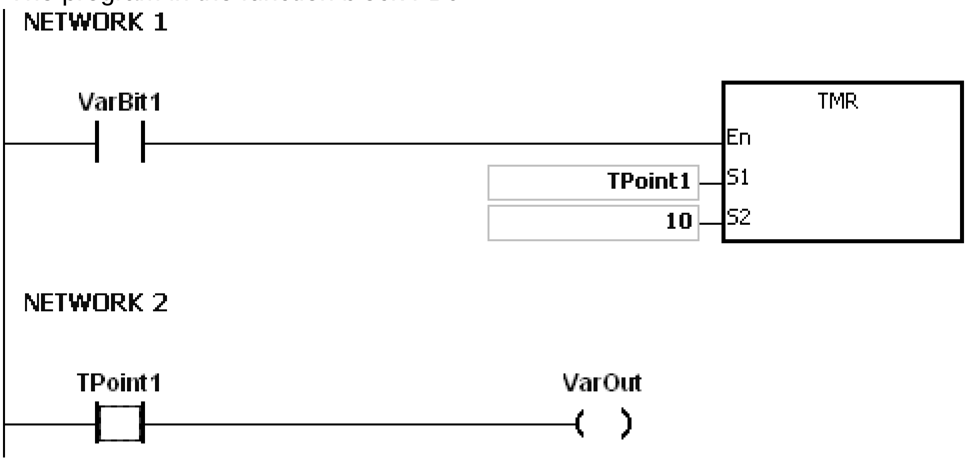
1. Establish a program organization unit (POU) in ISPSoft first.
2. Establish a function block which is called FB0.

3. Declare the varaible in the function block FB0.

Choose VAR_IN_OUT as the declaration type, TPoint1 as the identifier, T_POINTER as the data type. The variable is the pointer register of the timer.

Local Symbols					
Class	Identifiers	Address	Type...	Initial Value	Identifier Comment...
VAR	VarBit1	N/A [Auto]	BOOL	FALSE	
VAR_IN_OUT	TPoint1	N/A [Auto]	T_POINTER	N/A	
VAR	VarOut	N/A [Auto]	BOOL	FALSE	

4. The program in the function block FB0



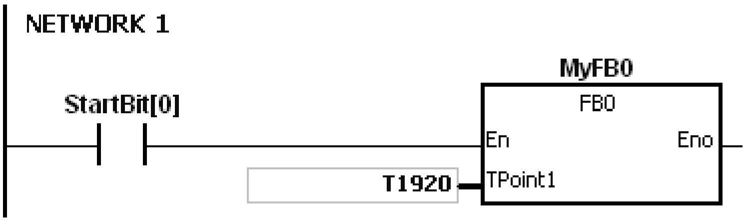
5. Declare the variable in the program organization unit (POU).

The data type of CVar1 should be TIMER.

Local Symbols					
Class	Identifiers	Address	Type...	Initial Value	Identifier Comment...
VAR	StartBit	N/A [Auto]	ARRAY [2] OF BOOL	[2(FALSE)]	
VAR	CVar1	T0	TIMER	N/A	
VAR	MyFB0	N/A [Auto]	FB0	N/A	

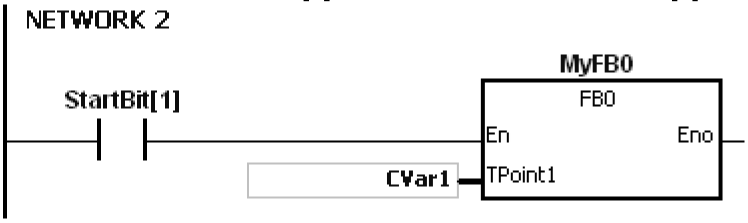
6. Call the function block FB0 in the program organization unit (POU).
7. The program in the program organization unit (POU)

Network 1: When StartBit[0] is ON, the address of T1920 is transmitted to TPoint1 in FB0.



When VarBit1 in the FB0 is ON, the instruction TMR is executed, and TPoint1 (T1920) starts counting. When the value of TPoint1 matches the setting value, VarOut is ON.

Network 2: When StartBit[1] is ON, the address of CVar1[0] is transmitted to TPoint1 in FB0.



When VarBit1 in FB0 is ON, the instruction TMR is executed, and TPoint (CVar1) starts counting. When the value of TPoint1 matches the setting value, VarOut is ON.

4.6 Pointer Registers of 16-bit Counters

- ISPSoft supports the function blocks. If users want to use the 16-bit counter in the function block, they have to declare a pointer register of the 16-bit counter in the function block. The address of the 16-bit counter is transmitted to the pointer register of the 16-bit counter when the function block is called.
- When the variable declaration type is VAR_IN_OUT, and the data type is C_POINTE, the variable is the pointer register of the 16-bit counter. The value in the pointer register of the 16-bit counter can refer directly to the value stored in the device T or in the variable which is the counter in ISPSoft.
- Users can declare 8 pointer registers of the 16-bit counters in every function block. The range is CR0~CR7.
- If users want to use an instruction in the function block, and the counter is supported among the operands, users have to use the pointer register of the 16-bit counter.

Example:

1. Establish a program organization unit (POU) in ISPSoft first.
2. Establish a function block which is called FB0.

3. Declare the varaible in the function block FB0.
   Choose VAR_IN_OUT as the declaration type, CPoint1 as the identifier, C_POINTER as the data type. The variable is the pointer register of the 16-bit counter.

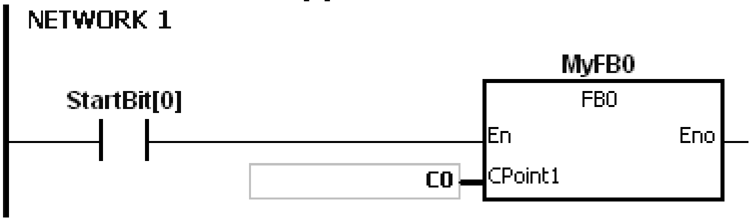
Local Symbols					
Class	Identifiers	Address	Type...	Initial Value	Identifier Comment...
VAR	VarBit1	N/A [Auto]	BOOL	FALSE	
VAR_IN_OUT	CPoint1	N/A [Auto]	C_POINTER	N/A	

4. The program in the function block FB0

5. Declare the variable in the program organization unit (POU).
   The data type of CVar1 should be COUNTER.

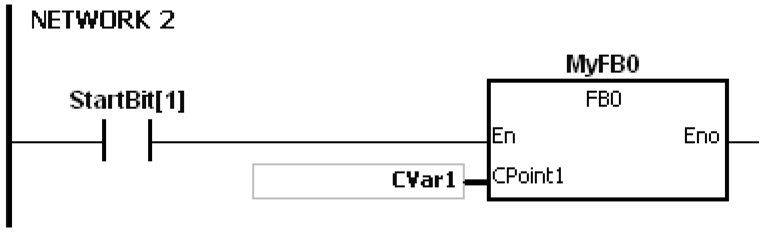
Local Symbols					
Class	Identifiers	Address	Type...	Initial Value	Identifier Comment...
VAR	StartBit	N/A [Auto]	ARRAY [2] OF BOOL	[2(FALSE)]	
VAR	CVar1	C1	COUNTER	N/A	
VAR	MyFB0	N/A [Auto]	FB0	N/A	

6. Call the function block FB0 in the program organization unit (POU).
7. The program in the program organization unit (POU)
   Network 1: When StartBit[0] is ON, the address of C0 is transmitted to CPoint1 in FB0.



When VarBit1 in FB0 is ON, CPoint1 (C0) is ON.

Network 2: When StartBit[1] is ON, the address of CVar1 is transmitted to CPoint1 in FB0.



When VarBit1 in FB0 is ON, CPoint1 (CVar1) is ON.

4.7 Pointer Registers of 32-bit Counters

- ISPSoft supports the function blocks. If users want to use the 32-bit counter in the function block, they have to declare a pointer register of the 32-bit counter in the function block. The address of the 32-bit counter is transmitted to the pointer register of the 32-bit counter when the function block is called.
- When the variable declaration type is VAR_IN_OUT, and the data type is HC_POINTER, the variable is the pointer register of the 32-bit counter. The value in the pointer register of the 32-bit counter can refer directly to the value stored in the device HC or in the variable which is the counter in ISPSoft.
- Users can declare 8 pointer registers of the 32-bit counters in every function block. The range is HCR0~HCR7.
- If users want to use an instruction in the function block, and the 32-bit counter is supported among the operands, users have to use the pointer register of the 32-bit counter.

Example:

1. Establish a program organization unit (POU) in ISPSoft first.
2. Establish a function block which is called FB0.

3. Declare the varaible in the function block FB0.

Choose VAR_IN_OUT as the declaration type, HCPoint1 as the identifier, HC_POINTER as the data type. The variable is the pointer register of the 32-bit counter.

Local Symbols					
Class	Identifiers	Address	Type...	Initial Value	Identifier Comment...
VAR	VarBit1	N/A [Auto]	BOOL	FALSE	
VAR_IN_OUT	HCPoint1	N/A [Auto]	HC_POINTER	N/A	

4. The program in the function block FB0

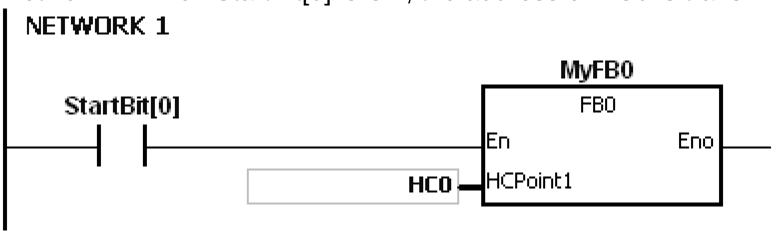
5. Declare the variable in the program organization unit (POU).

The data type of CVar1 should be COUNTER, and users have to fill in the address column with the practical address of the 32-bit counter.

Local Symbols					
Class	Identifiers	Address	Type...	Initial Value	Identifier Comment...
VAR	StartBit	N/A [Auto]	ARRAY [2] OF BOOL	[2(FALSE)]	
VAR	CVar1	HC1	COUNTER	N/A	
VAR	MyFB0	N/A [Auto]	FB0	N/A	

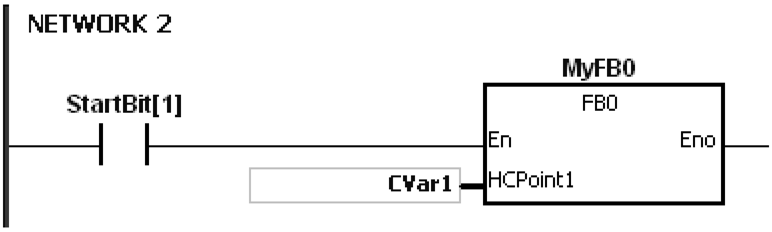
6. Call the function block FB0 in the program organization unit (POU).
7. The program in the program organization unit (POU)

Network 1: When StartBit[0] is ON, the address of HC0 is transmitted to HCPoint1 in FB0.



When VarBit1 in FB0 is ON, HCPoint1 (HC0) is ON.

Network: When StartBit[1] is ON, the address of CVar1 is transmitted to HCPoint1 in FB0.



When VarBit1 in FB0 is ON, HCPoint1 (CVar1) is ON.

Chapter 5 Basic Instructions

Table of Contents

5.1 List of Basic Instructions 5-2
5.2 Basic Instructions 5-3

5.1 List of Basic Instructions

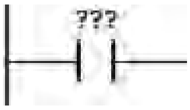
Instruction code	Function	Operand	Step
LD/AND/OR	Loading contact A/Connecting contact A in series/Connecting contact A in parallel	DX, X, Y, M, SM, S, T, C, HC, D, L, and PR	1-2
LDI/ANI/ORI	Loading contact B/Connecting contact B in series/Connecting contact B in parallel	DX, X, Y, M, SM, S, T, C, HC, D, L, and PR	1-2
ANB/ORB	Connecting the loop blocks in series/parallel	–	1
MPS/MRD/MPP	Storing the data in the stack/Reading the data from the stack/Popping the data from the stack	–	1
OUT	Driving the coil	DY, X, Y, M, SM, S, T, C, HC, D, L, and PR	1-2
SET	Keeping the device on	DY, X, Y, M, SM, S, T, C, HC, D, L, and PR	1-2
MC/MCR	Setting/Resetting the master control	N	1
LDP/ANDP/ORP	Starting the rising-edge detection/Connecting the rising-edge detection in series/Connecting the rising-edge detection in parallel	DX, X, Y, M, SM, S, T, C, HC, D, L, and PR	1-2
LDF/ANDF/ORF	Starting the falling-edge detection/Connecting the falling-edge detection in series/Connecting the falling-edge detection in parallel	DX, X, Y, M, SM, S, T, C, HC, D, L, and PR	1-2
PED/APED/OPED	Starting the rising-edge detection/Connecting the rising edge-detection in series/Connecting the rising-edge detection in parallel	X, Y, M, SM, S, T, C, HC, D, L, and PR	5
NED/ANED/ONED	Starting the falling-edge detection/Connecting the falling-edge detection in series/Connecting the falling-edge detection in parallel	X, Y, M, SM, S, T, C, HC, D, L, and PR	5
PLS	Rising-edge output	DY, X, Y, M, SM, S, T, C, HC, D, L, and PR	1-2
PLF	Falling-edge output	DY, X, Y, M, SM, S, T, C, HC, D, L, and PR	1-2
INV	Inverting the logical operation result	–	1
NOP	No operation	–	1
NP	The circuit is rising edge-triggered.	–	1
PN	The circuit is falling edge-triggered.	–	1
FB_NP	The circuit is rising edge-triggered.	X, Y, M, SM, S, T, C, HC, D, L, and PR	1-2
FB_PN	The circuit is falling edge-triggered.	X, Y, M, SM, S, T, C, HC, D, L, and PR	1-2
PSTOP	Stopping executing the program in the PLC	–	1

5.2 Basic Instructions

Instruction code	Operand	Function
LD/AND/OR	**S**	Loading contact A/Connecting contact A in series/Connecting contact A in parallel

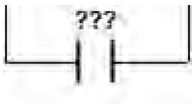
Device	DX	DY	X	Y	M	SM	S	T	C	HC	D	L	PR
S	●		●	●	●	●	●	●	●	●	●	●	●

Symbol:



LD

AND



OR

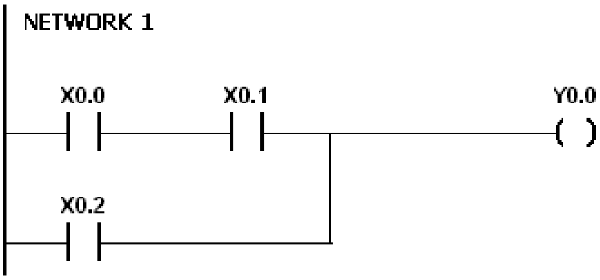
S : Specified device Bit

Explanation:

1. The instruction LD applies to contact A which starts from the mother line or contact A which is the start of a contact circuit. It functions to reserve the current contents, and store the contact state which is acquired in the accumulative register.
2. The instruction AND is used to connect contact A in series. It functions to read the state of the contact which is specified to be connected in series, and perform the AND operation with the previous logical operation result. The final result is stored in the accumulative register.
3. The instruction OR is used to connect contact A in parallel. It functions to read the state of the contact which is specified to be connected in parallel, and perform the OR operation with the previous logical operation result. The final result is stored in the accumulative register.

Example:

1. Contact A of X0.0 is loaded, contact A of X0.1 is connected in series, contact A of X0.2 is connected in parallel, and the coil Y0.0 is driven.
2. When both X0.0 and X0.1 are ON, or when X0.2 is ON, Y0.0 is ON.



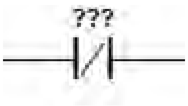
Instruction code	Operand	Function
LDI/ANI/ORI	**S**	Loading contact B/Connecting contact B in series/Connecting contact B in parallel

Device	DX	DY	X	Y	M	SM	S	T	C	HC	D	L	PR
S	●		●	●	●	●	●	●	●	●	●	●	●

Symbol:

LDI

ANI



ORI

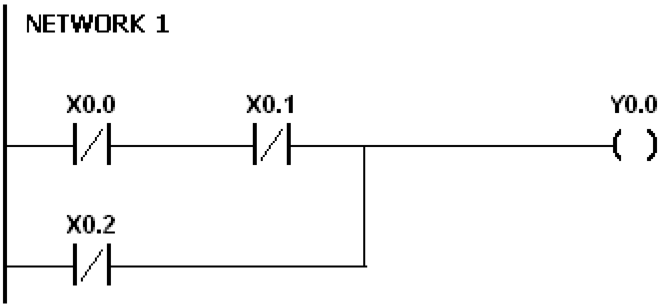
S : Specified device Bit

Explanation:

1. The instruction LDI applies to contact B which starts from the mother line or contact B which is the start of a contact circuit. It functions to reserve the current contents, and store the contact state which is acquired in the accumulative register.
2. The instruction ANI is used to connect contact B in series. It functions to read the state of the contact which is specified to be connected in series, and perform the AND operation with the previous logical operation result. The final result is stored in the accumulative register.
3. The instruction ORI is used to connect contact B in parallel. It functions to read the state of the contact which is specified to be connected in parallel, and perform the OR operation with the previous logical operation result. The final result is stored in the accumulative register.

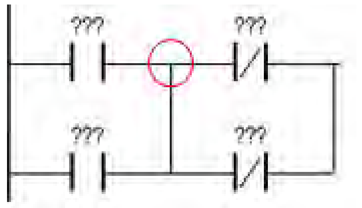
Example:

1. Contact B of X0.0 is loaded, contact B of X0.1 is connected in series, contact B of X0.2 is connected in parallel, and the coil Y0.0 is driven.
2. When both X0.0 and X0.1 are ON, or when X0.2 is ON, Y0.0 is ON.

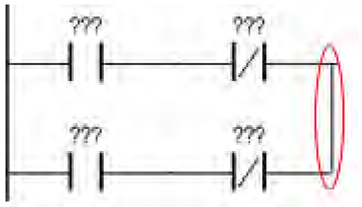


Instruction code	Operand	Function
ANB/ORB	-	Connecting the circuit blocks in series/parallel

Symbol:



ANB



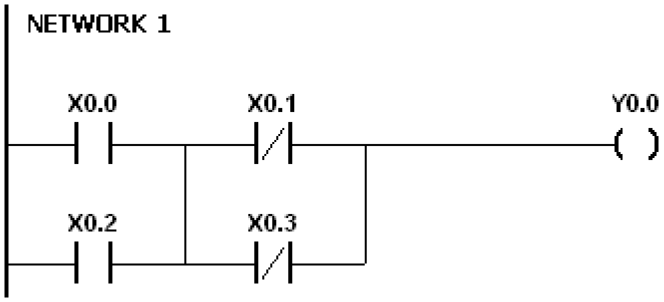
ORB

Explanation:

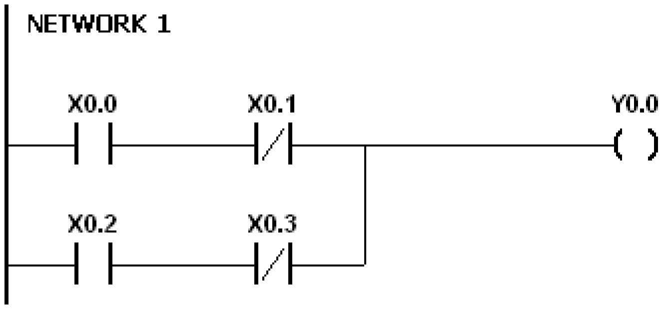
1. The instruction ANB is used to perform the AND operation between the reserved logical operation result and the contents of the accumulative register.
2. The instruction ANB is used to perform the OR operation between the reserved logical operation result and the contents of the accumulative register.

Example:

1. Contact A of X0.0 is loaded, contact A of X0.2 is connected in parallel, contact B of X0.1 is loaded, contact B of X0.3 is connected in parallel, the circuit blocks are connected in series, and the coil Y0.0 is driven.



2. Contact A of X0.0 is loaded, contact B of X0.1 is connected in series, contact A of X0.2 is loaded, contact B of X0.3 is connected in series, the circuit blocks are connected in parallel, and the coil Y0.0 is driven.



Instruction code	Operand	Function
MPS/MRD/MPP	-	Storing the data in the stack/Reading the data from the stack/Popping the data from the stack

Explanation:

1. The instruction MPS is used to store the data in the accumulative register in the stack (the value of the stack pointer increases by one).
2. The instruction MRD is used to read the data from the stack and store it in the accumulative register (the value of the stack pointer remains the same).
3. The instruction MPP is used to pop the previous logical operation result from the stack, and store it in the accumulative register (the value of the stack pointer decreases by one).

Example:

1. Contact A of X0.0 is loaded, and the data in the accumulative register is stored in the stack.
2. Contact A of X0.1 is connected in series, the coil Y0.1 is driven, and the data is read from the stack (the value of the stack pointer remains the same).
3. Contact A of X0.2 is connected in series, the coil M0 is driven, and the previous logical operation result is popped from the stack.

Instruction:	**Operation:**
LD X0.0	Contact A of X0.0 is loaded.
MPS	The data in the accumulative register is stored in the stack.
AND X0.1	Contact A of X0.1 is connected in series.
OUT Y0.1	The coil Y0.1 is driven.
MRD	The data is read from the stack.
AND X0.2	Contact A of X0.2 is connected in series.
OUT M0	The coil M0 is driven.
MPP	The previous logical operation result is popped from the stack.
OUT Y0.2	The coil Y0.2 is driven.
END	The program ends.

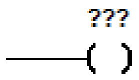
Note:

1. The number of MPS instructions must be equal to that of MPP instructions.
2. The instruction MPS can be used at most 31 times.

Instruction code	Operand	Function
OUT	**S**	Driving the coil

Device	DX	DY	X	Y	M	SM	S	T	C	HC	D	L	PR
S		●	●	●	●	●	●	●	●	●	●	●	●

Symbol:



S : Specified device   Bit

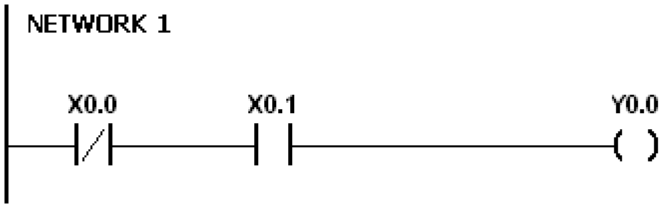
Explanation:

1. The logical operation result prior to the application of the instruction OUT is output into the specified device.
2. The action of the coil contact:

Operation result	OUT		
	Coil	Contact	
		Contact A (normally open)	Contact B (normally closed)
False	OFF	OFF	ON
True	ON	ON	OFF

Example:

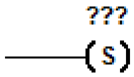
1. Contact B of X0.0 is loaded, contact A of X0.1 is connected in series, and the coil Y0.0 is driven.
2. When X0.0 is OFF, and X0.1 is ON, Y0.0 is ON.



Instruction code	Operand	Function
SET	**S**	Keeping the device on

Device	DX	DY	X	Y	M	SM	S	T	C	HC	D	L	PR
S		●	●	●	●	●	●	●	●	●	●	●	●

Symbol:



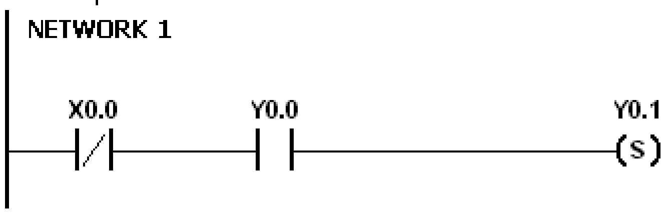
S : Specified device Bit

Explanation:

When the instruction SET is driven, the specified device is set to ON. No matter the instruction SET is still driven, the specified device keeps ON. Users can set the specified device to OFF by means of the instruction RST.

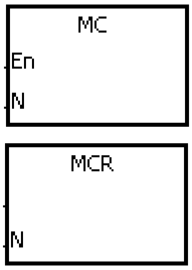
Example:

1. Contact B of X0.0 is loaded, contact A of Y0.0 is connected in series, and Y0.1 keeps ON.
2. When X0.0 is OFF, and Y0.0 is ON, Y0.1 is ON. Even if the operation result changes, Y0.1 still keeps ON.



Instruction code	Operand	Function
MC/MCR	**N**	Setting/Resetting the master control

Symbol:



MC	**N**	:	Level of the nested program structure	N0~N31
MCR				

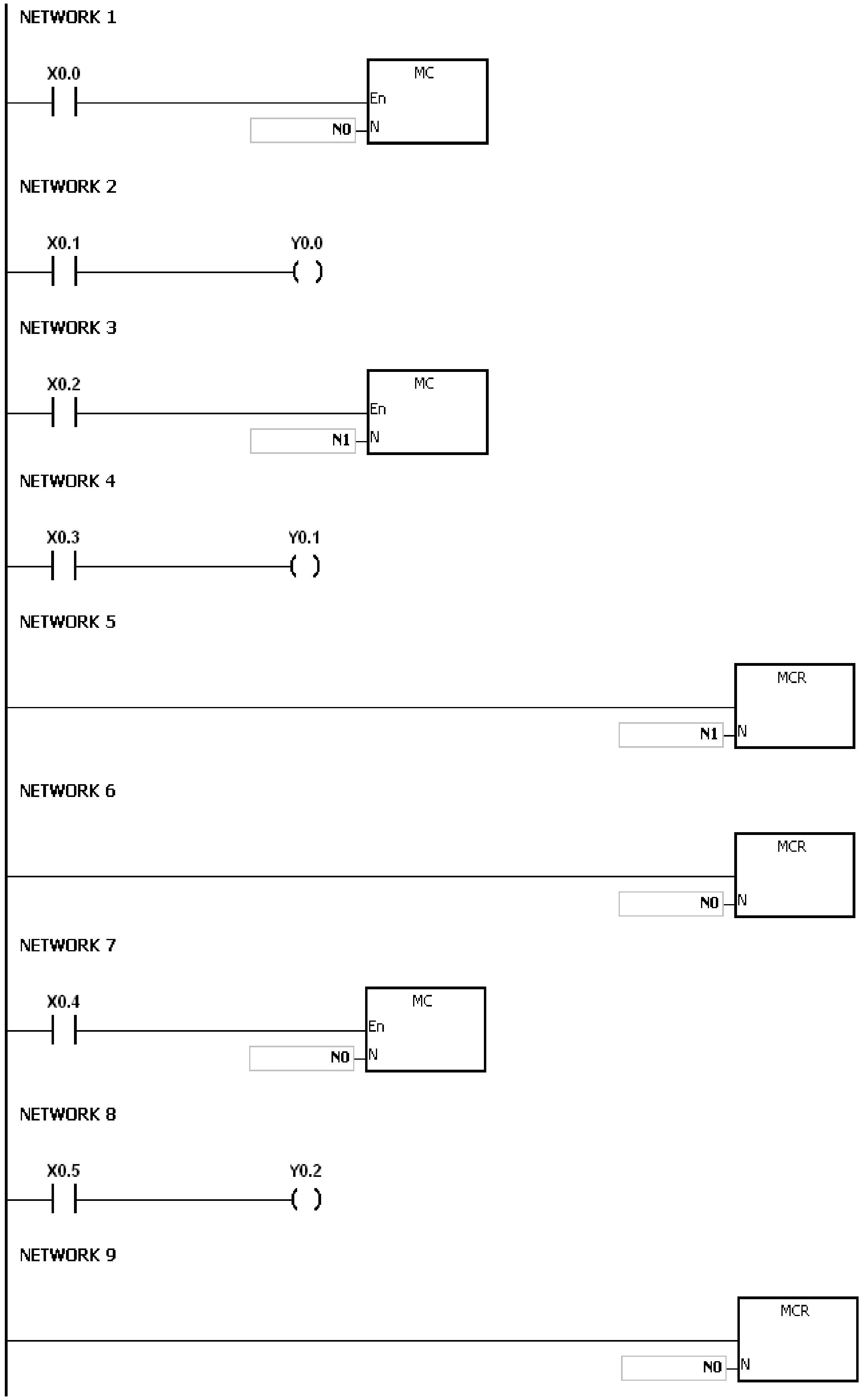
Explanation:

1. The instruction MCR is used to set the master control. When the instruction MC is executed, the instructions between MC and MCR are executed as usual. When the instruction MC is OFF, the actions of the instructions between MC and MCR are as follows.

Instruction type	Description
General-purpose timer	The timer value is reset to zero. The coil and the contact are OFF.
Timer used in the function block	The timer value is reset to zero. The coil and the contact are OFF.
Accumulative timer	The coil is OFF. The timer value and the state of the contact remains the same.
Counter	The coil is OFF. The timer value and the state of the contact remains the same.
Coils driven by OUT	All coils are OFF.
Devices driven by SET and RST	The states of the devices remain the same.
Applied instruction	All applied instructions are not executed. The FOR/NEXT loop is still repeated N times, but the actions of the instructions inside the FOR/NEXT loop follow those of the instructions between MC and MR.

2. The instruction MCR is used to reset the master control, and is placed at the end of the master control program. There should not be any contact instruction before MCR.
3. MC/MCR supports the nested program structure. There are at most 32 levels of nested program structures (N0~N31). Please refer to the example below.

Example:


NETWORK 1
X0.0
MC
En
N0
N
NETWORK 2
X0.1
Y0.0
NETWORK 3
X0.2
MC
En
N1
N
NETWORK 4
X0.3
Y0.1
NETWORK 5
MCR
N1
N
NETWORK 6
MCR
N0
N
NETWORK 7
X0.4
MC
En
N0
N
NETWORK 8
X0.5
Y0.2
NETWORK 9
MCR
N0
N

Instruction code	Operand	Function
LDP/ANDP/ORP	**S**	Starting the rising-edge detection/Connecting the rising-edge detection in series/Connecting the rising-edge detection in parallel

Device	DX	DY	X	Y	M	SM	S	T	C	HC	D	L	PR
S	●		●	●	●	●	●	●	●	●	●	●	●

Symbol:

LDP

ANDP

ORP

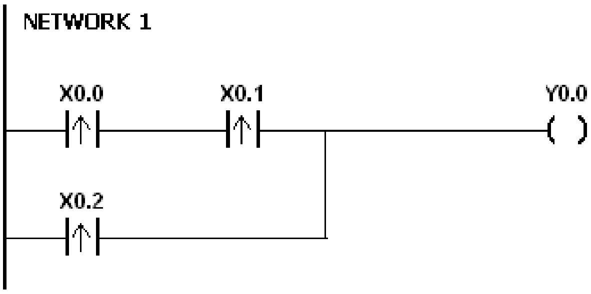
S : Specified device Bit

Explanation:

1. The instruction LDP functions to reserve the current contents, and store the rising-edge detection of the contact in the accumulative register.
2. The instruction ANDP is used to connect the rising-edge detection of the contact in series.
3. The instruction ORP is used to connect the rising-edge detection of the contact in parallel.
4. Only when LDP/ANDP/ORP is scanned can the state of the device be gotten, and not until LDP/ANDP/ORP is scanned next time can whether the state of the device changes be judged.
5. Please use the instructions PED, APED, and OPED in the subroutine.

Example:

1. The rising-edge detection of X0.0 starts, the rising-edge detection of X0.1 is connected in series, the rising-edge detection of X0.2 is connected in parallel, and the coil Y0.0 is driven.
2. When both X0.0 and X0.1 are switched from OFF to ON, or when X0.2 is switched from OFF to ON, Y0.0 is ON for a scan cycle.

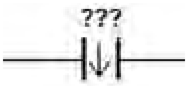


Instruction code	Operand	Function
LDF/ANDF/ORF	**S**	Starting the falling-edge detection/Connecting the falling-edge detection in series/Connecting the falling-edge detection in parallel

Device	DX	DY	X	Y	M	SM	S	T	C	HC	D	L	PR
S	●		●	●	●	●	●	●	●	●	●	●	●

Symbol:

LDF



ANDF

ORF

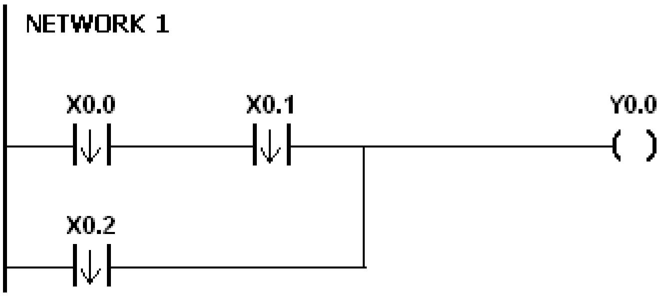
S : Specified device Bit

Explanation:

1. The instruction LDF functions to reserve the current contents, and store the falling-edge detection of the contact in the accumulative register.
2. The instruction ANDF is used to connect the falling-edge detection of the contact in series.
3. The instruction ORP is used to connect the falling-edge detection of the contact in parallel.
4. Only when LDF/ANDF/ORF is scanned can the state of the device be gotten, and not until LDF/ANDF/ORF is scanned next time can whether the state of the device changes be judged.
5. Please use the instructions NED, ANED, and ONED in the subroutine.

Example:

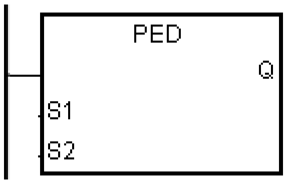
1. The falling-edge detection of X0.0 starts, the falling-edge detection of X0.1 is connected in series, the falling-edge detection of X0.2 is connected in parallel, and the coil Y0.0 is driven.
2. When both X0.0 and X0.1 are switched from OFF to ON, or when X0.2 is switched from OFF to ON, Y0.0 is ON for a scan cycle.



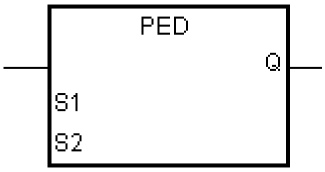
Instruction code	Operand	Function
PED/APED/OPED	**S_1, S_2**	Starting the rising-edge detection/Connecting the rising edge-detection in series/Connecting the rising-edge detection in parallel

Device	DX	DY	X	Y	M	SM	S	T	C	HC	D	L	PR
S_1			●	●	●	●	●	●	●	●	●	●	●
S_2			●	●	●	●	●	●	●	●	●	●	●

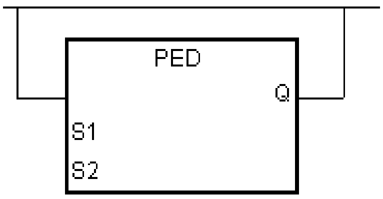
Symbol:



PED



APED



OPED

S_1 : Specified device Bit

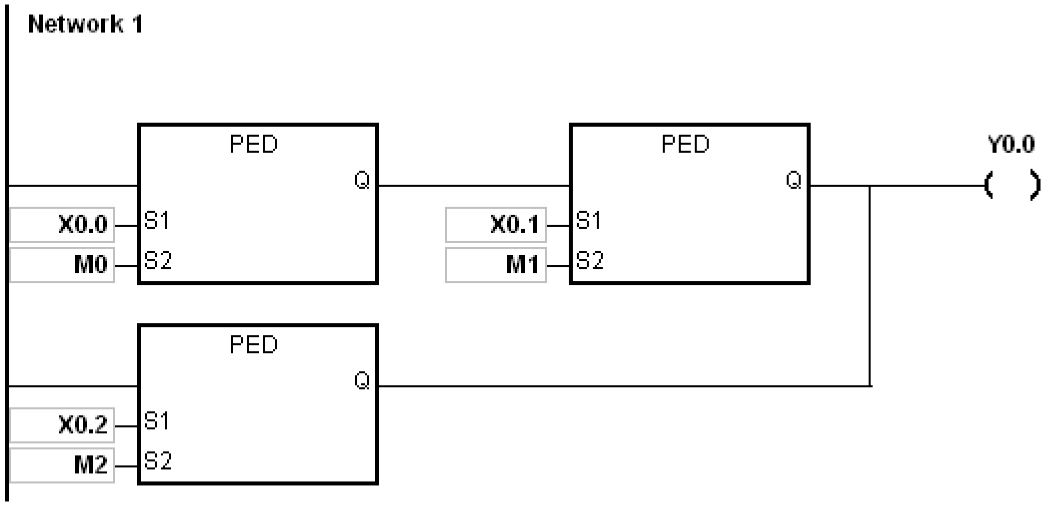
S_2 : For internal use Bit

Explanation:

1. PED/APED/OPED corresponds to LDP/ANDP/ORP. The only difference between PED/APED/OPED and LDP/ANDP/ORP lies in the fact that users need to specify the bit device **S_2** in which the previous state of the contact is stored when PED/APED/OPED is executed. Please do not use the device **S_2** repeatedly in the program. Otherwise, the wrong execution result will appear.
2. The instruction APED is used to connect the rising-edge detection of the contact in series.
3. The instruction OPED is used to connect the rising-edge detection of the contact in parallel.
4. Only when PED/APED/OPED is scanned can the state of the device be gotten, and not until PED/APED/OPED is scanned next time can whether the state of the device changes be judged.
5. PED/APED/OPED only can be used in the function block.

Example:

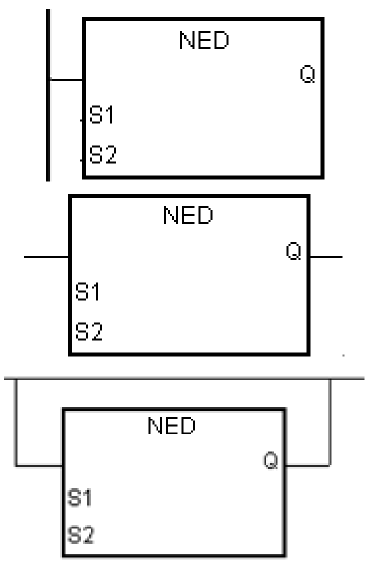
1. The rising-edge detection of X0.0 starts, the rising-edge detection of X0.1 is connected in series, the rising-edge detection of X0.2 is connected in parallel, and the coil Y0.0 is driven.
2. When both X0.0 and X0.1 are switched from OFF to ON, or when X0.2 is switched from OFF to ON, Y0.0 is ON for a scan cycle.


Network 1
PED
Q
X0.0
S1
M0
S2
PED
Q
X0.1
S1
M1
S2
Y0.0
PED
Q
X0.2
S1
M2
S2

Instruction code	Operand	Function
NED/ANED/ONED	**S_1, S_2**	Starting the falling-edge detection/Connecting the falling-edge detection in series/Connecting the falling-edge detection in parallel

Device	DX	DY	X	Y	M	SM	S	T	C	HC	D	L	PR
S_1			●	●	●	●	●	●	●	●	●	●	●
S_2			●	●	●	●	●	●	●	●	●	●	●

Symbol:



NED

ANED

ONED

S_1 : Specified device Bit

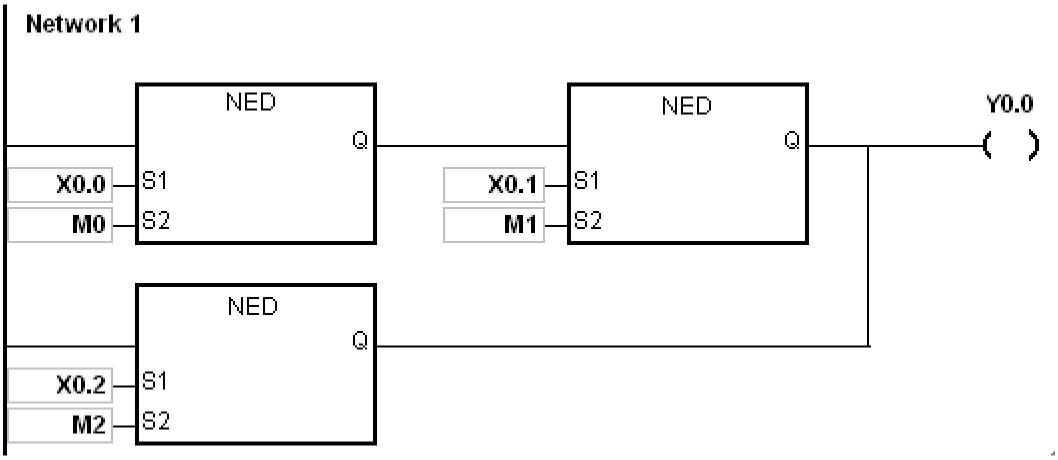
S_2 : For internal use Bit

Explanation:

1. NED/ANED/ONED corresponds to LDF/ANDF/ORF. The only difference between NED/ANED/ONED and LDF/ANDF/ORF lies in the fact that users need to specify the bit device **S_2** in which the previous state of the contact is stored when NED/ANED/ONED is executed. Please do not use the device **S_2** repeatedly in the program. Otherwise, the wrong execution result will appear.
2. The instruction ANED is used to connect the falling-edge detection of the contact in series.
3. The instruction ONED is used to connect the falling-edge detection of the contact in parallel.
4. Only when NED/ANED/ONED is scanned can the state of the device be gotten, and not until NED/ANED/ONED is scanned next time can whether the state of the device changes be judged.
5. NED/ANED/ONED only can be used in the function block.

Example:

1. The falling -edge detection of X0.0 starts, the falling -edge detection of X0.1 is connected in series, the falling -edge detection of X0.2 is connected in parallel, and the coil Y0.0 is driven.
2. When both X0.0 and X0.1 are switched from OFF to ON, or when X0.2 is switched from OFF to ON, Y0.0 is ON for a scan cycle.


Network 1
NED
Q
X0.0
S1
M0
S2
NED
Q
X0.1
S1
M1
S2
Y0.0
NED
Q
X0.2
S1
M2
S2

Instruction code	Operand	Function
PLS	**D**	Rising-edge output

Device	DX	DY	X	Y	M	SM	S	T	C	HC	D	L	PR
D		●	●	●	●	●	●	●	●	●	●	●	●

Symbol:

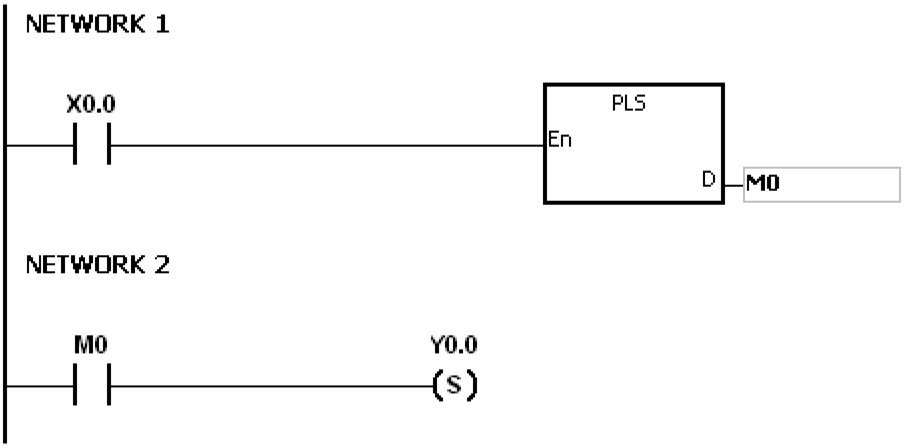
PLS | **D** : Specified device Bit

Explanation:

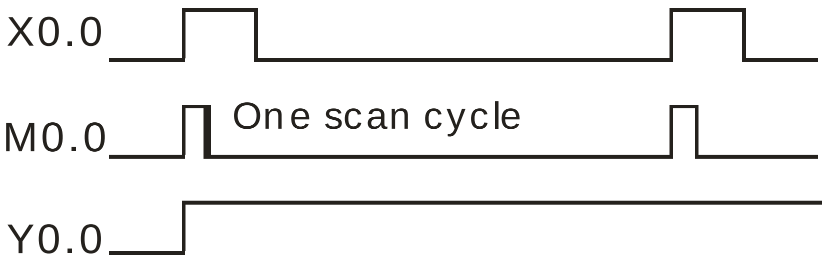
1. When the conditional contact is switched from OFF to ON, the instruction PLS is executed, and the device D sends out a pulse for a scan cycle.
2. Please do not use the instruction PLS in the function block.

Example:

When X0.0 is ON, M0 is ON for a pulse time. When M0 is ON, Y0.0 is set to ON.



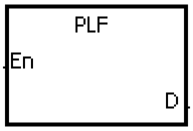
Timing diagram:



Instruction code	Operand	Function
PLF	**D**	Falling-edge output

Device	DX	DY	X	Y	M	SM	S	T	C	HC	D	L	PR
D		●	●	●	●	●	●	●	●	●	●	●	●

Symbol:



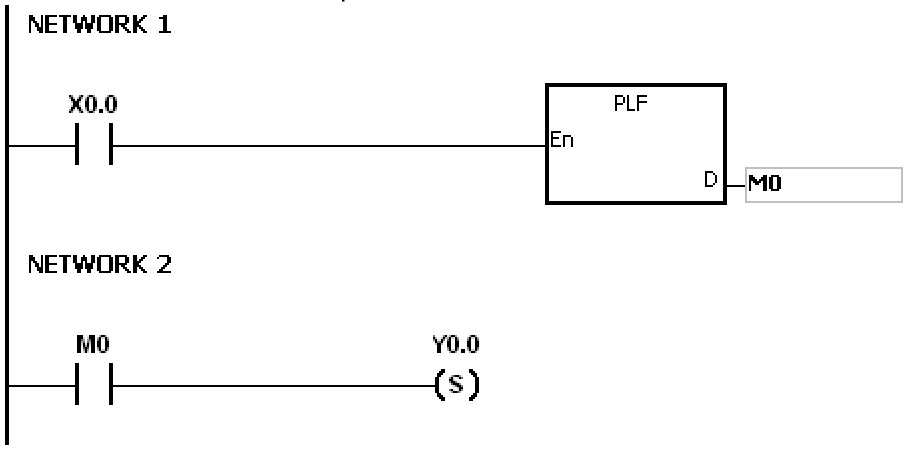
PLF | **D** : Specified device Bit

Explanation:

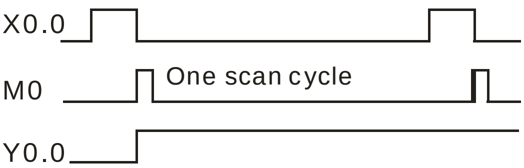
1. When the conditional contact is switched from ON to OFF, the instruction PLF is executed, and the device D sends out a pulse for a scan cycle.
2. Please do not use the instruction PLS in the function block.

Example:

When X0.0 is ON, M0 is ON for a pulse time. When M0 is ON, Y0.0 is set to ON.

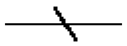


Timing diagram:



Instruction code	Operand	Function
INV	-	Inverting the logical operation result

Symbol:

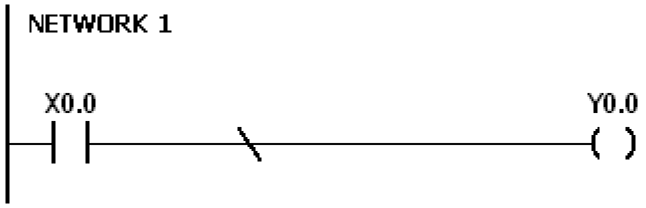


Explanation:

The logical operation result preceding the instruction INV is inverted, and the inversion result stored in the accumulative register.

Example:

When X0.0 is ON, Y0.0 is OFF. When X0.0 is OFF, Y0.0 is ON.



Instruction code	Operand	Function
NOP	-	No operation

Symbol: None

Explanation:

The instruction NOP does not perform any operation in the program. Therefore, the original logical operation result is retained after NOP is executed. If users want to delete a certain instruction without changing the length of the program, they can use NOP instead.

The instruction NOP only supports the instruction list in ISPSoft. It does not support ladder diagrams.

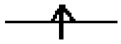
Example:

The instruction list in ISPSoft:

Instruction:		**Operation:**
LD	X0.0	Contact A of X0 is loaded.
NOP		**No action**
OUT	Y1.0	The coil Y1.0 is driven.

Instruction code	Operand	Function
NP	-	The circuit is rising edge-triggered.

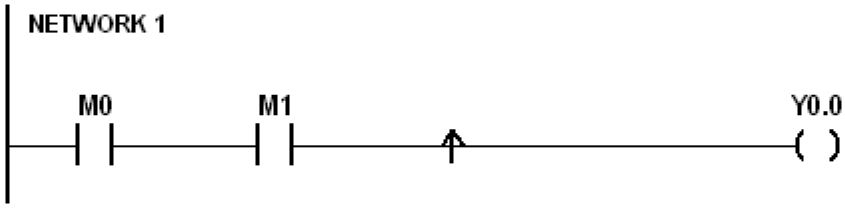
Symbol:



Explanation:

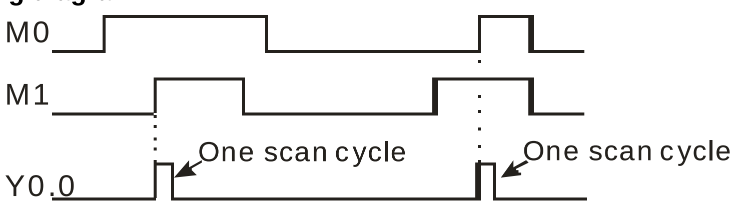
1. When the value in the accumulative register turns from 0 to 1, the instruction NP keeps the value 1 in the accumulative register for a scan cycle. After the second scan cycle is finished, the value in the accumulative register changes to 0.
2. Please use the instruction FB_NP in the function block.

Example:



Instruction:		**Operation:**
LD	M0	Contact A of M0 is loaded.
AND	M1	Contact A of M1 is connected in series.
NP		The circuit is rising edge-triggered.
OUT	Y0.0	The coil Y0.0 is driven.

Timing diagram:



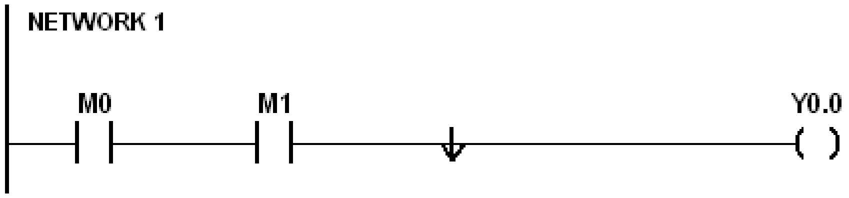
Instruction code	Operand	Function
PN	-	The circuit is falling edge-triggered.

Symbol:

Explanation:

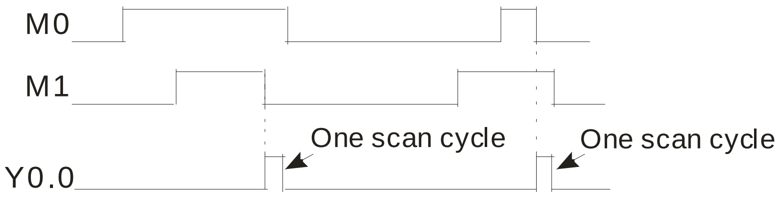
1. When the value in the accumulative register turns from 1 to 0, the instruction PN keeps the value 1 in the accumulative register for a scan cycle. After the second scan cycle is finished, the value in the accumulative register changes to 0.
2. Please use the instruction FB_ PN in the function block.

Example:



Instruction:		**Operation:** :
LD	M0	Contact A of M0 is loaded.
AND	M1	Contact A of M1 is connected in series.
PN		The circuit is falling edge-triggered.
OUT	Y0.0	The coil Y0.0 is driven.

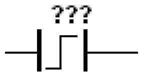
Timing diagram:



Instruction code	Operand	Function
FB_NP	**S**	The circuit is rising edge-triggered.

Device	DX	DY	X	Y	M	SM	S	T	C	HC	D	L	PR
S			●	●	●	●	●	●	●	●	●	●	●

Symbol:

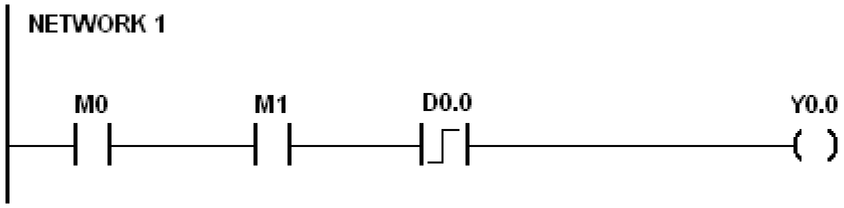


S : For internal use Bit

Explanation:

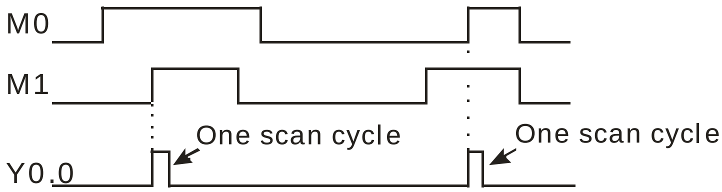
1. When the value in the accumulative register turns from 0 to 1, the instruction FB_NP keeps the value 1 in the accumulative register for a scan cycle. After the second scan cycle is finished, the value in the accumulative register changes to 0.
2. The previous state of the contact is stored in the bit device **S**. Please do not use **S** repeatedly in the program. Otherwise, the wrong execution result will appear.
3. The instruction FB_NP only can be used in the function block.

Example:



Instruction:		**Operation:**
LD	M0	Contact A of M0 is loaded.
AND	M1	Contact A of M1 is connected in series.
FB_NP	D0.0	The circuit is rising edge-triggered.
OUT	Y0.0	The coil Y0.0 is driven.

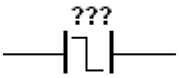
Timing diagram:



Instruction code	Operand	Function
FB_PN	**S**	The circuit is falling edge-triggered.

Device	DX	DY	X	Y	M	SM	S	T	C	HC	D	L	PR
S			●	●	●	●	●	●	●	●	●	●	●

Symbol:

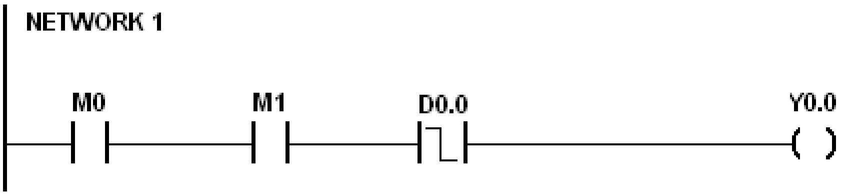


S : For internal use Bit

Explanation:

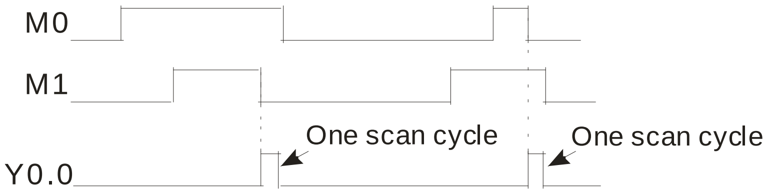
1. When the value in the accumulative register turns from 1 to 0, the instruction FB_PN keeps the value 1 in the accumulative register for a scan cycle. After the second scan cycle is finished, the value in the accumulative register changes to 0.
2. The previous state of the contact is stored in the bit device **S**. Please do not use **S** repeatedly in the program. Otherwise, the wrong execution result will appear.
3. The instruction FB_PN only can be used in the function block.

Example:



Instruction:		**Operation:**
LD	M0	Contact A of M0 is loaded.
AND	M1	Contact A of M1 is connected in series.
FB_PN	D0.0	The circuit is falling edge-triggered.
OUT	Y0.0	The coil Y0.0 is driven.

Timing diagram:



Instruction code	Operand	Function
PSTOP	-	Stopping executing the program in the PLC

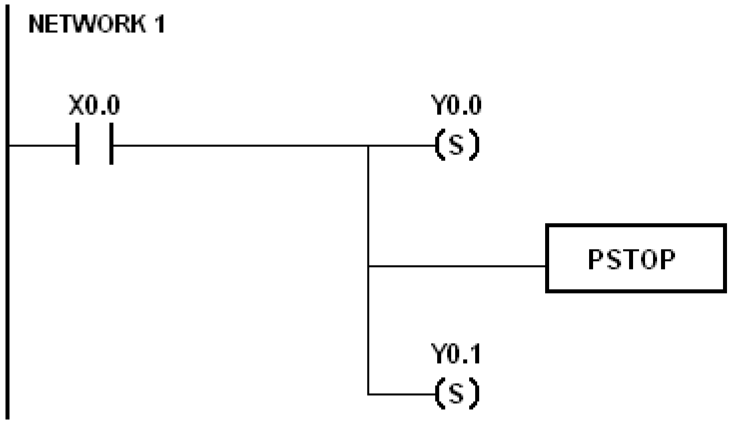
Symbol:

Explanation:

When the conditional contact is enabled, the instruction PSTOP stops the execution of the program, and the PLC stops running.

Example:

When X0.0 is ON, Y0.0 is set to ON, Y0.1 remains OFF, and the PLC stops running.



MEMO

Chapter 6 Applied Instructions

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6.1 Comparison Instructions

6.1.1 List of Comparison Instructions

API	Instruction code			Pulse instruction	Function	Step
	16-bit	32-bit	64-bit			
0000	LD=	DLD=	–	–	$S_1 = S_2$	5
0001	LD<>	DLD<>	–	–	$S_1 \neq S_2$	5
0002	LD>	DLD>	–	–	$S_1 > S_2$	5
0003	LD>=	DLD>=	–	–	$S_1>=S_2$	5
0004	LD<	DLD<	–	–	$S_1 < S_2$	5
0005	LD<=	DLD<=	–	–	$S_1<=S_2$	5
0006	AND=	DAND=	–	–	$S_1 = S_2$	5
0007	AND<>	DAND<>	–	–	$S_1 \neq S_2$	5
0008	AND>	DAND>	–	–	$S_1 > S_2$	5
0009	AND>=	DAND>=	–	–	$S_1>=S_2$	5
0010	AND<	DAND<	–	–	$S_1 < S_2$	5
0011	AND<=	DAND<=	–	–	$S_1<=S_2$	5
0012	OR=	DOR=	–	–	$S_1 = S_2$	5
0013	OR<>	DOR<>	–	–	$S_1 \neq S_2$	5
0014	OR>	DOR>	–	–	$S_1 > S_2$	5
0015	OR>=	DOR>=	–	–	$S_1>=S_2$	5
0016	OR<	DOR<	–	–	$S_1 < S_2$	5
0017	OR<=	DOR<=	–	–	$S_1<=S_2$	5
0018	–	FLD=	DFLD=	–	$S_1 = S_2$	5-7
0019	–	FLD<>	DFLD<>	–	$S_1 \neq S_2$	5-7
0020	–	FLD>	DFLD>	–	$S_1 > S_2$	5-7
0021	–	FLD>=	DFLD>=	–	$S_1>=S_2$	5-7
0022	–	FLD<	DFLD<	–	$S_1 < S_2$	5-7
0023	–	FLD<=	DFLD<=	–	$S_1<=S_2$	5-7
0024	–	FAND=	DFAND=	–	$S_1 = S_2$	5-7
0025	–	FAND<>	DFAND<>	–	$S_1 \neq S_2$	5-7
0026	–	FAND>	DFAND>	–	$S_1 > S_2$	5-7
0027	–	FAND>=	DFAND>=	–	$S_1>=S_2$	5-7
0028	–	FAND<	DFAND<	–	$S_1 < S_2$	5-7
0029	–	FAND<=	DFAND<=	–	$S_1<=S_2$	5-7
0030	–	FOR=	DFOR=	–	$S_1 = S_2$	5-7
0031	–	FOR<>	DFOR<>	–	$S_1 \neq S_2$	5-7
0032	–	FOR>	DFOR>	–	$S_1 > S_2$	5-7
0033	–	FOR>=	DFOR>=	–	$S_1>=S_2$	5-7

API	Instruction code			Pulse instruction	Function	Step
	16-bit	32-bit	64-bit			
0034	–	FOR<	DFOR<	–	$S_1 < S_2$	5-7
0035	–	FOR<=	DFOR<=	–	$S_1 <= S_2$	5-7
0036	LD$=	–	–	–	$S_1 = S_2$	5-17
0037	LD$<>	–	–	–	$S_1 \neq S_2$	5-17
0038	LD$>	–	–	–	$S_1 > S_2$	5-17
0039	LD$>=	–	–	–	$S_1 >= S_2$	5-17
0040	LD$<	–	–	–	$S_1 < S_2$	5-17
0041	LD$<=	–	–	–	$S_1 <= S_2$	5-17
0042	AND$=	–	–	–	$S_1 = S_2$	5-17
0043	AND$<>	–	–	–	$S_1 \neq S_2$	5-17
0044	AND$>	–	–	–	$S_1 > S_2$	5-17
0045	AND$>=	–	–	–	$S_1 >= S_2$	5-17
0046	AND$<	–	–	–	$S_1 < S_2$	5-17
0047	AND$<=	–	–	–	$S_1 <= S_2$	5-17
0048	OR$=	–	–	–	$S_1 = S_2$	5-17
0049	OR$<>	–	–	–	$S_1 \neq S_2$	5-17
0050	OR$>	–	–	–	$S_1 > S_2$	5-17
0051	OR$>=	–	–	–	$S_1 >= S_2$	5-17
0052	OR$<	–	–	–	$S_1 < S_2$	5-17
0053	OR$<=	–	–	–	$S_1 <= S_2$	5-17
0054	CMP	DCMP	–	✓	Comparing the values	7
0055	ZCP	DZCP	–	✓	Zone comparison	9
0056	–	FCMP	–	✓	Comparing the floating-point numbers	7-9
0057	–	FZCP	–	✓	Floating-point zone comparison	9-12
0058	MCMP	–	–	✓	Matrix comparison	9
0059	CMPT=	–	–	✓	Comparing the tables ON: =	9
0060	CMPT<>	–	–	✓	Comparing the tables ON: ≠	9
0061	CMPT>	–	–	✓	Comparing the tables ON: >	9
0062	CMPT>=	–	–	✓	Comparing the tables ON: >=	9

API	Instruction code			Pulse instruction	Function	Step
	16-bit	32-bit	64-bit			
0063	CMPT<	–	–	✓	Comparing the tables ON: <	9
0064	CMPT<=	–	–	✓	Comparing the tables ON: <=	9
0065	CHKADR	–	–	–	Checking the address of the contact type of pointer register	7

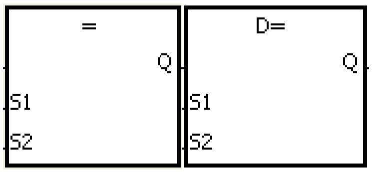
6.1.2 Explanation of Comparison Instructions

API		Instruction code		Operand	Function
0000~ 0005	D	LD※		S_1, S_2	Comparing the values

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
-	AH500	AH500

Symbol:



Taking LD= and DLD= for example

S_1 : Data source 1 Word/Double word

S_2 : Data source 2 Word/Double word

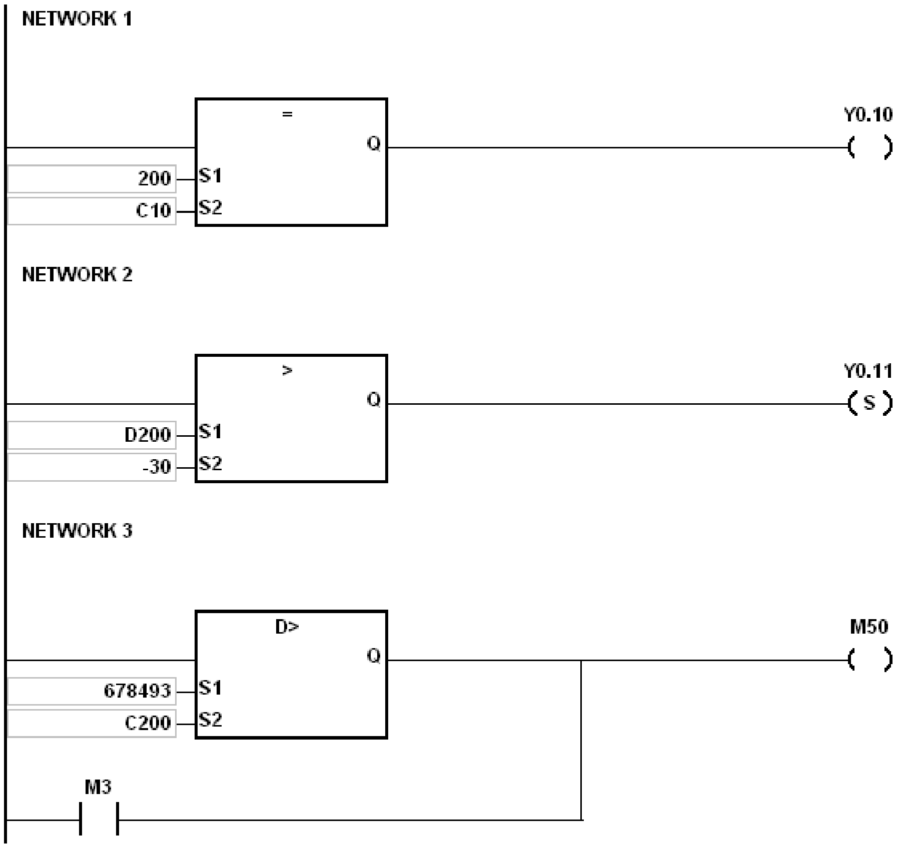
Explanation:

1. The instructions are used to compare the value in **S_1** with that in **S_2**. Take the instruction LD= for example. When the comparison result is that the value in **S_1** is equal to that in **S_2**, the condition of the instruction is met. When the comparison result is that the value in **S_1** is not equal to that in **S_2**, the condition of the instruction is not met.
2. Only the 32-bit instruction can use the 32-bit counter.

API number	16-bit instruction	32-bit instruction	Comparison operation result	
			ON	OFF
0000	LD =	DLD =	$S_1 = S_2$	$S_1 \neq S_2$
0001	LD < >	DLD < >	$S_1 \neq S_2$	$S_1 = S_2$
0002	LD >	DLD >	$S_1 > S_2$	$S_1 \leqq S_2$
0003	LD > =	DLD > =	$S_1 \geqq S_2$	$S_1 < S_2$
0004	LD <	DLD <	$S_1 < S_2$	$S_1 \geqq S_2$
0005	LD < =	DLD < =	$S_1 \leqq S_2$	$S_1 > S_2$

Example:

1. When the value in C10 is equal to 200, Y0.10 is ON.
2. When the value in D200 is greater than -30, Y0.11 keeps ON.
3. When the value in (C201, C200) is less than 678,493, or when M3 is ON, M50 is ON.

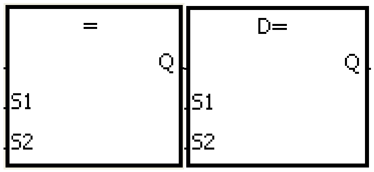

NETWORK 1
=
Q
Y0.10
200
S1
C10
S2
NETWORK 2
>
Q
Y0.11
S
D200
S1
-30
S2
NETWORK 3
D>
Q
M50
678493
S1
C200
S2
M3

API	Instruction code				Operand	Function
0006~ 0011		D	AND※		S_1, S_2	Comparing the values

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
-	AH500	AH500

Symbol:



Taking AND= and DAND= for example

S_1 : Data source 1 Word/Double word

S_2 : Data source 2 Word/Double word

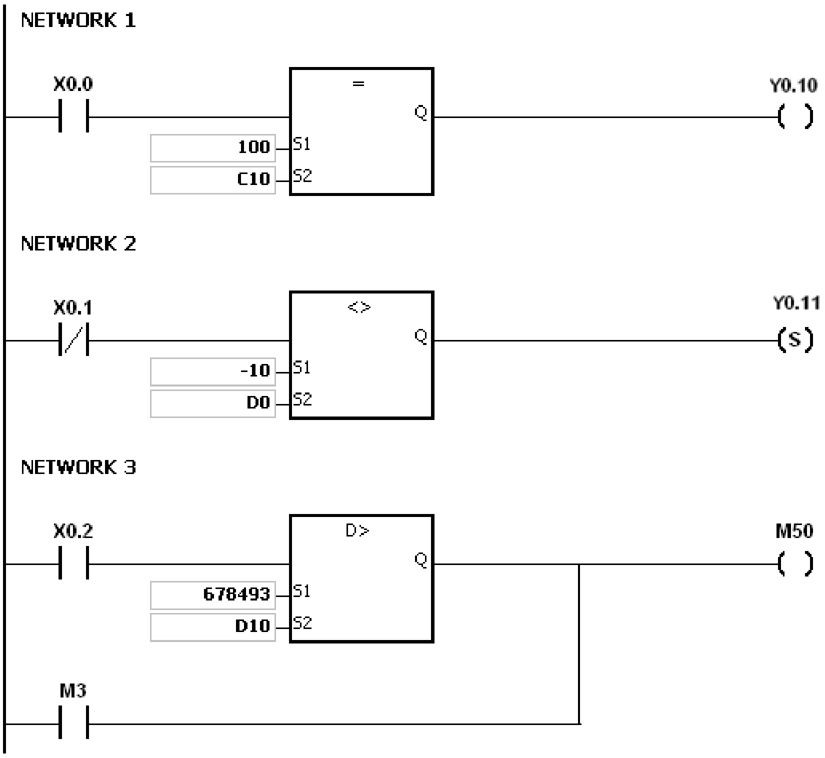
Explanation:

1. The instructions are used to compare the value in **S_1** with that in **S_2**. Take the instruction AND= for example. When the comparison result is that the value in **S_1** is equal to that in **S_2**, the condition of the instruction is met. When the comparison result is that the value in **S_1** is not equal to that in **S_2**, the condition of the instruction is not met.
2. Only the 32-bit instruction can use the 32-bit counter.

API number	16-bit instruction	32-bit instruction	Comparison operation result	
			ON	OFF
0006	AND =	DAND =	$S_1 = S_2$	$S_1 \neq S_2$
0007	AND < >	DAND < >	$S_1 \neq S_2$	$S_1 = S_2$
0008	AND >	DAND >	$S_1 > S_2$	$S_1 \leqq S_2$
0009	AND > =	DAND > =	$S_1 \geqq S_2$	$S_1 < S_2$
0010	AND <	DAND <	$S_1 < S_2$	$S_1 \geqq S_2$
0011	AND < =	DAND < =	$S_1 \leqq S_2$	$S_1 > S_2$

Example:

1. When X0.0 is ON and the current value in C10 is equal to 100, Y0.10 is ON.
2. When X0.1 is OFF and the value in D0 is not equal to -10, Y0.11 keeps ON.
3. When X0.2 is ON and the value in (D11, D10) is less than 678,493, or when M3 is ON, M50 is ON.

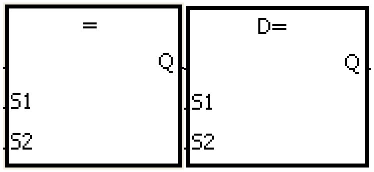


API	Instruction code				Operand	Function
0012~ 0017		D	OR※		**S_1, S_2**	Comparing the values

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
-	AH500	AH500

Symbol:



Taking OR= and DOR= for example

S_1 : Data source 1 Word/Double word

S_2 : Data source 2 Word/Double word

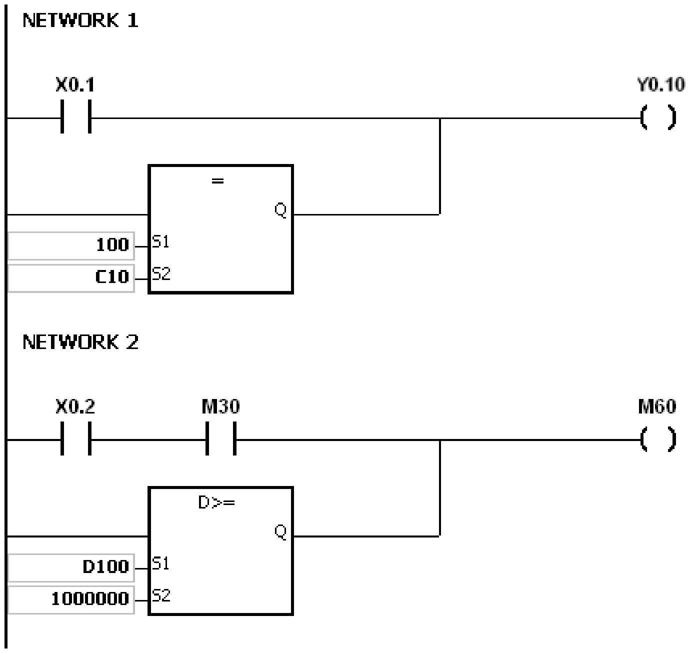
Explanation:

1. The instructions are used to compare the value in **S_1** with that in **S_2**. Take the instruction OR= for example. When the comparison result is that the value in **S_1** is equal to that in **S_2**, the condition of the instruction is met. When the comparison result is that the value in **S_1** is not equal to that in **S_2**, the condition of the instruction is not met.
2. Only the 32-bit instruction can use the 32-bit counter.

API number	16-bit instruction	32-bit instruction	Comparison operation result	
			ON	**OFF**
0012	OR =	**D**OR =	**$S_1 = S_2$**	**$S_1 \neq S_2$**
0013	OR < >	**D**OR < >	**$S_1 \neq S_2$**	**$S_1 = S_2$**
0014	OR >	**D**OR >	**$S_1 > S_2$**	**$S_1 \leqq S_2$**
0015	OR > =	**D**OR > =	**$S_1 \geqq S_2$**	**$S_1 < S_2$**
0016	OR <	**D**OR <	**$S_1 < S_2$**	**$S_1 \geqq S_2$**
0017	OR < =	**D**OR < =	**$S_1 \leqq S_2$**	**$S_1 > S_2$**

Example:

1. When X0.1 is ON, or when the current value in C10 is equal to 100, Y0.10 is ON.
2. When both X0.2 and M30 are ON, or when the value in (D101, D100) is greater than or equal to 1000,000, M60 is ON.

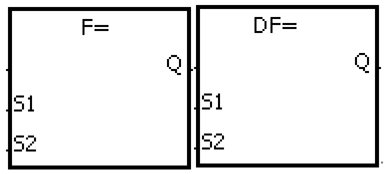


API	Instruction code			Operand	Function
0018~ 0023	D	FLD※		S_1, S_2	Comparing the floating-point numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●				○
S_2	●	●			●	●	●	●	●		●	○	●				○

Pulse instruction	32-bit instruction (5-7 steps)	64-bit instruction (5-7 steps)
-	AH500	AH500

Symbol:



S_1 : Data source 1 Double word/Long word

S_2 : Data source 2 Double word/Long word

Taking FLD= and DFLD= for example

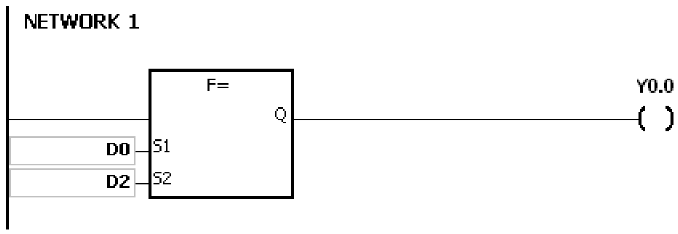
Explanation:

1. The instructions are used to compare the value in S_1 with that in S_2, and the values compared are floating-point numbers. Take the instruction FLD= for example. When the comparison result is that the value in S_1 is equal to that in S_2, the condition of the instruction is met. When the comparison result is that the value in S_1 is not equal to that in S_2, the condition of the instruction is not met.

API number	32-bit instruction	64-bit instruction	Comparison operation result	
			ON	OFF
0018	FLD =	DFLD =	$S_1 = S_2$	$S_1 \neq S_2$
0019	FLD < >	DFLD < >	$S_1 \neq S_2$	$S_1 = S_2$
0020	FLD >	DFLD >	$S_1 > S_2$	$S_1 \leq S_2$
0021	FLD > =	DFLD > =	$S_1 \geq S_2$	$S_1 < S_2$
0022	FLD <	DFLD <	$S_1 < S_2$	$S_1 \geq S_2$
0023	FLD < =	DFLD < =	$S_1 \leq S_2$	$S_1 > S_2$

Example:

Take the instruction FLD = for example. When the value in D0 is equal to that in D2, Y0.0 is ON.



Additional remark:

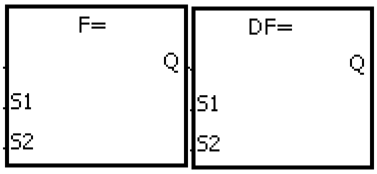
1. If the value in S_1 or S_2 exceeds the range of values which can be represented by the floating-point numbers, the contact is OFF, SM is ON, and the error code in SR0 is 16#2013.

API	Instruction code			Operand	Function
0024~ 0029	D	FAND※		S_1, S_2	Comparing the floating-point numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●				○
S_2	●	●			●	●	●	●	●		●	○	●				○

Pulse instruction	32-bit instruction (5-7 steps)	64-bit instruction (5-7 steps)
-	AH500	AH500

Symbol:



Taking FAND= and DFAND= for example

S_1 : Data source 1 Double word/Long word

S_2 : Data source 2 Double word/Long word

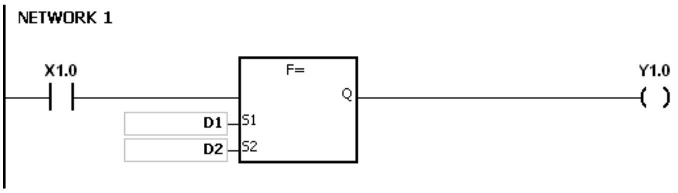
Explanation:

1. The instructions are used to compare the value in **S_1** with that in **S_2**, and the values compared are floating-point numbers. Take the instruction FAND= for example. When the comparison result is that the value in **S_1** is equal to that in **S_2**, the condition of the instruction is met. When the comparison result is that the value in **S_1** is not equal to that in **S_2**, the condition of the instruction is not met.

API number	32-bit instruction	64-bit instruction	Comparison operation result	
			ON	OFF
0024	FAND =	DFAND =	$S_1 = S_2$	$S_1 \neq S_2$
0025	FAND < >	DFAND < >	$S_1 \neq S_2$	$S_1 = S_2$
0026	FAND >	DFAND >	$S_1 > S_2$	$S_1 \leqq S_2$
0027	FAND > =	DFAND > =	$S_1 \geqq S_2$	$S_1 < S_2$
0028	FAND <	DFAND <	$S_1 < S_2$	$S_1 \geqq S_2$
0029	FAND < =	DFAND < =	$S_1 \leqq S_2$	$S_1 > S_2$

Example:

Take the instruction FAND = for example. When X1.0 is ON and the value in D1 is equal to that in D2, Y1.0 is ON.



Additional remark:

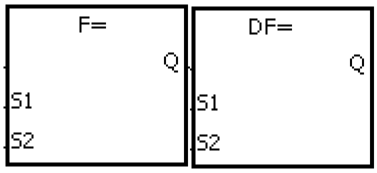
1. If the value in **S_1** or **S_2** exceeds the range of values which can be represented by the floating-point numbers, the contact is OFF, SM is ON, and the error code in SR0 is 16#2013.

API	Instruction code			Operand	Function
0030~ 0035	D	FOR※		S_1, S_2	Comparing the floating-point numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●				○
S_2	●	●			●	●	●	●	●		●	○	●				○

Pulse instruction	32-bit instruction (5-7 steps)	64-bit instruction (5-7 steps)
-	AH500	AH500

Symbol:



Taking FOR= and DFOR= for example

S_1 : Data source 1 — Double word/Long word

S_2 : Data source 2 — Double word/Long word

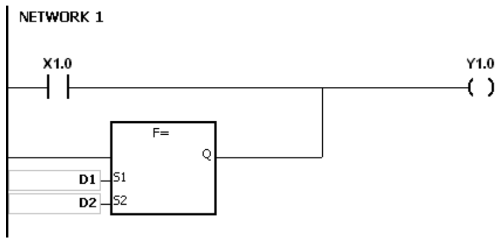
Explanation:

1. The instructions are used to compare the value in S_1 with that in S_2, and the values compared are floating-point numbers. Take the instruction FOR= for example. When the comparison result is that the value in S_1 is equal to that in S_2, the condition of the instruction is met. When the comparison result is that the value in S_1 is not equal to that in S_2, the condition of the instruction is not met.

API number	32-bit instruction	64-bit instruction	Comparison operation result	
			ON	OFF
0030	FOR =	DFOR =	$S_1 = S_2$	$S_1 \neq S_2$
0031	FOR < >	DFOR < >	$S_1 \neq S_2$	$S_1 = S_2$
0032	FOR >	DFOR >	$S_1 > S_2$	$S_1 \leqq S_2$
0033	FOR > =	DFOR > =	$S_1 \geqq S_2$	$S_1 < S_2$
0034	FOR <	DFOR <	$S_1 < S_2$	$S_1 \geqq S_2$
0035	FOR < =	DFOR < =	$S_1 \leqq S_2$	$S_1 > S_2$

Example:

When X1.0 is ON, or when the value in D1 is equal to that in D2, Y1.0 is ON.



Additional remark:

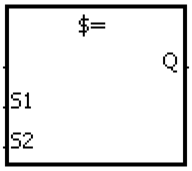
1. If the value in S_1 or S_2 exceeds the range of values which can be represented by the floating-point numbers, the contact is OFF, SM is ON, and the error code in SR0 is 16#2013.

API	Instruction code	Operand	Function
0036~ 0041	LD$※	S_1, S_2	Comparing the strings

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●	●			●	●		●	●		●	○	●			○	
S_2	●	●			●	●		●	●		●	○	●			○	

Pulse instruction	16-bit instruction (5-17 steps)	32-bit instruction
-	AH500	-

Symbol:



Taking LD$= for example

S_1 : Data source 1 String

S_2 : Data source 2 String

Explanation:

1. The instructions are used to compare the data in **S_1** with that in **S_2**, and the data compared is strings. Take the instruction LD$= for example. When the comparison result is that the data in **S_1** is equal to that in **S_2**, the condition of the contact is met. When the comparison result is that the data in **S_1** is not equal to that in **S_2**, the condition of the contact is not met.

API number	Instruction	Comparison operation result	
		ON	OFF
0036	LD$ =	$S_1 = S_2$	$S_1 \neq S_2$
0037	LD$ < >	$S_1 \neq S_2$	$S_1 = S_2$
0038	LD$ >	$S_1 > S_2$	$S_1 \leqq S_2$
0039	LD$ > =	$S_1 \geqq S_2$	$S_1 < S_2$
0040	LD$ <	$S_1 < S_2$	$S_1 \geqq S_2$
0041	LD$ < =	$S_1 \leqq S_2$	$S_1 > S_2$

2. Only when the data in **S**~**S**+n (n indicates the n^{th} device) includes 16#00 can the data be judged as a complete string.

	b15 … b8	b7 … b0
S	16#32(2)	16#31(1)
S+1	16#34(4)	16#33(3)
S+2	16#00	16#35(5)

" 12345"

3. When two strings are the same, the corresponding comparison operation results of the instructions are listed below.

	b15 ... b8	b7 ... b0
S1	16#42(B)	16#41(A)
S1 +1	16#44(D)	16#43(C)
S1 +2	16#00	16#45(E)

" ABCDE"

Comparison sign

	b15 ... b8	b7 ... b0
S2	16#42(B)	16#41(A)
S2 +1	16#44(D)	16#43(C)
S2 +2	16#00	16#45(E)

" ABCDE"

Comparison symbol	Comparison operation result
$ =	ON
$ < >	OFF
$ >	OFF
$ > =	ON
$ <	OFF
$ < =	ON

4. When the lengths of the strings are the same, but their contents are different, the first different values (ASCII codes) met in the strings are compared. For example, the string in **S$_1$** is "ABCDF", and the string in **S$_1$** is "ABCDE". The first different values met in the strings are "F" (16#46) and "E" (16#45). Owing to the fact that 16#46 is greater than 16#45, the string in **S$_1$** is greater than that in **S$_1$**. The corresponding comparison operation results of the instructions are listed below.

	b15 ... b8	b7 ... b0
S1	16#42(B)	16#41(A)
S1 +1	16#44(D)	16#43(C)
S1 +2	16#00	16#46(F)

" ABCDF"

Comparison sign

	b15 ... b8	b7 ... b0
S2	16#42(B)	16#41(A)
S2 +1	16#44(D)	16#43(C)
S2 +2	16#00	16#45(E)

" ABCDE"

Comparison symbol	Comparison operation result
$ =	OFF
$ < >	ON
$ >	ON
$ > =	ON
$ <	OFF
$ < =	OFF

5. When the lengths of the strings are different, the string whose length is longer is greater than the string whose length is shorter. For example, the string in **S$_1$** is "1234567", and the string in **S$_2$** is "99999"". Owing to the fact that the string in **S$_1$** is composed of 7 characters, and the string in **S$_2$** is composed of 5 characters, the string in **S$_1$** is greater than the string in **S$_2$**. The corresponding comparison operation results of the instructions are listed below.

	b15 ... b8	b7 ... b0
S1	16#32(2)	16#31(1)
S1 +1	16#34(4)	16#33(3)
S1 +2	16#36(6)	16#35(5)
S1 +3	16#00	16#37(7)

" 1234567"

Comparison sign

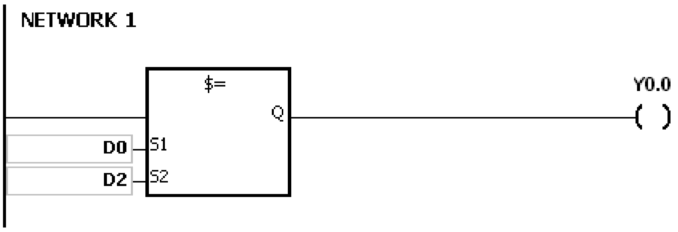
	b15 ... b8	b7 ... b0
S2	16#39(9)	16#39(9)
S2 +1	16#39(9)	16#39(9)
S2 +2	16#00	16#39(9)

" 99999"

Comparison symbol	Comparison operation result
$ =	OFF
$ < >	ON
$ >	ON
$ > =	ON
$ <	OFF
$ < =	OFF

Example:

When the string starting with the data in D0 is equal to the string staring with D2, Y0.0 is ON.



Additional remark:

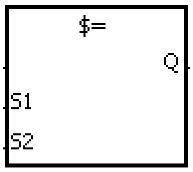
1. If the string does not end with 16#00, the instruction is not executed, SM is ON, and the error code in SR0 is 16#200E.

API	Instruction code	Operand	Function
0042~ 0047	AND$※	**S_1, S_2**	Comparing the strings

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●	○	●			○	
S_2	●	●			●	●		●	●		●	○	●			○	

Pulse instruction	16-bit instruction (5-17 steps)	32-bit instruction
-	AH500	-

Symbol:



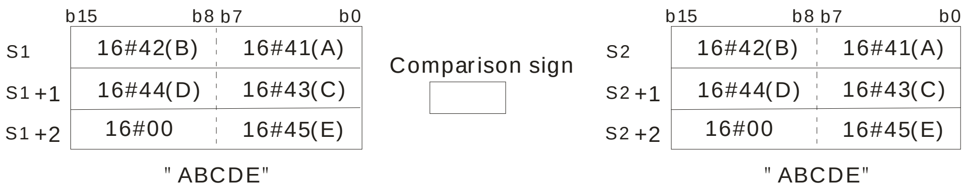
Taking AND$= for example

S_1 : Data source 1 String

S_2 : Data source 2 String

Explanation:

1. The instructions are used to compare the data in **S_1** with that in **S_2**, and the data compared is strings. Take the instruction AND$= for example. When the comparison result is that the data in **S_1** is equal to that in **S_2**, the condition of the contact is met. When the comparison result is that the data in **S_1** is not equal to that in **S_2**, the condition of the contact is not met.
2. Only when the data in **S**~**S**+n (n indicates the n_{th} device) includes 16#00 can the data be judged as a complete string.
3. When the strings are completely the same, the corresponding comparison operation results of the instructions are listed below.



Comparison symbol	Comparison operation result
$ =	ON
$ < >	OFF
$ >	OFF
$ > =	ON
$ <	OFF
$ < =	ON

4. When the lengths of the strings are the same, but their contents are different, the first different values (ASCII codes) met in the strings are compared. For example, the string in **S_1** is "ABCDF", and the string in **S_1** is "ABCDE". The first different values met in the strings are "F" (16#46) and "E" (16#45). Owing to the fact that 16#46 is greater than 16#45, the string in **S_1** is greater than that in **S_1**. The corresponding comparison operation results of the instructions are listed below.

	b15 b8	b7 b0
S1	16#42(B)	16#41(A)
S1 +1	16#44(D)	16#43(C)
S1 +2	16#00	16#46(F)

" ABCDF"

Comparison sign

	b15 b8	b7 b0
S2	16#42(B)	16#41(A)
S2 +1	16#44(D)	16#43(C)
S2 +2	16#00	16#45(E)

" ABCDE"

Comparison symbol	Comparison operation result
$=	OFF
$< >	ON
$>	ON
$> =	ON
$<	OFF
$< =	OFF

5. When the lengths of the strings are different, the string whose length is longer is greater than the string whose length is shorter. For example, the string in **S**$_1$ is “1234567”, and the string in **S**$_2$ is “99999””. Owing to the fact that the string in **S**$_1$ is composed of 7 characters, and the string in **S**$_2$ is composed of 5 characters, the string in **S**$_1$ is greater than the string in **S**$_2$. The corresponding comparison operation results of the instructions are listed below.

	b15 b8	b7 b0
S1	16#32(2)	16#31(1)
S1 +1	16#34(4)	16#33(3)
S1 +2	16#36(6)	16#35(5)
S1 +3	16#00	16#37(7)

" 1234567"

Comparison sign

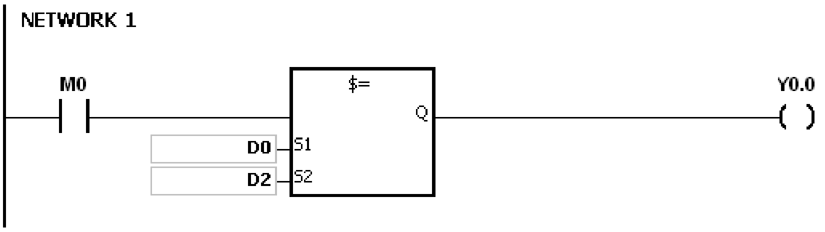
	b15 b8	b7 b0
S2	16#39(9)	16#39(9)
S2 +1	16#39(9)	16#39(9)
S2 +2	16#00	16#39(9)

" 99999"

Comparison symbol	Comparison operation result
$=	OFF
$< >	ON
$>	ON
$> =	ON
$<	OFF
$< =	OFF

Example:

When M0 is ON and the string starting with the data in D0 is equal to the string staring with D2, Y0.0 is ON.

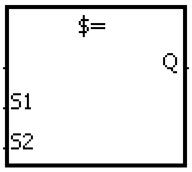


API	Instruction code	Operand	Function
0048~ 0053	OR$※	S_1, S_2	Comparing the strings

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●	○	●			○	
S_2	●	●			●	●		●	●		●	○	●			○	

Pulse instruction	16-bit instruction (5-17 steps)	32-bit instruction
-	AH500	-

Symbol:



Taking OR$= for example

S_1 : Data source 1 String

S_2 : Data source 2 String

Explanation:

1. The instructions are used to compare the data in **S_1** with that in **S_2**, and the data compared is strings. Take the instruction OR$= for example. When the comparison result is that the data in **S_1** is equal to that in **S_2**, the condition of the contact is met. When the comparison result is that the data in **S_1** is not equal to that in **S_2**, the condition of the contact is not met.
2. Only when the data in **S**~**S**+n (n indicates the n_{th} device) includes 16#00 can the data be judged as a complete string.
3. When the strings are completely the same, the corresponding comparison operation results of the instructions are listed below.

	b15 b8	b7 b0
S1	16#42(B)	16#41(A)
S1 +1	16#44(D)	16#43(C)
S1 +2	16#00	16#45(E)

"ABCDE"

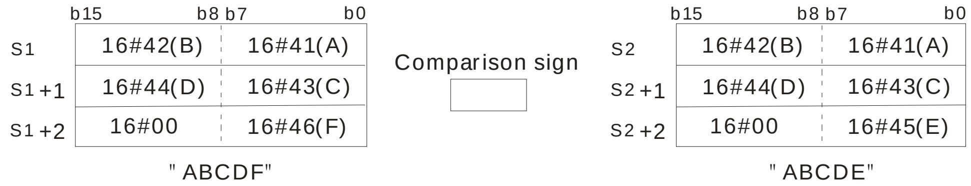
Comparison sign

	b15 b8	b7 b0
S2	16#42(B)	16#41(A)
S2 +1	16#44(D)	16#43(C)
S2 +2	16#00	16#45(E)

"ABCDE"

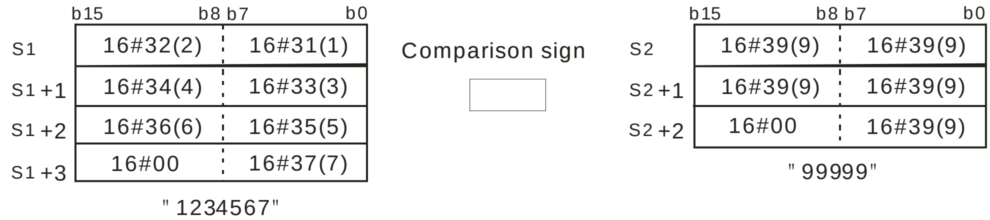
Comparison symbol	Comparison operation result
$ =	ON
$ < >	OFF
$ >	OFF
$ > =	ON
$ <	OFF
$ < =	ON

4. When the lengths of the strings are the same, but their contents are different, the first different values (ASCII codes) met in the strings are compared. For example, the string in **S_1** is "ABCDF", and the string in **S_1** is "ABCDE". The first different values met in the strings are "F" (16#46) and "E" (16#45). Owing to the fact that 16#46 is greater than 16#45, the string in **S_1** is greater than that in **S_1**. The corresponding comparison operation results of the instructions are listed below.



Comparison symbol	Comparison operation result
$=	OFF
$< >	ON
$>	ON
$> =	ON
$<	OFF
$< =	OFF

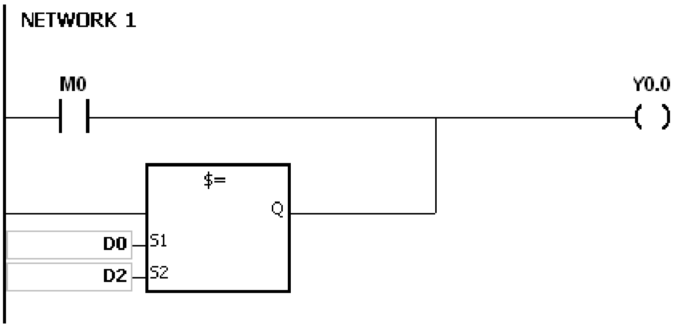
5. When the lengths of the strings are different, the string whose length is longer is greater than the string whose length is shorter. For example, the string in **S$_1$** is “1234567”, and the string in **S$_2$** is “99999””. Owing to the fact that the string in **S$_1$** is composed of 7 characters, and the string in **S$_2$** is composed of 5 characters, the string in **S$_1$** is greater than the string in **S$_2$**. The corresponding comparison operation results of the instructions are listed below.



Comparison symbol	Comparison operation result
$=	OFF
$< >	ON
$>	ON
$> =	ON
$<	OFF
$< =	OFF

Example:

When M0 is ON, or when the string starting with the data in D0 is equal to the string staring with D2, Y0.0 is ON.

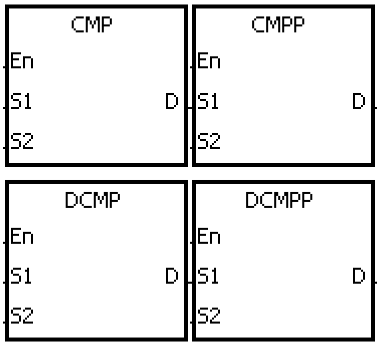


API	Instruction code			Operand	Function
0054	D	CMP	P	**S_1, S_2, D**	Comparing the values

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●	●	●				●	●	●			●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



S_1 : Comparison value 1 Word/Double word

S_2 : Comparison value 2 Word/Double word

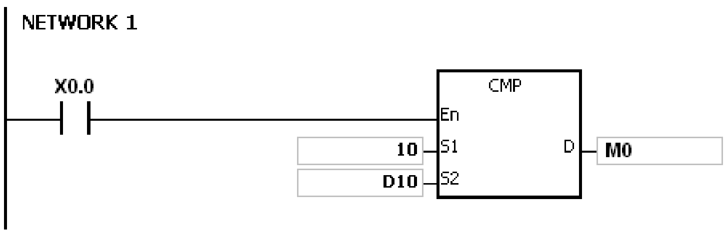
D : Comparison result Bit

Explanation:

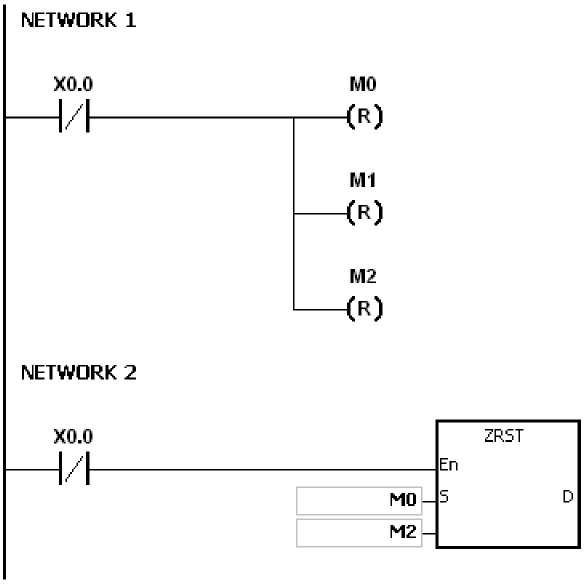
1. The instruction is used to compare the value in **S_1** with that in **S_2**, and the values compared are singed decimal numbers. The comparison results are stored in **D**.
2. The operand **D** occupies three consecutive devices. The comparison results are stored in **D**, **D**+1, and **D**+2. If the comparison value in **S_1** is greater than the comparison value in **S_2**, **D** will be ON. If the comparison value in **S_1** is equal to the comparison value in **S_2**, **D**+1 is ON. If the comparison value in **S_1** is less than the comparison value in **S_2**, **D**+2 will be ON.
3. Only the instructions **D**CMP and **D**CMPP can use the 32-bit counter.

Example:

1. If the operand **D** is M0, the comparison results will be stored in M0, M1 and M2, as shown below.
2. When X0.0 is ON, the instruction CMP is executed. M0, M1, or M2 is ON. When X0.0 is OFF, the execution of the instruction CMP stops. The state of M0, the state of M1, and the state of M1 remain unchanged.



3. If users want to clear the comparison result, they can use the instruction RST or ZRST.



Additional remark:

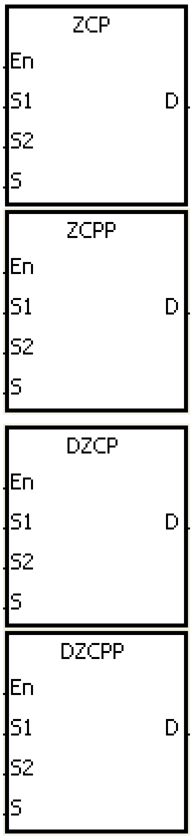
1. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [3] of BOOL.
2. If **D**+2 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
0055	D	ZCP	P	**S_1, S_2, S, D**	Zone comparison

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
S	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●	●	●				●	●	●			●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction (9 steps)
AH500	AH500	AH500

Symbol:



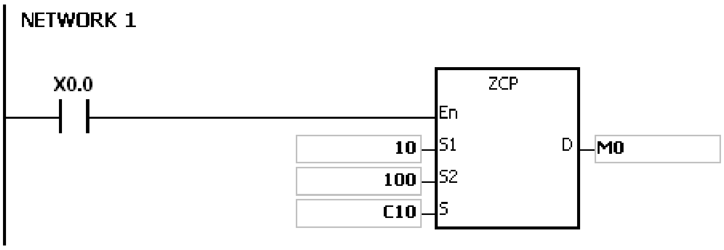
S_1	:	Minimum value of the zone comparison	Word/Double word
S_2	:	Maximum value of the zone comparison	Word/Double word
S	:	Comparison value	Word/Double word
D	:	Comparison result	Bit

Explanation:

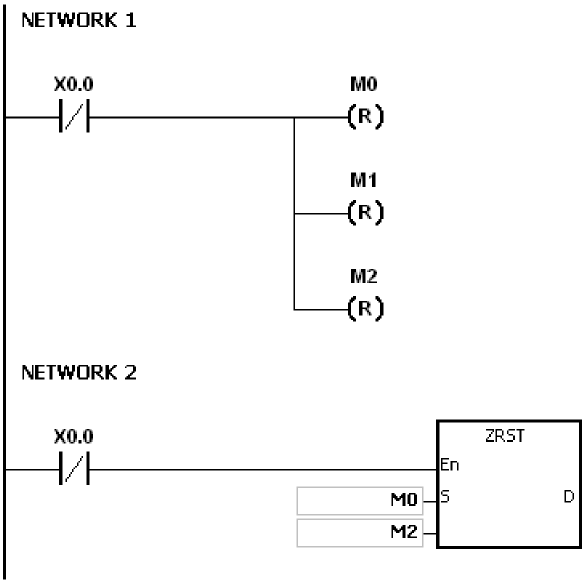
1. The instruction is used to compare the value in **S** with that in **S_1**, and compare the value in **S** with that in **S_2**. The values compared are singed decimal numbers, and the comparison results are stored in **D**.
2. The value in **S_1** must be less than that in **S_2**. If the value in **S_1** is larger than that in **S_2**, **S_1** will be taken as the maximum/minimum value during the execution of the instruction ZCP.
3. The operand **D** occupies three consecutive devices. The comparison results are stored in **D**, **D**+1, and **D**+2. If the comparison value in **S_1** is less than the comparison value in **S**, **D** will be ON. If the comparison value in **S** is within the range between the value in **S_1** and the value in **S_2**, **D**+1 will ON. If the comparison value in **S** is greater than the value in **S_2**, **D**+2 will be ON.
4. Only the instructions **D**ZCP and **D**ZCPP can use the 32-bit counter.

Example:

1. If the operand **D** is M0, the comparison results will be stored in M0, M1 and M2, as shown below.
2. When X0.0 is ON, the instruction ZCP is executed. M0, M1, or M2 is ON. When X0.0 is OFF, the instruction ZCP is not executed. The state of M0, the state of M1, and the state of M2 remain the same as those before X0.0's being OFF.



3. If users want to clear the comparison result, they can use the instruction RST or ZRST.



Additional remark:

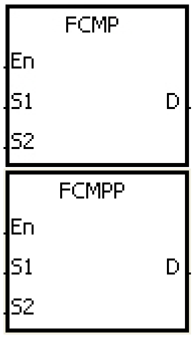
1. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [3] of BOOL.
2. If **D**+2 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
0056		FCMP	P	**S_1, S_2, D**	Comparing the floating-point numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●				○
S_2	●	●			●	●	●	●	●		●	○	●				○
D	●	●	●	●				●	●	●			●				

Pulse instruction	32-bit instruction (7-9 steps)	64-bit instruction
AH500	AH500	-

Symbol:



S_1 : Floating-point number 1 — Double word

S_2 : Floating-point number 2 — Double word

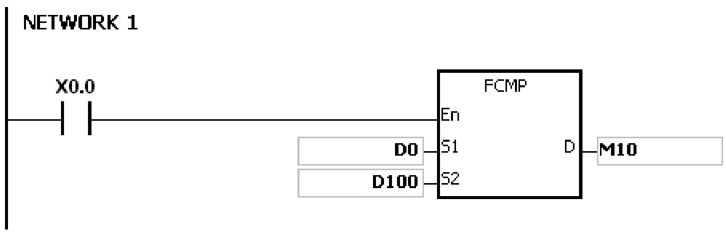
D : Comparison result — Bit

Explanation:

1. The instruction FCMP is used to compare the floating-point number in **S_1** with the floating-point number in **S_2**. The comparison results are stored in **D**.
2. The operand **D** occupies three consecutive devices. The comparison results are stored in **D**, **D**+1, and **D**+2. If the comparison value in **S_1** is greater than the comparison value in **S_1**, **D** will be ON. If the comparison value in **S_1** is equal to the value in **S_2**, **D**+1 will ON. If the comparison value in **S_1** is less than the value in **S_2**, **D**+2 will be ON.

Example:

1. If the operand **D** is M10, the comparison results will be stored in M10, M11 and M12, as shown below.
2. When X0.0 is ON, the instruction FCMP is executed. M10, M11, or M12 is ON. When X0.0 is OFF, the instruction FCMP is not executed. The state of M10, the state of M11, and the state of M12 remain the same as those before X0.0's being OFF.
3. If users want to get the comparison result ≧, ≦, or ≠, they can connect M10~M12 is series or in parallel.
4. If users want to clear the comparison result, they can use the instruction RST or ZRST.



Additional remark:

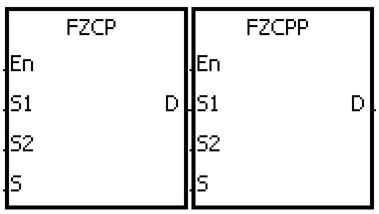
1. If the value in $\mathbf{S_1}$ or $\mathbf{S_2}$ exceeds the range of values which can be represented by the floating-point numbers, the contact is OFF, SM is ON, and the error code in SR0 is 16#2013.
2. If users declare the operand **D** in ISPSoft, the data type will ARRAY [3] of BOOL.
3. If **D**+2 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code		Operand	Function
0057	FZCP	P	S_1, S_2, S, D	Floating-point zone comparison

Device	X	Y	M	S	T	C	HC	D	W	L	Bm	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●	●	●		●	○	●				○
S_2	●	●			●	●	●	●	●	●	●		●	○	●				○
S	●	●			●	●	●	●	●	●	●		●	○	●				○
D	○	●	●	●				●	●	●	●	●			●				

Pulse instruction	32-bit instruction (9-12 steps)	64-bit instruction
AH500	AH500	-

Symbol:



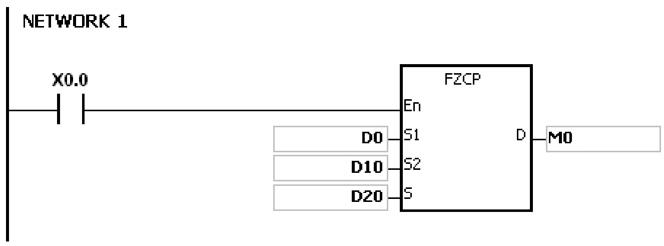
S_1	:	Minimum value of the zone comparison	Double word
S_2	:	Maximum value of the zone comparison	Double word
S	:	Comparison value	Double word
D	:	Comparison result	Bit

Explanation:

1. The instruction is used to compare the value in **S** with that in $\mathbf{S_1}$, and compare the value in **S** with that in $\mathbf{S_2}$. The values compared are floating-point numbers, and the comparison results are stored in **D**.
2. The value in $\mathbf{S_1}$ must be less than that in $\mathbf{S_2}$. If the value in $\mathbf{S_1}$ is larger than that in $\mathbf{S_2}$, $\mathbf{S_1}$ will be taken as the maximum/minimum value during the execution of the instruction FZCP.
3. The operand **D** occupies three consecutive devices. The comparison results are stored in **D**, **D**+1, and **D**+2. If the comparison value in $\mathbf{S_1}$ is greater than the comparison value in **S**, **D** will be ON. If the comparison value in **S** is within the range between the value in $\mathbf{S_1}$ and the value in $\mathbf{S_2}$, **D**+1 will be ON. If the compared value in $\mathbf{S_2}$ is less than the value in **S**, **D**+2 will be ON.

Example:

1. If the operand **D** is M0, the comparison results will be stored in M0, M1 and M2.
2. When X0.0 is ON, the instruction FZCP is executed. M0, M1, or M2 is ON. When X0.0 is OFF, the instruction FZCP is not executed. The state of M0, the state of M1, and the state of M2 remain the same as those before X0.0's being OFF.
3. If users want to clear the comparison result, they can use the instruction RST or ZRST.



Additional remark:

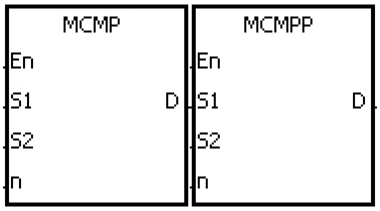
1. If the value in $\mathbf{S_1}$ or $\mathbf{S_2}$ or **S** exceeds the range of values which can be represented by the floating-point numbers, the contact is OFF, SM is ON, and the error code in SR0 is 16#2013.
2. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [3] of BOOL.
3. If **D**+2 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
0058		MCMP	P	S_1, S_2, n, D	Matrix comparison

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●		●				
S_2	●	●			●	●		●	●		●		●				
n	●	●			●	●		●	●		●		●	○	○		
D	●	●			●	●		●	●		●		●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



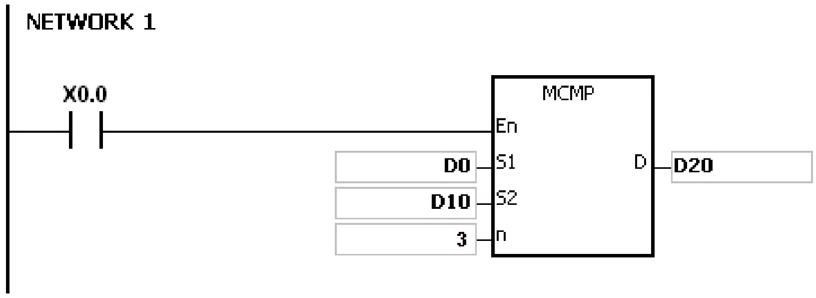
S_1	:	Matrix source device 1	Word
S_2	:	Matrix source device 2	Word
n	:	Length of the array	Word
D	:	Pointer	Word

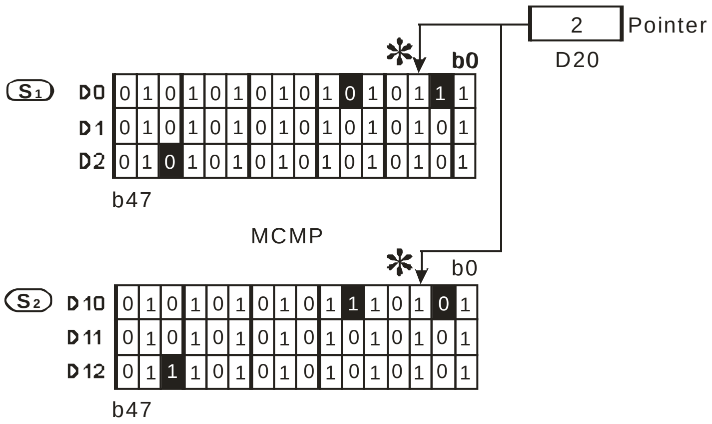
Explanation:

1. The search for the bits whose states are different starts from the bits specified by the number gotten from the addition of one to the current value in **D**. After the bits whose states are different are found, the bit number is stored in **D**, and the comparison is finished.
2. The operand **n** should be within the range between 1 and 256.
3. When SM607 is ON, the equivalent values are compared. When SM607 is OFF, the different values are compared. When the matching bits are compared, the comparison stops immediately, and SM610 is ON. When the last bits are compared, SM608 is ON, and the bit number is stored in **D**. The comparison starts from the 0^{th} bits in the next scan cycle, and SM609 is ON. When the value in **D** exceeds the range, SM611 is ON.
4. When the instruction MCMP is executed, users need a 16-bit register to specify a certain bit among the 16**n** bits in the matrix for the operation. The register is called the pointer, and is specified by users. The value in the register is within the range between 0 and 16**n**-1, and corresponds to the bit within the range between b0 and b16**n**-1. During the operation, users should be prevented from altering the value of the pointer in case the search for the matching bits is affected. If the value of the pointer exceeds the range, SM611 will be ON, and the instruction MCMP will not be executed.
5. If SM608 and SM610 occur simultaneously, they will be ON simultaneously.

Example:

1. When X0.0 is switched from OFF to ON, SM609 is OFF. The search for the bits whose states are different (SM607 is OFF) starts from the bits specified by the number gotten from the addition of one to the current value of the pointer.
2. Suppose the current value in D20 is 2. When X0.0 is switched from OFF to ON four times, users can get the following execution results.
   - The value in D20 is 5, SM610 is ON, and SM608 is OFF.
   - The value in D20 is 45, SM610 is ON, and SM608 is OFF.
   - The value in D20 is 47, SM610 is OFF, and SM608 is ON.
   - The value in D20 is 1, SM610 is ON, and SM608 is OFF.





Additional remark:

1. The description of the operation error code:

   If the devices **S_1+n**-1 and **S_2+n**-1 exceed the range, the instruction MCMP is not executed, SM is ON, and the error code in SR0 is 16#2003.

   If the value in the operand **n** is not within the range between 1 and 256, the instruction MCMP is not executed, SM is ON, and the error code in SR0 is 16#200B.

2. The description of the flags:

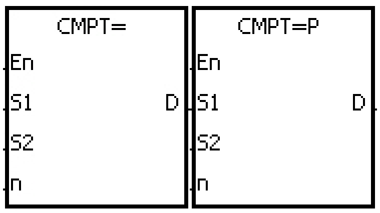
SM607:	It is the matrix comparison flag. ON: Comparing the equivalent values OFF: Comparing the different values
SM608:	The matrix comparison comes to an end. When the last bits are compared, SM608 is ON.
SM609:	When SM609 is ON, the comparison starts from bit 0.
SM610:	It is the matrix bit search flag. When the matching bits are compared, the comparison stops immediately, and SM610 is ON.
SM611:	It is the matrix pointer error flag. When the value of the pointer exceeds the comparison range, SM611 is ON.

API		Instruction code			Operand	Function
0059~ 0064			CMPT※	P	**S_1, S_2, n, D**	Comparing the tables

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●	○	●	○	○		
S_2	●	●			●	●		●	●		●	○	●				
n	●	●			●	●		●	●		●	○	●	○	○		
D	●	●	●	●				●	●	●			●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

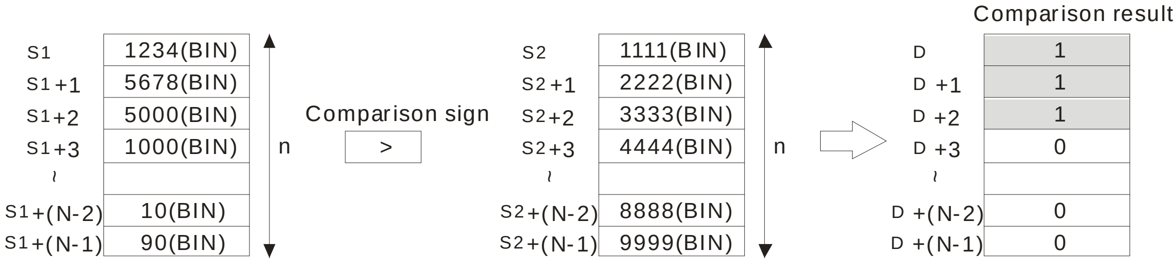
Symbol:



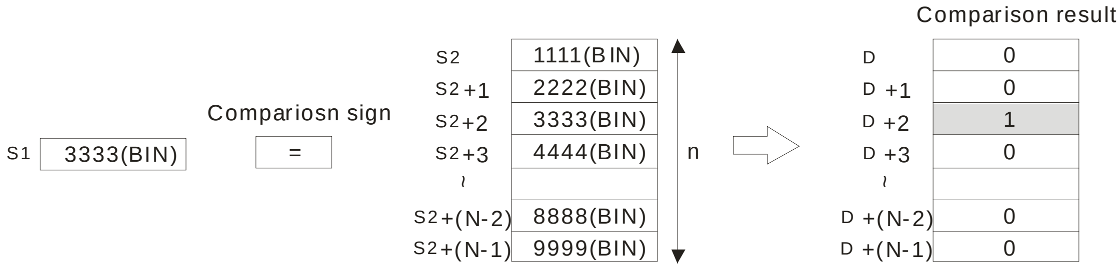
S_1	:	Source device 1	Word
S_2	:	Source device 2	Word
n	:	Data length	Word
D	:	Comparison result	Bit

Explanation:

1. The instruction is used to compare **n** pieces of data in devices starting from **S_1** with those in devices starting from **S_2**. The values compared are signed decimal numbers, and the comparison results are stored in **D**.
2. The operand **n** should be within the range between 1 and 256.
3. The value which is written into the operand **D** is a one-bit value.
4. When the results gotten from the comparison by using the instruction CMPT# are that all devices are ON, SM620 is ON. Otherwise, SM620 is OFF.
5. If the operand **S_1** is a device, the comparison will be as shown below.



6. If the operand **S_1** is a constant within the range between -32768 and 32767, the comparison will be as shown below.

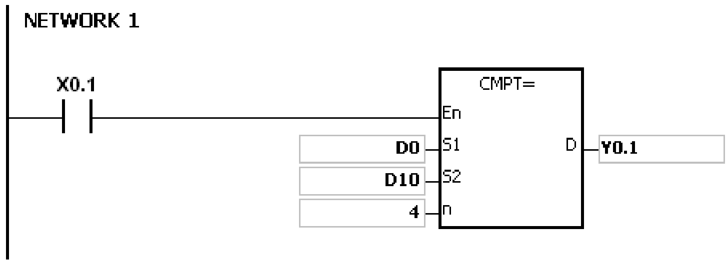


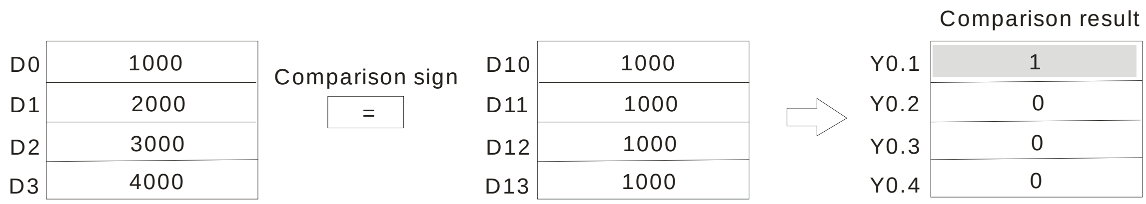
7. The corresponding comparison operation results of the instructions are listed below.

API number	16-bit instruction	Comparison operation result	
		ON	**OFF**
0059	CMPT =	$\mathbf{S_1 = S_2}$	$\mathbf{S_1 \neq S_2}$
0060	CMPT < >	$\mathbf{S_1 \neq S_2}$	$\mathbf{S_1 = S_2}$
0061	CMPT >	$\mathbf{S_1 > S_2}$	$\mathbf{S_1 \leqq S_2}$
0062	CMPT > =	$\mathbf{S_1 \geqq S_2}$	$\mathbf{S_1 < S_2}$
0063	CMPT <	$\mathbf{S_1 < S_2}$	$\mathbf{S_1 \geqq S_2}$
0064	CMPT < =	$\mathbf{S_1 \leqq S_2}$	$\mathbf{S_1 > S_2}$

Example:

The data in D0~D3 are compared with that in D10~D13. If the comparison result is that the data in D0~D3 is the same as that in D10~D13, Y0.1~Y0.4 will be ON.





Additional remark:

1. If the value in the operand **n** is not within the range between 1 and 256, the instruction is not executed, SM is ON, and the error code in SR0 is 16#200B.
2. If the number of devices specified by $\mathbf{S_1 \sim S_1 + n}$, $\mathbf{S_2 \sim S_2 + n}$, or **D** is insufficient, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code	Operand	Function
0065	CHKADR	**S, n, D**	Checking the address of the contact type of pointer register

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S													●				
n	●	●			●	●		●	●		●	○	●	○	○		
D	●	●	●	●				●	●	●			●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
-	AH500	-

Symbol:

S : Pointer register — POINTER/T_POINTER/ C_POINTER/HC_POINTER

n : Number of devices — Word

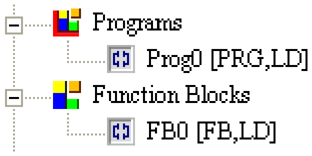
D : Check result — Bit

Explanation:

1. The instruction CHKADR is used to check whether the value in **S** and (the value in **S**)+**n**-1 exceed the device range. If the check result is that the value in **S** and (the value in **S**)+**n**-1 do not exceed the device range, the device **D** will be ON. Otherwise, it will be OFF.
2. **S** supports the pointer registers PR, TR, CR, and HCR.
3. The operand **n** should be within the range between 1 and 1024.
4. The instruction CHKADR only can be used in the function block.

Example:

1. Establish a program and a function block in ISPSoft.



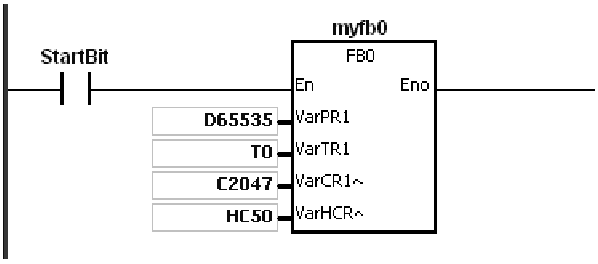
Declare two variables in the program.

Local Symbols					
Class	Identifiers	Address	Type...	Initial Value	Identifier Comment...
VAR	myfb0	N/A [Auto]	FB0	N/A	
VAR	StartBit	N/A [Auto]	BOOL	FALSE	

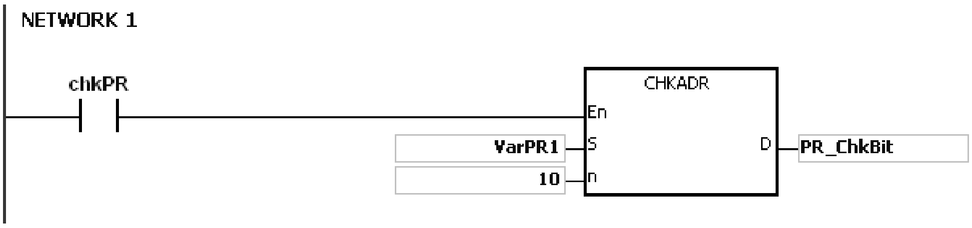
2. Declare VarPR1, VarTR1, VarCR1, and VarHCR1 in the function block, and assign the data types POINTER, T_POINTER, C_POINTER, and HC_POINTER to them respectively.

Local Symbols					
Class	Identifiers	Address	Type...	Initial Value	Identifier Comment...
VAR_IN_OUT	VarPR1	N/A [Auto]	POINTER	N/A	
VAR_IN_OUT	VarTR1	N/A [Auto]	T_POINTER	N/A	
VAR_IN_OUT	VarCR1	N/A [Auto]	C_POINTER	N/A	
VAR_IN_OUT	VarHCR1	N/A [Auto]	HC_POINTER	N/A	
VAR	PR_ChkBit	N/A [Auto]	BOOL	FALSE	
VAR	TR_ChkBit	N/A [Auto]	BOOL	FALSE	
VAR	CR_ChkBit	N/A [Auto]	BOOL	FALSE	
VAR	HCR_ChkBit	N/A [Auto]	BOOL	FALSE	
VAR	chkPR	N/A [Auto]	BOOL	N/A	
VAR	chkTR	N/A [Auto]	BOOL	N/A	
VAR	chkCR	N/A [Auto]	BOOL	N/A	
VAR	chkHCR	N/A [Auto]	BOOL	N/A	

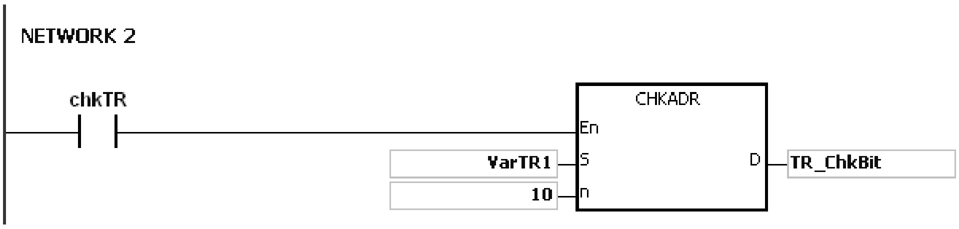
3. Call the function block FB0 in the program, and assign D65535, T0, C2047, and HC50 to VarPR1, VarTR1, VarCR1, and VarHCR1 in FB0 respectively.



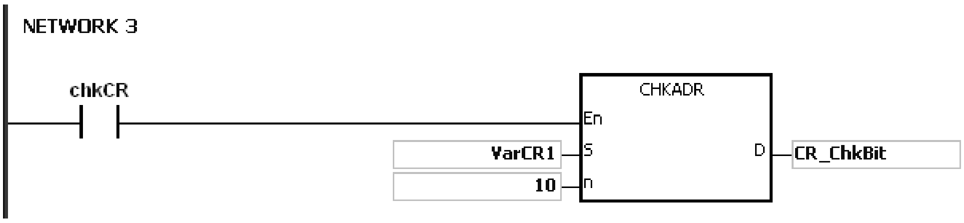
4. Use the instruction CHKADR to check whether VarPR1, VarTR1, VarCR1, and VarHCR1 exceed the range.
5. When chkPR is ON, the practical device represented by VarPR1 is D65535. Since the legal range of devices is from D0 to D65535, and D65535+10-1=D65544, which exceeds the range, PR_ChkBit is OFF.



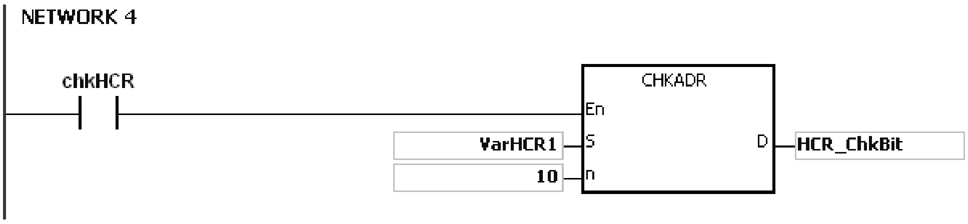
6. When chkTR is ON, the practical device represented by VarTR1 is T0. Since the legal range of devices is from T0 to T2047, and T0+10-1=T9, which does not exceed the range, TR_ChkBit is ON.



7. When chkCR is ON, the practical device represented by C2047. Since the legal range of devices is from C0 to C2047, and C2047+10-1=C2056, which exceeds the range, CR_ChkBit is OFF.



8. When chkHCR is ON, the practical device represented by HC50 is VarHCR1. Since the legal range of deices is from HC0 to HC63, and HC50+10-1=HC59, which does not exceed the range, HCR_ChkBit is ON.



Additional remark:

1. If the value (the practical device address) in **S** exceeds the device range, the instruction CHKADR is not executed, SM is ON, and the error code in SR0 is 16#2003.
2. If the value in the operand **n** is not within the range between 1 and 1024, the instruction CHKADR is not executed, SM is ON, and the error code in SR0 is 16#200B.

6.2 Arithmetic Instructions

6.2.1 List of Arithmetic Instructions

API	Instruction code			Pulse instruction	Function	Step
	16-bit	32-bit	64-bit			
0100	+	D+	–	✓	Addition of binary numbers	7
0101	-	D-	–	✓	Subtraction of binary numbers	7
0102	*	D*	–	✓	Multiplication of binary numbers	7
0103	/	D/	–	✓	Division of binary numbers	7
0104	–	F+	DF+	✓	Addition of floating-point numbers	7-9
0105	–	F-	DF-	✓	Subtraction of floating-point numbers	7-9
0106	–	F*	DF*	✓	Multiplication of floating-point numbers	7-9
0107	–	F/	DF/	✓	Division of floating-point numbers	7-9
0108	B+	DB+	–	✓	Addition of binary-coded decimal numbers	7
0109	B-	DB-	–	✓	Subtraction of binary-coded decimal numbers	7
0110	B*	DB*	–	✓	Multiplication of binary-coded decimal numbers	7
0111	B/	DB/	–	✓	Division of binary-coded decimal numbers	7
0112	BK+	–	–	✓	Binary number block addition	9
0113	BK-	–	–	✓	Binary number block subtraction	9
0114	$+	–	–	✓	Linking the strings	7-19
0115	INC	DINC	–	✓	Adding one to the binary number	3
0116	DEC	DDEC	–	✓	Subtracting one from the binary number	3
0117	MUL16	MUL32	–	✓	Multiplication of binary numbers	7
0118	DIV16	DIV32	–	✓	Division of binary numbers	7

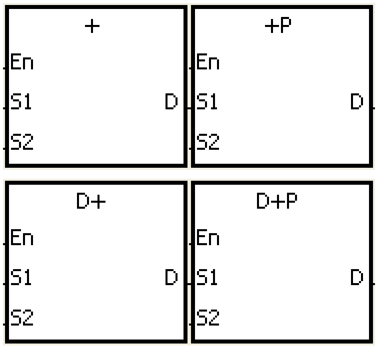
6.2.2 Explanation of Arithmetic Instructions

API	Instruction code			Operand	Function
0100	D	+	P	**S_1, S_2, D**	Addition of binary numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



S_1 : Augend — Word/Double word

S_2 : Addend — Word/Double word

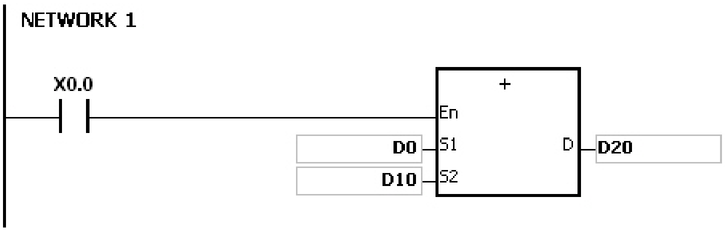
D : Sum — Word/Double word

Explanation:

1. The binary value in **S_2** is added to the binary value in **S_1**, and the sum is stored in **D**.
2. Only the 32-bit instructions can use the 32-bit counter.
3. The Flags: SM600 (zero flag), SM601 (borrow flag), and SM602 (carry flag)
4. When the operation result is zero, SM600 is ON. Otherwise, it is OFF.
5. The addition of 16-bit binary values:
   When the operation result exceeds the range of 16-bit binary values, SM602 is ON. Otherwise, it is OFF.
6. The addition of 32-bit binary values:
   When the operation result exceeds the range of 32-bit binary values, SM602 is ON. Otherwise, it is OFF.

Example 1:

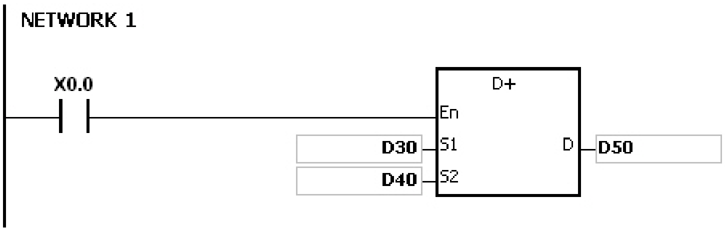
The addition of 16-bit binary values: When X0.0 is ON, the addend in D10 is added to the augend in D0, and sum is stored in D20.



- When the values in D0 and D10 are 100 and 10 respectively, D0 plus D10 equals 110, and 110 is stored in D20.
- When the values in D0 and D10 are 16#7FFF and 16#1 respectively, D0 plus D10 equals 16#8000, and 16#8000 is stored in D20.
- When the values in D0 and D10 are 16#FFFF and 16#1 respectively, D0 plus D10 equals 16#10000. Since the operation result exceeds the range of 16-bit binary values, SM602 is ON, and the value stored in D20 is 16#0. Besides, since the operation result is 16#0, SM600 is ON.

Example 2:

The addition of 32-bit binary values: When X0.0 is ON, the addend in (D41, D40) is added to the augend in (D31, D30), and sum is stored in (D51, D50). (The data in D30, D40, and D50 is the lower 16-bit data, whereas the data in D31, D41, and D51 is the higher 16-bit data).



- When the values in (D31, D30) and (D41, D40) are 11111111 and 44444444 respectively, (D31, D30) plus (D41, D40) equals 55555555, and 55555555 is stored in (D51, D50).
- When the values in (D31, D30) and (D41, D40) are 16#80000000 and 16#FFFFFFFF respectively, (D31, D30) plus (D41, D40) equals 16#17FFFFFFF. Since the operation result exceeds the range of 32-bit binary values, SM602 is ON, and the value stored in (D51, D50) is 16#7FFFFFFF.

Flag:

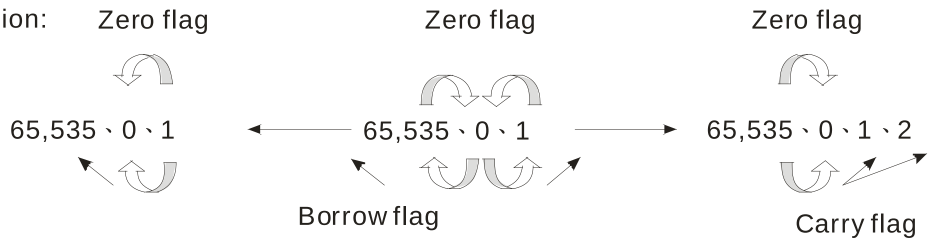
The 16-bit instruction:

1. If the operation result is zero, SM600 will be set to ON.
2. If the operation result exceeds 65,535, SM602 will be set to ON.

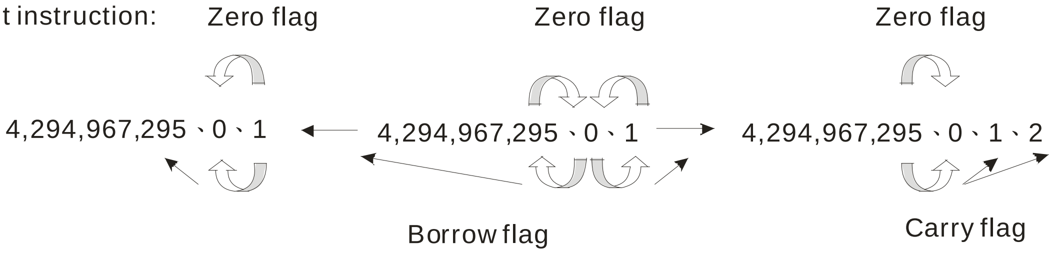
The 32-bit instruction:

1. If the operation result is zero, SM600 will be set to ON.
2. If the operation result exceeds 4,294,967,295, SM602 will be set to ON.

The 16-bit instruction:



The 32-bit instruction:

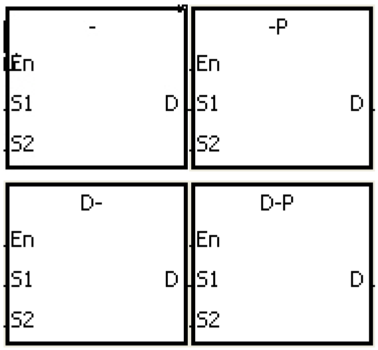


API	Instruction code			Operand	Function
0101	D	-	P	**S_1, S_2, D**	Subtraction of binary numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



S_1 : Minuend Word/Double word

S_2 : Subtrahend Word/Double word

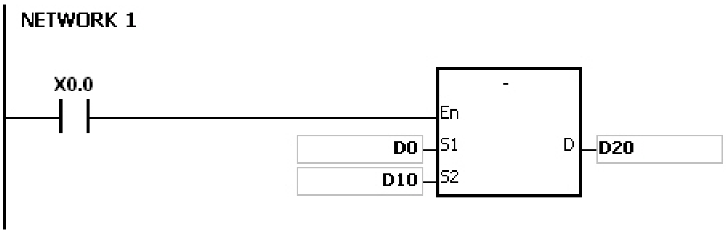
D : Difference Word/Double word

Explanation:

1. The binary value in **S_2** is subtracted from the binary value in **S_1**, and the difference is stored in **D**.
2. Only the 32-bit instructions can use the 32-bit counter.
3. The Flags: SM600 (zero flag), SM601 (borrow flag), and SM602 (carry flag)
4. When the operation result is zero, SM600 is ON. Otherwise, it is OFF.
5. When a borrow occurs during the arithmetic, SM601 is ON. Otherwise, it is OFF.

Example 1:

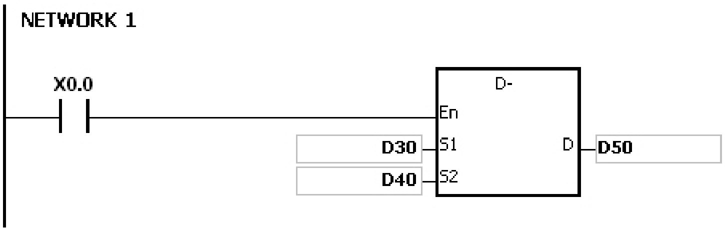
The subtraction of 16-bit binary values: When X0.0 is ON, the subtrahend in D10 is subtracted from the minuend in D0, and the difference is stored in D20.



- When the values in D0 and D10 are 100 and 10 respectively, D0 minus D10 leaves 90, and 90 is stored in D20.
- When the values in D0 and D10 are 16#8000 and 16#1 respectively, D0 minus D10 leaves 16#7FFF, and 16#7FFF is stored in D20.
- When the values in D0 and D10 are 16#1 and 16#2 respectively, D0 minus D10 leaves 16#FFFF. Since the borrow occurs during the arithmetic, SM601 is ON, and the value stored in D20 is 16#FFFF.
- When the values in D0 and D10 are 16#0 and 16#FFFF respectively, D0 minus D10 leaves 16#F0001. Since the borrow occurs during the arithmetic, SM601 is ON, and the value stored in D20 is 16#1.

Example 2: :

The addition of 32-bit binary values: When X0.0 is ON, the subtrahend in (D41, D40) is subtracted from the minuend in (D31, D30), and sum is stored in (D51, D50). (The data in D30, D40, and D50 is the lower 16-bit data, whereas the data in D31, D41, and D51 is the higher 16-bit data).



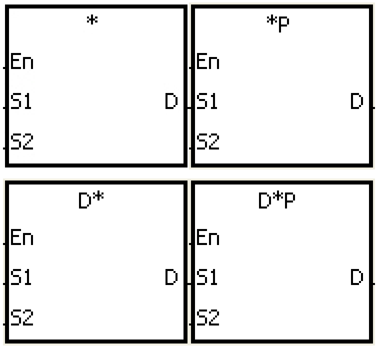
- When the values in (D31, D30) and (D41, D40) are 55555555 and 11111111 respectively, (D31, D30) minus (D41, D40) D10 leaves 44444444, and 44444444 is stored in (D51, D50).
- When the values in (D31, D30) and (D41, D40) are 16#80000000 and 16#FFFFFFFF respectively, (D31, D30) minus (D41, D40) leaves 16#F80000001. Since the borrow occurs during the arithmetic, SM601 is ON, and the value stored in (D51, D50) is 16#80000001.

API	Instruction code			Operand	Function
0102	D	*	P	**S_1, S_2, D**	Multiplication of binary numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



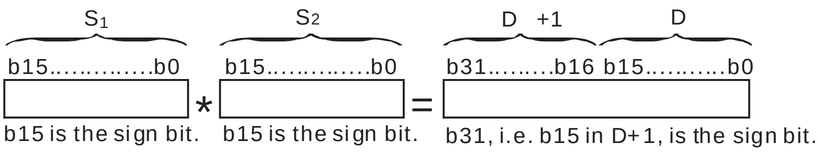
S_1 : Multiplicand — Word/Double word

S_2 : Multiplier — Word/Double word

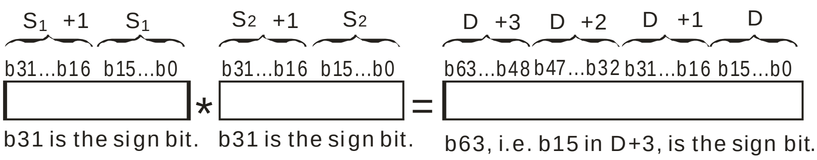
D : Product — Double word/Long word

Explanation:

1. The signed binary value in **S_1** is multiplied by the singed binary value in **S_2**, and the product is stored in **D**.
2. Only the instruction D* can use the 32-bit counter.
3. The multiplication of 16-bit binary values:



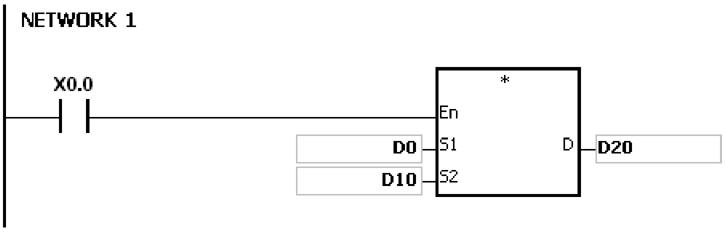
   The product is a 32-bit value, and is stored in the register (D+1, D), which is composed of 32 bits. When the sign bit b31 is 0, the product is a positive value. When the sign bit b31 is 1, the product is a negative value.
4. The multiplication of 32-bit binary values:



   The product is a 64-bit value, and is stored in the register (D+3, D+2, D+1, D0), which is composed of 64 bits. When the sign bit b63 is 0, the product is a positive value. When the sign bit b63 is 1, the product is a negative value.

Example:

The 16-bit value in D0 is multiplied by the 16-bit value in D10, and the 32-bit product is stored in (D21, D20). The data in D21 is the higher 16-bit data, whereas the data in D20 is the lower 16-bit data. Whether the result is a positive value or a negative value depends on the state of the highest bit b31. When b31 is OFF, the result is a positive value. When b31 is ON, the result is a negative value.



D0×D10=(D21, D20)

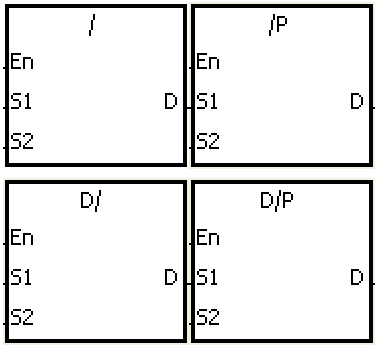
16-bit value×16-bit value=32-bit value

API	Instruction code			Operand	Function
0103	D	/	P	**S_1, S_2, D**	Division of binary numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



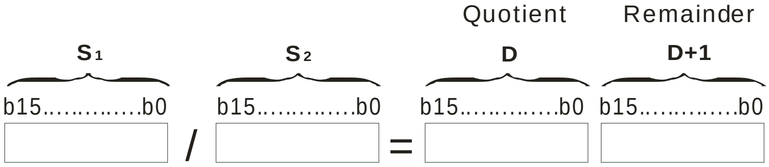
S_1 : Dividend — Word/Double word

S_2 : Divisor — Word/Double word

D : Quotient; remainder — Word/Double word

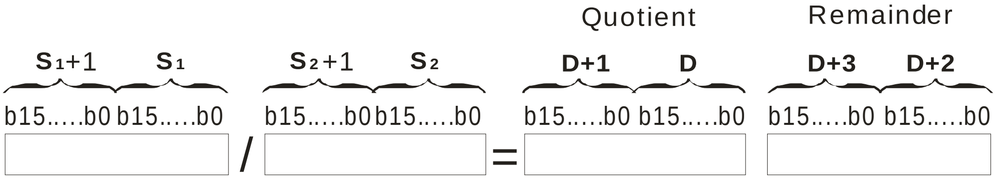
Explanation:

1. The singed binary value in **S_1** is divided by the signed binary value in **S_2**. The quotient and the remainder are stored in **D**.
2. Only the 32-bit instructions can use the 32-bit counter.
3. When the sign bit is 0, the value is a positive one. When the sign bit is 1, the value is a negative one.
4. The division of 16-bit values:



The operand **D** occupies two consecutive devices. The quotient is stored in **D**, and the remainder is stored in **D**+1.

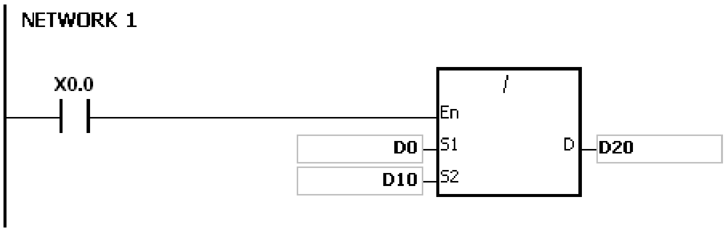
5. The division of 32-bit values:



The operand **D** occupies two devices. The quotient is stored in (**D**+1, **D)**, and the remainder is stored in (**D**+3, **D**+2).

Example:

When X0.0 is ON, the dividend in D0 is divided by the divisor in D10, the quotient is stored in D20, and the remainder is stored in D21. Whether the result is a positive value or a negative value depends on the state of the highest bit.



Additional remark:

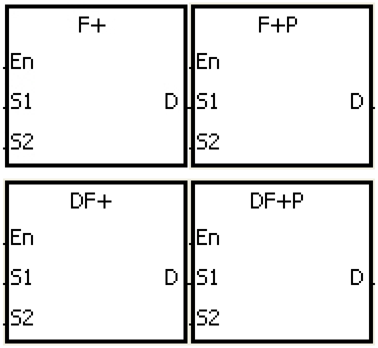
1. If the device exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the divisor is 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2012.
3. If the operand **D** used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of WORD/INT.
4. If the operand **D** used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of DWORD/DINT.

API	Instruction code			Operand	Function
0104	D	F+	P	**S_1, S_2, D**	Addition of floating-point numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●				○
S_2	●	●			●	●	●	●	●		●	○	●				○
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	32-bit instruction (7-9 steps)	64-bit instruction (7-9 steps)
AH500	AH500	AH500

Symbol:



S_1 : Augend — Double word/Long word

S_2 : Addend — Double word/Long word

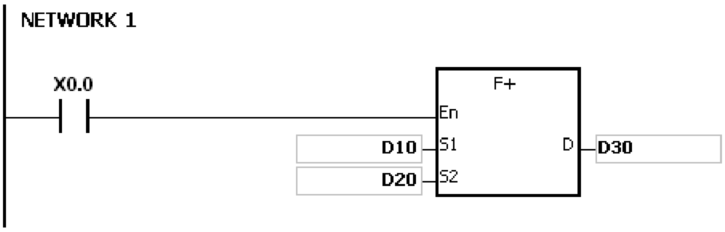
D : Sum — Double word/Long word

Explanation:

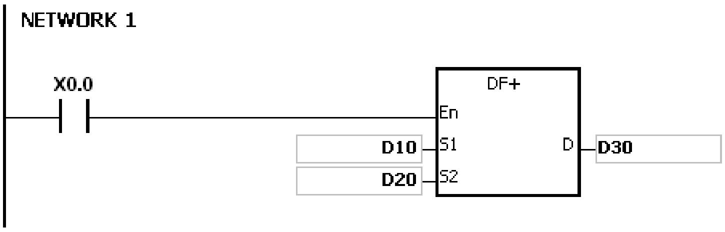
1. The floating-point number in **S_2** is added to the floating-point number in **S_1**, and the sum is stored in **D**.
2. When the operation result is zero, SM600 is ON.
3. The addition of 32-bit single-precision floating-point numbers:
   - When the operation result is zero, SM600 is ON.
   - When the absolute value of the operation result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16#FF7FFFFF.
   - When the absolute value of the operation result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7F7FFFFF.
4. The addition of 64-bit double-precision floating-point numbers:
   - When the operation result is zero, SM600 is ON.
   - When the absolute value of the operation result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16#FFEFFFFFFFFFFFFF.
   - When the absolute value of the operation result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7FEFFFFFFFFFFFFF.

Example:

The addition of single-precision floating-point numbers: When X0.0 is ON, the addend 16#4046B852 in (D21, D20) is added to the augend 16#3FB9999A in (D11, D10), and the sum 16#4091C28F is stored in (D31, D30). 16#4046B852, 16#3FB9999A, and 16#4091C28F represent the floating point numbers 3.105, 1.450, and 4.555 respectively.



The addition of double-precision floating-point numbers: When X0.0 is ON, the addend 16#4008D70A3D70A3D7 in (D23, D22, D21, D20) is added to the augend 16#3FF7333333333333 in (D13, D12, D11, D10), and the sum 16# 40123851EB851EB8 is stored in (D33, D32, D31, D30).



Additional remark:

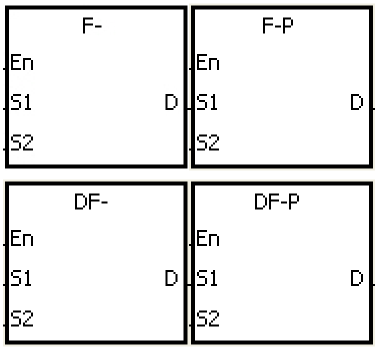
If the value in **S_1** or the value in **S_2** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.

API	Instruction code			Operand	Function
0105	D	F-	P	**S₁, S₂, D**	Subtraction of floating-point numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●				○
S_2	●	●			●	●	●	●	●		●	○	●				○
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	32-bit instruction (7-9 steps)	64-bit instruction (7-9 steps)
AH500	AH500	AH500

Symbol:



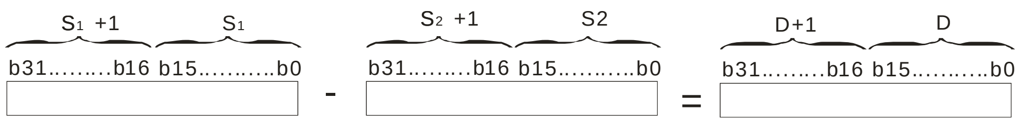
S_1 : Minuend — Double word/Long word

S_2 : Subtrahend — Double word/Long word

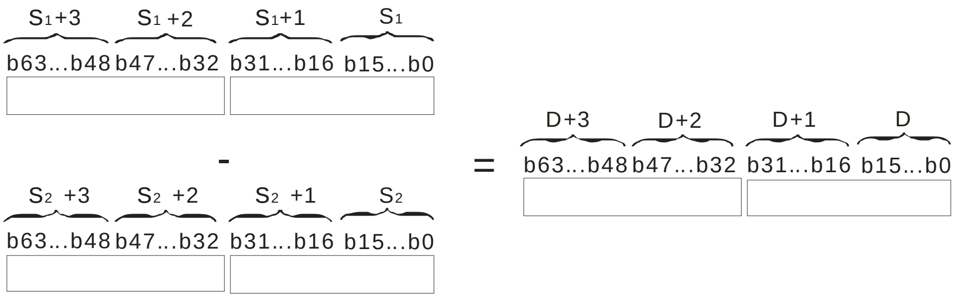
D : Difference — Double word/Long word

Explanation:

1. The floating-point number in **S_2** is subtracted from the floating-point number in **S_1**, and the difference is store in **D**.
2. When the operation result is zero, SM600 is ON.
3. The subtraction of 32-bit single-precision floating-point numbers:
   - When the absolute value of the operation result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16#FF7FFFFF.
   - When the absolute value of the operation result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7F7FFFFF.

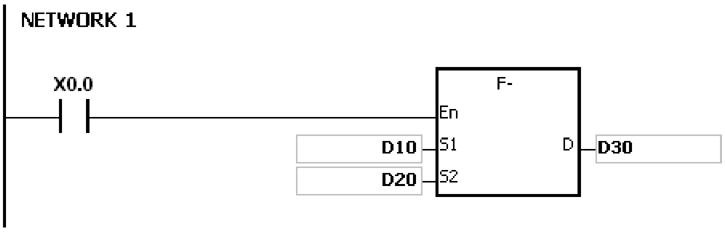


4. The subtraction of 64-bit double-precision floating-point numbers:
   - When the absolute value of the operation result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16#FFEFFFFFFFFFFFFF.
   - When the absolute value of the operation result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7FEFFFFFFFFFFFFF.

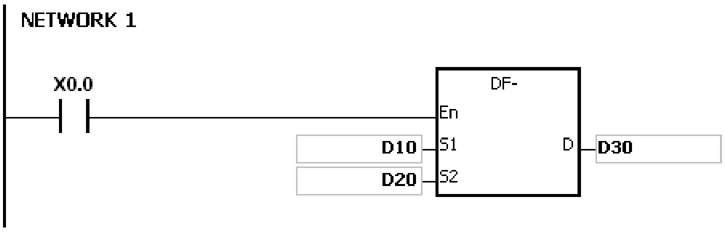


Example:

The subtraction of 32-bit single-precision floating-point numbers: When X0.0 is ON, the subtrahend in (D21, D20) is subtracted from the minuend in (D21, D20), and the difference is stored in (D31, D30).



The subtraction of 64-bit double-precision floating-point numbers: When X0.0 is ON, the subtrahend in (D23, D22, D21, D20) is subtracted from the minuend in (D13, D12, D11, D10), and the difference is stored in (D33, D32, D31, D30).



Additional remark:

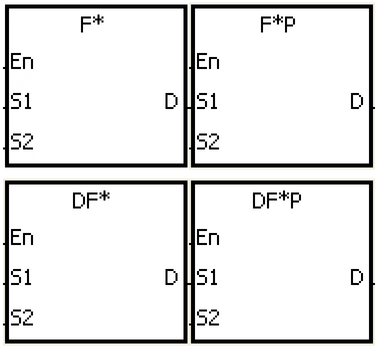
If the value in $\mathbf{S_1}$ or the value in $\mathbf{S_2}$ exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.

API	Instruction code			Operand	Function
0106	D	F*	P	**S_1, S_2, D**	Multiplication of floating-point numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●				○
S_2	●	●			●	●	●	●	●		●	○	●				○
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	32-bit instruction (7-9 steps)	64-bit instruction (7-9 steps)
AH500	AH500	AH500

Symbol:



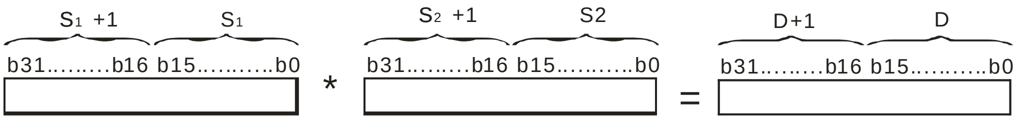
S_1 : Multiplicand Double word/Long word

S_2 : Multiplier Double word/Long word

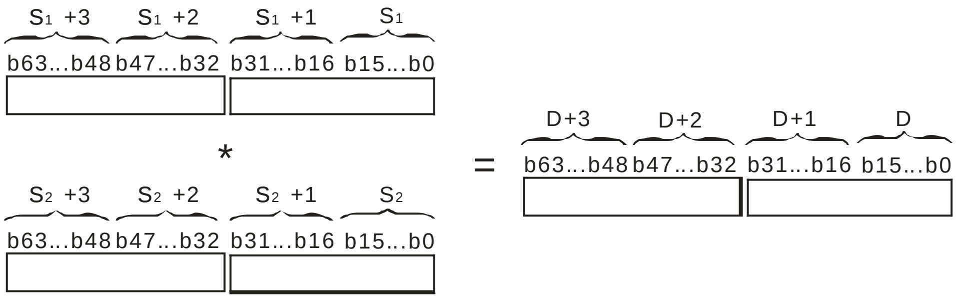
D : Product Double word/Long word

Explanation:

1. The floating-point number in **S_1** is multiplied by the floating-point number in **S_2**, and the product is stored in **D**.
2. When the operation result is zero, SM600 is ON.
3. The multiplication of 32-bit single-precision floating-point numbers:
   - When the absolute value of the operation result is less than value which can be represented by the minimum floating-point number, the value in **D** is 16#FF7FFFFF.
   - When the absolute value of the operation result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7F7FFFFF.

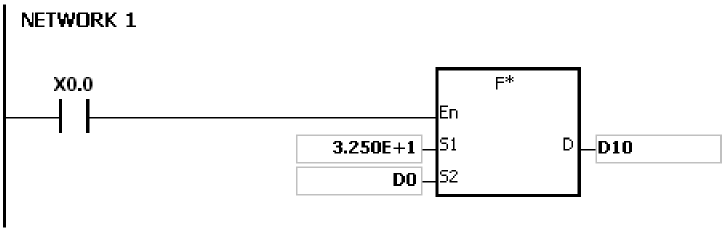


4. The multiplication of 64-bit double-precision floating-point numbers:
   - When the absolute value of the operation result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16#FFEFFFFFFFFFFFFF.
   - When the absolute value of the operation result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7FEFFFFFFFFFFFFF.

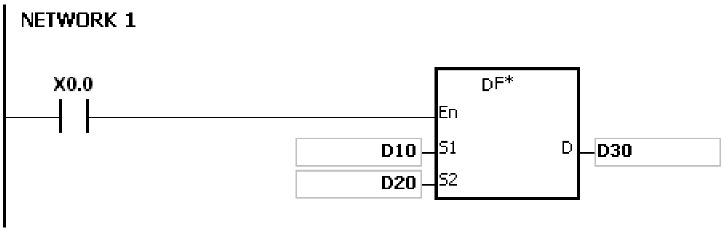


Example:

The multiplication of 32-bit single-precision floating-point numbers: When X0.0 is ON, the multiplicand 32.5 is multiplied by the multiplier in (D1, D0), and the product is stored in (D11, D10).



The multiplication of 64-bit double-precision floating-point numbers: When X0.0 is ON, the multiplicand in (D13, D12, D11, D10) is multiplied by the multiplier in (D23, D22, D21, D20), and the product is stored in (D33, D32, D31, D30).



Additional remark:

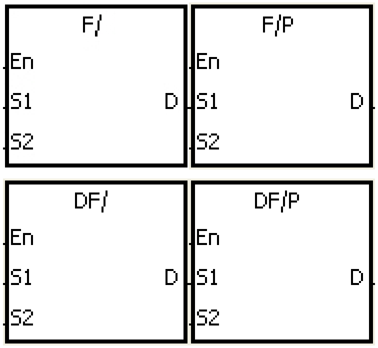
If the value in **S_1** or the value in **S_2** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.

API	Instruction code			Operand	Function
0107	D	F/	P	S_1, S_2, D	Division of floating-point numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●				○
S_2	●	●			●	●	●	●	●		●	○	●				○
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	32-bit instruction (7-9 steps)	64-bit instruction (7-9 steps)
AH500	AH500	AH500

Symbol:



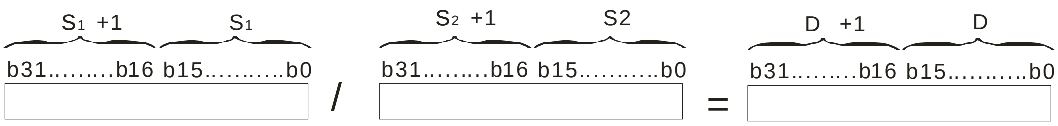
S_1 : Dividend — Double word/Long word

S_2 : Divisor — Double word/Long word

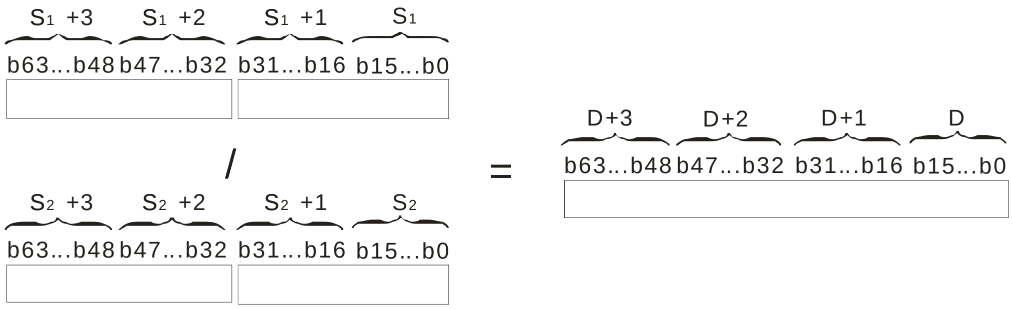
D : Quotient — Double word/Long word

Explanation:

1. The single-precision floating-point number in **S_1** is divided by the single-precision flaoting-point number in **S_2**. The quotient is stored in **D**.
2. When the operation result is zero, SM600 is ON.
3. The division of 32-bit single-precision floating-point numbers:
   - When the absolute value of the operation result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16#FF7FFFFF.
   - When the absolute value of the operation result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7F7FFFFF.

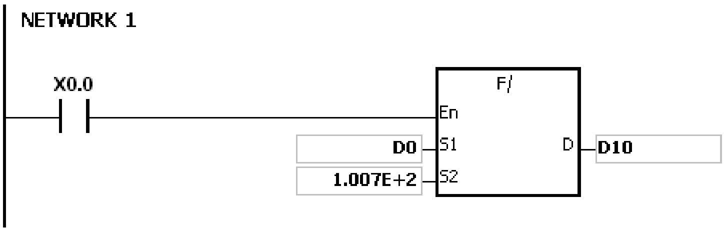


4. The division of 64-bit double-precision floating-point numbers:
   - When the absolute value of the operation result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16#FFEFFFFFFFFFFFFF.
   - When the absolute value of the operation result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7FEFFFFFFFFFFFFF.

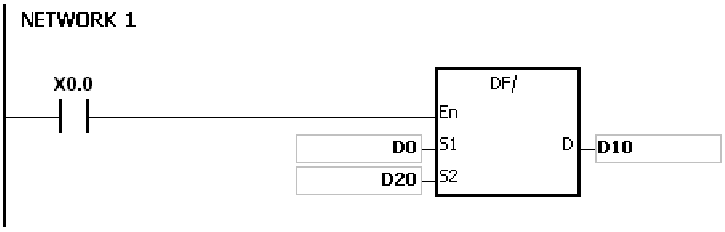


Example:

The division of 32-bit single-precision floating-point numbers: When X0.0 is ON, the dividend in (D1, D0) is divided by the divisor 100.7, and the quotient is stored in (D11, D10).



The division of 64-bit double-precision floating-point numbers: When X0.0 is ON, the dividend in (D3, D2, D1, D0) is divided by the divisor in (D23, D22, D21, D20), and the quotient is stored in (D13, D12, D11, D10).



Additional remark:

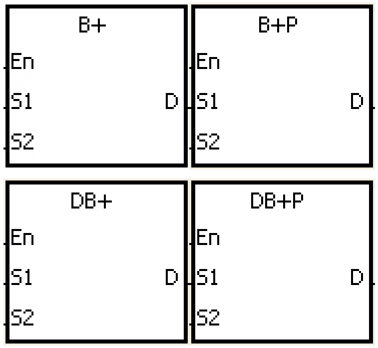
1. If the divisor is 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2012.
2. If the value in $\mathbf{S_1}$ or the value in $\mathbf{S_2}$ exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.

API	Instruction code			Operand	Function
0108	D	B+	P	**S_1, S_2, D**	Addition of binary-coded decimal numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



S_1 : Augend Word/Double word

S_2 : Addend Word/Double word

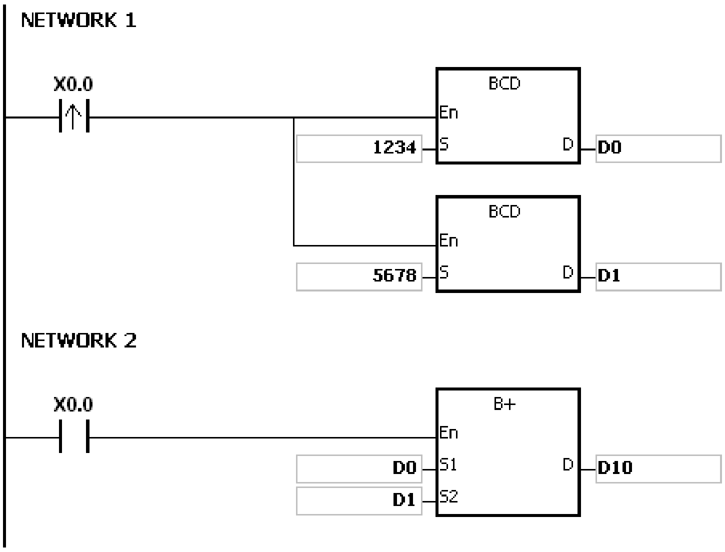
D : Sum Word/Double word

Explanation:

1. The binary-coded decimal value in **S_2** is added to the binary-coded decimal value in **S_1**, and the sum is stored in **D**.
2. Only the instruction DB+ can use the 32-bit counter.
3. The binary-coded decimal value is represented by the hexadecimal number, and every digit is within the range between 0 and 9.
4. The addition of 16-bit binary-coded decimal values:
   When the binary-coded decimal values in **S_1** and **S_2** are 9999 and 0002 respectively, **S_1** plus **S_2** equals the binary-coded decimal value 10001. Since the carry is ignored, the binary coded-decimal value stored in **D** is 0001.
5. The addition of 32-bit binary-coded decimal values:
   When the binary-coded decimal values in **S_1** and **S_2** are 99999999 and 00000002 respectively, **S_1** plus **S_2** equals the binary-coded decimal value 100000001. Since the carry is ignored, the binary coded-decimal value stored in **D** is 00000001.

Example:

When X0.0 is ON, the constants 1234 and 5678 are converted into the binary-coded decimal values which are stored in D0 and D1 respectively. The binary-coded decimal value in D1 is added to the binary-coded decimal value in D0, and the sum is stored in D10.



Additional remark:

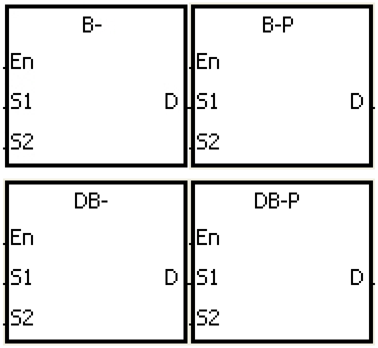
1. If the value in $\mathbf{S_1}$ or the value in $\mathbf{S_2}$ exceeds the range of values which can be represented by the binary-coded decimal values, i.e. 0~9999, the instruction B+ is not executed, SM0 is ON, and the error code in SR0 is 16#200D (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.).
2. If the value in $\mathbf{S_1}$ or the value in $\mathbf{S_2}$ exceeds the range of values which can be represented by the binary-coded decimal values, i.e. 0~99999999, the instruction DB+ is not executed, SM0 is ON, and the error code in SR0 is 16#200D (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.).
3. The instruction does not support SM600, SM601 and SM602.

API	Instruction code			Operand	Function
0109	D	B-	P	**S_1, S_2, D**	Subtraction of binary-coded decimal numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



S_1 : Minuend Word/Double word

S_2 : Subtrahend Word/Double word

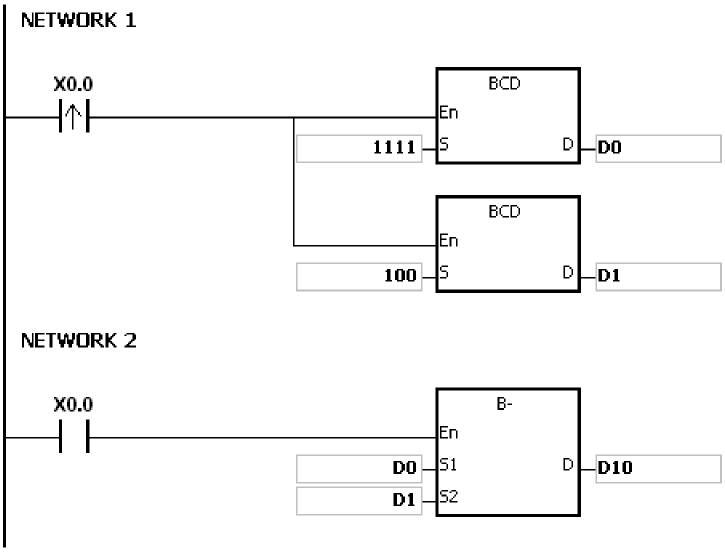
D : Difference Word/Double word

Explanation:

1. The binary-coded decimal value in **S_2** is subtracted from the binary-coded decimal value in **S_1**, and the difference is stored in **D**.
2. Only the instruction DB- can use the 32-bit counter.
3. The binary-coded decimal value is represented by the hexadecimal number, and every digit is within the range between 0 and 9.
4. The subtraction of 16-bit binary-coded decimal values:
   - When the binary-coded decimal values in **S_1** and **S_2** are 9999 and 9998 respectively, **S_1** minus **S_2** leaves the binary-coded decimal value 0001, and 0001 is stored in **D**.
   - When the binary-coded decimal values in **S_1** and **S_2** are 0001 and 9999 respectively, **S_1** minus **S_2** leaves the binary-coded decimal value -9998, and the binary-coded decimal value 0002 is stored in **D**.
   - When the binary-coded decimal values in **S_1** and **S_2** are 0001 and 0004 respectively, **S_1** minus **S_2** leaves the binary-coded decimal value -0003, and the binary-coded decimal value 9997 is stored in **D**.
5. The subtraction of 32-bit binary-coded decimal values:
   - When the binary-coded decimal values in **S_1** and **S_2** are 99999999 and 99999998 respectively, **S_1** minus **S_2** leaves the binary-coded decimal value 00000001, and 00000001 is stored in **D**.
   - When the binary-coded decimal values in **S_1** and **S_2** are 00000001 and 99999999 respectively, **S_1** minus **S_2** leaves the binary-coded decimal value -99999998, and the binary-coded decimal value 00000002 is stored in **D**.
   - When the binary-coded decimal values in **S_1** and **S_2** are 00000001 and 00000004 respectively, **S_1** minus **S_2** leaves the binary-coded decimal value -00000003, and the binary-coded decimal value 99999997 is stored in **D**.

Example:

When X0.0 is ON, the constants 1111 and 100 are converted into the binary-coded decimal values which are stored in D0 and D1 respectively. The binary-coded decimal value in D1 is subtracted from the binary-coded decimal value in D0, and the difference is stored in D10.



Additional remark:

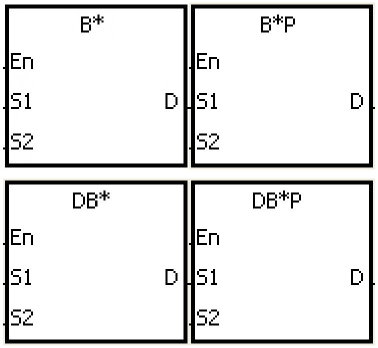
1. If the value in $\mathbf{S_1}$ or the value in $\mathbf{S_2}$ exceeds the range of values which can be represented by the binary-coded decimal values, i.e. 0~9999, the instruction B- is not executed, SM0 is ON, and the error code in SR0 is 16#200D (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.).
2. If the value in $\mathbf{S_1}$ or the value in $\mathbf{S_2}$ exceeds the range of values which can be represented by the binary-coded decimal values, i.e. 0~99999999, the instruction DB- is not executed, SM0 is ON, and the error code in SR0 is 16#200D (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.).
3. The instruction does not support SM600, SM601 and SM602.

API	Instruction code			Operand	Function
0110	D	B*	P	**S_1, S_2, D**	Multiplication of binary-coded decimal numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



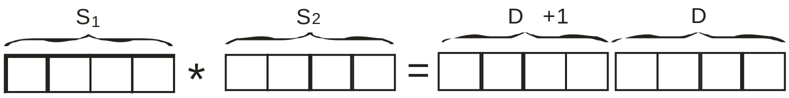
S_1 : Multiplicand — Word/Double word

S_2 : Multiplier — Word/Double word

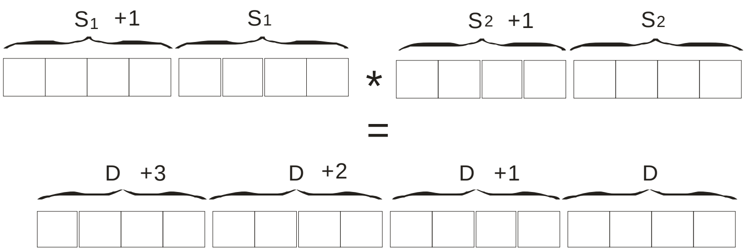
D : Product — Double word/Long word

Explanation:

1. The binary-coded decimal value in **S_1** is multiplied by the binary-coded decimal value in **S_2**, and the product is stored in **D**.
2. Only the instruction DB* can use the 32-bit counter.
3. The binary-coded decimal value is represented by the hexadecimal number, and every digit is within the range between 0 and 9.
4. The multiplication of 16-bit binary-coded decimal values:
   - When the binary-coded decimal values in **S_1** and **S_2** are 1234 and 5678 respectively, the binary-coded decimal value in **D** is 07006652.



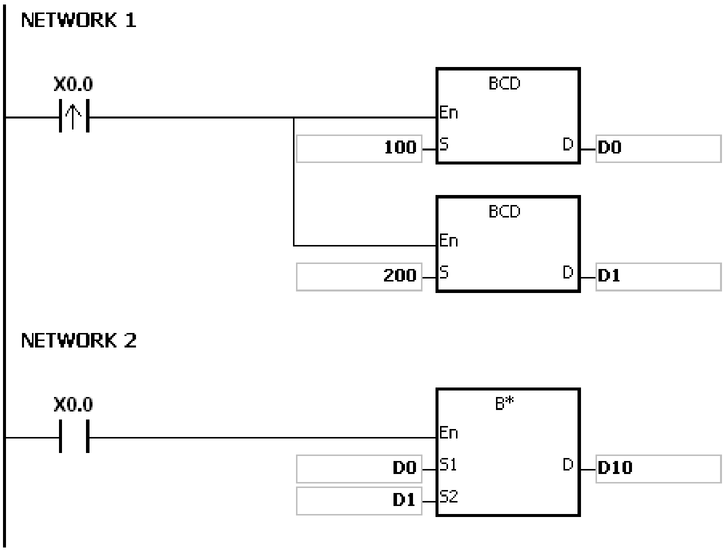
   The product is a 32-bit value, and is stored in the register (D+1, D), which is composed of 32 bits.
5. The multiplication of 32-bit binary-coded decimal values:
   - When the binary-coded decimal values in **S_1** and **S_2** are 99999999 and 99999998 respectively, the binary-coded decimal value in **D** is 9999999700000002.



   The product is a 64-bit value, and is stored in the register (D+3, D+2, D+1, D), which is composed of 64 bits.

Example:

When X0.0 is ON, the constants 100 and 200 are converted into the binary-coded decimal values which are stored in D0 and D1 respectively. The binary-coded decimal value in D0 is multiplied by the binary-coded decimal value in D1, and the product is stored in D10.



Additional remark:

1. When the value in $\mathbf{S_1}$ or the value in $\mathbf{S_2}$ exceeds the range of values which can be represented by the binary-coded decimal values, i.e. 0~9999, the instruction B* is not executed, SM0 is ON, and the error code in SR0 is 16#200D (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.).
2. When the value in $\mathbf{S_1}$ or the value in $\mathbf{S_2}$ exceeds the range of values which can be represented by the binary-coded decimal values, i.e. 0~99999999, the instruction DB* is not executed, SM0 is ON, and the error code in SR0 is 16#200D (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.).
3. The instruction does not support SM600, SM601 and SM602.

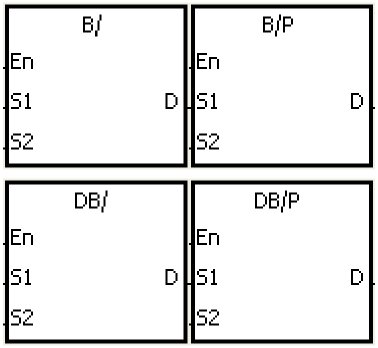
6

API	Instruction code			Operand	Function
0111	D	B/	P	**S**$_1$, **S**$_2$, **D**	Division of binary-coded decimal numbers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S$_1$	●	●			●	●	●	●	●		●	○	●	○	○		
S$_2$	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



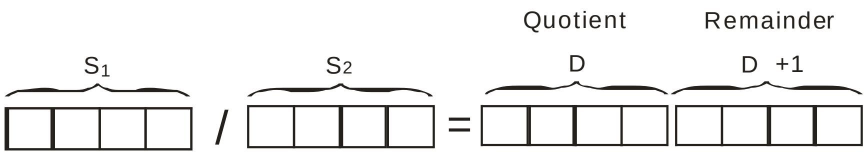
S$_1$: Dividend — Word/Double word

S$_2$: Divisor — Word/Double word

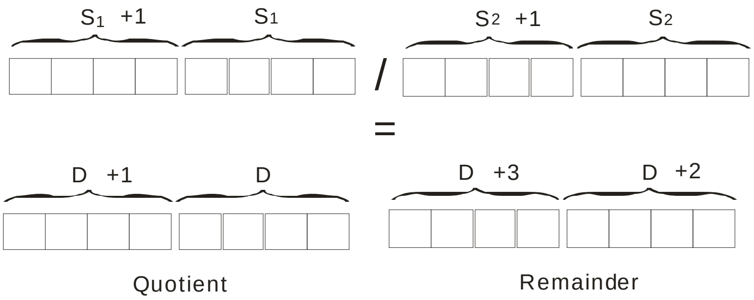
D : Quotient; remainder — Word/Double word

Explanation:

1. The binary-coded decimal value in **S**$_1$ is divided by the binary-coded decimal value in **S**$_2$, and the quotient is stored in **D**.
2. Only the instruction DB/ can use the 32-bit counter.
3. The binary-coded decimal value is represented by the hexadecimal number, and every digit is within the range between 0 and 9.
4. The division of 16-bit binary-coded decimal values:
   - When the binary-coded decimal values in **S**$_1$ and **S**$_2$ are 1234 and 5678 respectively, the binary-coded decimal values in **D** and **D**+1 are 0004 and 0742 respectively.



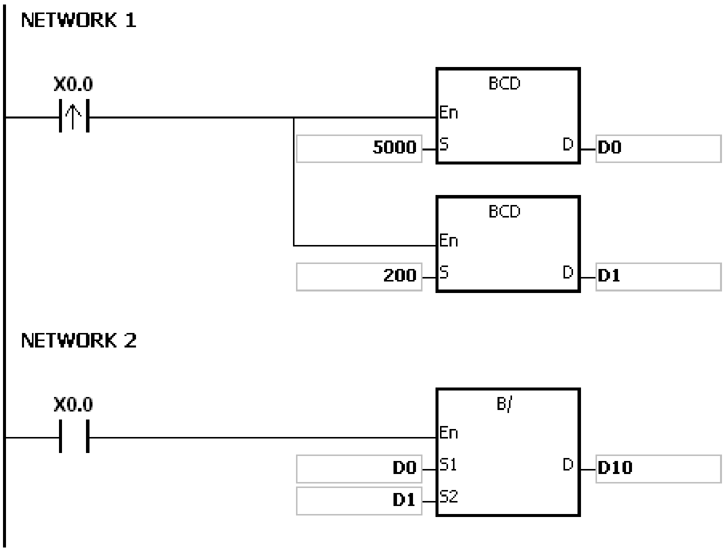
   The operand **D** occupies two consecutive devices. The quotient is stored in **D**, and the remainder is stored in **D**+1.
5. The division of 32-bit binary-coded decimal values:
   - When the binary-coded decimal values in **S**$_1$ and **S**$_2$ are 87654321 and 12345678 respectively, the binary-coded decimal values in (**D**+1, **D**) and (**D**+3, **D**+2) are 00000007 and 01234575 respectively.



The operand **D** occupies two devices. The quotient is stored in (**D**+1, **D**), and the remainder is stored in (**D**+3, **D**+2).

Example:

When X0.0 is ON, the constants 5000 and 200 are converted into the binary-coded decimal values which are stored in D0 and D1 respectively. The binary-coded decimal value in D0 is divided by the binary-coded decimal value in D1. The quotient and the remainder are stored in D10 and D11 respectively.



Additional remark:

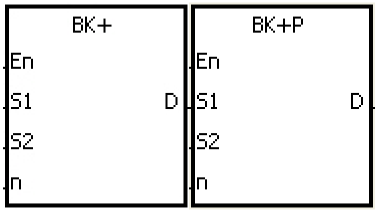
1. If the divisor is 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2012.
2. If the value in $\mathbf{S_1}$ or the value in $\mathbf{S_2}$ exceeds the range of values which can be represented by the binary-coded decimal values, i.e. 0~9999, the instruction B/ is not executed, SM0 is ON, and the error code in SR0 is 16#200D (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.).
3. If the value in $\mathbf{S_1}$ or the value in $\mathbf{S_2}$ exceeds the range of values which can be represented by the binary-coded decimal values, i.e. 0~99999999, the instruction DB/ is not executed, SM0 is ON, and the error code in SR0 is 16#200D (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.).
4. The instruction does not support SM600, SM601 and SM602.
5. If the operand **D** used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of WORD/INT.
6. If the operand **D** used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of WORD/INT.

API	Instruction code		Operand	Function
0112	BK+	P	S_1, S_2, n, D	Addition of binary numbers in blocks

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●				
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
n	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1 : Augend — Word

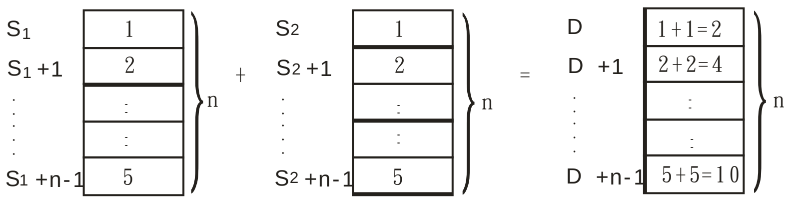
S_2 : Addend — Word

n : Data length — Word

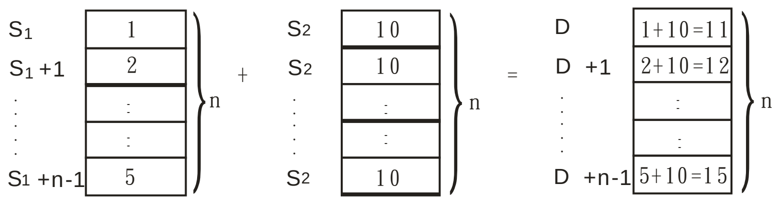
D : Sum — Word

Explanation:

1. **n** pieces of data in devices starting from **S_2** are added to those in devices starting from **S_1**. The augends and the addends are binary numbers, and the sums are stored in **D**.
2. The operand **n** should be within the range between 1 and 256.
3. When the operation result is zero, SM600 is ON.
4. When the operation result is less than –32,768, SM601 is ON.
5. When the operation result is larger than 32,767, SM602 is ON.
6. When the operand **S_2** is a device (not a constant or a hexadecimal value):

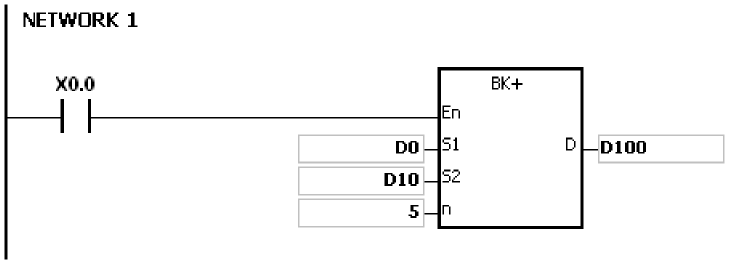


7. When the operand **S_2** is a constant or a hexadecimal value:



Example 1:

When X0.0 is ON, the binary values in D10~D14 are added to the binary values in D0~D4, and the sums are stored in D100~D104.

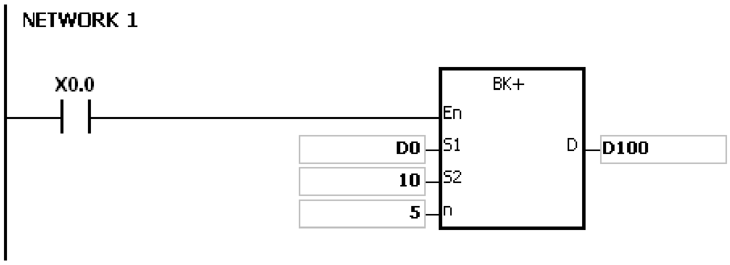


Execution result

D0	1		D10	10		D100	11
D1	2		D11	11		D101	13
D2	3	+	D12	12	⇨	D102	15
D3	4		D13	13		D103	17
D4	5		D14	14		D104	19

Example 2:

When X0.0 is ON, the addend 10 is added to the binary values in D0~D4, and the sums are stored in D100~D104.



Execution result

D0	1		10		D100	11
D1	2		10		D101	12
D2	3	+	10	⇨	D102	13
D3	4		10		D103	14
D4	5		10		D104	15

Additional remark:

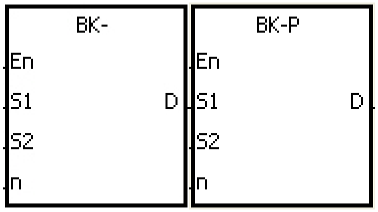
1. If the devices $\mathbf{S_1}$~$\mathbf{S_1}$**+n**-1, $\mathbf{S_2}$~$\mathbf{S_2}$**+n**-1, or **D**~**D+n**-1 exceed the device range, the instruction is not executed, SM is ON, and the error code in SR0 is 16#2003.
2. If **n**<1 or **n**>256, the instruction is not executed, SM0 is ON,and the error code in SR0 is 16#200B.
3. If $\mathbf{S_1}$~$\mathbf{S_1}$**+n**-1 overlap **D**~**D+n**-1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200C.
4. If $\mathbf{S_2}$~$\mathbf{S_2}$**+n**-1 overlap **D**~**D+n**-1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200C.
5. If $\mathbf{S_1}$~$\mathbf{S_1}$**+n**-1 overlap $\mathbf{S_2}$~$\mathbf{S_2}$**+n**-1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200C.

API	Instruction code			Operand	Function
0113		BK-	P	**S_1, S_2, n, D**	Subtraction of binary numbers in blocks

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●				
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
N	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1 : Minuend Word

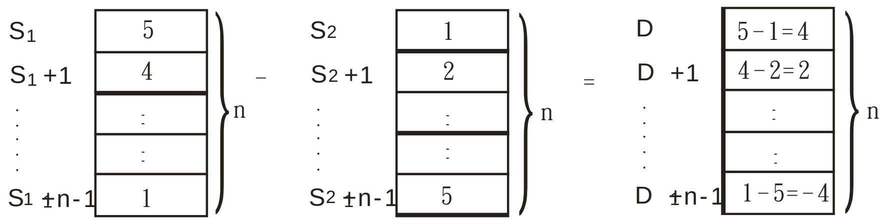
S_2 : Subtrahend Word

n : Data length Word

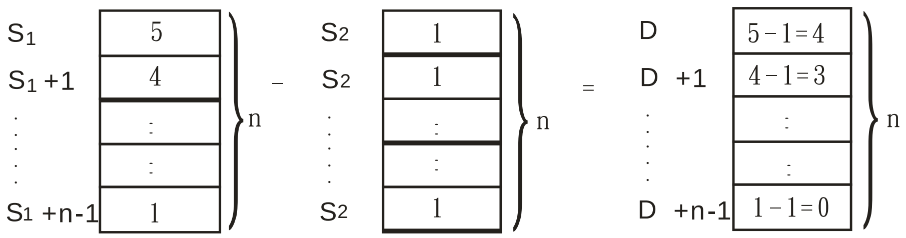
D : Difference Word

Explanation:

1. **n** pieces of data in devices starting from **S_2** are subtracted from those in devices starting from **S_1**. The minuends and the subtrahends are binary numbers, and the differences are stored in **D**.
2. The operand **n** should be within the range between 1 and 256.
3. When the operation result is zero, SM600 is ON.
4. When the operation result is less than –32,768, SM601 is ON.
5. When the operation result is larger than 32,767, SM602 is ON.
6. When the operand **S_2** is a device (not a constant or a hexadecimal value):

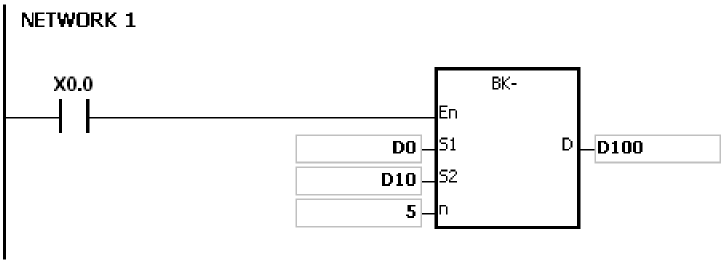


7. When the operand **S_2** is a constant or a hexadecimal value:



Example 1:

When X0.0 is ON, the binary values in D10~D14 are subtracted from the binary values in D0~D4, and the differences are stored in D100~D104.

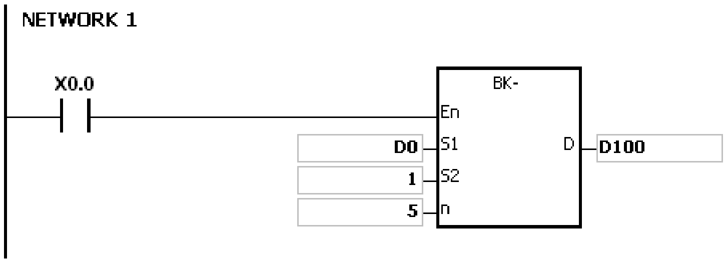


Execution result

D0	5		D10	1		D100	4		1
D1	4		D11	2		D101	2		SM600
D2	3	-	D12	3	⇨	D102	0		
D3	2		D13	4		D103	−2		
D4	1		D14	5		D104	−4		

Example 2:

When X0.0 is ON, the subtrahend 1 is subtracted from the binary values in D0~D4, and the differences are stored in D100~D104.



Execution result

D0	10		1		D100	9
D1	9		1		D101	8
D2	8	-	1	⇨	D102	7
D3	7		1		D103	6
D4	6		1		D104	5

Additional remark:

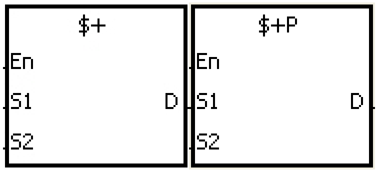
1. If the devices $\mathbf{S_1}$~$\mathbf{S_1}$**+n**-1, $\mathbf{S_2}$~$\mathbf{S_2}$**+n**-1, or **D**~**D+n**-1 exceed the device range, the instruction is not executed, SM is ON, and the error code in SR0 is 16#2003.
2. If **n**<1 or **n**>256, the instruction is not executed, SM0 is ON,and the error code in SR0 is 16#200B.
3. If $\mathbf{S_1}$~$\mathbf{S_1}$**+n**-1 overlap **D**~**D+n**-1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200C.
4. If $\mathbf{S_2}$~$\mathbf{S_2}$**+n**-1 overlap **D**~**D+n**-1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200C.
5. If $\mathbf{S_1}$~$\mathbf{S_1}$**+n**-1 overlap $\mathbf{S_2}$~$\mathbf{S_2}$**+n**-1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200C.

API	Instruction code			Operand	Function
0114		$+	P	**S_1, S_2, D**	Linking the strings

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●	○	●			○	
S_2	●	●			●	●		●	●		●	○	●			○	
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (7-19 steps)	32-bit instruction
AH500500	AH500500	-

Symbol:



S_1 : String 1 — Word

S_2 : String 2 — Word

D : Device in which the string is stored — Word

Explanation:

1. When the instruction is executed, the string starting with the data in the device specified by **S_1** (exclusive of 16#00), and the string starting with the data in the device specified by **S_2** (exclusive of 16#00) are linked and moved to the operand **D**. Besides, the code 16#00 is added to the end of the linked string in the operand **D**. When the instruction is not executed, the data in **D** is unchanged.
2. The string in the operand **S_1** and the string in the operand **S_2** are linked and moved to the operand **D**, as illustrated below.

S1	b(16#62)	a(16#61)
S1 +1	d(16#64)	c(16#63)
S1 +2	(16#00)	e(16#65)

S2	B(16#42)	A(16#41)
S2 +1	D(16#44)	C(16#43)
S2 +2	(16#00)	(16#00)

=

D	b(16#62)	a(16#61)
D +1	d(16#64)	c(16#63)
D +2	A(16#41)	e(16#65)
D +3	C(16#43)	B(16#42)
D +4	(16#00)	D(16#44)

Turning into 16#00 automatically

S1	b(16#62)	a(16#61)
S1 +1	d(16#64)	c(16#63)
S1 +2	e(16#65)	(16#00)

S2	B(16#42)	A(16#41)
S2 +1	D(16#44)	C(16#43)
S2 +2	(16#00)	(16#00)

=

D	b(16#62)	a(16#61)
D +1	d(16#64)	c(16#63)
D +2	B(16#42)	A(16#41)
D +3	D(16#44)	C(16#43)
D +4	(16#00)	(16#00)

Turning into 16#00 automatically

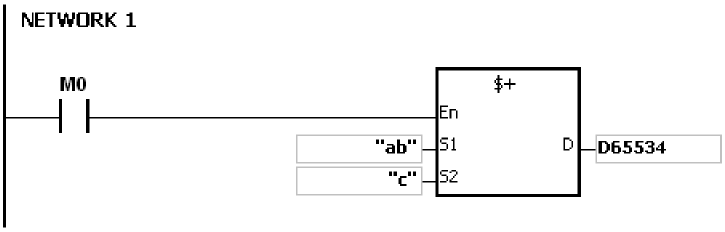
3. When **S_1** or **S_2** is not a string, the code 16#00 should be added to the end of the data which is moved.
4. Suppose **S_1** or **S_2** is not a string. When the instruction is executed and the first character is the code 16#00, 16#00 is still linked and moved.

5. For a string “abcde” in **S₁** will be shown as below.

S_1	b(16#62)	a(16#61)
S_1 +1	d(16#64)	c(16#63)
S_1 +2	(16#00)	e(16#65)

Example:

Suppose $\mathbf{S_1}$ is the string “ab” and $\mathbf{S_2}$ is the string “c”. After the conditional contact M0 is enabled, the data in D65534 is 16#6261, and the data in D65535 is 16#0063.



Additional remark:

1. If $\mathbf{S_1}$ or $\mathbf{S_2}$ is a string, at most 31 characters can be moved. For a string, the number of steps=1+(the number of characters +1)/4 (The value will be rounded up to the nearest whole digit if (the number of characters +1) is not divisible by 4.).

Number of characters	1~3	4~7	8~11	12~15	16~19	20~23	24~27	28~31
Number of steps	2	3	4	5	6	7	8	9

Example: For $+“ABCDE” D0 D100, the number of steps= 1 (instruction)+3 (string)+2 (D0)+2 (D100)=8.

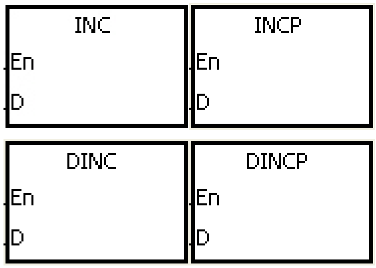
2. If **D** is not sufficient to contain the string composed of the strings in $\mathbf{S_1}$ and $\mathbf{S_2}$, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If $\mathbf{S_1}$ or $\mathbf{S_2}$ overlaps **D**, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200C.
4. If the string in $\mathbf{S_1}$ or $\mathbf{S_2}$ does not end with 16#00, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200E.

API	Instruction code			Operand	Function
0115	D	INC	P	**D**	Adding one to the binary number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction (3 steps)
AH500	AH500	AH500

Symbol:



D : Destination device Word/Double word

Explanation:

1. One is added to the value in **D**.
2. Only the instruction DINC can use the 32-bit counter.
3. When the 16-bit operation is performed, 32,767 plus 1 equals -32,768. When the 32-bit operation is performed, 2,147,483,647 plus 1 equals -2,147,483,648.

Example:

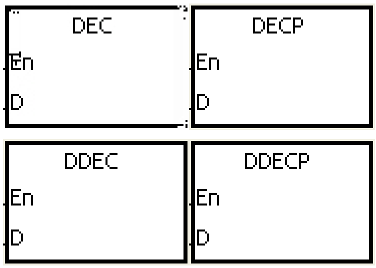
When X0.0 is switched from OFF to ON, the value in D0 increases by one.

API	Instruction code			Operand	Function
0116	D	DEC	P	**D**	Subtracting one from the binary number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction (3 steps)
AH500	AH500	AH500

Symbol:



D : Destination device Word/Double word

Explanation:

1. One is subtracted from the value in **D**.
2. Only the instruction DDEC can use the 32-bit counter.
3. When the 16-bit operation is performed, -32,768 minus 1 leaves 32,767. When the 32-bit operation is performed, -2,147,483,648 minus 1 leaves 2,147,483,647.

Example:

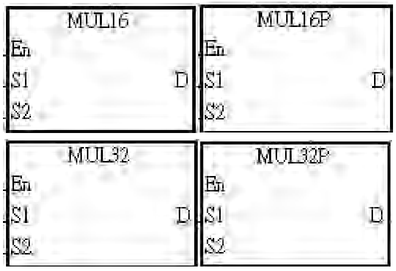
When X0.0 is switched from OFF to ON, the value in D0 decreases by one.

API	Instruction code			Operand	Function
0117		MUL16 MUL32	P	**S_1 · S_2 · D**	Multiplication of binary numbers for 16-bit/32-bit

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



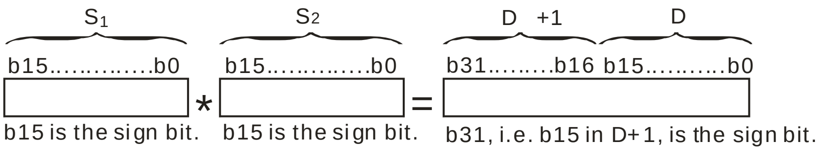
S_1 : Multiplicand Word/Double Word

S_2 : Multiplier Word/Double Word

D : Product Word/Double Word

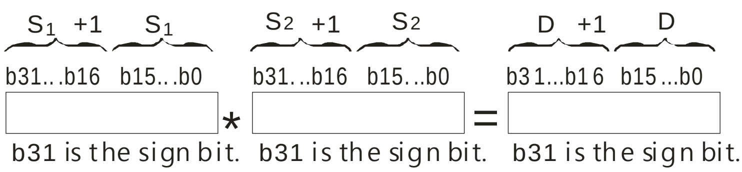
Explanation:

1. The signed binary value in **S_1** is multiplied by the singed binary value in **S_2**, and the product is stored in **D**.
2. Only the instruction MUL32 can use the 32-bit counter.
3. The multiplication of 16-bit binary values:



The product is a 16-bit value, and is stored in the register (D), which is composed of 16 bits. When the sign bit b15 is 0, the product is a positive value. When the sign bit b15 is 1, the product is a negative value.

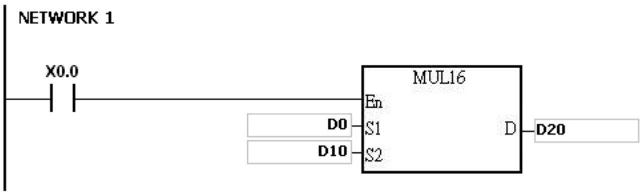
4. The multiplication of 32-bit binary values:



The product is a 32-bit value, and is stored in the register (D+1, D), which is composed of 32 bits. When the sign bit b31 is 0, the product is a positive value. When the sign bit b31 is 1, the product is a negative value.

Example:

The 16-bit value in D0 is multiplied by the 16-bit value in D10, and the 16-bit product is stored in (D20). Whether the result is a positive value or a negative value depends on the state of the highest bit b15. When b15 is OFF, the result is a positive value. When b15 is ON, the result is a negative value.



D0×D10=D20
16-bit value×16-bit value=16-bit value

Additional remark:

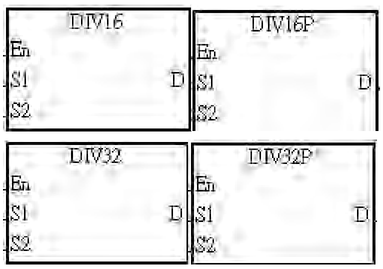
1. When the 16-bit product exceeds the range of what a16-bit singed value can be shown, for example a 16-bit product is either bigger than the maximum positive value (K32767) or smaller than the maximum negative value (K-32768), set the SM602 (carry flag) to ON and only write the lower 16-bit data.
2. Please use API0102*/*P instruction for a complete multiplication result of 16-bit values (recorded as 32-bit). Refer to API0102*/*P instruction for details.
3. When the 32-bit product exceeds the range of what a 32-bit singed value can be shown, for example a 32-bit product is either bigger than the maximum positive value (K2147483647) or smaller than the maximum negative value (K-2147483648), set the SM602 (carry flag) to ON and only write the lower 32-bit data.
4. Please use API0102 D*/D*P instruction for a complete multiplication result of 32-bit values (recorded as 64-bit). Refer to API0102 D*/D*P instruction for details.

API	Instruction code			Operand	Function
0118		DIV16 DIV32	P	**S₁** · **S₂** · **D**	Division of binary numbers for 16-bit/32-bit

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●	●			●	●	●	●	●		●	○	●	●	●		
S_2	●	●			●	●	●	●	●		●	○	●	●	●		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol：



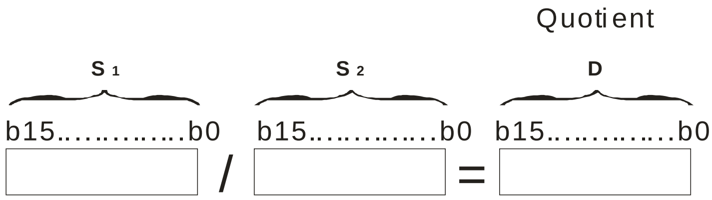
S_1 : Dividend Word/Double Word

S_2 : Divisor Word/Double Word

D : Quotient Word/Double Word

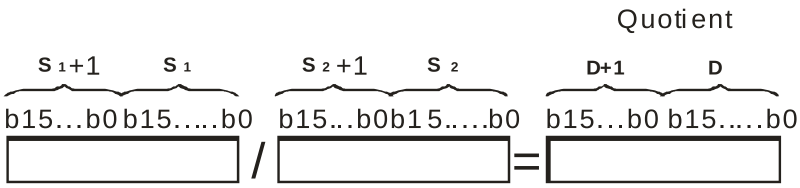
Explanation:

1. The singed binary value in **S_1** is divided by the signed binary value in **S_2**. The quotient and the remainder are stored in **D**.
2. Only the 32-bit instructions can use the 32-bit counter.
3. When the sign bit is 0, the value is a positive one. When the sign bit is 1, the value is a negative one.
4. The division of 16-bit values:



The quotient D occupies one consecutive device and the quotient is stored in **D.**

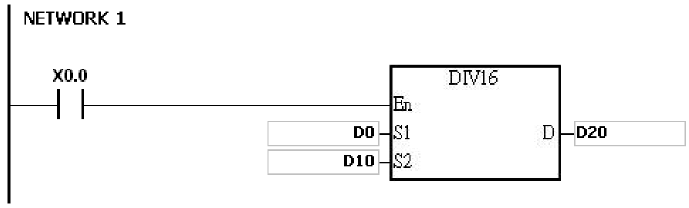
5. The division of 32-bit values:



The operand **D** occupies two devices. The quotient is stored in (**D**+1, **D)**

Example:

When X0.0 is ON, the dividend in D0 is divided by the divisor in D10, the quotient is stored in D20, and the remainder is stored in D21. Whether the result is a positive value or a negative value depends on the state of the highest bit.



Additional remark:

1. If the device exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the divisor is 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2012.
3. Please use API0103 instruction for recoding remainders. Refer to API0103 instruction for details.

6.3 Data Conversion Instructions

6.3.1 List of Data Conversion Instructions

API	Instruction code			Pulse instruction	Function	Step
	16-bit	32-bit	64-bit			
0200	BCD	DBCD	–	✓	Converting the binary number into the binary-coded decimal number	5
0201	BIN	DBIN	–	✓	Converting the binary-coded decimal number into the binary number	5
0202	FLT	DFLT	–	✓	Converting the binary integer into the binary floating-point number	5
0203	FLTD	DFLTD	–	✓	Converting the binary integer into the 64-bit floating-point number	5
0204	INT	DINT	–	✓	Converting the 32-bit floating-point number into the binary integer	5
0205	–	FINT	DFINT	✓	Converting the 64-bit floating-point number into the binary integer	5
0206	MMOV	–	–	✓	Converting the 16-bit value into the 32-bit value	5
0207	RMOV	–	–	✓	Converting the 32-bit value into the 16-bit value	5
0208	GRY	DGRY	–	✓	Converting the binary number into the Gray code	5
0209	GBIN	DGBIN	–	✓	Converting the Gray code into the binary number	5
0210	NEG	DNEG	–	✓	Two's complement	3
0211	–	FNEG	–	✓	Reversing the sign of the 32-bit floating-point number	3
0212	–	FBCD	–	✓	Converting the binary floating-point number into the decimal floating-point number	5
0213	–	FBIN	–	✓	Converting the decimal floating-point number into the binary floating-point number	5
0214	BKBCD	–	–	✓	Converting the binary numbers in blocks into the binary-coded decimal numbers in blocks	7
0215	BKBIN	–	–	✓	Converting the binary numbers in blocks into the binary-coded decimal numbers in blocks	7
0216	SCAL	–	–	✓	Scale value operation	9
0217	SCLP	DSCLP	–	✓	Parameter type of scale value operation	9
0218	LINE	DLINE	–	✓	Converting a column of data into a line of data	7
0219	COLM	DCOLM	–	✓	Converting a line of data into a column of data	7

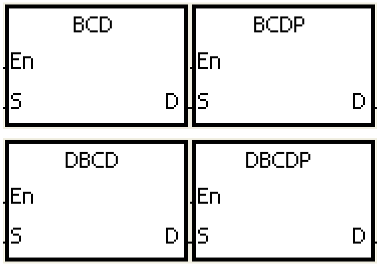
6.3.2 Explanation of Data Conversion Instructions

API	Instruction code			Operand	Function
0200	D	BCD	P	**S, D**	Converting the binary number into the binary-coded decimal number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●	○	●				
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Source device Word/Double word

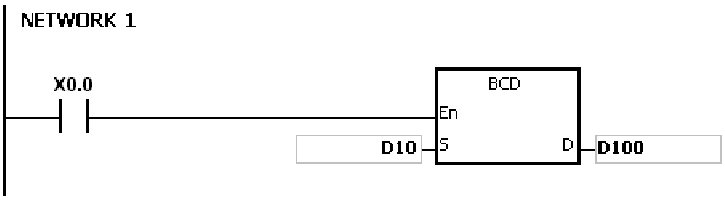
D : Conversion result Word/Double word

Explanation:

1. The binary value in **S** is converted into the binary-coded decimal value, and the conversion result is stored in **D**.
2. Only the instruction DBCD can use the 32-bit counter.
3. The four fundamental operations of arithmetic in the PLC, the instruction INC, and the instruction DEC all involve binary numbers. To show the decimal value on the display, users can use the instruction BCD to convert the binary value into the binary-coded decimal value

Example:

1. When X0.0 is ON, the binary value in D10 is converted into the binary-code decimal value, and the conversion result is stored in D100.



2. If D10=16#04D2=1234, the conversion result will be that D100=16#1234.

Additional remark:

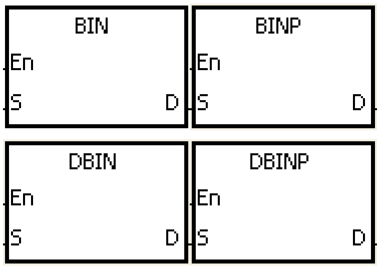
1. If the conversion result exceeds the range between 0 and 9,999, the instruction BCD is not executed, SM0 is ON, and the error code in SR0 is 16#200D (The binary-coded decimal value is represented by the hexadecimal value, but one of digits is not within the range between 0 and 9.).
2. If the conversion result exceeds the range between 0 and 99,999,999, the instruction DBCD is not executed, SM0 is ON, and the error code in SR0 is 16#200D (The binary-coded decimal value is represented by the hexadecimal value, but one of digits is not within the range between 0 and 9.).

API	Instruction code			Operand	Function
0201	D	BIN	P	**S, D**	Converting the binary-coded decimal number into the binary number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●	○	●				
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Source device Word/Double word

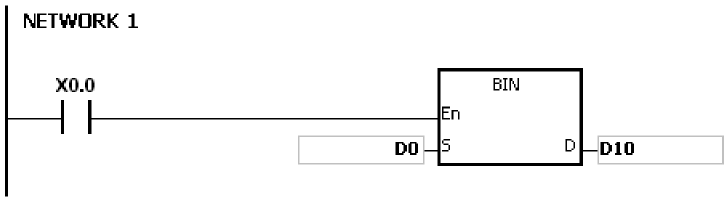
D : Conversion result Word/Double word

Explanation:

1. The binary-coded decimal value in **S** is converted into the binary value, and the conversion result is stored in **D**.
2. The 16-bit binary-coded decimal value in **S** should be within the range between 0 and 9,999, and the 32-bit binary-coded decimal value in **S** should be within the range between 0 and 99,999,999.
3. Only the 32-bit instructions can use the 32-bit counter.
4. Constants and hexadecimal values are converted into binary values automatically. Therefore, users do not need to use the instruction.

Example:

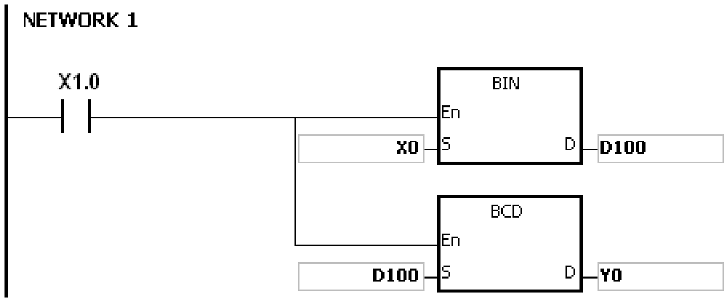
When X0.0 is ON, the binary-coded decimal value in D0 is converted into the binary value, and the conversion result is stored in D10.

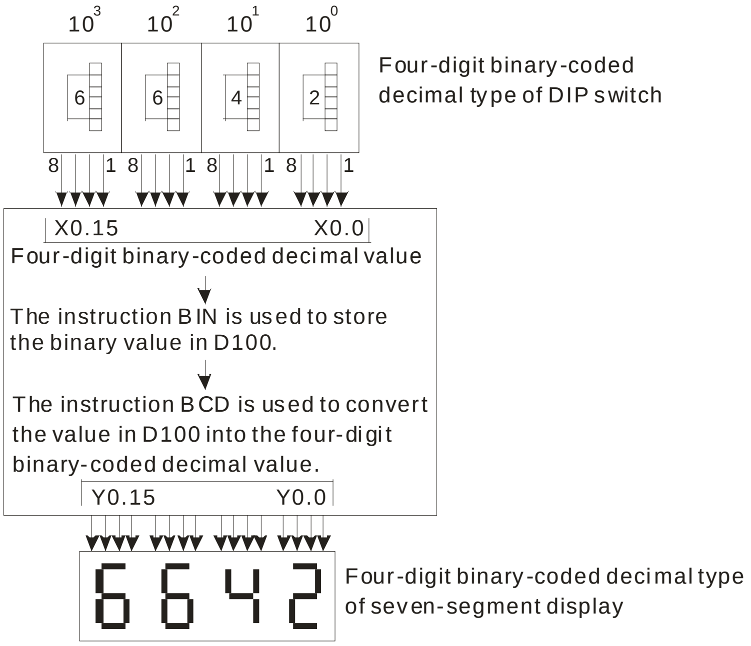


Additional remark:

1. If the value in **S** is not the binary-coded decimal value, the operation error occurs, SM0 is ON, and the error code in SR0 is 16#200D (The binary-coded decimal value is represented by the hexadecimal value, but one of digits is not within the range between 0 and 9.).
2. The application of the instructions BCD and BIN:
   - Before the value of the binary-coded decimal type of DIP switch is read into the PLC, users have to use the instruction BIN to convert the data into the binary value and store the conversion result in the PLC.

- If users want to display the data stored inside the PLC in a seven-segment display of the binary-coded decimal type, they have to use the instruction BCD to convert the data into the binary-coded decimal value before the data is sent to the seven-segment display.
- When X1.0 is ON, the binary-coded decimal value in X0.0~X0.15 is converted into the binary value, and the conversion result is stored in D100. Subsequently, the binary value in D100 is converted into the binary-coded decimal value, and the conversion result is stored in Y0.0~Y0.15.



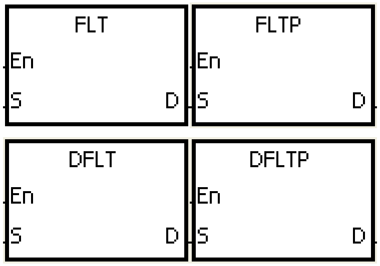


API	Instruction code			Operand	Function
0202	D	FLT	P	**S, D**	Converting the binary integer into the binary floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●	○	●				
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Source device — Word/Double word

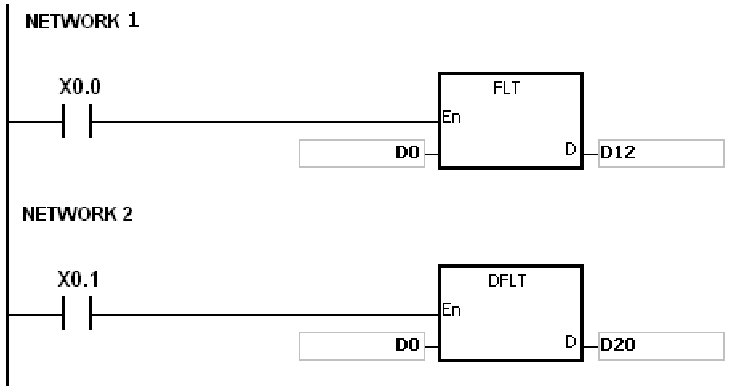
D : Conversion result — Double word

Explanation:

1. The instruction is used to convert the binary integer into the single-precision floating-point number.
2. The operand **S** used in the instruction FLT can not be the 32-bit counter.
3. The source device **S** used in the instruction FLT occupies one register, and **D** used in FLT occupies two registers.
4. The source device **S** used in the instruction DFLT occupies two registers, and **D** used in DFLT also occupies two registers.
   - When the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, SM602 is ON, and the maximum floating-point number is stored in **D**.
   - When the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, SM601 is ON, and the minimum floating-point number is stored in **D**.
   - When the conversion result is zero, SM600 is ON.

Example 1:

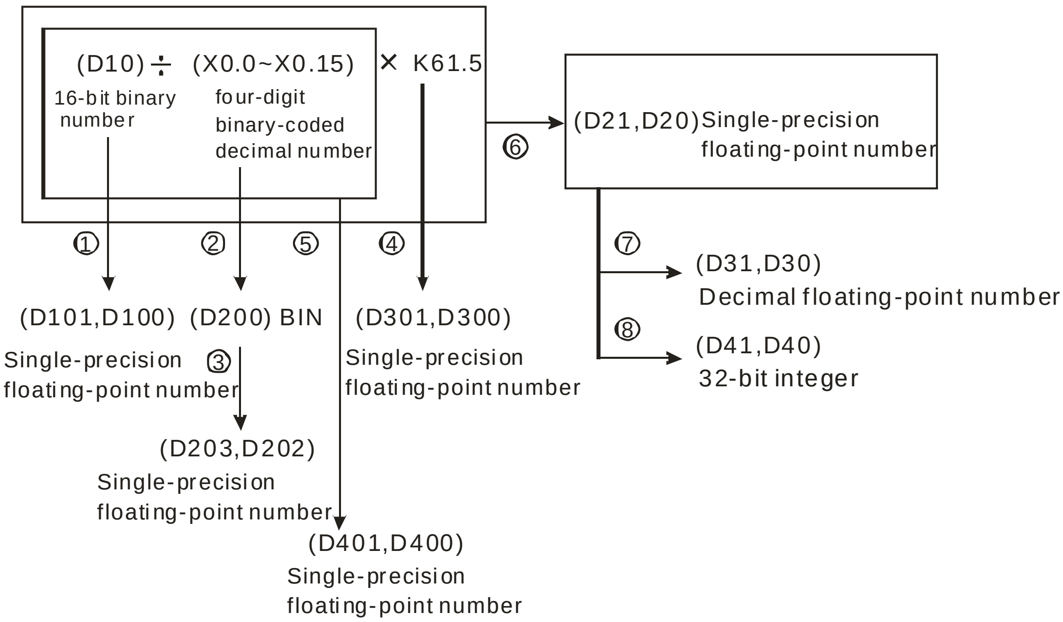
1. When X0.0 is ON, the binary integer in D0 is converted into the single-precision floating-point number, and the conversion result is stored in (D13, D12).
2. When X0.1 is ON, the binary integer in (D1, D0) is converted into the single-precision floating-point number, and the conversion result is stored in (D21, D20).
3. Suppose the value in D0 is 10. When X0.0 is ON, 10 is converted into the single-precision floating-point number 16#41200000, and 16#41200000 is stored in the 32-bit register (D13, D12).
4. Suppose the value in the 32-bit register (D1, D0) is 100,000. When X0.1 is ON, 100,000 is converted into the single-precision floating-point number 16#47C35000, 16#47C35000 is stored in the 32-bit register (D21, D20).

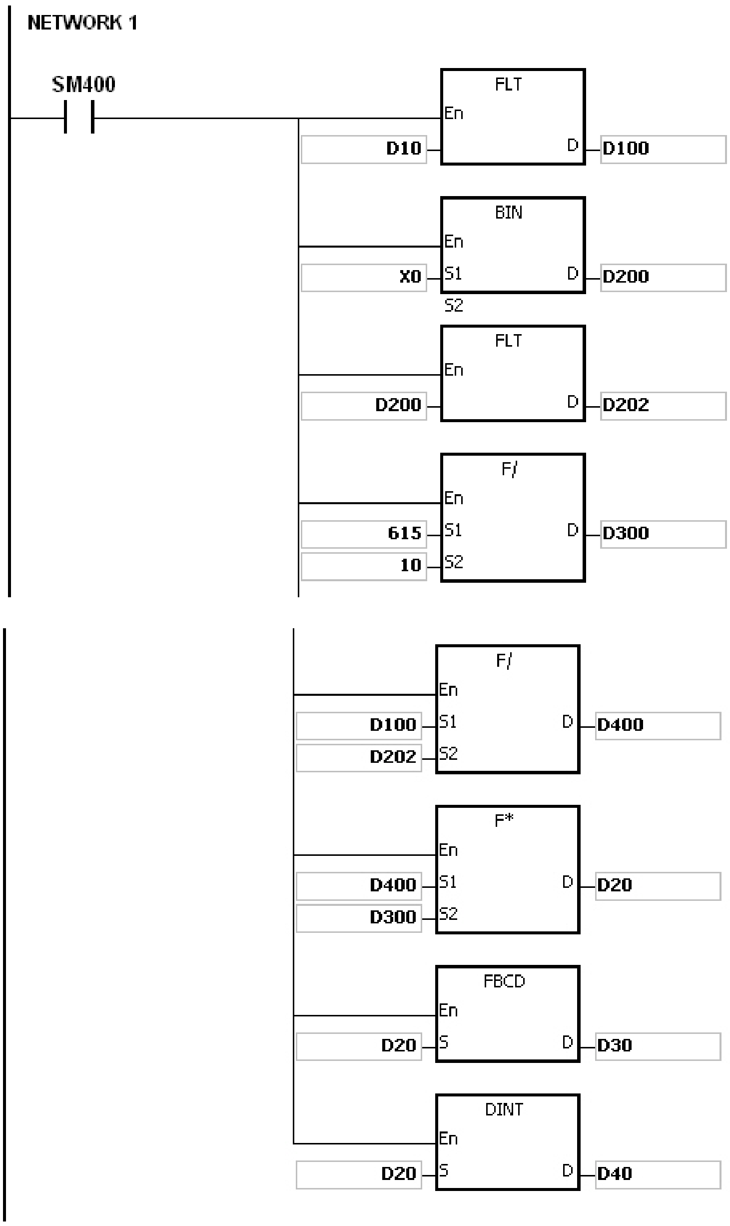


Example 2:

Users can use the applied instructions to perform the following calculation.

- The binary integer in D10 is converted into the single-precision floating-point number, and the conversion result is stored in (D101, D100).
- The binary-coded decimal value in X0.0~X0.15 is converted into the binary value, and the conversion result is stored in D200.
- The binary integer in D200 is converted into the single-precision floating-point number, and the conversion result is stored in (D203, D202).
- The constant 615 is divided by the constant 10, and the quotient which is the single-precision floating-point number is stored in (D301, D300).
- The single-precision floating-point number in (D101, D100) is divided by the single-precision floating-point number in (D203, D202), and the quotient which is the single-precision floating-point number is stored in (D401, D400).
- The single-precision floating-point number in (D401, D400) is multiplied by the single-precision floating-point number in (D301, D300), and the product which is the single-precision floating-point number is stored in (D21, D20).
- The single-precision floating-point number in (D21, D20) is converted into the decimal floating-point number, and the conversion result is stored in (D31, D30).
- The single-precision floating-point number in (D21, D20) is converted into the binary integer, and the conversion result is stored in (D41, D40).



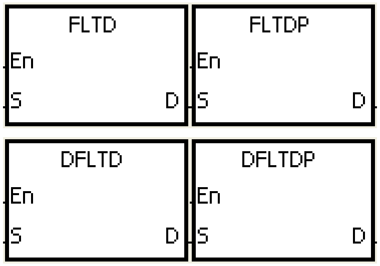

NETWORK 1
SM400
FLT
En
D10
D
D100
BIN
En
X0
S1
D
D200
S2
FLT
En
D200
D
D202
F/
En
615
S1
D
D300
10
S2
F/
En
D100
S1
D
D400
D202
S2
F*
En
D400
S1
D
D20
D300
S2
FBCD
En
D20
S
D
D30
DINT
En
D20
S
D
D40

API	Instruction code			Operand	Function
0203	D	FLTD	P	**S, D**	Converting the binary integer into the 64-bit floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●	○	●				
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Source device Word/Double word

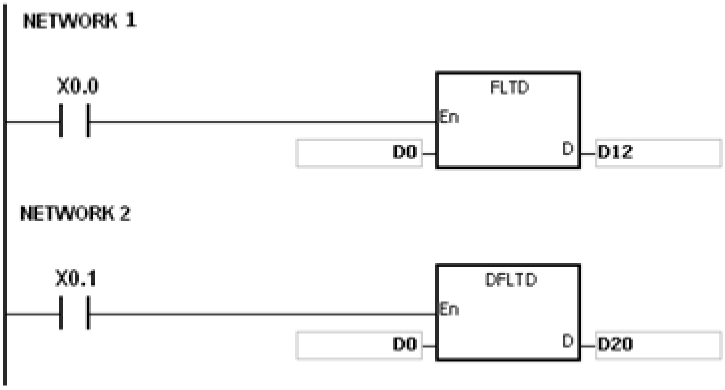
D : Conversion result Long word

Explanation:

1. When the instruction is executed, the binary integer is converted into the double-precision floating-point number.
2. The operand **S** used in the instruction FLTD can not be the 32-bit counter.
3. The source device **S** used in the instruction FLTD occupies one register, and **D** used in FLTD occupies four registers.
4. The source device **S** used in the instruction DFLTD occupies two registers, and **D** used in DFLTD occupies four registers.
5. When the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, SM602 is ON, and the maximum floating-point number is stored in **D**.
6. When the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, SM601 is ON, and the minimum floating-point number is stored in **D**.
7. When the conversion result is zero, SM600 is ON.

Example:

1. When X0.0 is ON, the 16-bit binary integer in D0 is converted into the double-precision floating-point number, and the conversion result is stored in (D15, D14, D13, D12).
2. When X0.1 is ON, the 32-bit binary integer in (D1, D0) is converted into the double-precision floating-point number, and the conversion result is stored in (D23, D22, D21, D20).
3. Suppose the 16-bit binary integer in D0 is 10. When X0.0 is ON, 10 is converted into 16#4024000000000000, and 16#4024000000000000 is stored in the 64-bit register (D15, D14, D13, D12).
4. Suppose the 32-bit binary integer in (D1, D0) is 100,000. When X0.1 is ON, 100,000 is converted into 16#40F86A0000000000, and 16#40F86A0000000000 is stored in the 64-bit register (D23, D22, D21, D20).

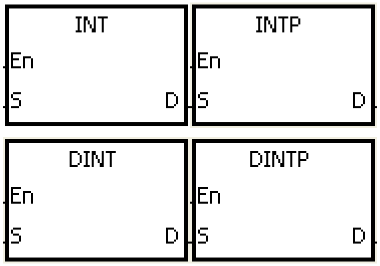

NETWORK 1
X0.0
FLTD
En
D0
D
D12
NETWORK 2
X0.1
DFLTD
En
D0
D
D20

API	Instruction code			Operand	Function
0204	D	INT	P	**S, D**	Converting the 32-bit floating-point number into the binary integer

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●	○	●				
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Source device Double word

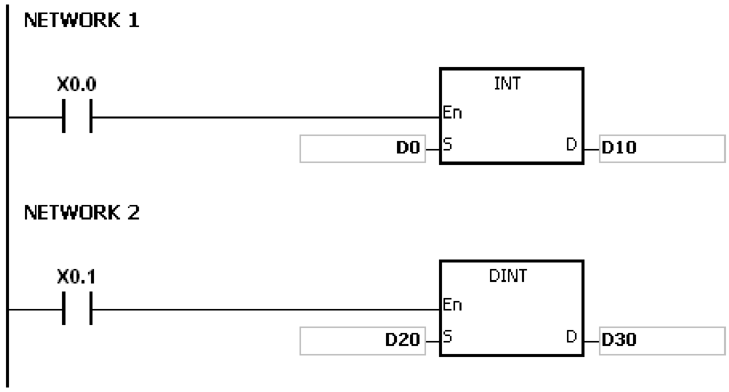
D : Conversion result Word/Double word

Explanation:

1. The single-precision floating-point number in the register specified by **S** is converted into the binary integer. The binary floating-point number is rounded down to the nearest whole digit, and becomes the bianry integer. The binary integer is stored in the register specified by **D**.
2. The source device **S** used in the instruction INT occupies two registers, and **D** used in INT occupies one register.
3. The source device **S** used in the instruction DINT occupies two registers, and **D** used in DINT also occupies two registers.
4. The operand **D** used in the instruction INT can not be the 32-bit counter.
5. The instruction INT is the opposite of the instruction FLT.
6. When the conversion result is zero, SM600 is ON.
7. During the conversion, if the floating-point number is rounded down to the nearest whole digit, SM601 will be ON.
8. When the conversion result exceeds the range, SM602 is ON.
9. For the instruction INT/IINTP, the range of conversion results is between -32,768 and 32,767.
10. For the instruction DINT/DINTP, the range of conversion results is between -2,147,483,648 and 2,147,483,647.

Example:

1. When X0.0 is ON, the single-precision floating-point number in (D1, D0) is converted into the binary integer, and the conversion result is stored in D10. The binay floating-point number is rounded down to the nearest whole digit.
2. When X0.1 is ON, the single-precision floating-point number in (D21, D20) is converted into the binary integer, and the conversion result is stored in (D31, D30). The binary floating-point number is rounded down to the nearest whole digit.



Additional remark:

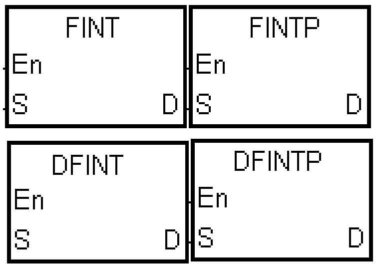
If the value in **S** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.

API	Instruction code			Operand	Function
0205	D	FINT	P	**S, D**	Converting the 64-bit floating-point number into the binary integer

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●	○	●				
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Source device Long word

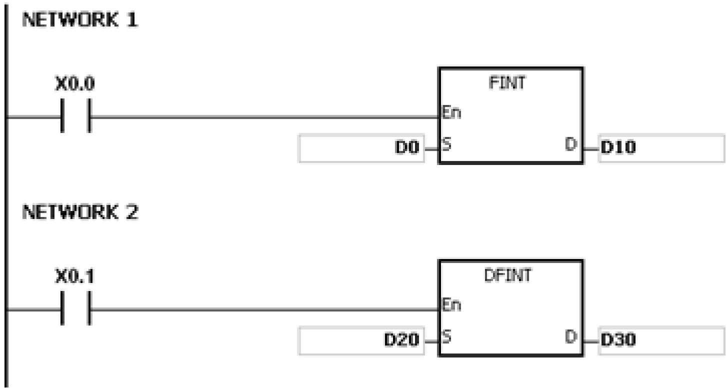
D : Conversion result Word/Double word

Explanation:

1. The double-precision floating-point number in the register specified by **S** is converted into the binary integer. The binary floating-point number is rounded down to the nearest whole digit, and becomes the bianry integer. The binary integer is stored in the register specified by **D**.
2. The source device **S** used in the instruction FINT occupies four registers, and **D** used in FINT occupies one register.
3. The source device **S** used in the instruction DFINT occupies four registers, and **D** used in DFINT occupies two registers.
4. The operand **D** used in the instructions FINT and FLTP can not be the 32-bit counter.
5. The instruction FINT is the opposite of the instruction FLTD.
6. When the conversion result is zero, SM600 is ON.
7. During the conversion, if the floating-point number is rounded down to the nearest whole digit, SM601 will be ON.
8. When the conversion result exceeds the range, SM602 is ON.
   For the instruction FINT/FINTP, the range of conversion results is between -32,768 and 32,767.
   For the instruction DFINT/DFINTP, the range of conversion results is between -2,147,483,648 and 2,147,483,647.

Example:

1. When X0.0 is ON, the double-precision floating-point number in (D3, D2, D1, D0) is converted into the binary integer, and the conversion result is stored in D10. The binay floating-point number is rounded down to the nearest whole digit.
2. When X0.1 is ON, the double-precision floating-point number in (D23, D22, D21, D20) is converted into the binary integer, and the conversion result is stored in (D31, D30). The binay floating-point number is rounded down to the nearest whole digit.

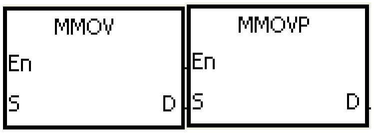

NETWORK 1
X0.0
FINT
En
D0
S
D
D10
NETWORK 2
X0.1
DFINT
En
D20
S
D
D30

API	Instruction code			Operand	Function
0206		MMOV	P	S, D	Converting the 16-bit value into the 32-bit value

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Source device Word

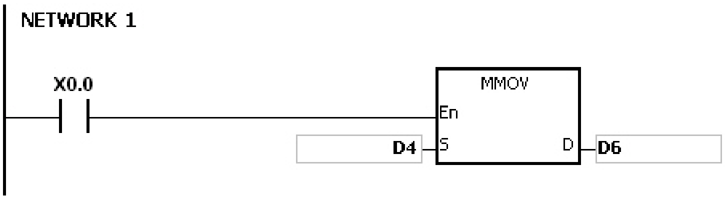
D : Conversion result Double word

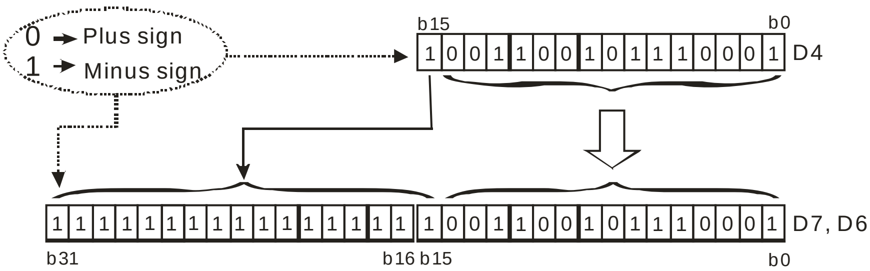
Explanation:

The data in the 16-bit device **S** is transmitted to the 32-bit device **D**. The sing bit which is specified is copied repeatedly to the destination.

Example:

When X0.0 is ON, the value of b15 in D4 is transmitted to b15~b31 in (D7, D6). The data in (D7, D6) becomes a negative value.



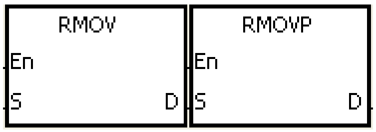


API	Instruction code			Operand	Function
0207		RMOV	P	S, D	Converting the 32-bit value into the 16-bit value

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Source device Double word

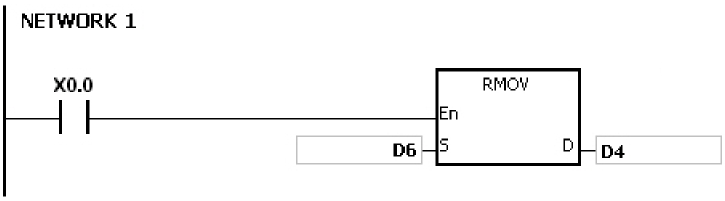
D : Conversion result Word

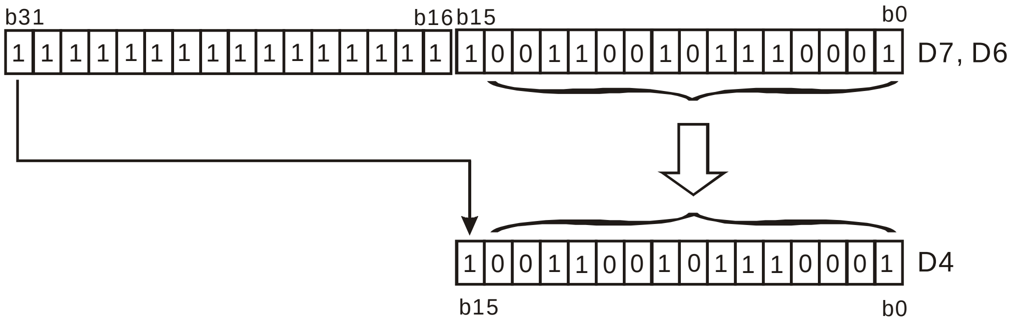
Explanation:

The data in the 32-bit device **S** is transmitted to the 16-bit device **D**. The sing bit which is specified is retained.

Example:

When X0.0 is ON, the value of b31 in D7 is transmitted to b15 in D4, the values of b0~b14 are transmitted to the corresponding bits, and the values of b15~b30 are ignored.



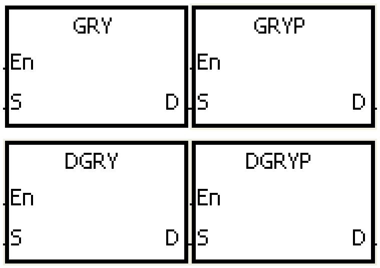


API	Instruction code			Operand	Function
0208	D	GRY	P	**S, D**	Converting the binary number into the Gray code

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Source device Word/Double word

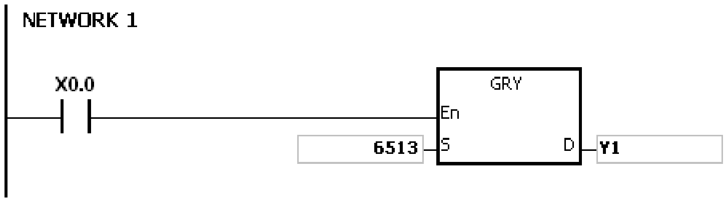
D : Conversion result Word/Double word

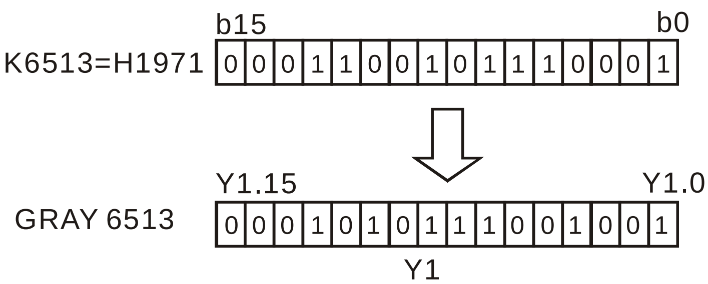
Explanation:

1. The binary value in the device specified by **S** is converted into the Gray code, and the conversion result is stored in the device specified by **D**.
2. Only the instruction DGRY can use the 32-counter.
3. The value in the operand **S** should be within the available range.
   The value in the operand **S** used in the 16-bit instruction should be within the range between 0 and 32,767.
   The value in the operand **S** used in the 32-bit instruction should be within the range between 0 and 2,147,483,647.

Example:

When X0.0 is ON, the constant 6513 is converted into the Gray code, and the conversion result is stored in Y1.0~Y1.15.





Additional remark:

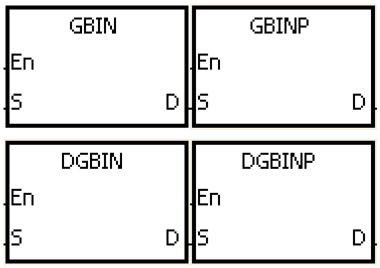
If the value in **S** is less than 0, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API		Instruction code			Operand	Function
0209		D	GBIN	P	S, D	Converting the Gray code into the binary number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Source device Word/Double word

D : Conversion result Word/Double word

Explanation:

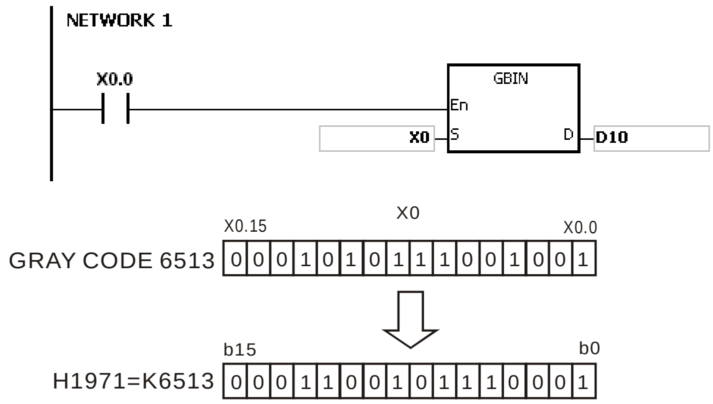
1. The Gray code in the device specified by **S** is converted into the binary value, and the conversion result is stored in the device specified by **D**.
2. The instruction is used to convert the Gary code in the absolute position encoder which is connected to the input terminal of the PLC to the binary value, and the conversion result is stored in the register which is specified.
3. The value in the operand **S** should be within the available range.

   The value in the operand **S** used in the 16-bit instruction should be within the range between 0 and 32,767.

   The value in the operand **S** used in the 32-bit instruction should be within the range between 0 and 2,147,483,647.

Example:

When X0.0 is ON, the Gary code in the absolute position encoder which is connected to the inputs X0.0~X0.15 is converted into the binary value, and the conversion result is stored in D10.



Additional remark:

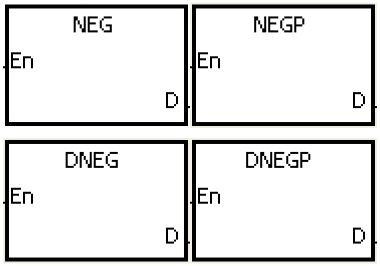
If the value in **S** is less than 0, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
0210	D	NEG	P	**D**	Two's complement

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction (3 steps)
AH500	AH500	AH500

Symbol:



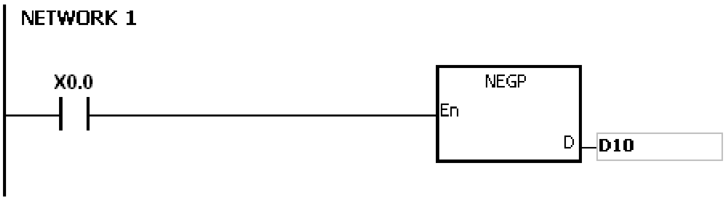
D :	Device in which the two's complement is stored	Word/Double word

Explanation:

1. The instruction is used to convert the negative binary value into the absolute value.
2. Only the instruction DNEG can use the 32-bit counter.
3. Generally, the pulse instructions NEGP and DNEGP are used.

Example 1:

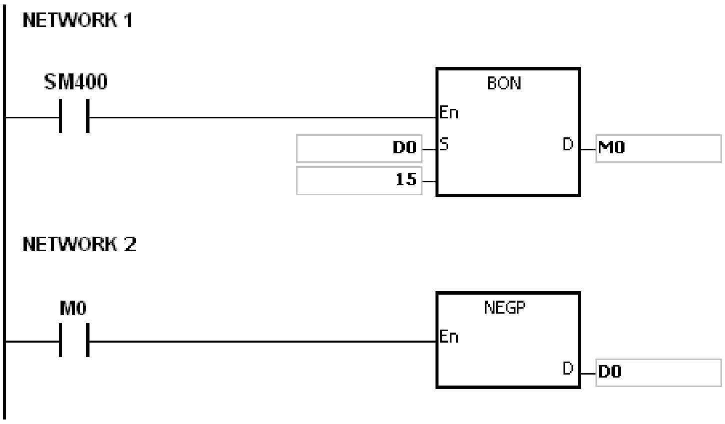
When X0.0 is switched from OFF to ON, all bits in D0 are inverted (0 becomes 1, and 1 becomes 0), and 1 is added to the result. The final value is stored in the original register D10.



Example 2:

The absolute value of the negative value:

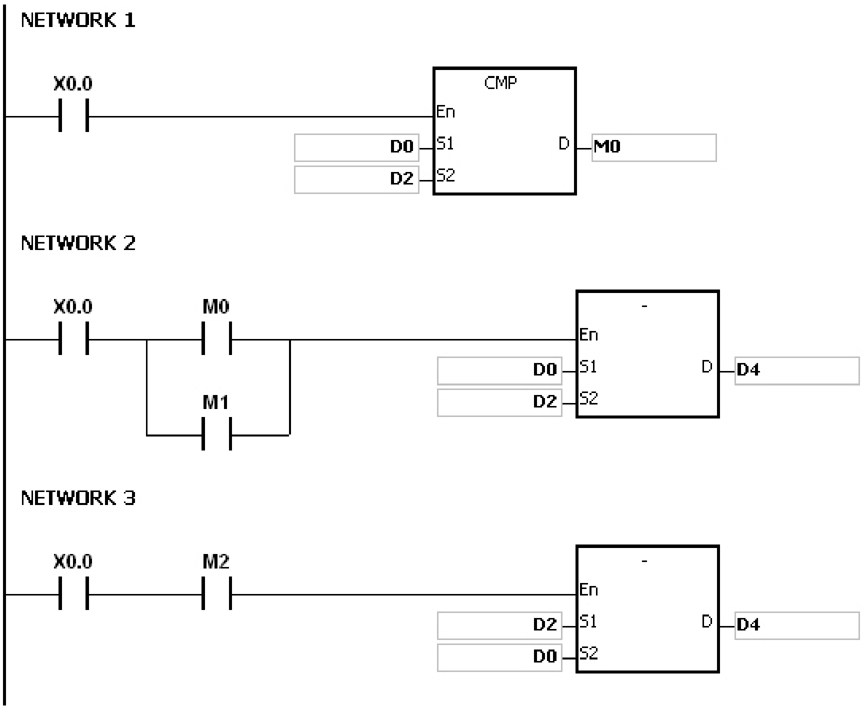
1. When the value of the 15th bit in D0 is 1, M0 is ON. (The value in D0 is a negative value.)
2. When M0 is ON, the instruction NEG is used to obtain the two's complement of the negative value in D0. (The corresponding positive value is obtained.)



Example 3:

The absolute value of the difference between two values:
Suppose X0.0 is ON.

1. When the value in D0 is greater than that in D2, M0 is ON.
2. When the value in D0 is equal to that in D2, M1 is ON.
3. When the value in D0 is less than that in D2, M2 is ON.
4. The value in D4 is a positive value.



Additional remark:

The representation of the value and its absolute value:

1. Whether the data is a positive value or a negative value depends on the value of the highest bit in the register. If the value of the highest in the register is 0, the data is a positive value. If it is 1, the data is a negative value.
2. The negative value can be converted into its absolute value by means of the instruction NEG.

(D0)=2

0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

(D0)=1

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

(D0)=0

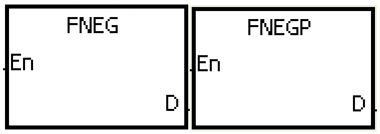
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

API	Instruction code			Operand	Function
0211		FNEG	P	**D**	Reversing the sign of the 32-bit floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	32-bit instruction (3 steps)	64-bit instruction
AH500	AH500	-

Symbol:



D : Device in which the sign of the value is reversed — Double word

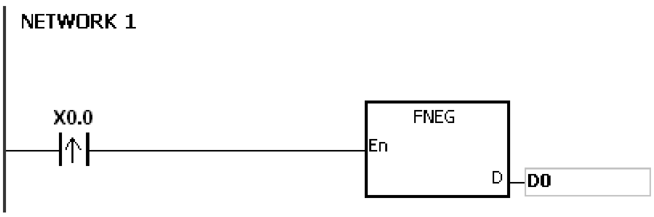
Explanation:

The sign of the single-precision floating-point number in the device **D** is reversed.

Example:

Before the instruction is executed, the value in (D1, D0) is the negative value 16#AE0F9000. When X0.0 is switched from OFF to ON, the sign of the single-precision floating-point number in (D1, D0) is reversed. In other words, after the instruction is executed, the value in (D1, D0) is the positive value 16#2E0F9000.

Before the instruction is executed, the value in (D1, D0) is the positive value 16#2E0F9000. When X0.0 is switched from OFF to ON, the sign of the single-precision floating-point number in (D1, D0) is reversed. In other words, after the instruction is executed, the value in (D1, D0) is the negative value 16#AE0F9000.

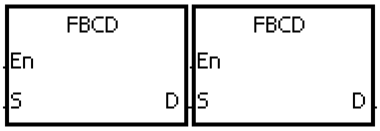


API	Instruction code			Operand	Function
0212		FBCD	P	**S, D**	Converting the binary floating-point number into the decimal floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●	○	●				
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction
AH500	AH500	-

Symbol:



S : Data source Double word

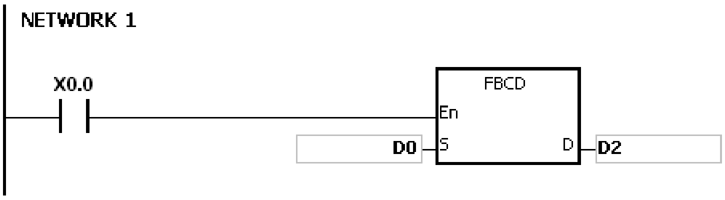
D : Conversion result Double word

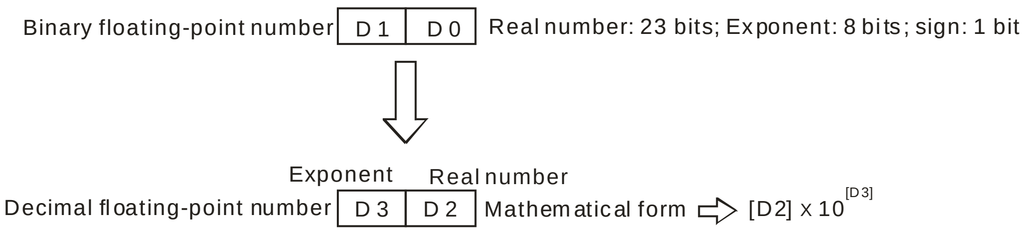
Explanation:

1. The single-precision floating-point number in the register specified by **S** is converted into the decimal floating-point number, and the conversion result is stored in the register specified by **D**.
2. The floating-point operation in the PLC is based on the single-precision floating-point numbers, and the instruction FBCD is used to convert the single-precision floating-point number into the decimal floating-point number.
3. The Flags: SM600 (zero flag), SM601 (borrow flag), and SM602 (carry flag)
   When the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, SM602 is ON.
   When the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, SM601 is ON.
   When the conversion result is zero, SM600 is ON.

Example:

When X0.0 is ON, the single-precision floating-point number in (D1, D0) is converted into the decimal floating-point number, and the conversion result is stored in (D3, D2).





Additional remark:

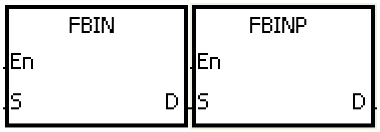
If the value in **S** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.

API	Instruction code			Operand	Function
0213		FBIN	P	**S, D**	Converting the decimal floating-point number into the binary floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●	○	●				
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction
AH500	AH500	-

Symbol:



S : Data source Double word

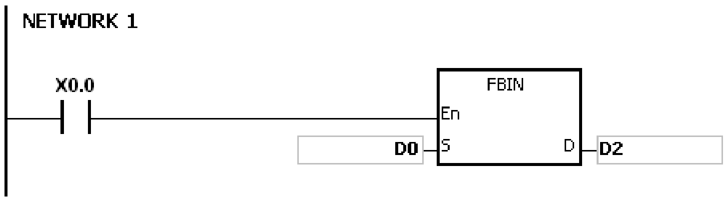
D : Conversion result Double word

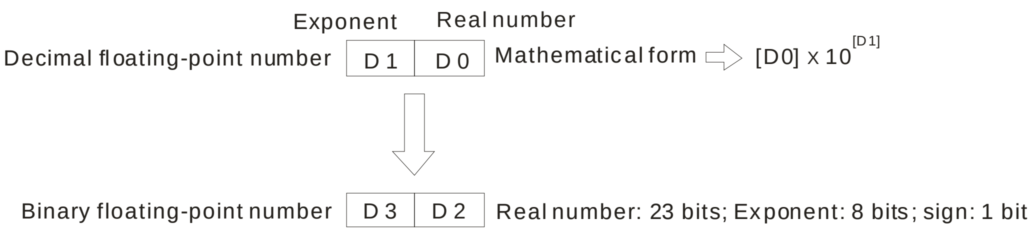
Explanation:

1. The decimal floating-point number in the register specified by **S** is converted into the single-precision floating-point number, and the conversion result is stored in the register specified by **D**.
2. Suppose the value in **S** is 1234, and the value in **S**+1 is 3. The value in **S** is converted into 1.234×10^6.
3. The value in **D** should be a single-precision floating-point number, and the values in **S** and **S**+1 represent the decimal real number and the decimal exponent respectively.
4. The instruction FBIN is used to convert the decimal floating-point number into the single-precision floating-point number.
5. The real number of decimal floating-point numbers range from -9,999 to +9,999, the exponents of decimal floating-point numbers range from -41 to +35, and the practical range of decimal floating-point numbers in PLC is between ±1175×10-41 and ±3402×10+35. When the operation result is zero, SM600 is ON.

Example 1:

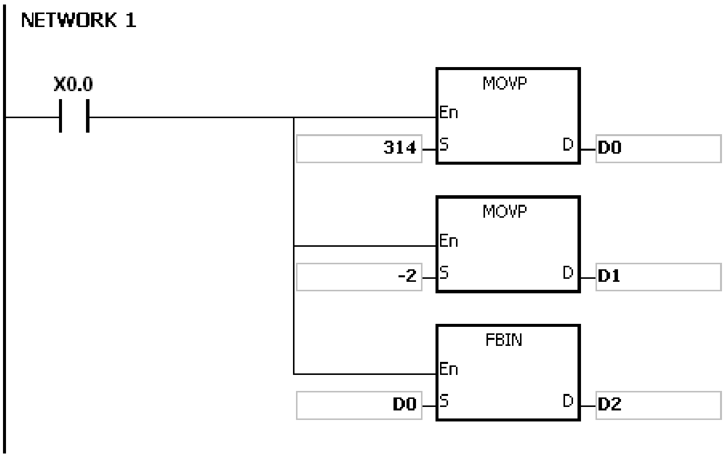
When X0.0 is ON, the decimal floating-point number in the register in (D1, D0) is converted into the single-precision floating-point number, and the conversion result is stored in (D3, D2).





Example 2:

1. Before the floating-point operation is performed, users have to use the instruction FLT to convert the binary integer into the single-precision floating-point number. The premise of the conversion is that the value converted in the binary integer. However, the instruction FBIN can be used to convert the floating-point number into the single-precision floating-point number.
2. When X0.0 is ON, K314 and K-2 are moved to D0 and D1 respectively, and combine into the decimal floating-point number ($3.14=314\times10^{-2}$).



Additional remark:

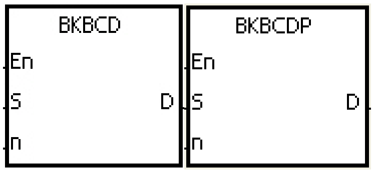
If the real number of the decimal floating-point number in the operand **S** is not within the range between -9,999 and +9,999, or if the exponent of the decimal floating-point number in the operand **S** is not within the range between -41 and +35, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.

API	Instruction code			Operand	Function
0214		BKBCD	P	**S, n, D**	Converting the binary numbers in blocks into the binary-coded decimal numbers in blocks

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●		●	●		●	○	●				
n	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Data source Word

n : Data length Word

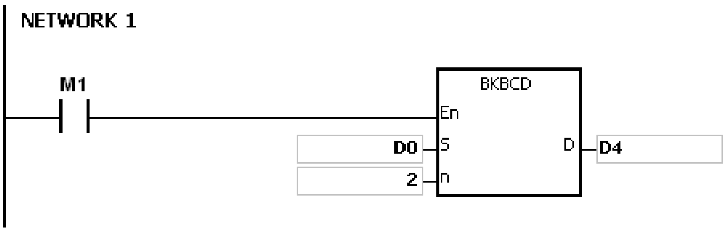
D : Conversion result Word

Explanation:

1. **n** pieces of data (the binary values) in devices starting from **S** are converted into the binary-coded decimal values, and the conversion results are stored in **D**.
2. The operand **n** should be within the range between 1 and 256.

Example:

When M1 is ON, the binary values in D0 and D1 are converted into the binary-coded decimal values, and the conversion results are stored in D4 and D5.



Additional remark:

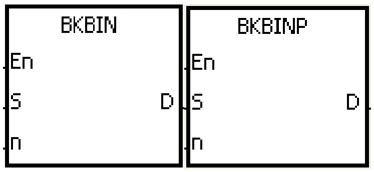
1. If **n** is less than 1, or when **n** is larger than 256, the instruction is not execute, SM0 is ON, and the error code in SR0 is 16#200B.
2. If the devices specified by **S**+**n**-1 and **D**+**n**-1 exceed the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the conversion result is not within the range between 0 and 9,999, the instruction is not executed, and the error code in SR0 is 16#200D (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.).
4. If **S**~**S**+**n**-1 overlap **D**~**D**+**n**-1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200C.

API	Instruction code			Operand	Function
0215		BKBIN	P	**S, n, D**	Converting the binary numbers in blocks into the binary-coded decimal numbers in blocks

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●				
n	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Data source — Word

n : Data length — Word

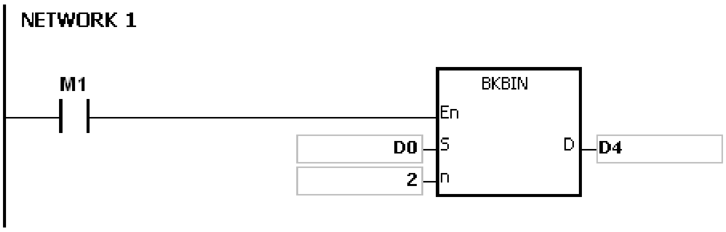
D : Conversion result — Word

Explanation:

1. **n** pieces of data (the binary-coded decimal values) in devices starting from **S** are converted into the binary values, and the conversion results are stored in **D**.
2. The binary-coded decimal value in **S** should be within the range between 0 and 9,999.
3. The operand **n** should be within the rang between 1 and 256.

Example:

When M1 is ON, the binary-code decimal values in D0 and D1 are converted into the binary values, and the conversion results are stored in D4 and D5.



Additional remark:

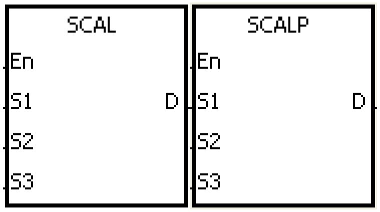
1. If **n** is less than 1, or when **n** is larger than 256, the instruction is not execute, SM0 is ON, and the error code in SR0 is 16#200B.
2. If the devices specified by **S**+**n**-1 and **D**+**n**-1 exceed the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the data in **S** is not the binary-coded decimal, the instruction is not executed, and the error code in SR0 is 16#200D (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.).
4. If **S**~**S**+**n**-1 overlap **D**~**D**+**n**-1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200C.

API		Instruction code		Operand	Function
0216		SCAL	P	**S_1, S_2, S_3, D**	Scale value operation

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●	○	●	○	○		
S_2	●	●			●	●		●	●		●	○	●	○	○		
S_3	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1 : Data source Word

S_2 : Slope Word

S_3 : Offset Word

D : Destination device Word

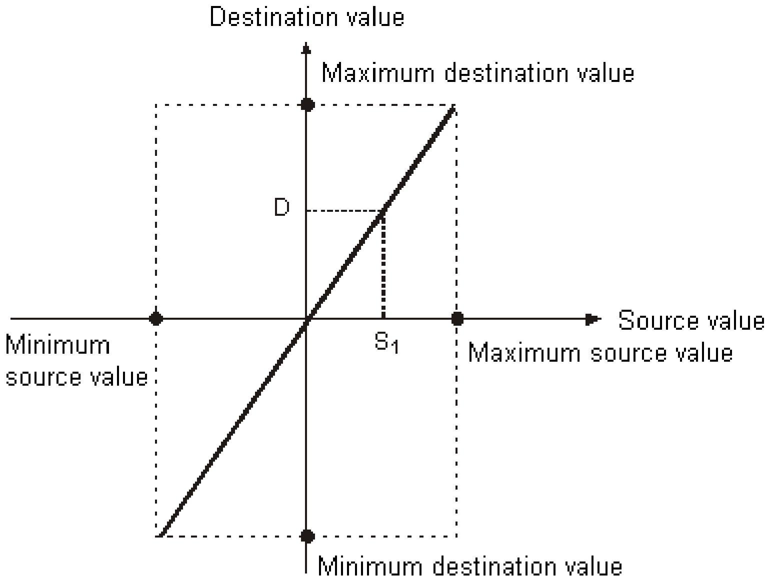
Explanation:

1. The operation equation in the instruction: **D**=(**S_1**×**S_2**)÷1,000+**S_3**
2. To obtain the values in **S_2** and **S_3**, users have to use the slope equation and the offset equation below first, and then round off the results to the nearest whole digit. The final 16-bit values are entered into **S_2** and **S_3**.

   The slope equation: **S_2**=[(Maximum destination value–Minimum destination value)÷(Maximum source value–Minimum source value)]×1,000

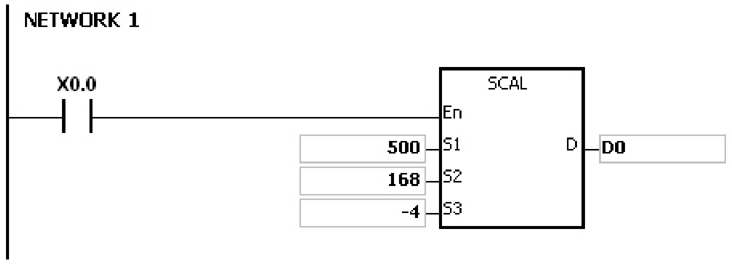
   The offset equation: **S_3**=Minimum destination value–Minimum source value×**S_2**÷1,000

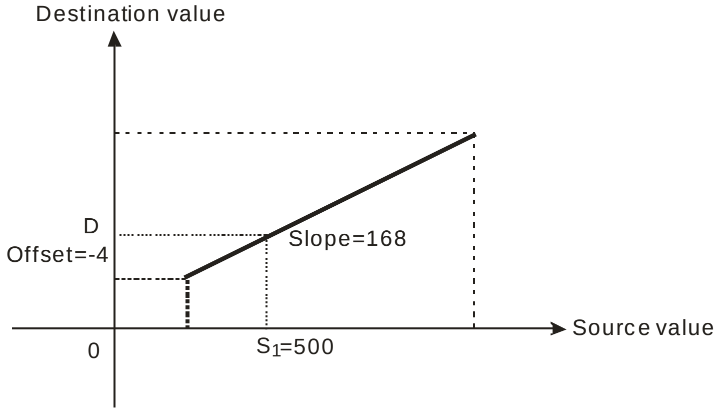
   The output curve is as shown below:



Example 1:

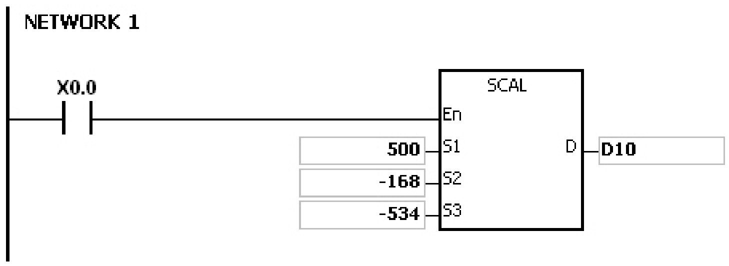
1. Suppose the values in $\mathbf{S_1}$, $\mathbf{S_2}$, and $\mathbf{S_3}$ are 500, 168, and -4 respectively. When X0.0 is ON, the instruction SCAL is executed, and the scale value is stored in D0.
2. The operation equation: D0=(500×168)÷1,000+(-4)=80

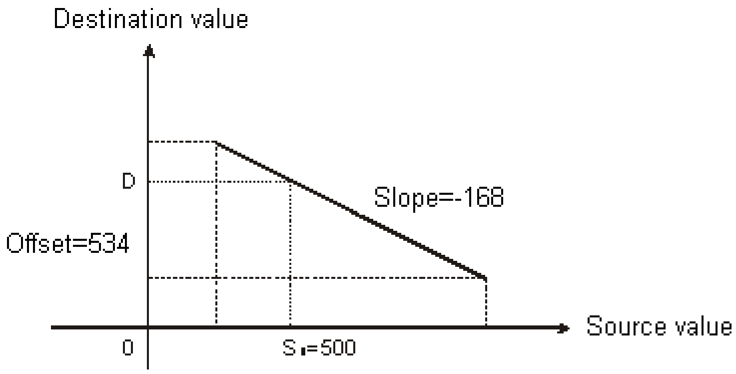




Example 2:

1. Suppose the values in $\mathbf{S_1}$, $\mathbf{S_2}$, and $\mathbf{S_3}$ are 500, -168, and 534 respectively. When X0.0 is ON, the instruction SCAL is executed, and the scale value is stored in D10.
2. The operation equation: D10=(500×-168)÷1,000+534=450





Additional remark:

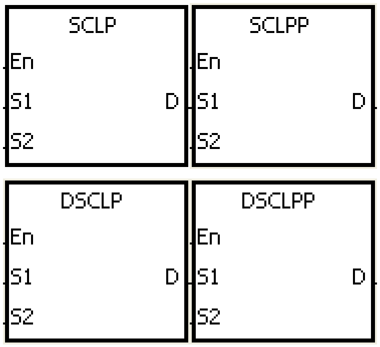
1. Only when the slope and the offset are known can the instruction SCAL be used. If the slope and the offset are unknown, users are suggested to use the instruction SCLP to perform the operation.
2. The value entered into $\mathbf{S_2}$ should be within the range between –32,768 and 32,767. (The practical value is within the range between –32,768 and 32,767.
3. When users use the slope equation, they have to notice that the maximum source value should be larger than the minimum source value. However, the maximum destination value is not necessarily larger than the minimum destination value.
4. If the value in **D** is larger than 32,767, the value stored in **D** will be 32,767. If the value in **D** is less than -32,768, the value stored in **D** will be -32,768.

API	Instruction code			Operand	Function
0217	D	SCLP	P	**S_1, S_2, S_3, D**	Parameter type of scale value operation

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●				
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction (9 steps)
AH500	AH500	AH500

Symbol:



S_1 : Data source — Word/Double word

S_2 : Parameter — Word/Double word

D : Destination device — Word/Double word

Explanation:

1. Only the 32-bit instructions can use the 32-bit counter.
2. The operand **S_2** used in the 16-bit instruction is set as follows.

Device number	Parameter	Setting range
S_2	Maximum source value	-32,768~32,767
S_2+1	Minimum source value	-32,768~32,767
S_2+2	Maximum destination value	-32,768~32,767
S_2+3	Minimum destination value	-32,768~32,767

3. The operand **S_2** used in the 16-bit instruction occupies four devices.
4. The operand **S_2** used in the 32-bit instruction is set as follows.

Device number	Parameter	Setting range	
		Integer	Floating-point number
S_2, **S_2**+1	Maximum source value	-2,147,483,648~ 2,147,483,647	The range of 32-bit floating-point numbers
S_2+2, **S_2**+3	Minimum source value		
S_2+4, **S_2**+5	Maximum destination value		
S_2+6, **S_2**+7	Minimum destination value		

5. The operand **S_2** used in the 32-bit instruction occupies eight devices.
6. If the values used in the 32-bit instruction are floating-point numbers, SM658 can be set to ON. If the values are decimal integers, SM685 can be set to OFF.
7. The operation equation in the instruction: **D**=[(**S_1**–Minimum source value)×(Maximum destination value–Minimum destination value)]÷(Maximum source value)+Minimum destination value
8. The operational relation between the source value and the destination value:
   y=kx+b
   y=Destination value (D)

k=Slope=(Maximum destination value–Minimum destination value)÷(Maximum source value–Minimum source value)

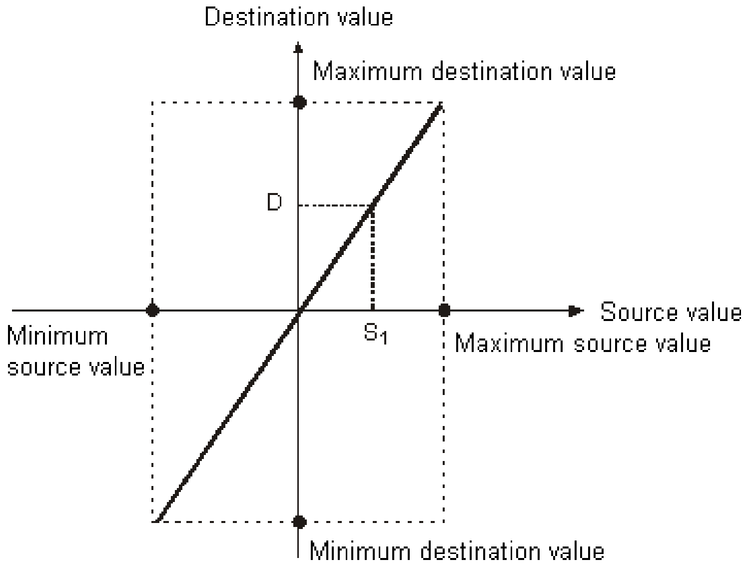
x=Source value (**S_1**)

b=Offset =Minimum destination value–Minimum source value×Slope

The parameters above are being substituted for y, k, x, and b in the equation y=kx+b, and the operation equation in the instruction is obtained.

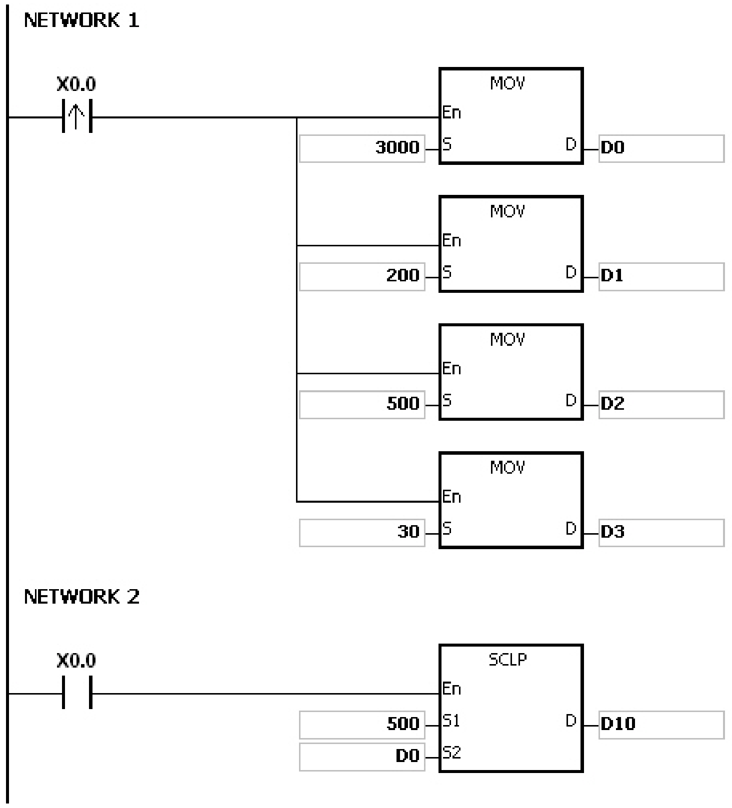
y=kx+b=D=k**S_1**+b=Slope×**S_1** + Offset = Slope×**S_1** + Minimum destination value–Minimum source value×Slope=Slope×(**S_1**–Minimum source value) + Minimum destination value =(**S_1**–Minimum source value)×(Maximum destination value–Minimum destination value)÷(Maximum source value–Minimum source value) + Minimum destination value

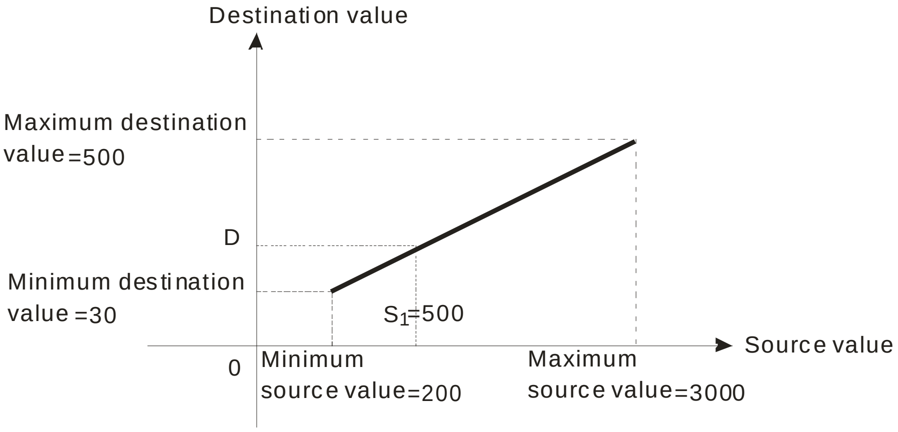
9. If **S_1** is larger than the maximum source value, the maximum source value will be the value in **S_1**. If **S_1** is less than the minimum source value, the minimum source value will be the value in **S_1**. After the input values and the parameters are set, the output curve is as shown below.



Example 1:

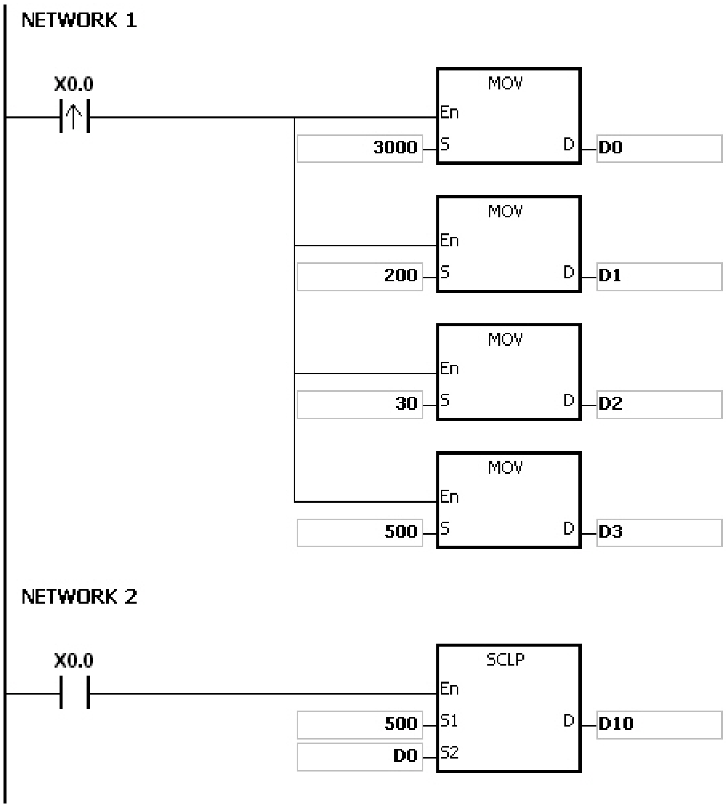
1. Suppose the value in **S$_1$** is 500, the maximum source value in D0 is 3,000, the minimum source value in D1 is 200, the maximum destination value in D2 is 500, and the minimum destination value in D3 is 30. When X0.0 is ON, the instruction SCLP is executed, and the scale value is stored in D10.
2. The operation equation: D10=[(500–200)×(500–30)]÷(3,000–200)+30=80.35
   80.35 is rounded off to the nearest whole digit, and becomes 80. 80 is stored in D10.

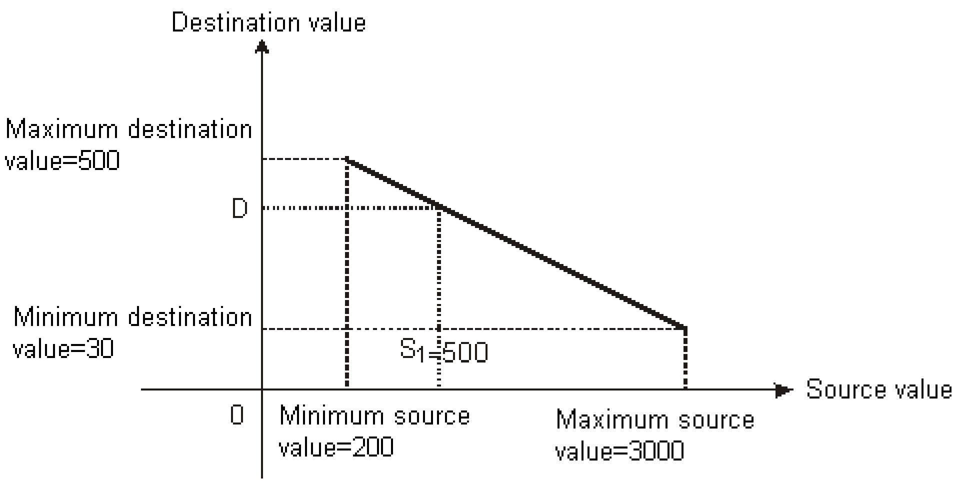




Example 2:

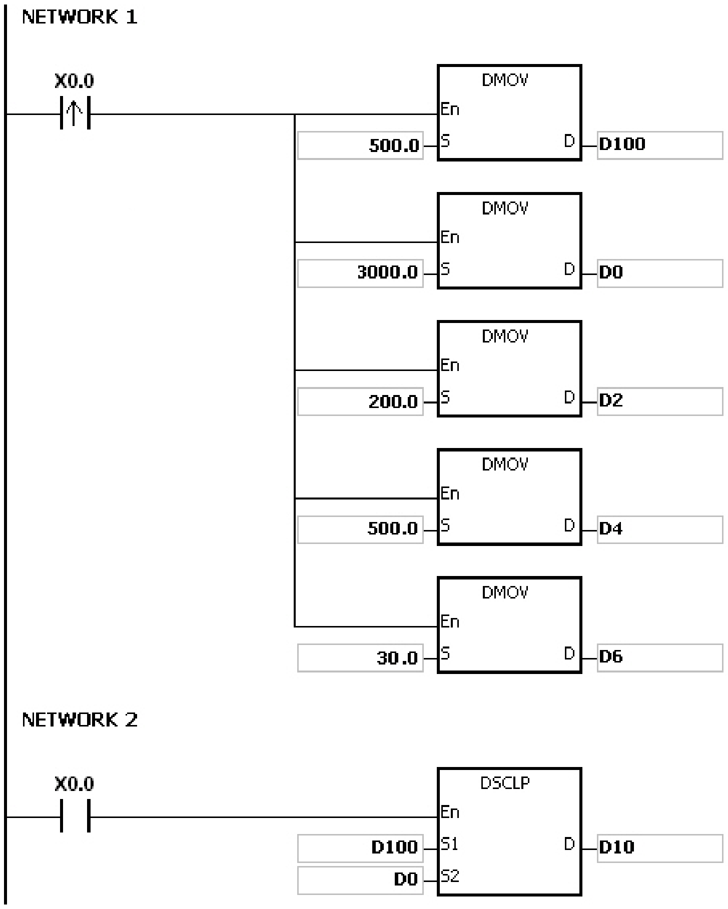
1. Suppose the value in **S₁** is 500, the maximum source value in D0 is 3,000, the minimum source value in D1 is 200, the maximum destination value in D2 is 30, and the minimum destination value in D3 is 500. When X0.0 is ON, the instruction SCLP is executed, and the scale value is stored in D10.
2. The operation equation: D10=[(500–200)×(30–500)]÷(3,000–200)+500=449.64
   449.64 is rounded off to the nearest whole digit, and becomes 450. 450 is stored in D10.

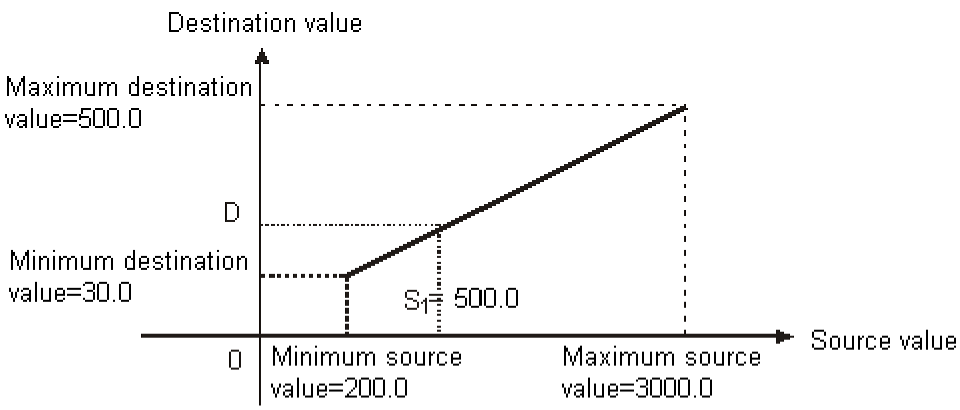




Example 3:

1. Suppose the value in $\mathbf{S_1}$ is 500.0, the maximum source value in D0 is 3000.0, the minimum source value in D2 is 200.0, the maximum destination value in D4 is 500.0, and the minimum destination value in D6 is 30.0. When X0.0 is ON, SM685 is set to ON, the instruction DSCLP is executed, and the scale value is stored in D10.
2. The operation equation: D10=[(500.0–200.0)×(500.0–30.0)]÷(3000.0–200.0)+30.0=80.35
   80.35 is rounded off to the nearest whole digit, and becomes 80.0. 80.0 is stored in D10.





Additional remark:

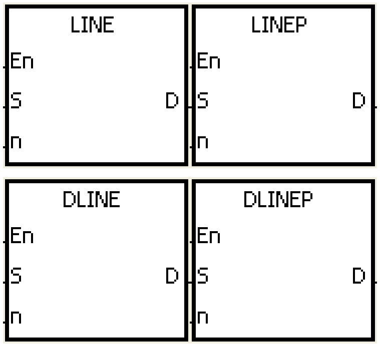
1. The value in $\mathbf{S_1}$ which is used in the 16-bit instruction should be within the range between the minimum source value and the maximum source value, i.e. between -32,768 and 32,767. If the value exceeds the boundary value, the boundary value is used in the operation.
2. The integer in $\mathbf{S_1}$ which is used in the 32-bit instruction should be within the range between the minimum source value and the maximum source value, i.e. between -2,147,483,648 and 2,147,483,647. If the integer exceeds the boundary value, the boundary value is used in the operation.
3. The floating-point number in $\mathbf{S_1}$ which is used in the 32-bit instruction should be within the range between the minimum source value and the maximum source value, i.e. within the range of floating-point numbers. If the floating-point number exceeds the boundary value, the boundary value is used in the operation.
4. When users use the instruction, they have to notice that the maximum source value should be larger than the minimum source value. However, the maximum destination value is not necessarily larger than the minimum destination value.
5. When the maximum source value is the same as the minimum source value, the instruction will not be executed and it will be seen as an operation error; SM0 will be ON and the error code in SR0 is 16#2012.
6. If the operand $\mathbf{S_2}$ used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [4] of WORD.
7. If the operand $\mathbf{S_2}$ used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [4] of DWORD.

API	Instruction code			Operand	Function
0218	D	LINE	P	**S, n, D**	Converting a column of data into a line of data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●		●				
n	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



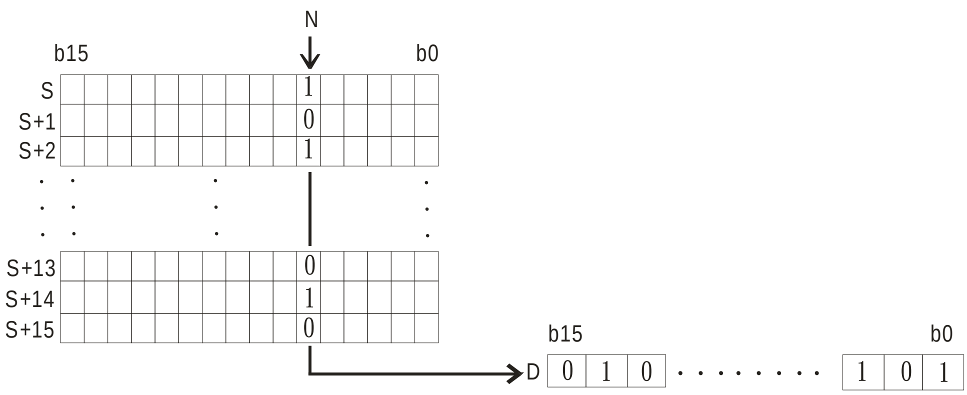
S : Data source — Word/Double word

n : Number of bits — Word/Double word

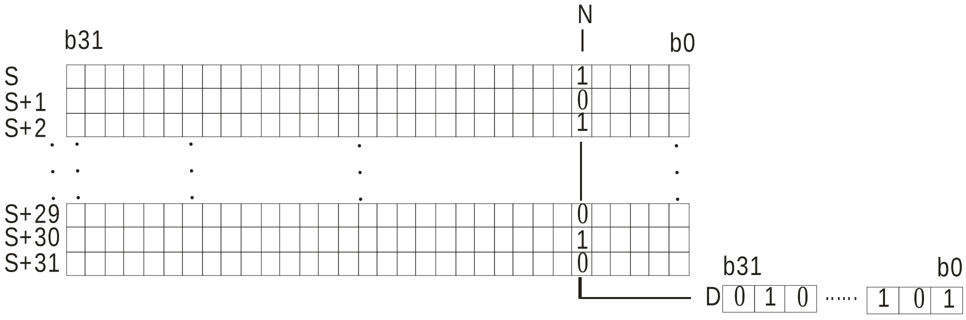
D : Data destination — Word/Double word

Explanation:

1. The operand **S** used in the 16-bit instruction occupies sixteen 16-bit registers, i.e. **S**~**S**+15.
2. The operand **S** used in the 32-bit instruction occupies thirty-two 32-bit registers, i.e. **S**~**S**+31.
3. The operand **n** indicates that the value of the n^{th} bit in every piece of data in the operand **S** is retrieved. Besides, the operand **n** used in the 16-bit instruction should be within the range between 0 and 15, and the operand **n** used in the 32-bit instruction should be within the range between 0 and 31.
4. The operand **n** used in the 16-bit instruction indicates that the values of the n^{th} bits in **S**~**S**+15 are retrieved, and the values of the **n**th bits are stored in the operand **D** in order.
5. The operand **n** used in the 32-bit instruction indicates that the values of the n^{th} bits in **S**~**S**+31 are retrieved, and the values of the **n**th bits are stored in the operand **D** in order.
6. Only the 32-bit instructions can use the 32-bit counter.
7. Take the 16-bit instruction for example.

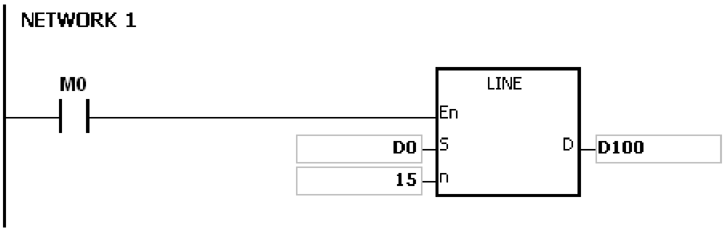


8. Take the 32-bit instruction for example.



Example:

When M0 is ON, the values of the 15th bits in D0~D14 are stored in b0~b15 in D100.



Additional remark:

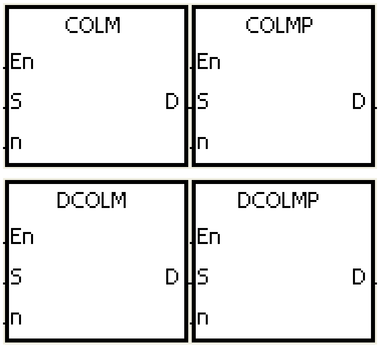
1. If the device **S+15** used in the 16-bit instruction exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the device **S+31** used in the 32-bit instruction exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If **n** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
0219	D	COLM	P	S, n, D	Converting a line of data into a column of data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●	○	●	○	○		
n	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



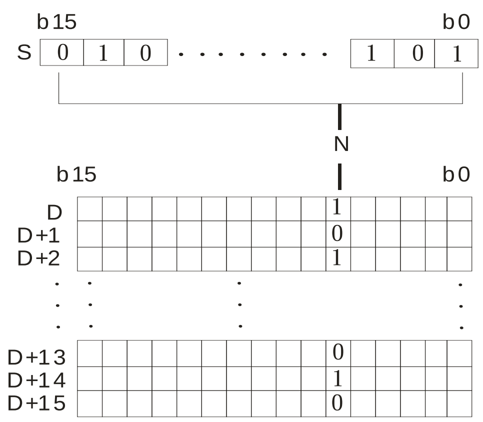
S : Data source — Word/Double word

n : Number of bits — Word/Double word

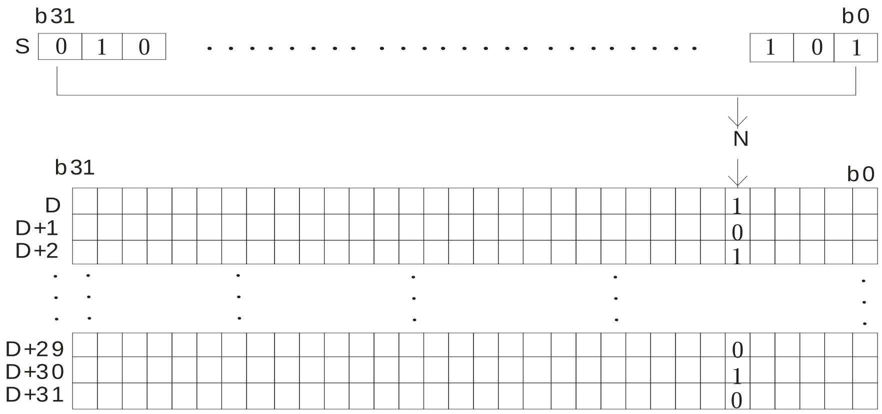
D : Data destination — Word/Double word

Explanation:

1. The operand **D** used in the 16-bit instruction occupies sixteen 16-bit registers, i.e. **D**~**D**+15.
2. The operand **D** used in the 32-bit instruction occupies thirty-two 32-bit registers, i.e. **D**~**D**+31.
3. The operand **n** indicates that the values of the bits in the operand **S** are stored in the n^{th} bits in the operand **D**. Besides, the operand **n** used in the 16-bit instruction should be within the range between 0 and 15, and the operand **n** used in the 32-bit instruction should be within the range between 0 and 31.
4. The operand **n** used in the 16-bit instruction indicates that the values of the bits in **S** are stored in the n^{th} bits in **D**~**D**+15 in order.
5. The operand **n** used in the 32-bit instruction indicates that the values of the bits in **S** are stored in the n^{th} bits in **D**~**D**+31 in order.
6. Only the 32-bit instructions can use the 32-bit counter.
7. Take the 16-bit instruction for example.

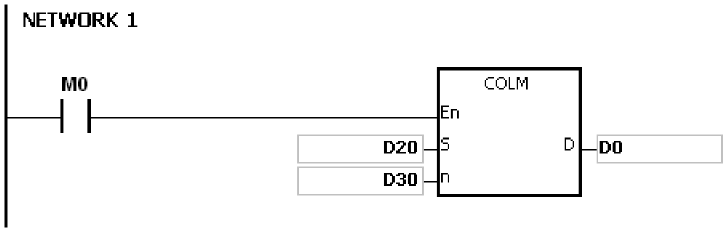


8. Take the 32-bit instruction for example.



Example:

Suppose the value in D30 is 3. When M0 is ON, the values of the bits in D20 are stored in the third bits in D0~D15 in order.



Additional remark:

1. If the device **D+15** used in the 16-bit instruction exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the device **D+31** used in the 32-bit instruction exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If **n** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

6.4 Data Transfer Instructions

6.4.1 List of Data Transfer Instructions

API	Instruction code			Pulse instruction	Function	Step
	16-bit	32-bit	64-bit			
0300	MOV	DMOV	–	✓	Transferring the data	5
0301	–	–	DFMOV	✓	Transferring the 64-bit floating-point number	5-6
0302	$MOV	–	–	✓	Transferring the string	5-11
0303	CML	DCML	–	✓	Inverting the data	5
0304	BMOV	–	–	✓	Transferring all data	7
0305	NMOV	DNMOV	–	✓	Transferring the data to several devices	7
0306	XCH	DXCH	–	✓	Exchanging the data	5
0307	BXCH	–	–	✓	Exchanging all data	7
0308	SWAP	DSWAP	–	✓	Exchange the high byte with the low byte	3
0309	SMOV	–	–	✓	Transferring the digits	11
0310	MOVB	–	–	✓	Transferring several bits	7

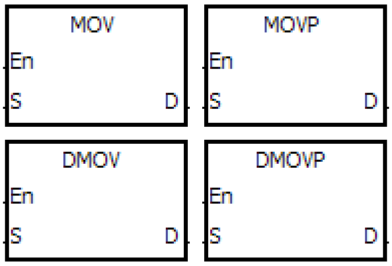
6.4.2 Explanation of Data Transfer Instructions

API	Instruction code			Operand	Function
0300	D	MOV	P	**S, D**	Transferring the data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	F
S	●	●			●	●	●	●	●		●	○	●	○	○		○
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Data source Word/Double word

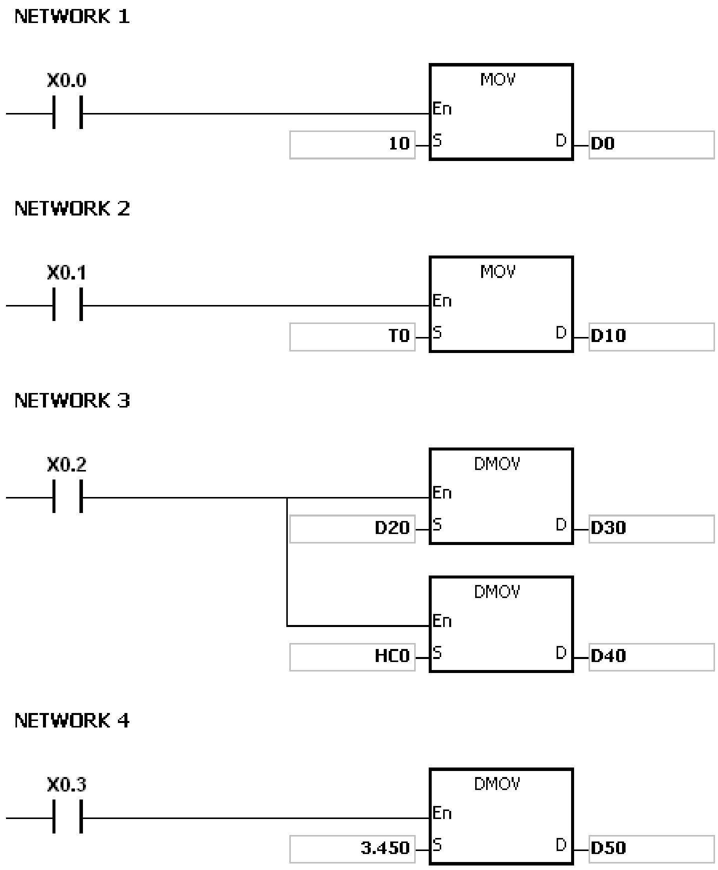
D : Data destination Word/Double word

Explanation:

1. When the instruction is executed, the data in **S** is transferred to **D**. When the instruction is not executed, the data in **D** is unchanged.
2. Only the data in **S** which is used in the 32-bit instruction can be the floating-point number.
3. Only the 32-bit instructions can use the 32-bit counter.

Example:

1. To transfer the 16-bit data, users should use the instruction MOV.
   - When X0.0 is OFF, the data in D0 is unchanged. When X0.0 is ON, the value 10 is transferred to the data register D0.
   - When X0.1 is OFF, the data in D10 is unchanged. When X0.1 is ON, the current value of T0 is transferred to the data register D10.
2. To transfer the 32-bit data, users should use the instruction DMOV.
   - When X0.0 is OFF, the data in (D31, D30) and (D41, D40) is unchanged. When X0.2 is ON, the current value in (D21, D20) is transferred to (D31, D30), and the current value of HC0 is transferred to (D41, D40).
3. To transfer the floating-point number, users should use the instruction DMOV.
   - When X0.3 is OFF, the data in (D51, D50) is unchanged. When X0.3 is ON, the floating-point number 3.450 is converted into the binary floating-point number, and the conversion result is transferred to (D51, D50).

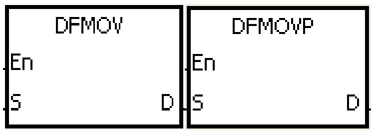

NETWORK 1
X0.0
MOV
En
10
S
D
D0
NETWORK 2
X0.1
MOV
En
T0
S
D
D10
NETWORK 3
X0.2
DMOV
En
D20
S
D
D30
DMOV
En
HC0
S
D
D40
NETWORK 4
X0.3
DMOV
En
3.450
S
D
D50

API	Instruction code			Operand	Function
0301	D	FMOV	P	**S, D**	Transferring the 64-bit floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●	○	●				○
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	32-bit instruction	64-bit instruction (5-6 steps)
AH500	-	AH500

Symbol:



S : Data source Long word

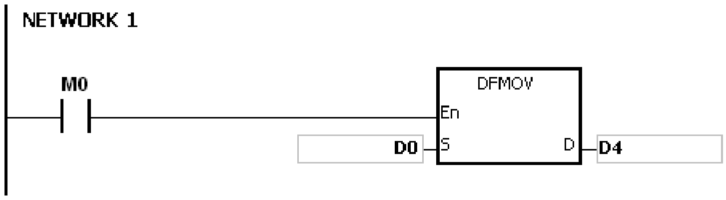
D : Data destination Double word/Long word

Explanation:

1. When the instruction is executed, the data in **S** is transferred to **D**. When the instruction is not executed, the data in **D** is unchanged.
2. Only the 64-bit instructions are supported.
3. The instrucitons DFMOV and DFMOVP are double-precision data transfer instructions.

Example:

When M0 is ON, the values in D0~D3 are transferred to D4~D7.

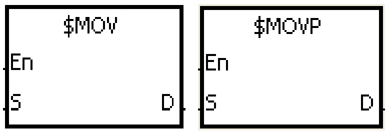


API	Instruction code			Operand	Function
0302		$MOV	P	**S, D**	Transferring the string

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●			○	
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5-11 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Data source String

D : Data destination String

Explanation:

1. If the operand **S** is a string, at most 31 characters can be moved. For a string, the number of steps=1+(the number of characters +1)/4 (The value will be rounded up to the nearest whole digit if (the number of characters +1) is not divisible by 4.).

Number of characters	1~3	4~7	8~11	12~15	16~19	20~23	24~27	28~31
Number of steps	2	3	4	5	6	7	8	9

2. When the operand **S** is a string and the insturction is executed, the string is transferred to **D**, and the code 16#00 is added to the end of the data
3. When the operand **S** is not a string, the code 16#00 should be added to the end of the data transferred.
4. When the the operand **S** is not a string and the instruction is executed, the string starting with the data in the device specified by **S** (including 16#00) is transferred to **D**. When the instruction is not executed, the data in **D** is unchanged.
5. Suppose the operand **S** is not a string. When the instruction is executed and the first character is the code 16#00, 16#00 is still transferred to **D**.
6. When 16#00 appears in the low byte, the execution of the instruction is as follows.

Before the instruction is executed:

	b15~b8	b7~b0
S	16#31	16#30
S+1	16#33	16#32
S+2	16#35	16#34
S+3	16#30	16#00

→

	B15~b8	b7~b0
D	16#38	16#39
D+1	16#36	16#37
D+2	16#34	16#35
D+3	16#32	16#33

After the instruction is executed:

	b15~b8	b7~b0
S	16#31	16#30
S+1	16#33	16#32
S+2	16#35	16#34
S+3	16#30	16#00

→

	b15~b8	b7~b0
D	16#31	16#30
D+1	16#33	16#32
D+2	16#35	16#34
D+3	16#00	16#00

16#30 in the high byte is not transferred.

16#32 in the high byte turns into 16#00.

7. When 16#00 appears in the high byte, the execution of the instruction is as follows.

Before the instruction is executed:

	b15~b8	b7~b0
S	16#31	16#30
S+1	16#33	16#32
S+2	16#00	16#34
S+3	16#37	16#36

	b15~b8	b7~b0
D	16#38	16#39
D+1	16#36	16#37
D+2	16#34	16#35
D+3	16#32	16#33

After the instruction is executed:

	b15~b8	b7~b0
S	16#31	16#30
S+1	16#33	16#32
S+2	16#00	16#34
S+3	16#37	16#36

	b15~b8	b7~b0
D	16#31	16#30
D+1	16#33	16#32
D+2	16#00	16#34
D+3	16#32	16#33

8. When **S** overlaps **D** and the device number of **S** is less than the device number of **D**, the transfer of the data to **D** starts form the ending code 16#00.

Before the instruction is executed:

	b15~b8	b7~b0
D0	16#31	16#30
D1	16#33	16#32
D2	16#35	16#34
D3	16#30	16#00

	b15~b8	b7~b0
D1	16#33	16#32
D2	16#35	16#34
D3	16#30	16#00
D4	16#38	16#37

After the instruction is executed:

	b15~b8	b7~b0
D0	16#31	16#30
D1	16#33	16#32
D2	16#35	16#34
D3	16#30	16#00

	b15~b8	b7~b0
D1	16#31	16#30
D2	16#33	16#32
D3	16#35	16#34
D4	16#00	16#00

Example 1:

Suppose the operand **S** is the even string “1234”. When the conditional contact X0.0 is enabled, the data in D0~D3 is as follows.

The operand **S**:

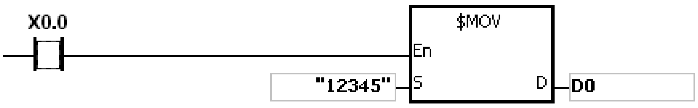
String	‘1’	‘2’	‘3’	‘4’
Hexadecimal value	16#31	16#32	16#33	16#34

After the instruction is executed, the data in the operand **D** is as follows.

Device	High byte	Low byte	Note
D0	16#32	16#31	‘1’=16#31; ‘2’=16#32
D1	16#34	16#33	‘3’=16#33; ‘4’=16#34
D2	16#00	16#00	The ending code 16#00 is in the low byte. 16#00 is automatically added in the high byte.
D3	Unchanged	Unchanged	

Example 2:

Suppose the operand **S** is the odd string “12345”. When the conditional contact X0.0 is enabled, the data in D0~D3 is as follows.



The operand **S**:

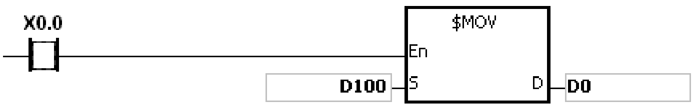
String	‘1’	‘2’	‘3’	‘4’	‘5’
Hexadecimal value	16#31	16#32	16#33	16#34	16#35

After the instruction is executed, the data in the operand **D** is as follows.

Device	High byte	Low byte	Note
D0	16#32	16#31	‘1’=16#31; ‘2’=16#32
D1	16#34	16#33	‘3’=16#33; ‘4’=16#34
D2	16#00	16#35	The ending code 16#00 is in the high byte.
D3	Unchanged	Unchanged	

Example 3:

When the operand **S** is not a string and the ending code 16#00 appears in the low byte, the execution of the instruction is as follows.



The operand **S**:

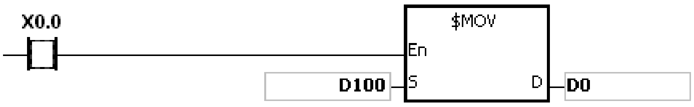
Device	High byte	Low byte	Note
D100	16#31	16#30	‘1’=16#31; ‘0’=16#30
D101	16#33	16#32	‘3’=16#33; ‘2’=16#32
D102	16#35	16#34	‘5’=16#35; ‘4’=16#34
D103	16#30	16#00	‘0’=16#30; 16#00 is the ending code.

After the instruction is executed, the data in the operand **D** is as follows.

Device	High byte	Low byte	Note
D0	16#31	16#30	‘1’=16#31; ‘0’=16#30
D1	16#33	16#32	‘3’=16#33; ‘2’=16#32
D2	16#35	16#34	‘5’=16#35; ‘4’=16#34
D3	16#00	16#00	The ending code 16#00 is in the low byte. 16#00 is automatically added in the high byte.
D4	Unchanged	Unchanged	

Example 4:

When the operand **S** is not a string and the ending code 16#00 appears in the high byte, the execution of the instruction is as follows.



The operand **S**:

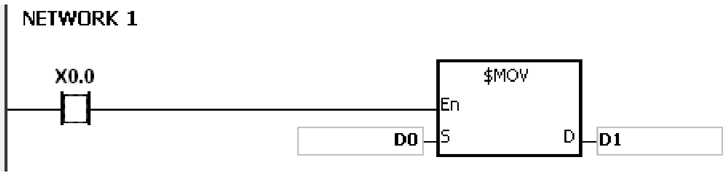
Device	High byte	Low byte	Note
D100	16#31	16#30	‘1’=16#31; ‘0’=16#30
D101	16#33	16#32	‘3’=16#33; ‘2’=16#32
D102	16#00	16#34	16#00 is the ending code. ‘4’=16#34
D103	16#37	16#36	‘7’=16#37; ‘6’=16#36

After the instruction is executed, the data in the operand **D** is as follows.

Device	High byte	Low byte	Note
D0	16#31	16#30	‘1’=16#31; ‘0’=16#30
D1	16#33	16#32	‘3’=16#33; ‘2’=16#32
D2	16#00	16#34	16#00 is the ending code. ‘4’=16#34
D3	Unchanged	Unchanged	

Example 5:

When **S** overlaps **D**, and the device number of **S** is less than the device number of **D**, the transfer of the data to **D** starts form the ending code 16#00.



The operand **S**:

Device	High byte	Low byte	Note
D0	16#31	16#30	‘1’=16#31; ‘0’=16#30
D1	16#33	16#32	‘3’=16#33; ‘2’=16#32
D2	16#35	16#34	‘5’=16#35; ‘4’=16#34
D3	16#30	16#00	‘0’=16#30; 16#00 is the ending code.
D4	16#38	16#37	‘8’=16#38; ‘7’=16#37

After the instruction is executed, the data in the operand **D** is as follows.

Device	High byte	Low byte	Note
D1	16#31	16#30	‘1’=16#31; ‘0’=16#30
D2	16#33	16#32	‘3’=16#33; ‘2’=16#32
D3	16#35	16#34	‘5’=16#35; ‘4’=16#34
D4	16#00	16#00	The ending code 16#00 is in the low byte. 16#00 is automatically added in the high byte.
D5	Unchanged	Unchanged	

Additional remark:

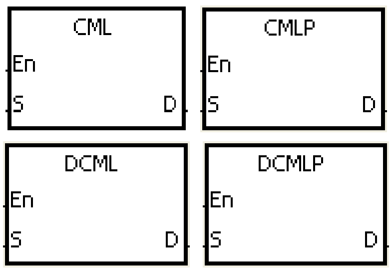
1. If the string in **S** does not end with 16#00, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200E.
2. If the capacity of the device **D** is not sufficient to contain the string in **S**, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
0303	D	CML	P	**S, D**	Inverting the data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Data source — Word/Double word

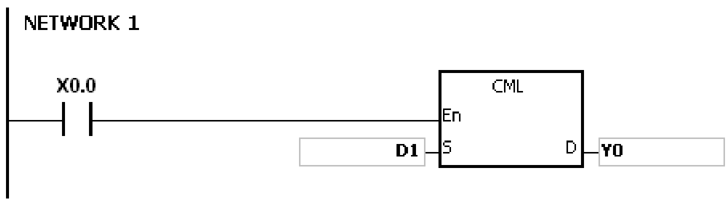
D : Data destination — Word/Double word

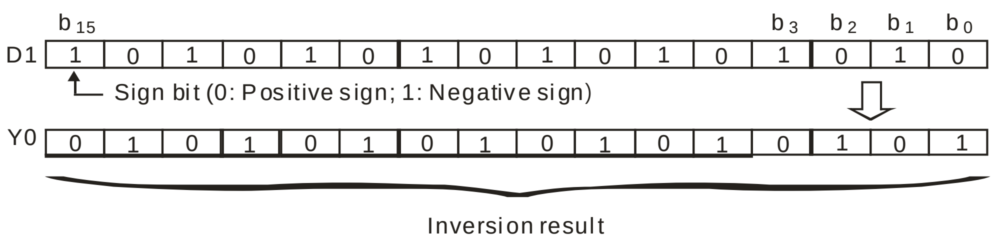
Explanation:

1. The instruction is used to invert all bits in **S**, i.e. 0 becomes 1, and 1 becomes 0. The inversion result is stored in **D**. If the data in **S** is the constant, the constant will be converted into the binary value.
2. Only the 32-bit instructions can use the 32-bit counter.

Example 1:

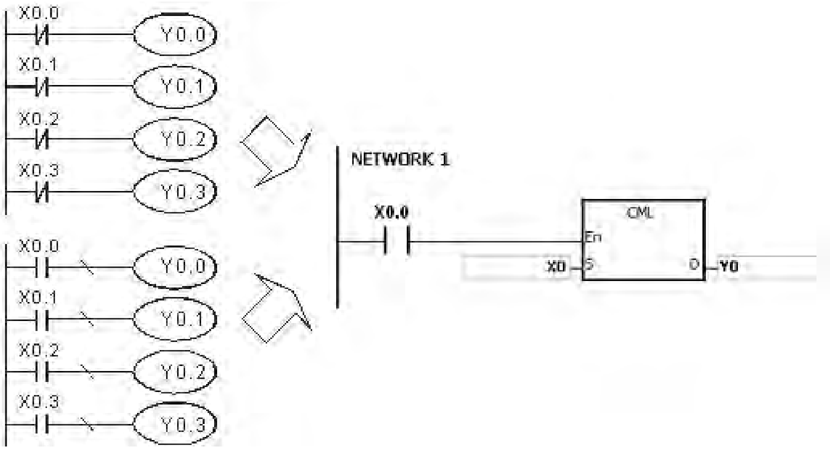
When X0.0 is ON, all bit in D1 are inverted, and the conversion result is stored in Y0.0~Y0.15.





Example 2:

The circuits below can be represented by means of the instruction CML.

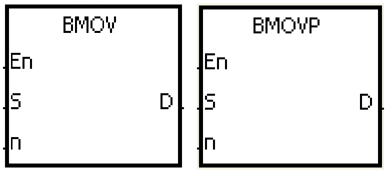


API	Instruction code		Operand	Function
0304	BMOV	P	**S, D, n**	Transferring all data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●				
D	●	●			●	●		●	●		●	○	●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

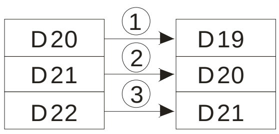
Symbol:



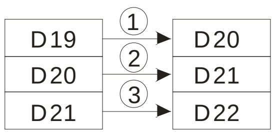
S	:	Data source	Word
D	:	Data destination	Word
n	:	Data length	Word

Explanation:

1. **n** pieces of data in devices starting from the device specified by **S** are transferred to the devices starting from the device specified by **D**.
2. The operand **n** should be within the range between 1 and 256.
3. In order to prevent the error which results from the overlap between the source devices and the destination devices, the data is transferred in the following way.
   When the device number of **S** is larger than the device number of **D**, the data is transferred in the order from ① to ③.

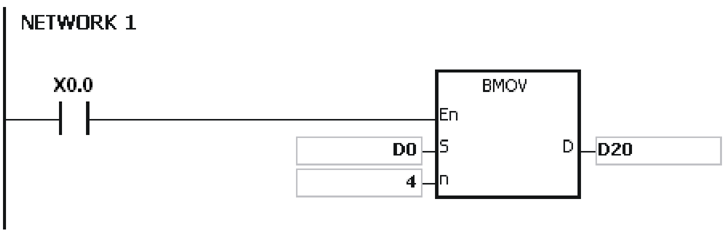


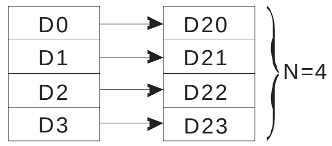
   When the device number of **S** is less than the device number of **D**, the data is transferred in the order from ③ to ①.



Example 1:

When X0.0 is ON, the data in D0~D3 is transferred to D20~D23.

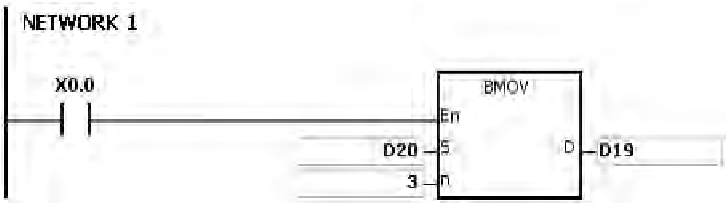


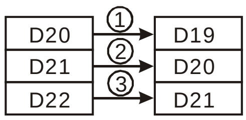


Example 2:

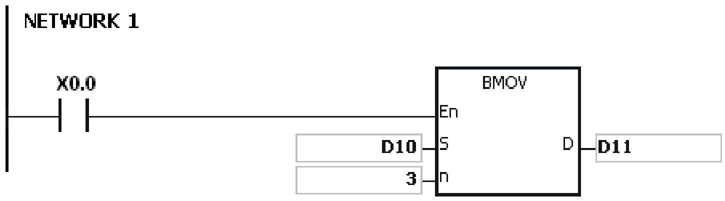
In order to prevent the error which results from the overlap between the source devices and the destination devices, the data is transferred in the following way.

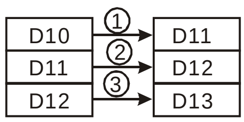
1. When the device number of **S** is larger than the device number of **D**, the data is transferred in the order from ① to ③.





2. When the device number of **S** is less than the device number of **D**, the data is transferred in the order from ③ to ①.





Additional remark:

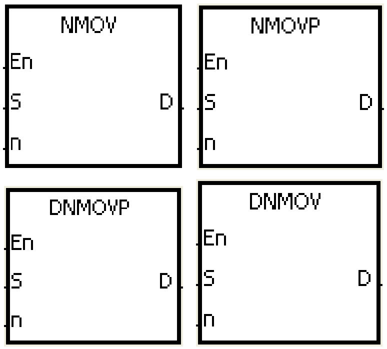
1. If **D**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **S**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If **n** is larger than 256, or if **n** is less than 1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
0305	D	NMOV	P	**S, D, n**	Transferring the data to several devices

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



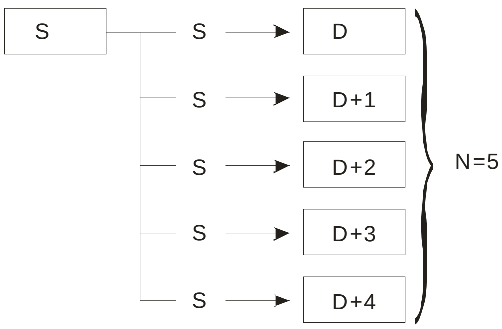
S : Data source Word/Double word

D : Data destination Word/Double word

n : Data length Word/Double word

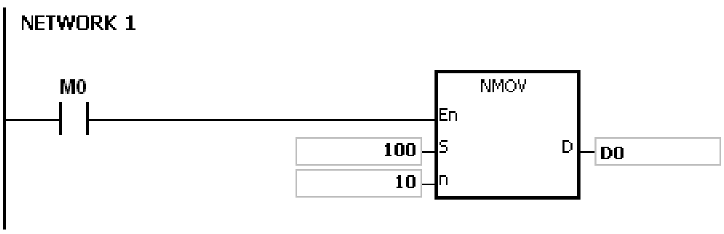
Explanation:

1. When the instruciton is executed, the data in **S** is transferred to the **n** devices starting from the device specified by **D**. When the instruction is not executed, the data in **D** is unchanged.
2. Only the 32-bit instructions can use the 32-bit counter.
3. The operand **n** used in the instruction NMOV should be within the range between 1 and 256, and the operand **n** used in the instruction DNMOV should be within the range between 1 and 128.



Example:

When M0 is ON, 100 is transferred to D0~D9.



Additional remark:

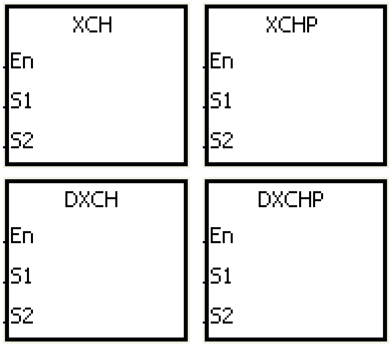
1. If **D**~**D**+**n**-1 exceed the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the operand **n** used in the 16-bit instruciton is larger than 256 or less than 1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. If the operand **n** used in the 32-bit instruciton is larger than 128 or less than 1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
0306	D	XCH	P	**S_1, S_2**	Exchanging the data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●				
S_2	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S_1 : Data which will be exchanged — Word/Double word

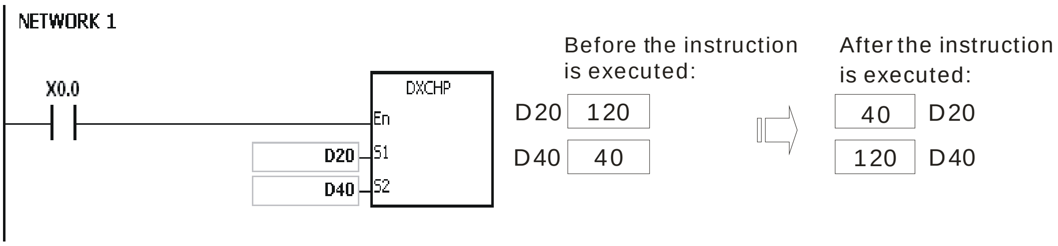
S_2 : Data which will be exchanged — Word/Double word

Explanation:

1. The data in the device specified by **S_1** is exchanged with the data in the device specified by **S_2**.
2. Only the 32-bit instructions can use the 32-bit counter.

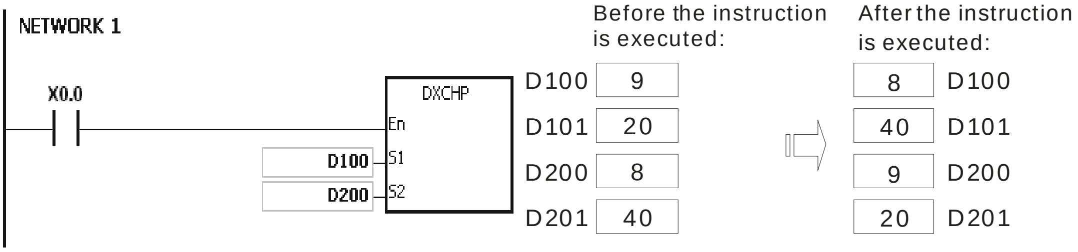
Example 1:

When X0.0 is switched from OFF to ON, the data in D20 is exchanged with the data in D40.



Example 2:

When X0.0 is switched from OFF to ON, the data in D100 is exchanged with the data in D200.

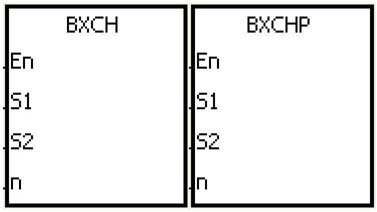


API	Instruction code		Operand	Function
0307	BXCH	P	**S_1, S_2, n**	Exchanging all data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●	○	●				
S_2	●	●			●	●		●	●		●	○	●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



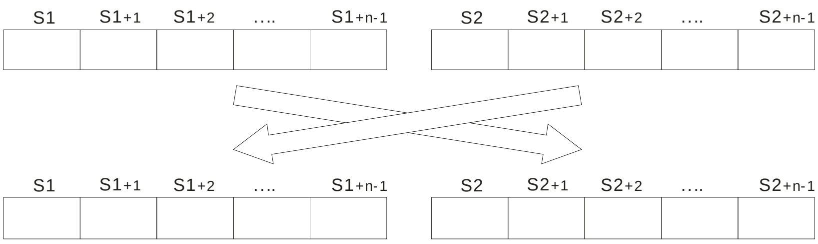
S_1 : Data which will be exchanged — Word/Double word

S_2 : Data which will be exchanged — Word/Double word

n : Data length — Word/Double word

Explanation:

1. The data in the devices specified by **S_1~S_1+n**-1 is exchnaged with the data in the devices specified by **S_2~S_2+n**-1.
2. The operand **n** used in the instruction should be within the range between 1 and 256.



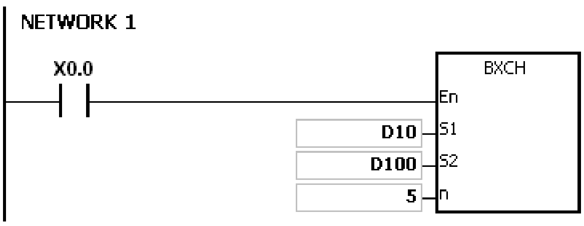
Example:

When X0.0 is ON, the data in D10~D14 is exchanged with the data in D100~D104.

D10	D11	D12	D13	D14	D100	D101	D102	D103	D104
1	2	3	4	5	16	17	18	19	20

After the instruction is executed

D10	D11	D12	D13	D14	D100	D101	D102	D103	D104
16	17	18	19	20	1	2	3	4	5



Additional remark:

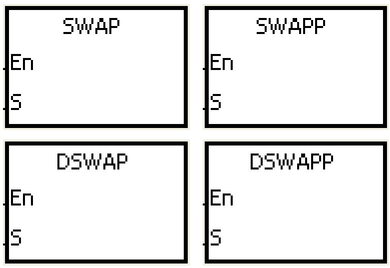
1. If $\mathbf{S_1}$+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If $\mathbf{S_2}$+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the operand **n** used in the instruciton is larger than 256 or less than 1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
0308	D	SWAP	P	**S**	Exchange the high byte with the low byte

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction (3 steps)
AH500	AH500	AH500

Symbol:



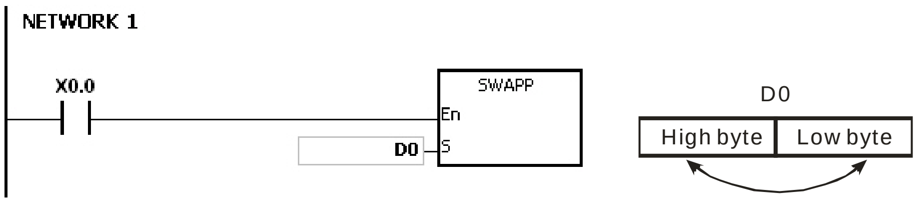
S : Data source Word/Double word

Explanation:

1. When the 16-bit instruction is executed, the data in the low byte in **S** is exchanged with the data in the high byte in **S**.
2. When the 32-bit instruction is executed, the data in the low byte of the high word in **S** is exchanged with the data in the high byte of the high word in **S**, and the data in the low byte of the low word in **S** is exchanged with the data in the high byte of the low word in **S**.
3. Only the 32-bit instructions can use the 32-bit counter.

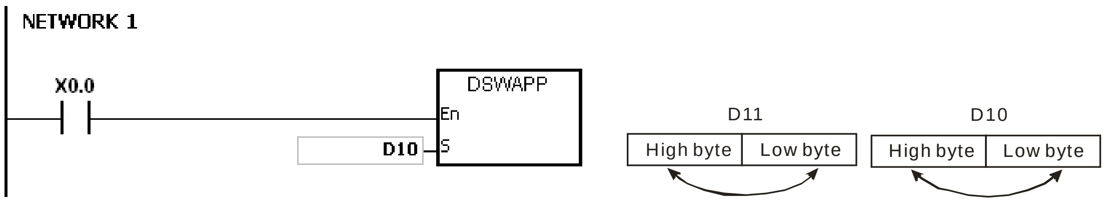
Example 1:

When X0.0 is ON, the data in the low byte in D0 is exchanged with the data in the high byte in D0.



Example 2:

When X0.0 is ON, the data in the low byte in D11 is exchanged with the data in the high byte in D11, and the data in the low byte in D10 is exchanged with the data in the high byte in D10.

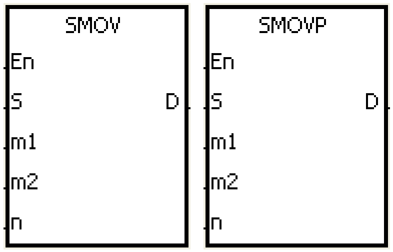


API	Instruction code			Operand	Function
0309		SMOV	P	**S, m_1, m_2, D, n**	Transferring the digits

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●	○	○		
m_1	●	●			●	●		●	●		●	○	●	○	○		
m_2	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●	○	●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (11 steps)	32-bit instruction
AH500	AH500	-

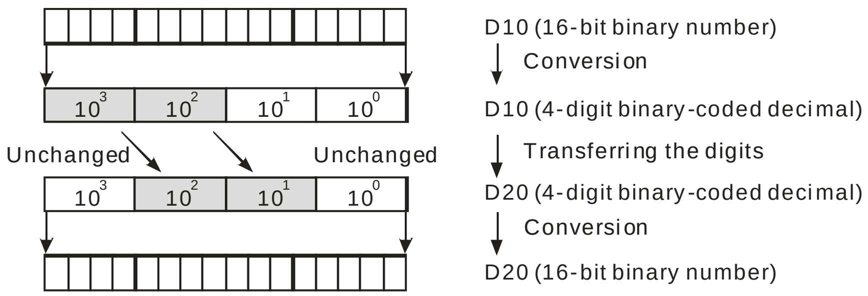
Symbol:



S	:	Data source	Word
m_1	:	Start digit which will be transferred from the source device	Word
m_2	:	Number of digits which will be transferred	Word
D	:	Data destination	Word
n	:	Start digit where the source data is stored in the destination device	Word

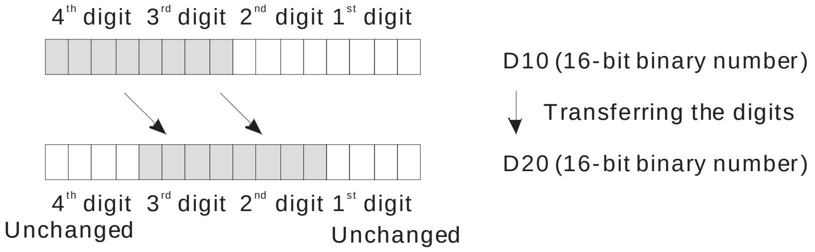
Explanation:

1. The instruction can be used to allocate and combine the data. When the instruction is executed, the **m_2** digits of the number which start from the **m_1**th digit of the number in **S** are transferred to the **m_2** digits of the number which starts from the **n**th digit of the number in **D**.
2. The operand **m_1** should be within the range between 1 and 4. The operand **m_2** should be within the range between 1 and **m_1**. The operand **n** should be within the range between **m_2** and 4. (Four bits are regarded as a unit.)
3. When SM605 is OFF, the data involved in the instruction is binary-coded decimal numbers.



Suppose the number in **S** is K1234, and the number in **D** is K5678. After the instruction is executed, the number in **S** is 1234, and the number in **D** is 5128.

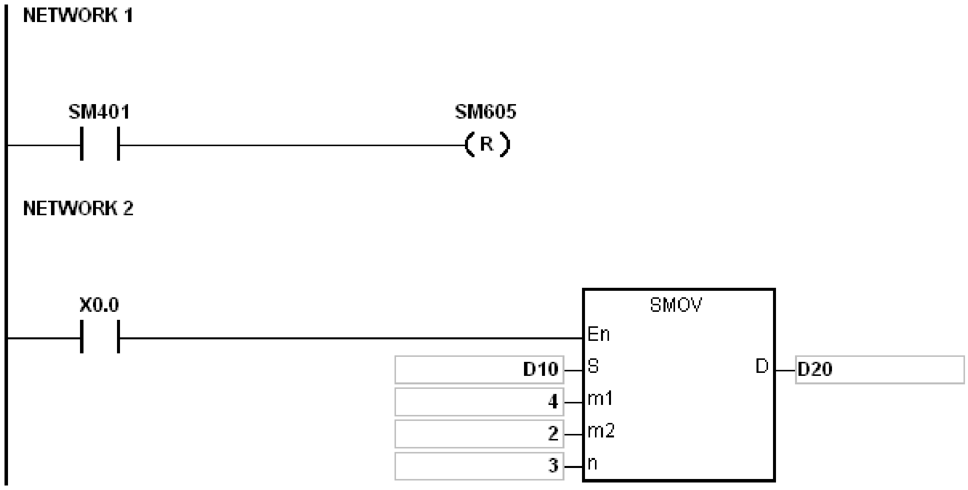
4. When SM605 is ON, the data involved in the instruction is binary numbers.

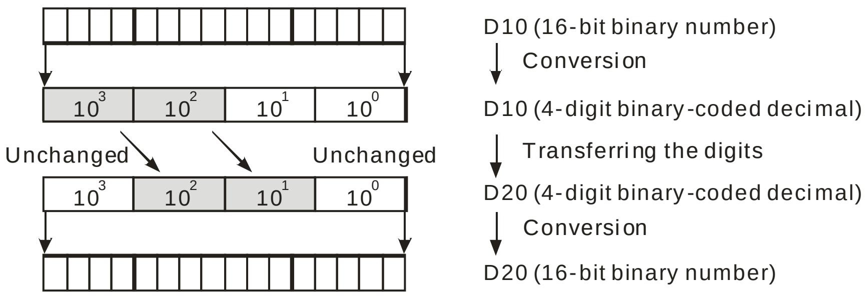


Suppose the number in **S** is 16#1234, and the number in **D** is 16#5678. After the instruction is executed, the number in **S** is 16#1234, and the number in **D** is 16#5128.

Example 1:

1. When SM605 is OFF, the data involved in the instruction is binary-coded decimal numbers. When X0.0 is ON, the two digits of the decimal number which start from the fourth digit of the decimal number (the digit in the thousands place of the decimal number) in D10 are transferred to the two digits of the decimal number which start from the third digit of the decimal number (the digit in the hundreds place of the decimal number) in D20. After the instruction is executed, the digits in the thousands place of the decimal number (10^3) and the ones place of the decimal number (10^0) in D20 are unchanged.
2. When the binary-code decimal number exceeds the range between 0 and 9,999, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200D.

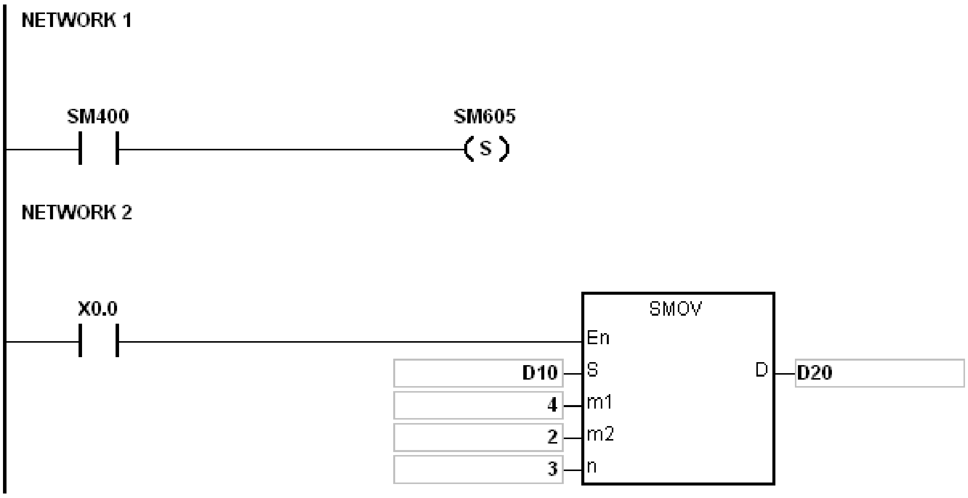


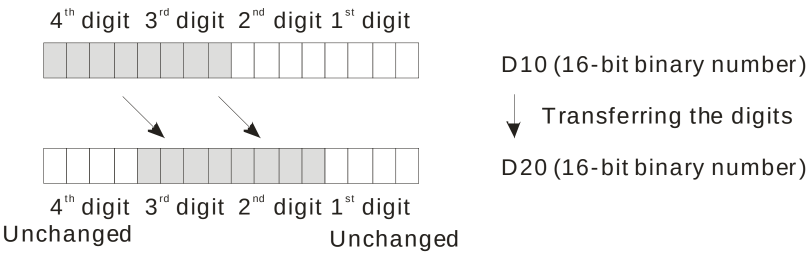


Suppose the number in D10 is 1234, and the number in D20 is 5678. After the instruction is executed, the number in D10 is unchanged, and the number in D20 is 5128.

Example 2:

When SM605 is ON, the data involved in the instruction is binary numbers. When the instruction SMOV is executed, the binary numbers in D10 and D20 are not trasnformed into the binary-coded decimal numbers, and the digit which is transferred is composed of four bits.

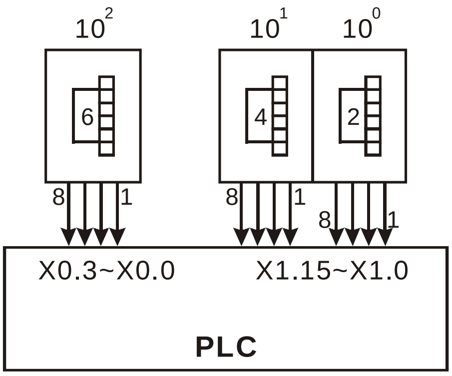


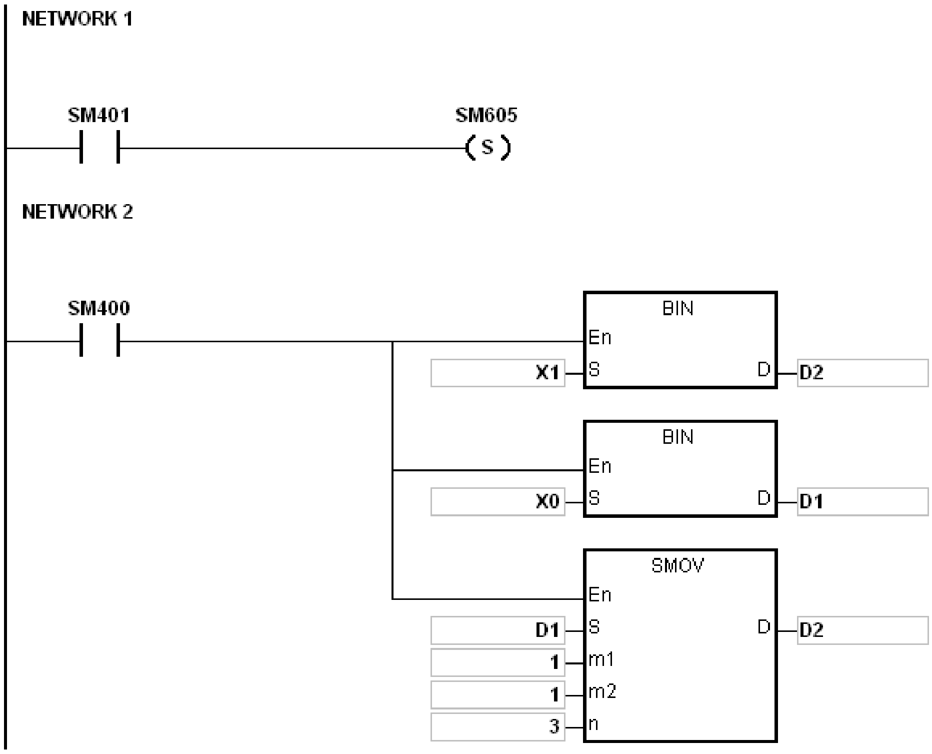


Suppose the number in D10 is 16#1234, and the number in D20 is 16#5678. After the instruction is executed, the number in D10 is unchanged, and the number in D20 is 16#5128.

Example 3:

1. The instruction can be used to combine the values of the DIP switches which are connected to the input terminals whose numbers are not consecutive.
2. The two digits of the value of the DIP switch at the right are transferred to the the two digits of the number which start from the second digit of the number in D2, and the one digit of the value of the DIP switch at the left is transferred to the the first digit of the number in D1.
3. The instruction SMOV can be used to transfer the first digit of the number in D1 to the third digit of the number in D2. In other words, the two DIP switches can be combined into one DIP switch by means of the instruction SMOV.





Additional remark:

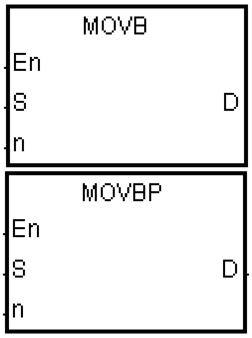
1. Suppose the data involved in the instruction is binary-coded decimal numbers. If the number in **S** is not within the range between 0 and 9999, or if the number in **D** is not within the range between 0 and 9999, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200D.
2. If $\mathbf{m_1}$ is less than 1, or if $\mathbf{m_1}$ is larger than 4, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. If $\mathbf{m_2}$ is less than 1, or if $\mathbf{m_2}$ is larger than $\mathbf{m_1}$, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
4. If **n** is less than $\mathbf{m_2}$, or if **n** is larger than 4, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code		Operand	Function
0310	MOVB	P	**S, n, D**	Transferring several bits

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●	●	●	●	●	●	●	●	●			●				
n	●	●			●	●		●	●		●	○	●	○	○		
D	●	●	●	●	●	●	●	●	●				●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Data source Bit

n : Data length Word

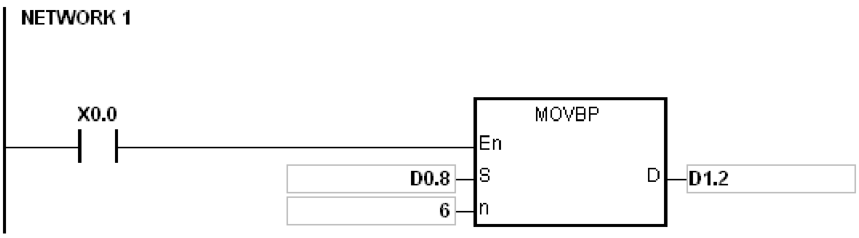
D : Data destination Bit

Explanation:

1. When the instruciton is executed, **n** pieces of data in devices starting from the device specified by **S** are transferred to the devices starting from the device specified by **D**.
2. When **S** or **D** is T, C or HC, only the state of the device is transferred, and the current value of the device is not transferred.
3. The operand **n** should be within the range between 1 and 256. When **n** is less than 1, or when **n** is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

Example:

When X0.0 is ON, the data in D0.8~D0.13 is transferred to D1.2~D1.7.



Additional remark:

1. If **D**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **S**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

6.5 Jump Instructions

6.5.1 List of Jump Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
0400	CJ	–	✓	Conditional jump	3
0401	JMP	–	–	Unconditional jump	3
0402	GOEND	–	–	Jumping to the end of the program	1

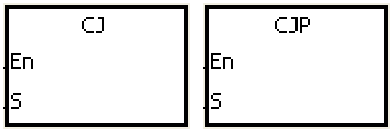
6.5.2 Explanation of Jump Instructions

API		Instruction code		Operand	Function
0400		CJ	P	**S**	Conditional jump

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S																	

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
AH500	AH500	-

Symbol:



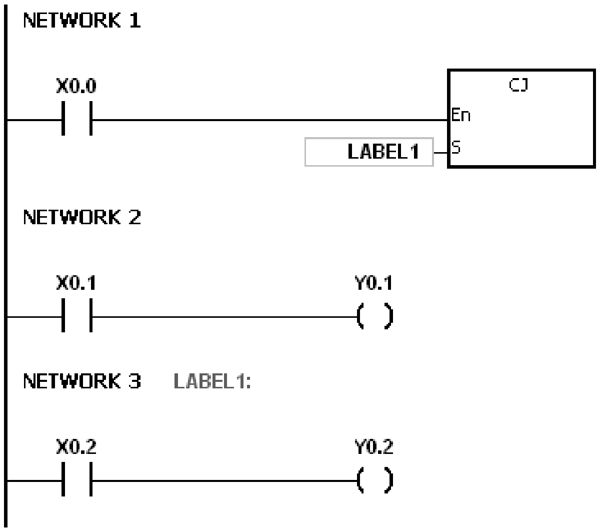
S : Jump destination

Explanation:

1. When some part of the program in the PLC does not need to be executed, users can use CJ or CJP to shorten the scan time. Besides, when a dual output is used, users also can use CJ or CJP.
2. If the program specified by the label is prior to the instruction CJ, the watchdog timer error will occur, and the PLC will stop running. Please use the instruction carefully.
3. The instruction CJ can specify the same label repeatedly.
4. When the instruction is executed, the actions of the devices are as follows.
   - The state of Y, the state of M, and the state of S remain the same as those before the execution of the jump.
   - The timer stops counting.
   - The general applied instructions are not executed.

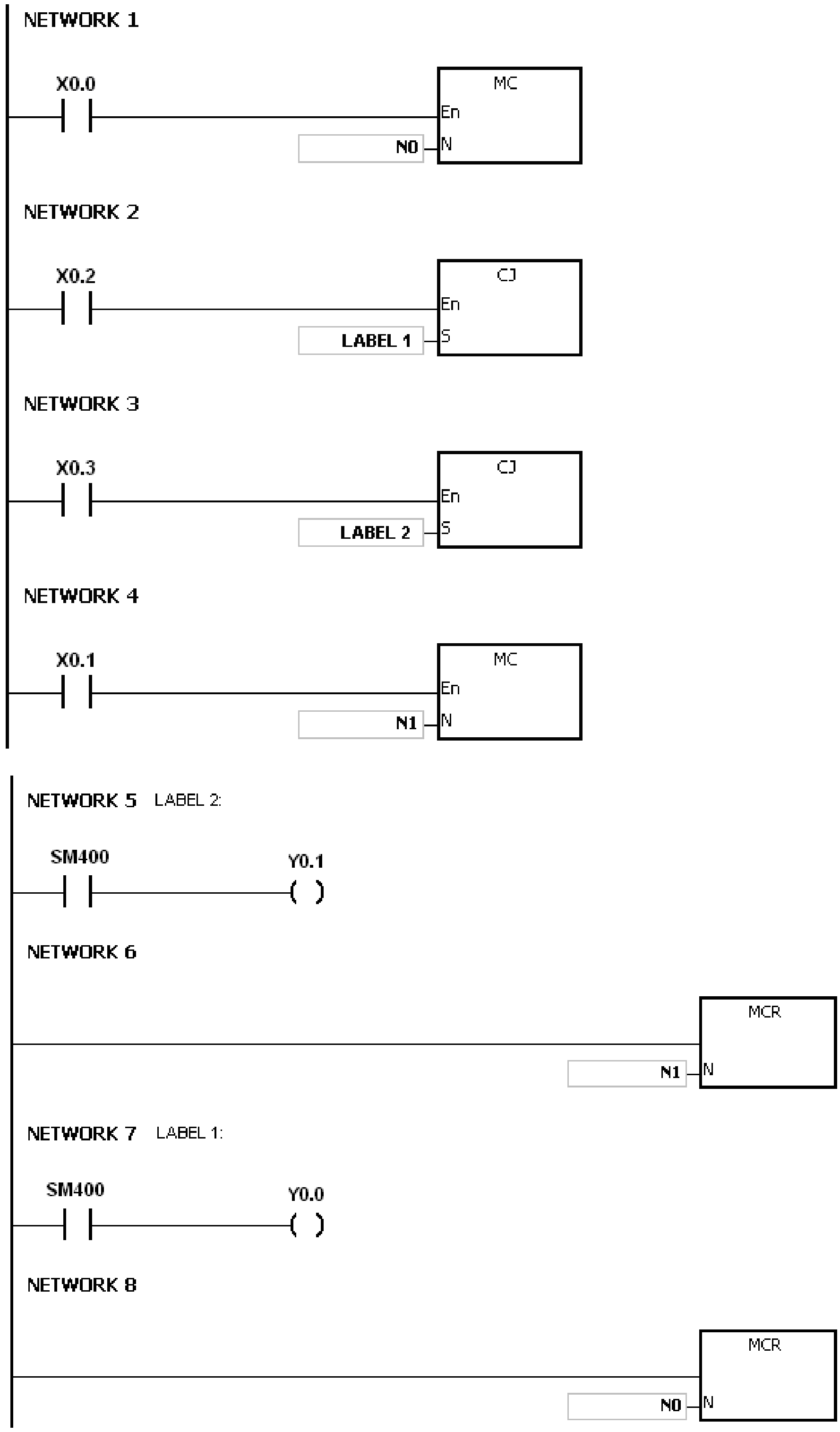
Example 1:

1. When X0.0 is ON, the execution of the program jumps from address 0 to address N (LABEL1:).
2. When X0.0 is OFF, the execution of the program starts from address 0, and the instruction CJ is not executed.



Example 2:

1. The instruction CJ between the instruction MC and the instruction MCR can be used in the five conditions below.
   (a) The execution of the program jumps from the part of the program outside one MC/MCR loop to the part of the program outside another MC/MCR loop.
   (b) The execution of the program jumps from the part of the program outside the MC/MCR loop to the part of the program inside the MC/MCR loop.
   (c) The execution of the program jumps from the part of the program inside the MC/MCR loop to the part of the program inside the MC/MCR loop.
   (d) The execution of the program jumps from the part of the program inside the MC/MCR loop to the part of the program outside the MC/MCR loop.
   (e) The execution of the program jumps from the part of the program inside one the MC/MCR loop to the part of the program inside another the MC/MCR loop.
2. When the instruction MC is executed, the previous state of the switch contact is put onto the top of the stack inside the PLC. The stack is controlled by the PLC, and can not be changed by users. When the instruction MCR is executed, the previous state of the switch contact is popped from the top of the stack. Under the conditions listed in (b), (d), and (e) above, the number of times the items are pushed onto the stack may be different from the number of times the items are popped from the stack. When this situation occurs, at most 32 items can be pushed onto the stack, and the items can be popped form the stack until the stack is empty. Therefore, when CJ or CJP is used with MC and MCR, users have to be careful of the pushing of the item onto the stack and the popping of the item from the stack.



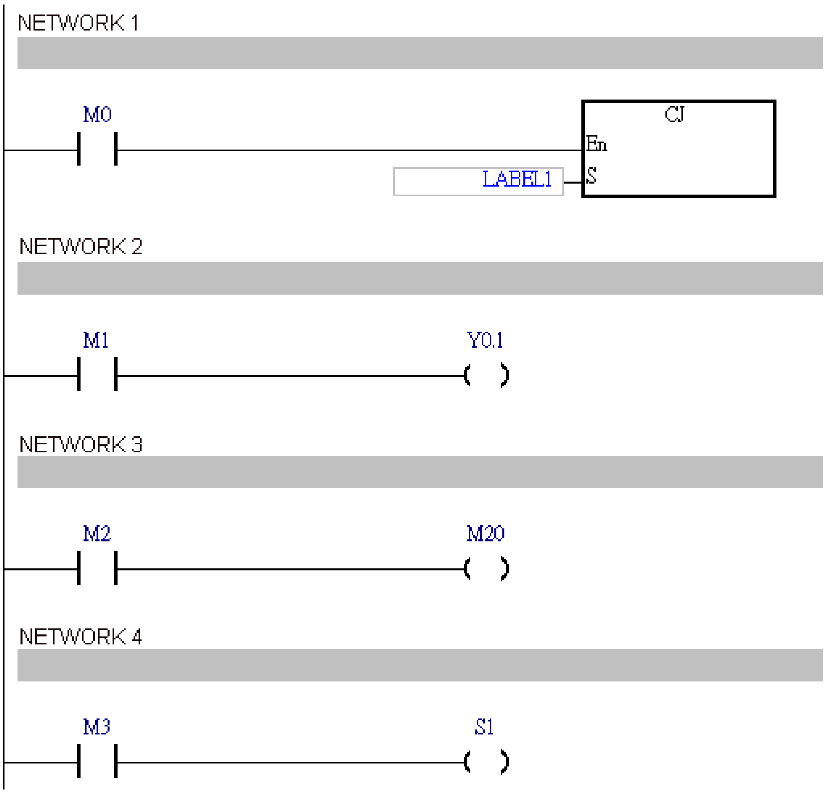
NETWORK 1
X0.0
MC
En
N0
N
NETWORK 2
X0.2
CJ
En
LABEL 1
S
NETWORK 3
X0.3
CJ
En
LABEL 2
S
NETWORK 4
X0.1
MC
En
N1
N
NETWORK 5 LABEL 2:
SM400
Y0.1
NETWORK 6
MCR
N1
N
NETWORK 7 LABEL 1:
SM400
Y0.0
NETWORK 8
MCR
N0
N

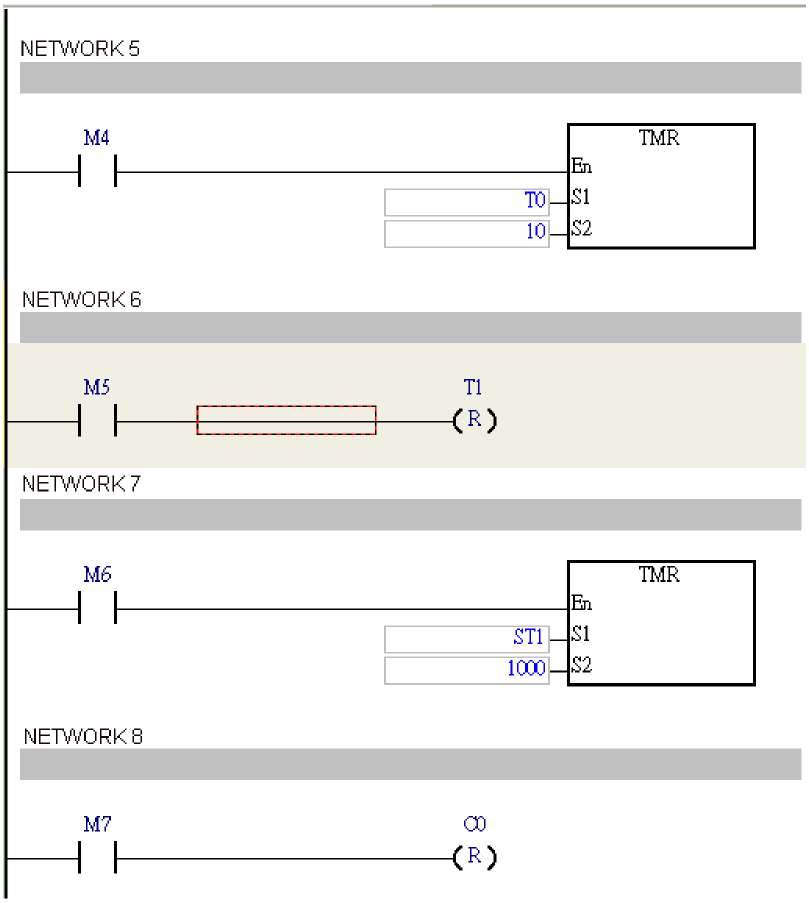
Example 3:

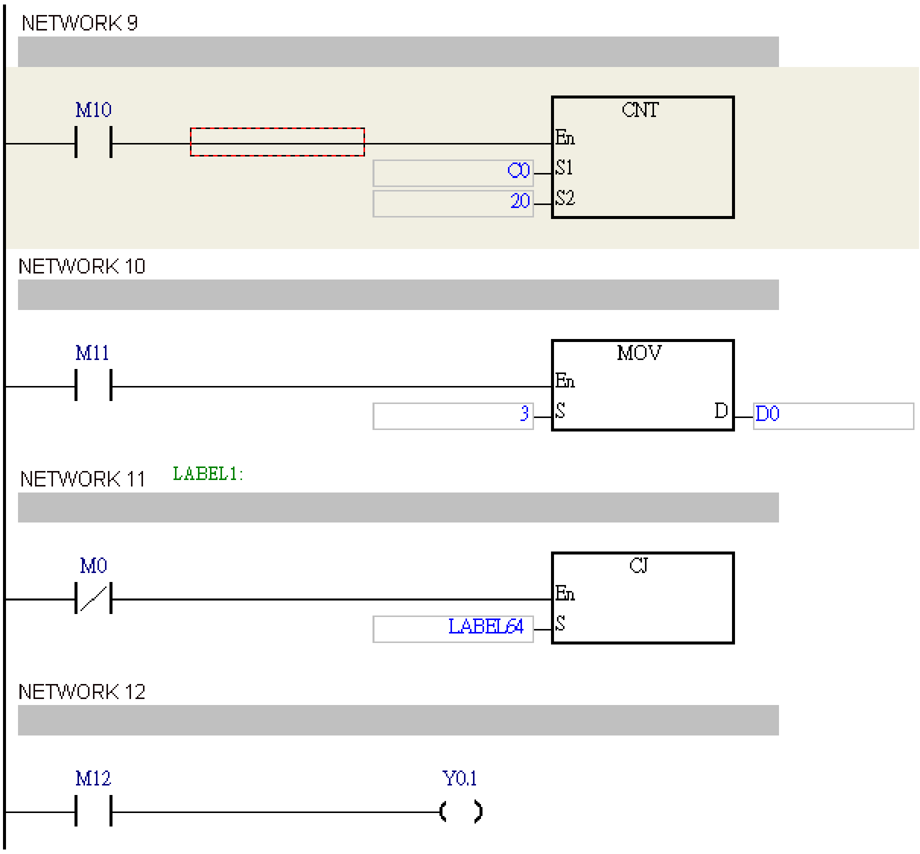
The states of the devices are listed below.

Device	State of the contact before the execution of CJ	State of the contact during the execution of CJ	State of the output coil during the execution of CJ
Y, M, and S	M1, M2, and M3 are OFF.	M1, M2, and M3 are switched from OFF to ON.	Y0.1[*1], M20, and S1 are OFF.
	M1, M2, and M3 are ON.	M1, M2, and M3 are switched from ON to OFF.	Y0.1[*1], M20, and S1 are ON.
Timer	M4 is OFF.	M4 is switched from OFF to ON.	The timer is not enabled.
	M4 is ON.	M4 is switched from ON to OFF	The timer stops counting immediately. When M0 is switched from ON to OFF, the timer is reset to 0.
Accumulative timer	M6 is OFF.	M6 is switched from OFF to ON.	ST1 is not enabled.
	M6 is ON.	M6 is switched from ON to OFF.	If the instruction CJ is executed after the accumulative timer is enabled, the accumulative timer stops counting.
Counter	M7 and M10 are OFF.	M10 is ON/OFF.	The counter is not enabled.
	M7 is OFF. M10 is ON/OFF.	M10 is ON/OFF.	C0 stops counting. When M0 is switched OFF, C0 keeps counting.
Applied instruction	M11 is OFF.	M11 is switched from OFF to ON	The applied instruction is not executed.
	M11 is ON.	M11 is switched from ON to OFF	The applied instruction which is skipped is not executed.

*1:Y0.1 is a dual output. When M0 is OFF, Y0.1 is controlled by M1. When M0 is ON, Y0.1 is controlled by M12.


NETWORK 1
M0
CJ
En
LABEL1
S
NETWORK 2
M1
Y0.1
NETWORK 3
M2
M20
NETWORK 4
M3
S1


NETWORK 5
M4
TMR
En
T0
S1
10
S2
NETWORK 6
M5
T1
R
NETWORK 7
M6
TMR
En
ST1
S1
1000
S2
NETWORK 8
M7
C0
R



Additional remark:

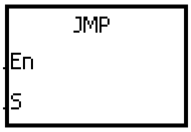
Please refer to ISPSoft User Manual for more information about the use of the label.

API	Instruction code	Operand	Function
0401	JMP	S	Unconditional jump

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S																	

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
-	AH500	-

Symbol:



S : Jump destination

Explanation:

1. The execution of the program jumps to the part of the program specified by the pointer without any condition.
2. If the program specified by the label is prior to the instruction JMP, the watchdog timer error will occur, and the PLC will stop running. Please use the instruction carefully.
3. When the instruction is executed, the actions of the devices are as follows.
   - The state of Y, the state of M, and the state of S remain the same as those before the execution of the jump.
   - The timer stops counting.
   - If the instruction which is used to reset the timer is driven before the jump is executed, the timer will still be in the condition of being reset during the execution of the jump.
   - The general applied instructions are not executed.

API		Instruction code			Operand	Function
0402			GOEND		–	Jumping to END

Pulse instruction	16-bit instruction (1 step)	32-bit instruction
-	AH500	-

Symbol:

Explanation:

1. When the condition is met, the execution of the program jumps to END in the program.
2. Function blocks and interrupt tasks do not support the instruction. Besides, the instruction can not be between the instruction FOR and the instruction NEXT.
3. When the instruction GOEND is executed, the instructions skipped are not executed, the data in all devices is unchanged, and the states of all devices are also unchanged.

6.6 Program Execution Instructions

6.6.1 List of Program Execution Instructions

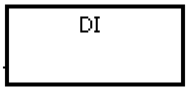
API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
0500	DI	–	–	Disabling the interrupt	1
0501	EI	–	–	Enabling the interrupt	1
0502	IMASK	–	–	Controlling the interrupt	3

6.6.2 Explanation of Program Execution Instructions

API		Instruction code			Operand	Function
0500			DI		-	Disabling the interrupt

Pulse instruction	16-bit instruction (1 step)	32-bit instruction
-	AH500	-

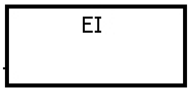
Symbol:



API	Instruction code			Operand	Function
0501		EI		-	Enabling the interrupt

Pulse instruction	16-bit instruction (1 step)	32-bit instruction
-	AH500	-

Symbol:



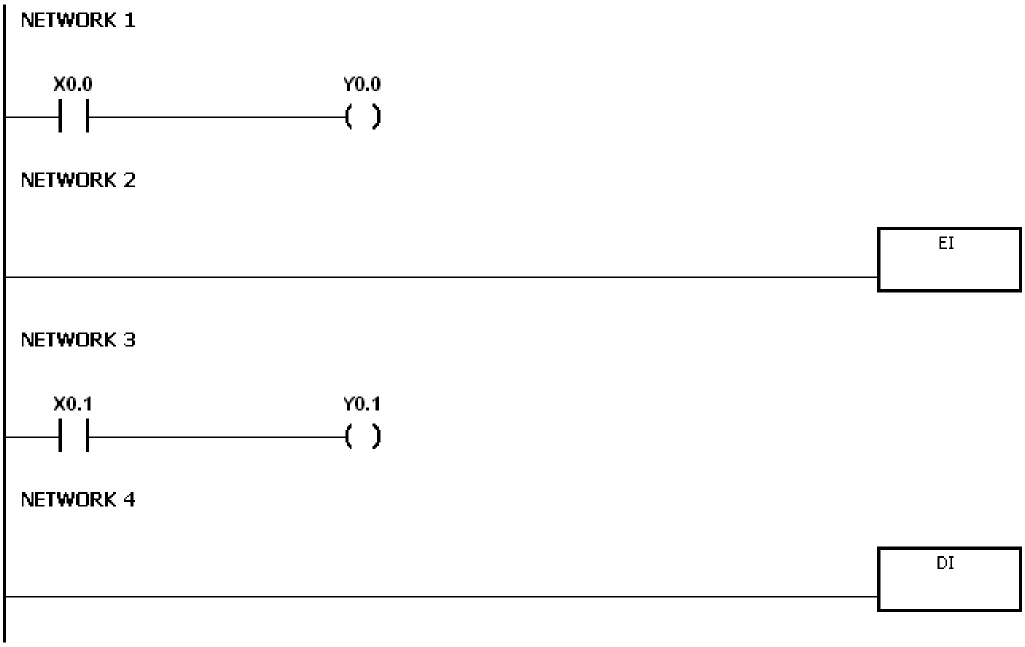
Explanation:

1. The use of the instruction EI indicates that the interrupt task is allowed to be used in the program. (Please refer to section 6.6 in AH500 Operation Manual for more information about task I0~task I255.)
2. The interrupt task is allowed to be used between the instruction EI and the instruction DI in the program. When there is no part of the program in which the interrupt is disabled, users can choose not to use the instruction DI.
3. During the execution of one interrupt task, other interrupts generated will not be executed, but will be memorized. Not until the execution of the present interrupt task is complete will the next interrupt task be executed.
4. When several interrupts occur, the interrupt task which should be executed first has higher priority. When several interrupts occur simultaneously, the interrupt task whose pointer number is smaller is executed first.
5. When the interrupt task occurring between DI and EI can not be executed immediately, the interrupt request is memorized once, and the interrupt task is executed in the part of the program in which the execution of the interrupt task is allowed.
6. When the immediate I/O signal is required in the execution of the interrupt task, users can use the instruction REF in the program to refresh the state of the I/O.

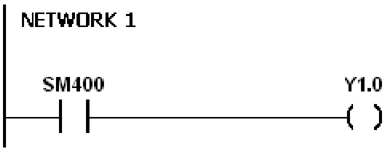
Example:

If the PLC runs and the part of the program Cyclic_0 between the instruction EI and the instruction DI is scanned, the interrupt task is executed when it is enabled. When the execution of the interrupt task is complete, the main program is executed.

The program Cyclic_0:



The interrupt task:



Additional remark:

There are 256 interrupt tasks, i.e. task I0~task I255.

1. The I/O interrupts (I0~I31)

   The I/O interrupts are used by the special high-speed module. The interrupt conditions and the interrupt numbers are set in HWCONFIG in ISPSoft, and the interrupt programs are downloaded to the PLC. If the interrupt conditions are satisfied when the PLC runs, the corresponding interrupt programs will be executed.
2. The communication interrupts (I32 and I33)

   The communication interrupt can be used as the instruction RS, that is, the receiving of the specific character triggers the interrupt, or can be used as the general interrupt.

   Please refer to the explanation of the instruction RS for more information.

   COM1: I32

   COM2: I33
3. 24 V low voltage interrupt

   Whether the external 24 V voltage is normal can be checked by the terminals VS+ and VS- on AH500PS05-5A. If the external 24 V voltage is abnormal, users can execute the corresponding program by means of the interrupt subroutine I34.

   Note: If the external 24 V voltage of a backplane is abnormal, the corresponding bit in SR731 will be set to ON. After the external 24 V voltage of the backplane returns to normal, the bit will be set to OFF. The high 8 bits in SR731 are reserved bits.

SR731

Bit 15 ~8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit2	Bit1	Bit0
Reserved bits	For the backplanes							

For example:

(a) If the external 24 V voltage of the local main backplane is abnormal, bit 0 in SR731 will be set to ON.

(b) If the external 24 V voltage of the first local extension backplane is abnormal, bit 1 in SR731 will be set to ON.

4. The external interrupts (I40~I251)

   If a peripheral device, e.g. a special I/O module, sends an interrupt request, the PLC will execute the specific interrupt task.

5. The timed interrupts (I252~I255)

   Timed interrupt 0 (I252): The default value is 100 milliseconds (1~1000 milliseconds).

   Timed interrupt 1 (I253): The default value is 40 milliseconds (1~1000 milliseconds).

   Timed interrupt 2 (I254): The default value is 20 milliseconds (1~1000 milliseconds).

   Timed interrupt 3 (I255): The default value is 10 milliseconds (1~1000 milliseconds).

   The timed interrupt task is executed every specific period of time. For example, the timed interrupt task is executed every 10 milliseconds.

- The priority order is a follows.

Interrupt number	Description	Priority order
I0	I/O interrupt 0	1
I1	I/O interrupt 1	2
I2	I/O interrupt 2	3
I3	I/O interrupt 3	4
I4	I/O interrupt 4	5
I5	I/O interrupt 5	6
I6	I/O interrupt 6	7
I7	I/O interrupt 7	8
I8	I/O interrupt 8	9
I9	I/O interrupt 9	10
I10	I/O interrupt 10	11
I11	I/O interrupt 11	12
I12	I/O interrupt 12	13
I13	I/O interrupt 13	14
I14	I/O interrupt 14	15
I15	I/O interrupt 15	16
I16	I/O interrupt 16	17
I17	I/O interrupt 17	18
I18	I/O interrupt 18	19
I19	I/O interrupt 19	20
I20	I/O interrupt 20	21
I21	I/O interrupt 21	22
I22	I/O interrupt 22	23
I23	I/O interrupt 23	24
I24	I/O interrupt 24	25
I25	I/O interrupt 25	26
I26	I/O interrupt 26	27
I27	I/O interrupt 27	28
I28	I/O interrupt 28	29
I29	I/O interrupt 29	30
I30	I/O interrupt 30	31
I31	I/O interrupt 31	32
I32	Communication interrupt	33

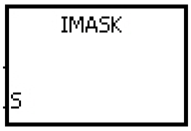
Interrupt number	Description	Priority order
	(COM1)	
I33	Communication interrupt (COM2)	34
I34	24 V low voltage interrupt Whether the external 24 V voltage is normal can be checked by the terminals VS+ and VS- on AH500PS05-5A. If the external 24 V voltage is abnormal, users can execute the corresponding program by means of the interrupt subroutine I34.	35
I35~I39	Reserved	36~40
I40~I251	External interrupt	41~252
I252	Timed interrupt 0 Default value: 100 ms (1~1000 ms)	253
I253	Timed interrupt 1 Default value: 40 ms (1~1000 ms)	254
I254	Timed interrupt 2 Default value: 20 ms (1~1000 ms)	255
I255	Timed interrupt 3 Default value: 10 ms(1~1000 ms)	256

API	Instruction code			Operand	Function
0502		IMASK		**S**	Controlling the interrupt

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●		●				

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
-	AH500	-

Symbol:



S : Data source   Word

Explanation:

1. The values of the bits in **S**~**S**+15 determine whether the interrupts are enabled or disabled. When the value of the bit is 1 and the instruction EI is executed, the corresponding interrupt is executed. When the value of the bit is 0, the corresponding interrupt can not be executed.
2. When the instruction is executed, the values in **S**~**S**+15 are transferred to SR623~SR638.
3. When the instruction is not executed, the values of the bits in SR623~SR638 determine whether the interrupts are enabled or disabled.

S	I15	I14	I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1	I0
S +1	I31	I30	I29	I28	I27	I26	I25	I24	I23	I22	I21	I20	I19	I18	I17	I16
S +2	I47	I46	I45	I44	I43	I42	I41	I40	I39	I38	I37	I36	I35	I34	I33	I32
S +3	I63	I62	I61	I60	I59	I58	I57	I56	I55	I54	I53	I52	I51	I50	I49	I48
S +4	I79	I78	I77	I76	I75	I74	I73	I72	I71	I70	I69	I68	I67	I66	I65	I64
S +5	I95	I94	I93	I92	I91	I90	I89	I88	I87	I86	I85	I84	I83	I82	I81	I80
S +6	I111	I110	I109	I108	I107	I106	I105	I104	I103	I102	I101	I100	I99	I98	I97	I96
S +7	I127	I126	I125	I124	I123	I122	I121	I120	I119	I118	I117	I116	I115	I114	I113	I112
S +8	I143	I142	I141	I140	I139	I138	I137	I136	I135	I134	I133	I132	I131	I130	I129	I128
S +9	I159	I158	I157	I156	I155	I154	I153	I152	I151	I150	I149	I148	I147	I146	I145	I144
S +10	I175	I174	I173	I172	I171	I170	I169	I168	I167	I166	I165	I164	I163	I162	I161	I160
S +11	I191	I190	I189	I188	I187	I186	I185	I184	I183	I182	I181	I180	I179	I178	I177	I176
S +12	I207	I206	I205	I204	I203	I202	I201	I200	I199	I198	I197	I196	I195	I194	I193	I192
S +13	I223	I222	I221	I220	I219	I218	I217	I216	I215	I214	I213	I212	I211	I210	I209	I208
S +14	I239	I238	I237	I236	I235	I234	I233	I232	I231	I230	I229	I228	I227	I226	I225	I224
S +15	I255	I254	I253	I252	I251	I250	I249	I248	I247	I246	I245	I244	I243	I242	I241	I240

Additional remark:

If **S**~**S**+15 exceed the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

6.7 I/O Refreshing Instructions

6.7.1 List of I/O Refreshing Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
0600	REF	–	✓	Refreshing the I/O	5

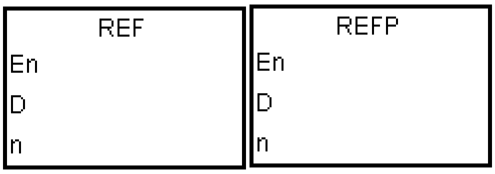
6.7.2 Explanation of I/O Refreshing Instructions

API	Instruction code			Operand	Function
0600		REF	P	**D, n**	Refreshing the I/O

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	○	○						○					○				
n	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



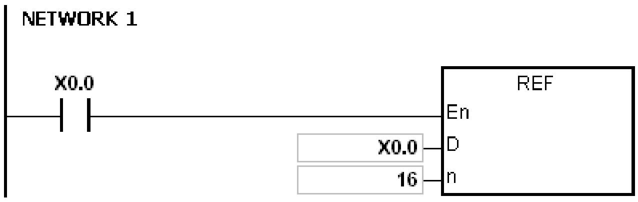
D	:	I/O point whose state is refreshed	Bit
n	:	Number of I/O points whose states are refreshed	1~256

Explanation:

The I/O states are not refreshed until the instruction END is executed. When the scanning of the program starts, the states of the external inputs are read and stored in the memory. After the instruction END is executed, the states of the outputs in the memory is sent to the output terminals. Therefore, users can use this instruction when they need the latest I/O data in the operation process.

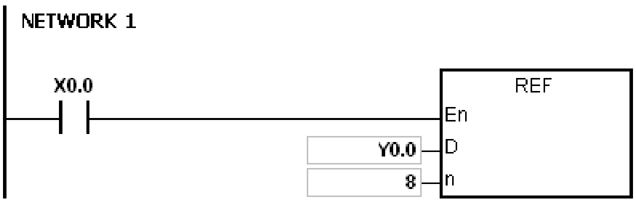
Example 1:

When X0.0 is ON, the PLC reads the states of the inputs X0.0~X0.15 immediately. The input signals are refreshed without any delay.



Example 2:

When X0.0 is ON, the output signals from Y0.0~Y0.7 are sent to the output terminals. The output signals are refreshed immediately without the need to wait for the execution of the instruction END.



Additional remark:

1. If **D**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is larger than 256, or if **n** is less than 1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

6.8 Miscellaneous Instructions

6.8.1 The List of Miscellaneous Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-Bit	32-Bit			
0700	ALT	–	✓	Alternating between ON and OFF	3
0701	TTMR	–	–	Teach mode timer	5
0702	STMR	–	–	Special timer	7
0703	RAMP	–	–	Ramp signal	9
0704	MTR	–	–	Matrix input	9
0705	ABSD	DABSD	–	Absolute drum sequencer	9
0706	INCD	–	–	Incremental drum sequencer	9
0707	–	DPID	–	PID algorithm	35
0708	–	DPIDE	–	PID algorithm	43

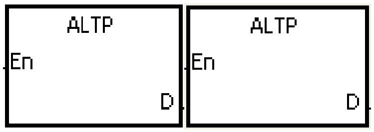
6.8.2 Explanation of Miscellaneous Instructions

API		Instruction code		Operand	Function
0700		ALT	P	**D**	Alternating between ON and OFF

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●	●	●				●	●	●			●				

Pulse instruction	16-Bit instruction (3 steps)	32-Bit instruction
AH500	AH500	-

Symbol:



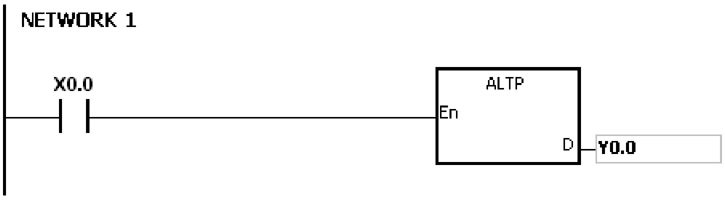
D : Destination device Bit

Explanation:

1. When the instruction ALT is executed, the state of the device specified by **D** alternate between ON and OFF.
2. Generally, the pulse instruction ALTP is used.

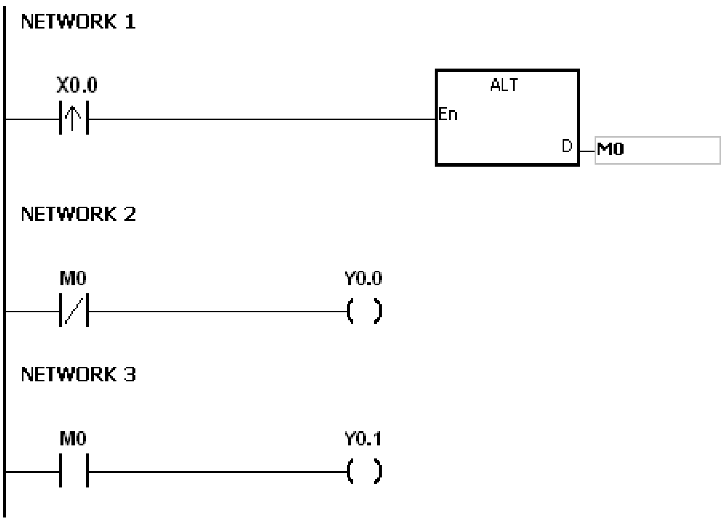
Example 1:

When X0.0 is switched from OFF to ON for the first time, Y0.0 is ON. When X0.0 is switched from OFF to ON for the second time, Y0.0 is OFF.



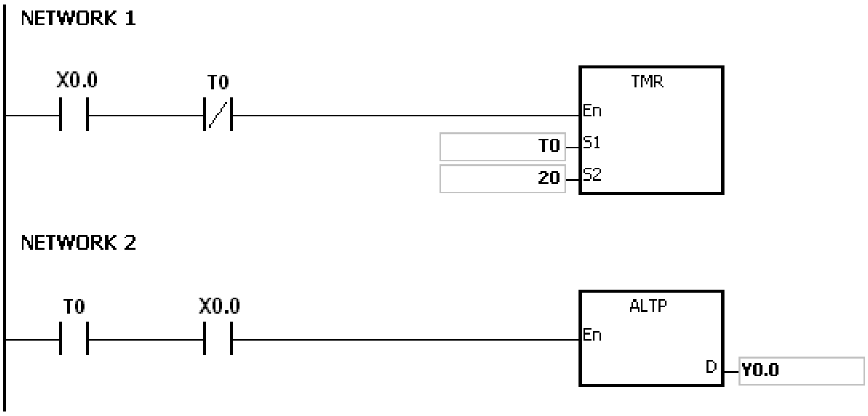
Example 2:

In the beginning, M0 is OFF. Therefore, Y0.0 is ON, and Y0.1 is OFF. When X0.0 is switched from OFF to ON for the first time, M0 is ON. Therefore, Y0.1 is ON, and Y0.0 is OFF. When X0.0 is switched from OFF to ON for the second time, M0 is OFF. Therefore, Y0.0 is ON, and Y0.1 is OFF.



Example 3:

When X0.0 is ON, T0 generates a pulse every two seconds. The output Y0.0 alternates between ON and OFF according to the pulses generated by T0.

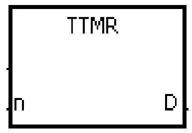


API	Instruction code			Operand	Function
0701		TTMR		D, n	Teach mode timer

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●						●	●		●		●				
n	●	●						●	●		●		●	○	○		

Pulse instruction	16-Bit instruction (5 steps)	32-Bit instruction
-	AH500	-

Symbol:



D : Device in which the time is stored Word

n : Multiplier Word

Explanation:

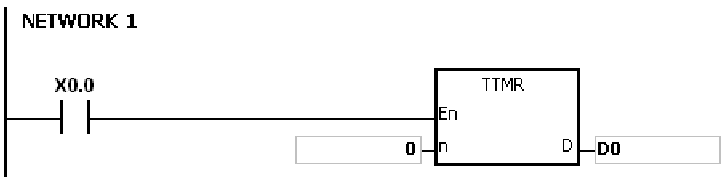
1. A second is taken as the timing unit. The time for which the button switch has been turned ON is multiplied by **n**, and the product is stored in **D**. **D+1** is for system use only. When the instruction is executed, the value in **D+1** can not be altered. Otherwise, the time will be counted incorrectly.
2. When the conditional contact is ON, **D** is reset to 0.
3. Setting the multiplier: When **n** is 0, **D** takes a second as the timing unit. When **n** is 1, the time for which the button switch has been turned ON is multiplied by 10, and **D** takes 100 milliseconds as the timing unit. When **n** is 2, the time for which the button switch has been turned ON is multiplied by 100, and **D** takes 10 milliseconds as the timing unit.

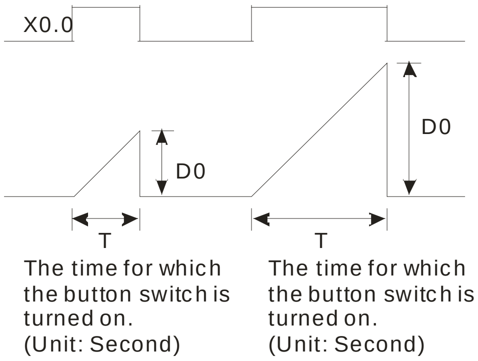
n	D
K0 (unit: 1 second)	1×T
K1 (unit: 100 milliseconds)	10×T
K2 (unit: 10 milliseonds)	100×T

4. When the on-line editing is used, please reset the conditional contact to initialize the instruction.
5. The operand **n** should be within the range between 0 and 2.

Example 1:

1. The time for which the button switch X0.0 has been turned ON is multiplied by n, and the product is stored in D0.
2. When X0.0 is switched OFF, the value in D0 is unchanged.





Additional remark:

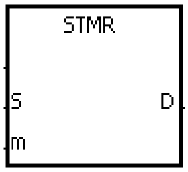
1. If **D**+1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 0, or if **n** is larger than 2, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [2] of WORD/INT.

API	Instruction code			Operand	Function
0702		STMR		S, m, D	Special timer

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S					○												
m	●	●						●	●		●		●	○	○		
D	●	●	●	●				●	●	●			●				

Pulse instruction	16-Bit instruction (7 steps)	32-Bit instruction
-	AH500	-

Symbol:



S : Timer number T0~T2047

m : Setting value of the timer Word

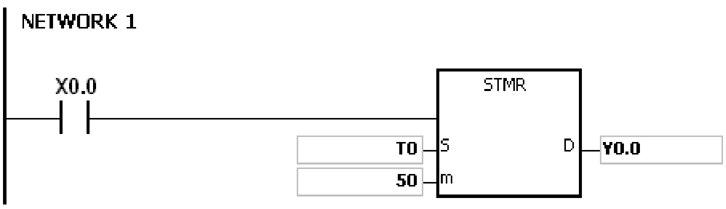
D : Output device Bit

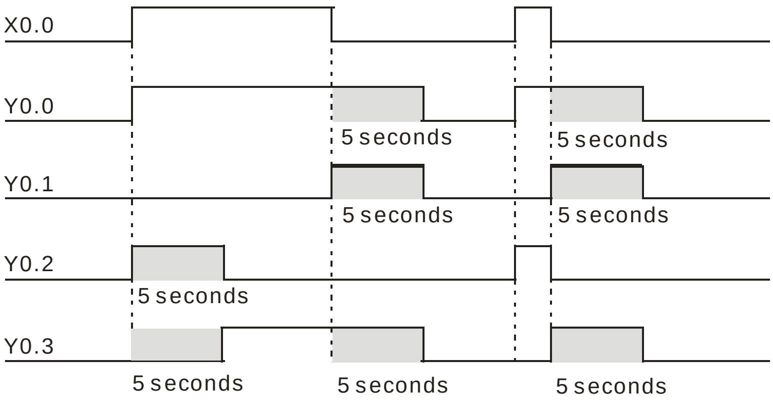
Explanation:

1. The instruction STMR is used to generate the off-delay relay, the one-shot circuit, and the flashing circuit.
2. The timer specified by the instruction TMR takes 100 milliseconds as the timing unit.
3. The timer specified by the instruction STMR can not be used repeatedly.
4. **D** occupies four consecutive devices.
5. Before the instruction is executed, please reset **D**~**D**+3.
6. When the conditional contact is not enabled and the value of the device meets one of the two conditions mentioned below, **D**, **D**+1, and **D**+3 are ON for **m** seconds before they are switched OFF. When the conditional contact is not enabled and the value of the device does not meet either of the two conditions mentioned below, **D**~**D**+3 keep OFF.
   - The value of the timer is less than or equal to **m**, **D** is ON, and **D**+1 is OFF.
   - The value of the timer is less than **m**, **D** +2 is OFF, and **D**, **D**+1, and **D**+3 are ON.
7. When the on-line editing is used, please reset the conditional contact to initialize the instruction.
8. The operand **m** should be within the range between 1 and 32767.

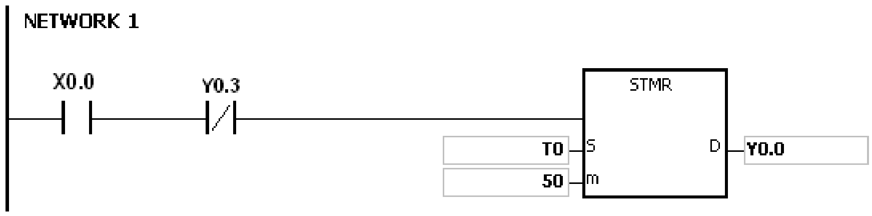
Example:

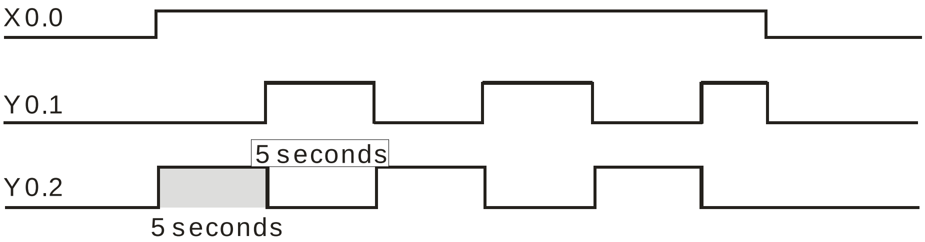
1. When X0.0 is ON, the instruction STMR specifies the timer T0, and the setting value of T0 is five seconds.
2. Y0.0 is the off-delay contact. When X0.0 is switched from OFF to ON, Y0.0 is ON. Five minutes after X0.0 is switched from ON to OFF, Y0.0 is OFF.
3. When X0.0 is switched from ON to OFF, Y0.0 is ON for five seconds.
4. When X0.0 is switched from OFF to ON, Y0.2 is ON for five seconds.
5. Five seconds after X0.0 is switched from OFF to ON, Y0.3 is ON. Five seconds after X0.0 is switched from ON to OFF, Y0.3 is OFF.





6. When the conditional contact X0.0 is followed by the normally-closed contact Y0.0, the flashing currents pass through Y0.1 and Y0.2. When X0.0 is switched OFF, Y0.0, Y0.1, and Y0.3 are switched OFF, and T0 is reset to 0.





Additional remark:

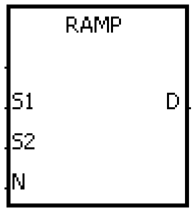
1. If **D**+3 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **m** is less than 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [4] of BOOL.

API	Instruction code			Operand	Function
0703		RAMP		**S_1, S_2, D, n**	Ramp signal

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●						●	●		●		●				
S_2	●	●						●	●		●		●				
D	●	●						●	●		●		●				
n	●	●						●	●		●		●	○	○		

Pulse instruction	16-Bit instruction (9 steps)	32-Bit instruction
-	AH500	-

Symbol:



S_1	:	Initial value of the ramp signal	Word
S_2	:	Final value of the ramp signal	Word
D	:	Duration of the ramp signal	Word
n	:	Number of scan cycles	Word

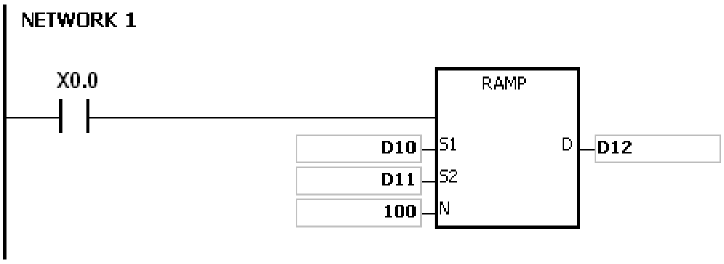
Explanation:

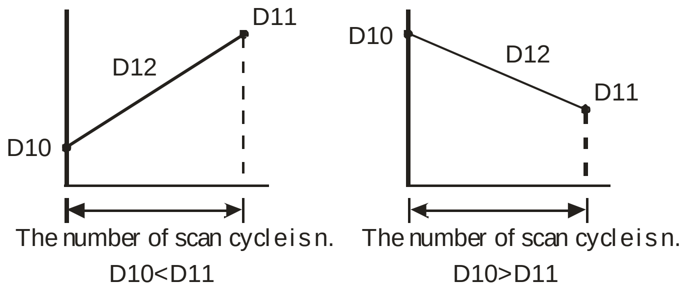
1. The instruction is used to get the slope. The slope is linear, and has an absolute relationship with the scan time.
2. The initial value of the ramp signal and the final value of the ramp signal are written into **S_1** and **S_2** respectively in advance. When X0.0 is ON, D increases from the setting value in **S_1** to the setting value in **S_2**. The number of scan cycles is stored in D+1. When the value in D is equal to that in **S_2**, or when the value in D+1 is equal to **n**, reached to the scan cycles, SM687 is ON.
3. When the conditional contact is not enabled, the value in D, and D+1 are both 0, and SM687 is OFF.
4. When the on-line editing is used, please reset the conditional contact to initialize the instruction.
5. Please refer to ISPSoft User Manual for more information related to the fixing of the scan time.
6. The operand **n** should be within the range between 1 and 32767.

Example:

When the instruction is used with the analog signal output, the action of cushioning the start/stop can be executed.

1. Suppose the instruction is being executed. When X0.0 is switched OFF, the execution of the instruction stops. When X0.0 is ON again, SM687 is OFF, D12 is reset to the setting value in D10, D13 is reset to 0, and the calculation is restarted.
2. When SM686 is OFF, SM687 is ON, D12 is reset to the setting value in D10, and D13 is reset to 0.

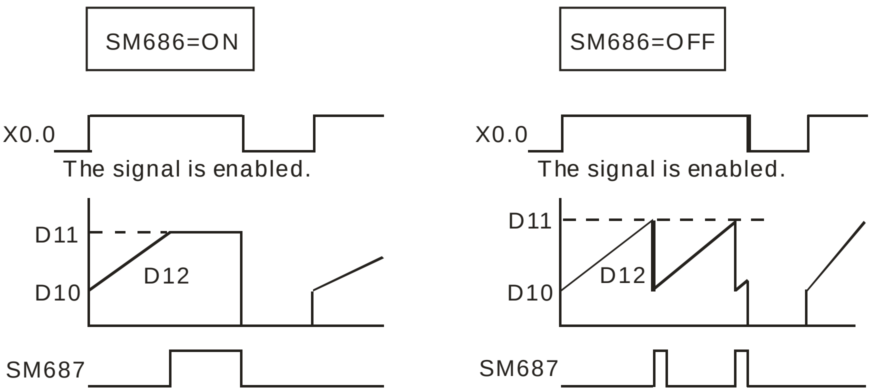




The number of scan cycle is stored in D13.

Additional remark:

1. If **D**+1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [2] of WORD/INT.
4. When SM686 is ON/OFF, the value in D12 changes as follows.

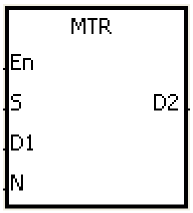


API	Instruction code	Operand	Function
0704	MTR	S, D_1, D_2, n	Matrix input

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	○																
D_1		○															
D_2	○	○	○	○				○	○				○				
n	●	●	●	●				●	●		●		●	○	○		

Pulse instruction	16-Bit instruction (9 steps)	32-Bit instruction
-	AH500	-

Symbol:



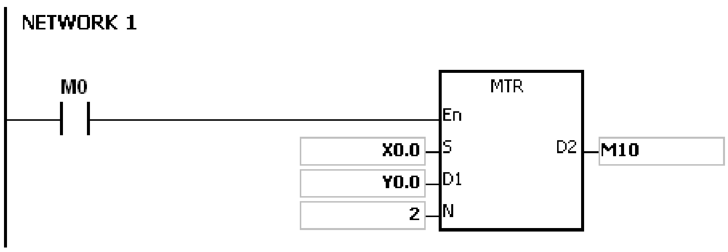
S	:	Initial input device in the matrix scan	Bit
D_1	:	Initial output device in the matrix scan	Bit
D_2	:	Initial corresponding device in the matrix scan	Bit
n	:	Number of rows which are scanned	Word

Explanation:

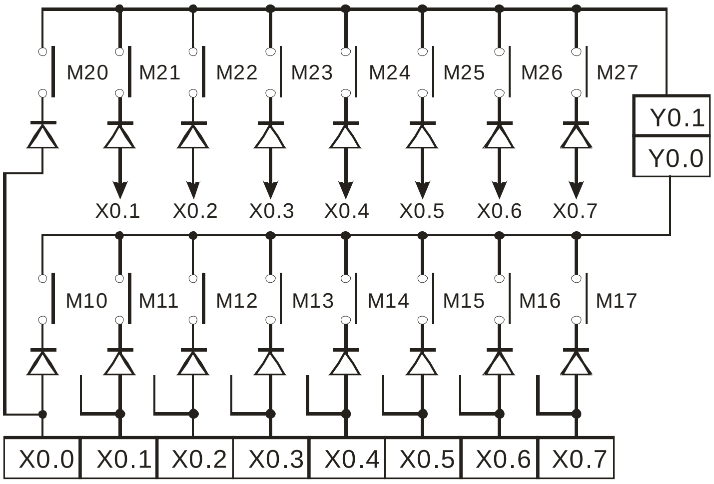
1. **S** specifies the initial input device in the matrix scan. The eight devices starting from the device specified by **S** are the input devices in the matrix scan.
2. **D_1** specifies the transistor output device Y as the initial device in the matrix scan. When the conditional contact is OFF, the states of the **n** devices starting from **D_1** are OFF.
3. One row of inputs is refreshed every scan cycle. There are 16 inputs in a row, and the scan starts from the first row to the **n**th row.
4. The eight input devices starting from the device specified by **S** are connected to the **n** output devices starting from the device specified by **D_1** to form the **n** rows of switches. The states of the **n** rows of switches are read in the matrix scan, and stored in the devices starting from the device specified by **D_2**.
5. When the instruction is used, users can connect at most 8 rows of input switches in parallel to get 64 inputs (8×8=64).
6. The interval between the time when the instruction is executed and the next time when it is executed should be longer than the time it takes for the states of the I/O points on the module to be refreshed. Otherwise, the correct states of the inputs can not be read.
7. Generally, the conditional contact used in the instruction is the normally-open contact SM400.
8. The operand **n** should be within the range between 2 and 8.

Example 1:

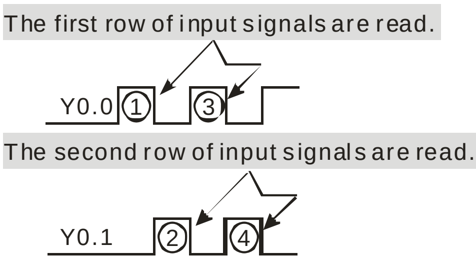
1. When M0 is ON, the instruction MTR is executed. The states of the two rows of switches are read in order, and stored in the internal relays M10~M17 and M20~M27 respectively.



2. The diagram below is the external wiring diagram of the 2-by-8 matrix input circuit which is composed of X0.0~X0.7 and Y0.0~Y0.7. The corresponding internal relays of the 16 switches are M10~M17 and M20~M27.



3. The eight input devices starting from X0.0 are connected to the two output devices starting from Y0.0 to form the two rows of switches. The states of the two rows of switches are read in the matrix scan, and stored in the devices starting from M10 specified by **D₂**. That is, the states of the first row of switches are stored in M10~M17, and the states of the second row of switches are stored in M20~M27.



Additional remark:

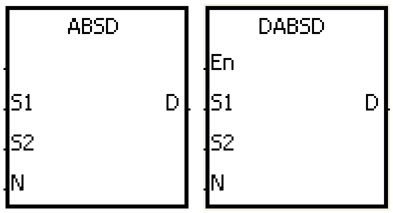
1. If **S**+7, **D_1**+**n**-1, or **D_2**+(**n***8)-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 2, or if **n** is larger than 8, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. If users declare the operand **S** in ISPSoft, the data type will be ARRAY [8] of BOOL.

API	Instruction code			Operand	Function
0705	D	ABSD		**S_1, S_2, D, n**	Absolute drum sequencer

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●	●			●	●	●	●	●		●		●				
S_2	●	●			●	●	●	●	●		●		●				
D	●	●	●	●				●	●	●			●				
n	●	●						●	●		●		●	○	○		

Pulse instruction	16-Bit instruction (9 steps)	32-Bit instruction (9 steps)
-	AH500	AH500

Symbol:



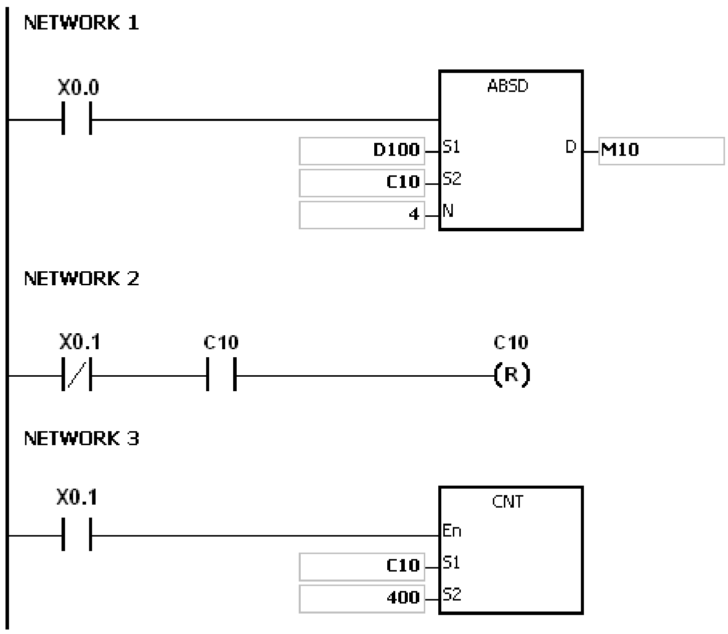
S_1	:	Initial device in the comparison	Word/Double word
S_2	:	Comparison value	Word/Double word
D	:	Comparison result	Bit
n	:	Number of comparison groups	Word

Explanation:

1. The instruction ABSD is used to generate multiple pulses corresponding to the current values of the counter.
2. Only the instruction DABSD can use the 32-Bit counter.
3. When the instruction ABSD is used, **n** should be within the range between 1 and 256. When the instruction DABSD is used, **n** should be within the range between 1 and 128.

Example 1:

1. Before the instruction ABSD is executed, the instruction MOV is used to write the setting values in D100~D107. The values in the even devices are minimum values, and the values in the odd devices are maximum values.
2. When X0.0 is ON, the current value of the counter C10 is compared with the maximum values and the minimum values in D100~D107, and the comparison results are stored in M10~M13.
3. When X0.0 is OFF, the original states of M10~M13 are unchanged.

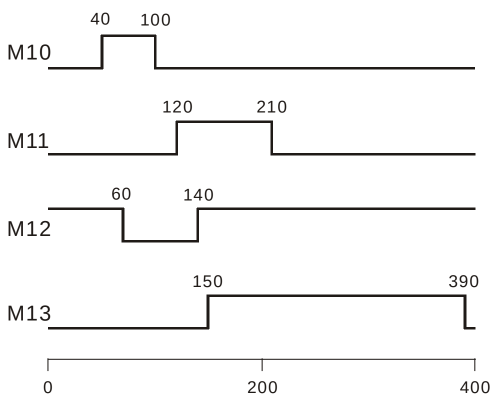


4. When the current value of C10 is within the range between the minimum value and the maximum value, M10~M13 are ON. Otherwise, M10~M13 are OFF.

Minimum value	Maximum value	Current value of C10	Output
D100=40	D101=100	40≦C10≦100	M10=ON
D102=120	D103=210	120≦C10≦210	M11=ON
D104=140	D105=170	140≦C10≦170	M12=ON
D106=150	D107=390	150≦C10≦390	M13=ON

5. Suppose the minimum value is larger than the maximum value. When the current value of C10 is less than the maximum value (C10 < 60), or when the current value of C10 is larger than the minimum value (C10 > 140), M12 is ON. Otherwise, M12 is OFF.

Minimum value	Maximum value	Current value of C10	Output
D100=40	D101=100	40≦C10≦100	M10=ON
D102=120	D103=210	120≦C10≦210	M11=ON
D104=140	D105=60	60≦C10≦140	M12=OFF
D106=150	D107=390	150≦C10≦390	M13=ON



Additional remark:

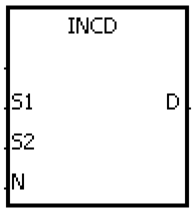
1. If **S**+2***n**-1 used in the instruction ABSD exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **S**+4***n**-1 used in the instruction DABSD exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If **D**+**n**-1 used in the instruction ABSD exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If **D**+2***n**-1 used in the instruction DABSD exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
5. If **n** used in the instruction ABSD is less than 1 or larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
6. If **n** used in the instruction DABSD is less than 1 or larger than 128, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code	Operand	Function
0706	INCD	**S_1, S_2, n, D**	Incremental drum sequencer

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●	●			●	●		●	●		●		●				
S_2	●	●			●	●		●	●		●		●				
D	●	●	●	●				●	●	●			●				
n	●	●						●	●		●		●	○	○		

Pulse instruction	16-Bit instruction (9 steps)	32-Bit instruction
-	AH500	-

Symbol:



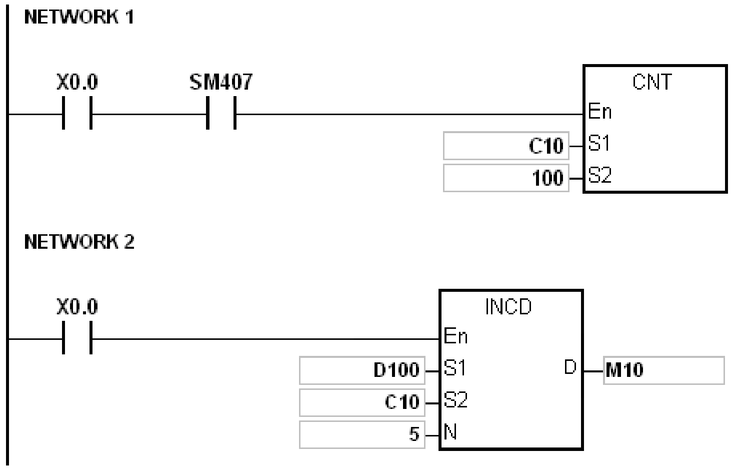
S_1	:	Initial device in the comparison	Word
S_2	:	Counter number	Word
D	:	Comparison result	Bit
n	:	Number of comparison groups	Word

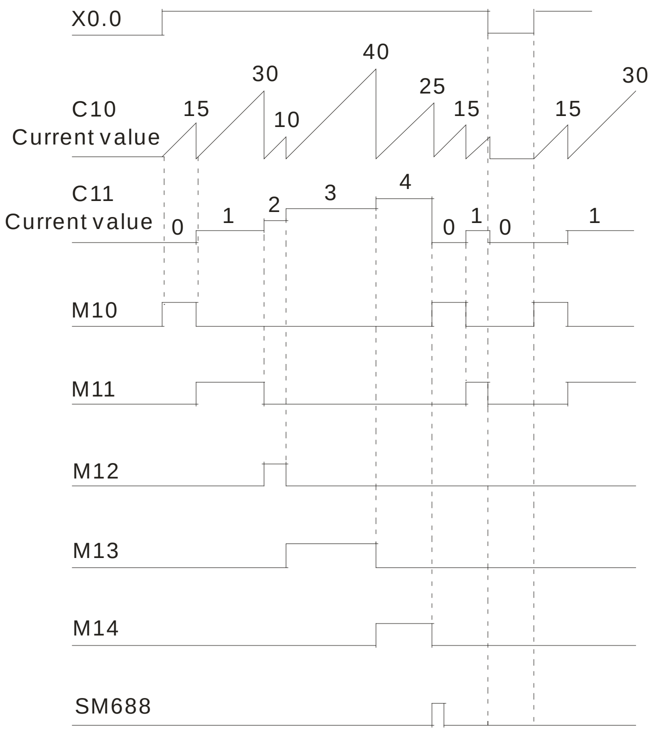
Explanation:

1. The instruction INCD is used to generate multiple pulses for a pair of counters.
2. The current value of **S_2** is compared with the setting value in **S_1**. When the current value matches the setting value, the current value of **S_2** is rest to 0, and the current comparison group number is stored in **S_2**+1.
3. After the comparison between the current values of **S_2** and the **n** groups of values is complete, SM688 is ON for a scan cycle.
4. When the conditional contact is not enabled, the value in **S_2** is 0, the value in **S_2**+1 is 0, **D**~**D**+**n**-1 are OFF, and SM688 is OFF.
5. When the on-line editing is used, please reset the conditional contact to initialize the instruction.
6. The operand **n** should be within the range between 1 and 256.

Example:

1. Before the instruction INCD is executed, the instruction MOV is used to write the setting values in D100~D104. The values in D100~D104 are 15, 30, 10, 40, and 25 respectively.
2. The current values of C10 is compared with the setting values in D100~D104. When the current value matches the setting value, C10 is rest to 0, and counts again.
3. The current comparison group number is stored in C11.
4. When the value in C11 changes by one, M10~M14 act correspondingly. Please refer to the timing diagram below.
5. When the comparison between the current values of C10 and the values in D100~D104 is complete, SM688 is ON for a scan cycle.
6. When X0.0 is switched from ON to OFF, C10 and C11 are reset to 0, and M10~M14 are switched OFF. When X0.0 is ON again, the execution of the instruction starts from the beginning.





Additional remark:

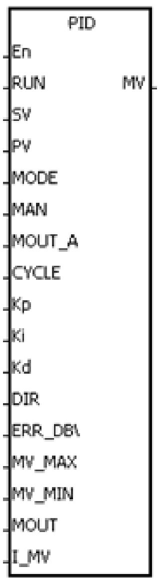
1. If $\mathbf{S_2}$+1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If $\mathbf{S_1}$+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If **D**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If **n** is less than 1, or if **n** is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
5. If users declare the operand $\mathbf{S_2}$ in ISPSoft, the data type will be ARRAY [2] of WORD/INT.

API	Instruction code		Operand	Function
0707	D	PID	PID_RUN, SV, PV, PID_MODE, PID_MAN, MOUT_AUTO, CYCLE, Kp, Ki, Kd, PID_DIR, ERR_DBW, MV_MAX, MV_MIN, MOUT, I_MV, MV	PID algorithm

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
PID_RUN	●	●	●					●	●	●			●				
SV								●	●				●				
PV								●	●				●				
PID_MODE								●	●				●				
PID_MAN	●	●	●					●	●	●			●				
MOUT_AUTO	●	●	●					●	●	●			●				
CYCLE								●	●				●				
Kp								●	●				●				
Ki								●	●				●				
Kd								●	●				●				
PID_DIR	●	●	●					●	●	●			●				
ERR_DBW								●	●				●				
MV_MAX								●	●				●				
MV_MIN								●	●				●				
MOUT								●	●				●				
I_MV								●	●				●				
MV								●	●				●				

Pulse instruction	16-Bit instruction	32-Bit instruction (35 steps)
-	-	AH500

Symbol:



PID_RUN	:	Enabling the PID algorithm	Bit
SV	:	Target value (SV)	Double word
PV	:	Process value (PV)	Double word
PID_MODE	:	PID control mode	Double word
PID_MAN	:	PID A/M mode (PID_MAN)	Bit
MOUT_AUTO	:	MOUT_AUTO	Bit
CYCLE	:	Sampling time (CYCLE)	Double word
K_p	:	Proportional gain (K_p)	Double word
K_i	:	Integral gain (K_i)	Double word
K_d	:	Derivative gain (K_d)	Double word
PID_DIR	:	PID forward/reverse direction (PID_DIR)	Bit

ERR_DBW	:	Range within which the error value is count as 0 (ERR_DBW)	Double word
MV_MAX	:	Maximum output value (MV_MAX)	Double word
MV_MIN	:	Minimum output value (MV_MIN)	Double word
MOUT	:	Manual output value (MOUT)	Double word
I_MV	:	Accumulated integral value (I_MV)	Double word
MV	:	Output value (MV)	Double word

Explanation:

1. The instruction is used to implement the PID algorithm. After the sampling time is reached, the PID algorithm is implemented. PID stands for Proportional, Integral, Derivative. The PID control is widely applied to mechanical equipments, pneumatic equipments, and electronic equipments.
2. The setting of the parameters is as follows.

Device number	Data type	Function	Setting range	Description
PID_RUN	BOOL	Enabling the PID algorithm	True: The PID algorithm is implemented. False: The output value (MV) is reset to 0, and the PID algorithm is not implemented.	
SV	REAL	SV	Range of single-precision floating-point numbers	Target value
PV	REAL	PV	Range of single-precision floating-point numbers	Process value
PID_MODE	Double word/DINT	PID control mode	0: Automatic control When PID_MAN is switched from ON to OFF, the output value (MV) then is involved in the automatic algorithm. 1: The parameters are tuned automatically. When the tuning of the parameters is complete, the device is automatically set to 0, and is filled in with appropriate parameters K_P, K_I, and K_D. 2: Automatic control When PID_MAN is switched from ON to OFF, the MV	

Device number	Data type	Function	Setting range	Description
			involved in the internal algorithm is involved in the automatic algorithm. If the setting value exceeds the range, it will be counts as 0.	
PID_MAN	BOOL	PID A/M mode	True: Manual The MV is output according to the MOUT, but it is still within the range between the MV_MIN and the MV_MAX. When PID_MODE is set to 1, the setting is ineffective. False: Automatic The MV is output according to the PID algorithm, and the output value is within the range between MV_MIN and MV_MAX.	
MOUT_AUTO	BOOL	MOUT automatic change mode	True: Automatic The MOUT varies with the MV. False: Normal The MOUT deos not vary with the MV.	
Cycle	Double word/DINT	Sampling time (T_S)	1~2,000 (unit: 10ms)	When the instruction is scanned, the PID algorithm is implmented according to the sampling time, and the MV is refreshed. If T_S is less than 1, it will be count as 1. If T_S is larger than 2000, it will be count as 2000. When the instruction PID is used in the interval interrupt task, the sampling time is the same as the interval between the

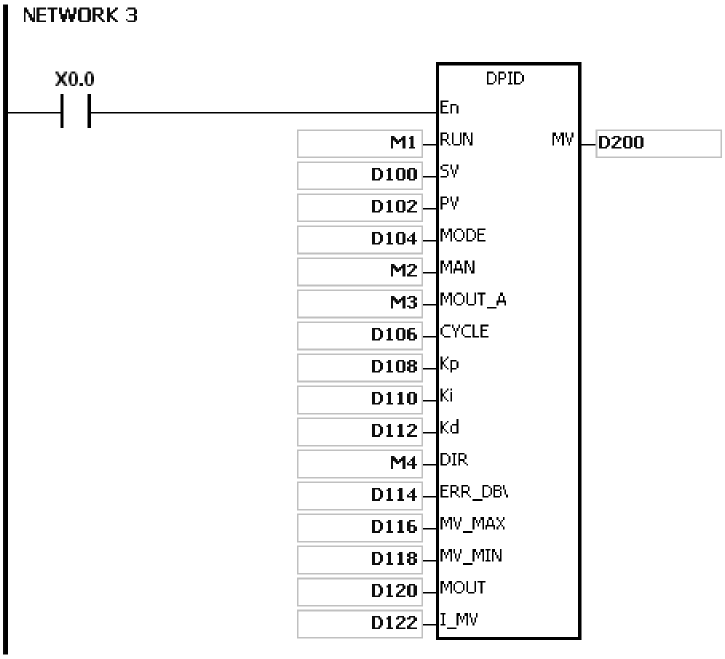
Device number	Data type	Function	Setting range	Description
				timed interrupt tasks.
K_p	REAL	Proportional gain (K_p)	Range of positive single-precision floating-point numbers	It is the magnified proportional value of the error between the SV and the PV. If the magnified proportional value of the error is less than 0, the K_p will be count as 0.
K_i	REAL	Integral gain (K_i)	Range of positive single-precision floating-point numbers	It is the integral gain (K_i). If the integral gain is less than 0, the K_i will be count as 0.
K_d	REAL	Derivative gain (K_d)	Range of positive single-precision floating-point numbers	It is the derivative gain (K_d). If the derivative gain is less than 0, the K_d will be count as 0.
PID_DIR	BOOL	PID forward/reverse direction	True: Reverse action (E=SV-PV) False: Forward action (E=PV-SV)	
ERR_DBW	REAL	Range within which the error value is count as 0	Range of single-precision floating-point numbers	The error value (E) is the difference between the SV and the PV. When the setting value is 0, the function is not enabled. For example, the E within the range between -5 and 5 will be count as 0 if the setting value is 5 or -5.

<table>
<tr><th>Device number</th><th>Data type</th><th colspan="2">Function</th><th>Setting range</th><th>Description</th></tr>
<tr><td>MV_MAX</td><td>REAL</td><td colspan="2">Maximum output value</td><td>Range of single-precision floating-point numbers</td><td>Suppose MV_MAX is set to 1,000. When the MV is larger than 1,000, 1,000 is output. The value in MV_MAX should be larger than that in MV_MIN. Otherwise, the maximum MV and the minimum MV will be reversed.</td></tr>
<tr><td>MV_MIN</td><td>REAL</td><td colspan="2">Minimum output value</td><td>Range of single-precision floating-point numbers</td><td>Suppose MV_MIN is set to -1,000. When the MV is less than -1,000, -1,000 is output.</td></tr>
<tr><td>MOUT</td><td>REAL</td><td colspan="2">Manual output value</td><td colspan="2">It is used with the PID_MAN mode. Users set the MV directly.</td></tr>
<tr><td rowspan="3">I_MV
(It occupies six consecutive 32-Bit devices.)</td><td rowspan="3">REAL</td><td>I_MV</td><td>The accumulated integral value is temporarily stored in it.</td><td>Range of single-precision floating-point numbers</td><td>The accumulated integral value is only for reference. It still can be cleared or modified according to users’ need. When the MV is larger than the MV_MAX, or when the MV is less than MV_MIN, the accumulated integral value in I_MV is unchanged.</td></tr>
<tr><td>I_MV+1</td><td>The previous PV is temporarily stored in it.</td><td colspan="2">The previous PV is only for reference. It still can be modified according to users’ need.</td></tr>
<tr><td>I_MV+2</td><td colspan="3">For system use only</td></tr>
</table>

Device number	Data type	Function	Setting range	Description
		~ I_MV+5		
MV	REAL	MV	The MV is withing the range between the MV_MIN and the MV_MAX.	

Example:

1. Before the instruction PID is executed, the setting of the parameters should be complete.
2. When X0.0 is ON, the instruction is executed. When M1 is ON, the PID algorithm is implemented. When M1 is OFF, the MV is 0, and the MV is stored in D200. When X0.0 is switched OFF, the instruction is not executed, and the previous data is unchanged.



Additional remark:

1. The instruction can be used several times, but the registers specified by **I_MV**~**I_MV**+5 can not be the same.
2. **I_MV** occupies 12 registers. **I_MV** used in the instruction PID in the above example occupies D122~D133.
3. The instruction PID only can be used in the cyclic task and the interval interrupt task. When the instruction PID is used in the interval interrupt task, the sampling time is the same as the interval between the timed interrupt tasks.
4. When the instruction is scanned, the PID algorithm is implmented according to the sampling time, and the MV is refreshed. When the instruction is used in the interrupt task, the sampling time is the same as the interval between the timed interrupt tasks. The PID algorithm is implemented according to the interval between the timed interrupt tasks.
5. Before the PID algorithm is implemented, the process value used in the instruction PID has to be a stable value. When users need the input value in the module to implement the PID algorithm, they have to notice the time it takes for the analog input to be converted into the digital input.

The PID algorithm:

1. When **PID_MODE** is set to 0 or 2, the PID control mode is the automatic control mode.
2. When **PID_MODE** is set to 1, the PID control mode is the automatic tuning mode. After the tuning of the parameter is complete, **PID_MODE** is set to 0. The PID control mode becomes the automatic control mode.
   a) The PID algorithm includes the forward action and the reverse action. Whether the action is the forward one or the reverse one depends on the setting of **PID_DIR**.
   The PID algorithm is as follows.

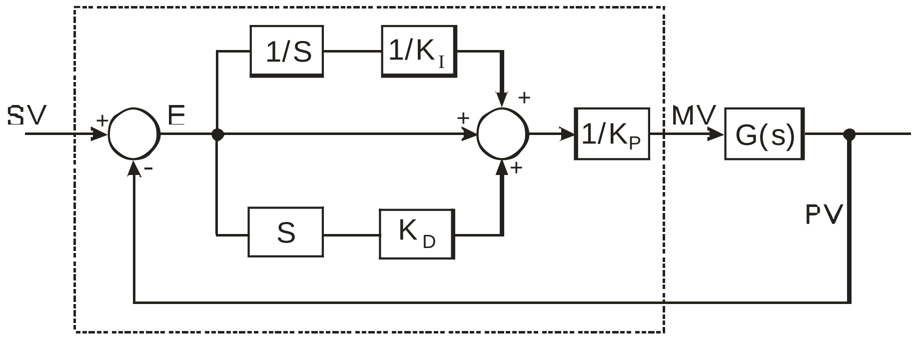
$$MV = K_P E(t) + K_I \int_0^t E(t)dt + K_D * \frac{dE(t)}{dt}$$

E(t)S represents the derivative value of E(t), and $E(t)\frac{1}{S}$ represents the integral value of $E(t)$.

Action direction	PID algorithm
Forward action	$E(t) = PV(t) - SV(t)$
Reverse action	$E(t) = SV(t) - PV(t)$

- Control diagram: S represents the derivative action, and is defined as (Current E(t)-previous E(t))/Sampling time. 1/S represents the integral action, and is defined as (Previous integral value+Error value)×Sampling time. G(S) represents the plant.

The instruction PID is inside the dotted line.

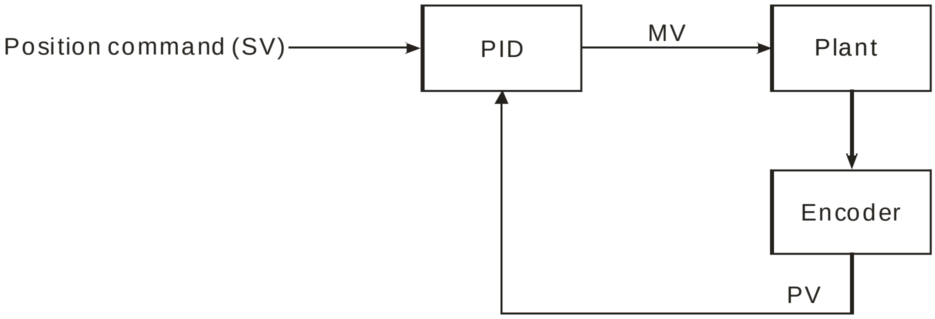


- The symbols:
  MV : Output value
  $E(t)$: Error value
  Forward action $E(t) = PV - SV$
  Reverse action $E(t) = SV - PV$
  K_P : Proportional gain
  PV : Process value
  SV : Target value
  K_D : Derivative gain
  K_I : Integral gain

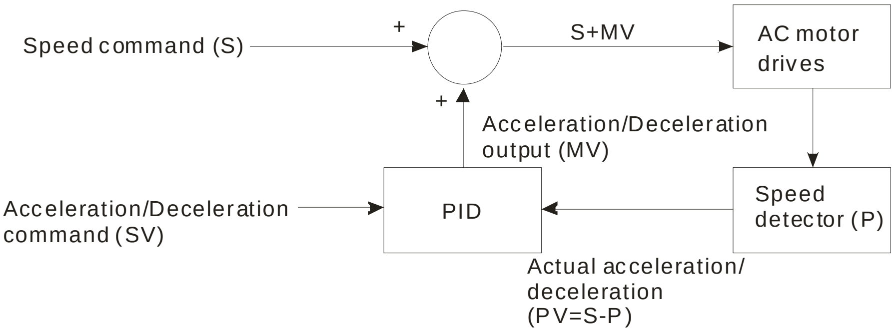
Suggestion:

1. Owing to the fact that the instruction PID can be used in a lot of controlled environments, users have to choose the control function appropriately. For example, to prevent the improper control from occurring, **PID_MODE** can not be used in the motor controlled environment when it is set to 1.
2. When users tune the parameters K_P, K_I, and K_D (**PID_MODE** is set to 0 or 2), they have to tune the K_P first (according to the experience), and then set set the K_I and the K_D to 0. When users can handle the control, they can increase the K_I and the K_D, as illustrated in example four below. When the K_P is 100, it means that the proportional gain is 100%. That is, the error value is increased by a factor of one. When the proportional gain is less than 100%, the error value is decreased. When th proportional gain is larger than 100%, the error value is increased.
3. To prevent the parameters which have been tuned automatically from disappearing after a power cut, users have to store the parameters in the latched data registers when is **PID_MODE** set to 1. The parameters which have been tuned automatically are not necessarily suitable for every controlled environment. Therefore, users can modify the parameters which have been tuned automatically. However, it is suggested that users only modify the K_I or the K_D.
4. The instruction should be used with many parameters. To prevent the improper control from occurring, please do not set the parameters randomly.

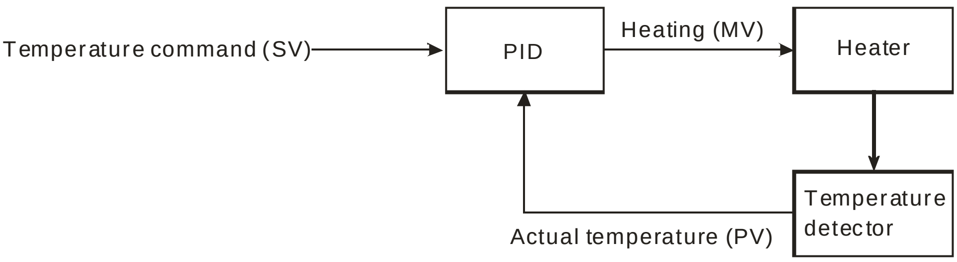
Example 1: The use of the instruction PID in the position control (**PID_MODE** is set to 0 or 2.)



Example 2: The instruction PID is used with the AC motor drives. (**PID_MODE** is set to 0 or 2.)



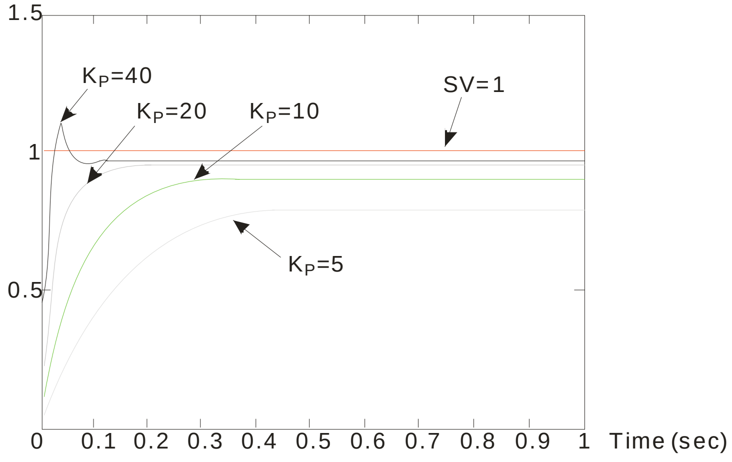
Example 3: The use of the instruction PID in the temperature control (**PID_MODE** is set to 0 or 2.)



Example 4: The steps of tuning the parameters used with the instruction PID

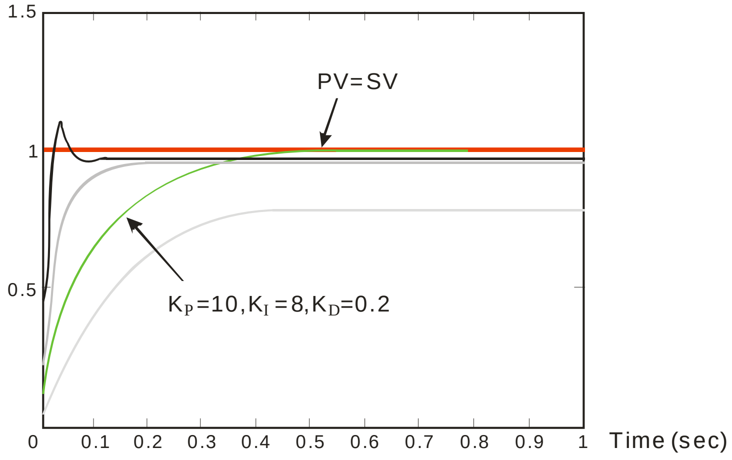
Suppose that the transfer function of the plant is the first-order function $G(s) = \frac{b}{s+a}$, the SV is 1, the sampling time Ts is 10 milliseconds. It is suggested that the steps of tuning the parameters are as follows.

Step 1: First, set the K_I and the K_D to 0. Next, set the K_P to 5, 10, 20 and 40 successively, and record the target values and the process values. The results are shown in the diagram below.



Step 2: When the K_P is 40, there is overreaction. Thus, the K_P is not chosen. When the K_P is 20, the reaction curve of the PV is close to the SV, and there is no overreaction. However, due to the fast start-up, the transient output value (MV) is big. The K_P is not chosen, either. When the K_P is 10, the reaction curve of the PV approaches the SV smoothly. Therefore, the K_P is chosen. When the K_P is 5, the reaction is slow. Thus, the K_P is not chosen.

Step 3: After the K_P is set to 10, increase the K_I. For example, the K_I is set to 1, 2, 4, and 8 successively. The K_I should not be larger than the K_P. Then, increase the K_D. For example, the K_D is set to 0.01, 0.05, 0.1, and 0.2 successively. The K_D should not be larger than ten percent of the K_P. Finally, the relation between the PV and the SV is present in the following diagram.



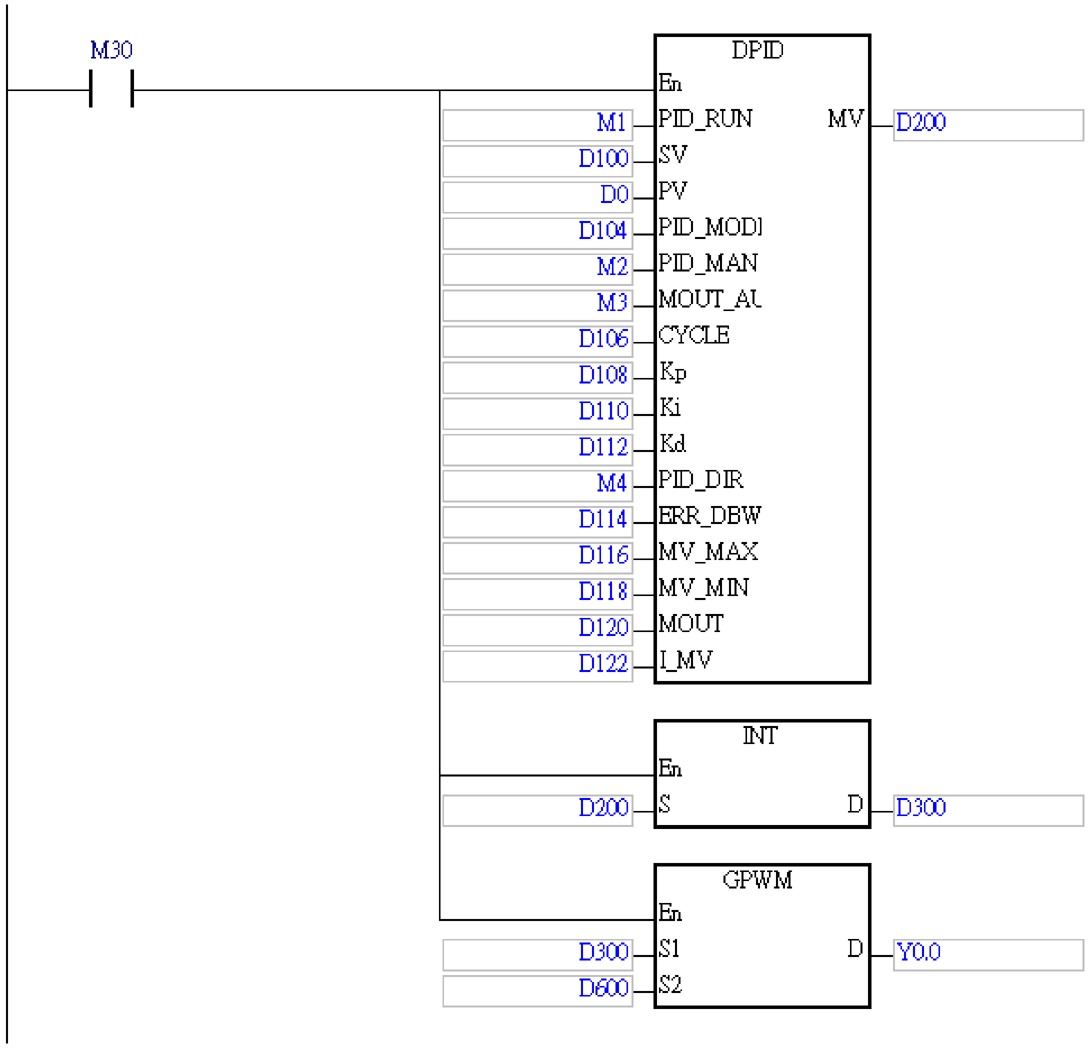
Note: The example is only for reference. Users have to tune the parameters properly according to the practical condition of the control system.

Sample 1: Using the automatic tuning function to control the temperature

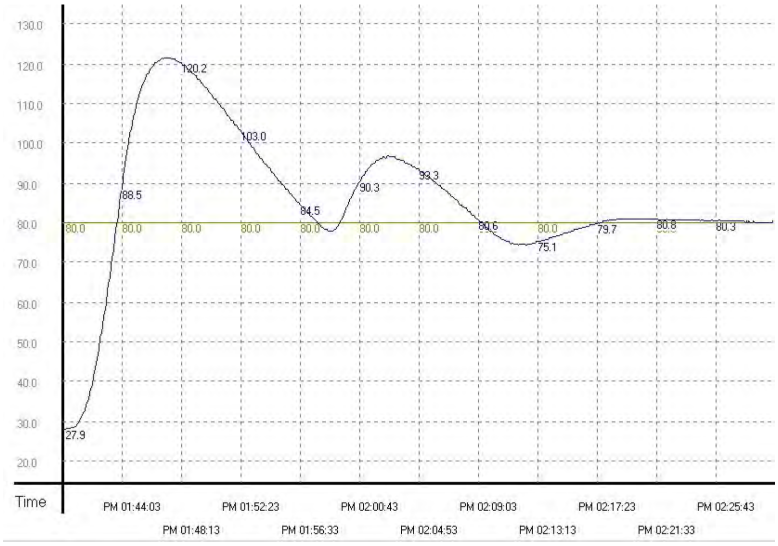
Purpose: Using the automatic tuning function to calcaulte the most appropriate parameters for the PID temperature control

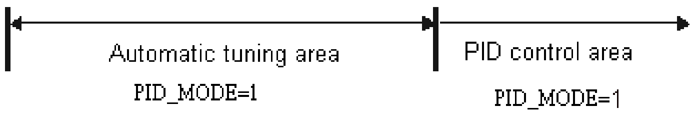
Explanation:

Due to the fact that users may not be familiar with the characteristics of the temperature environment which is controlled for the first time, they can use the automatic tuning function to make an initial adjustment (**PID_MODE** is set to 1). After the tuning of the parameter is complete, **PID_MODE** is set to 0. The controlled environment in this sample is an oven. The program example is as below.

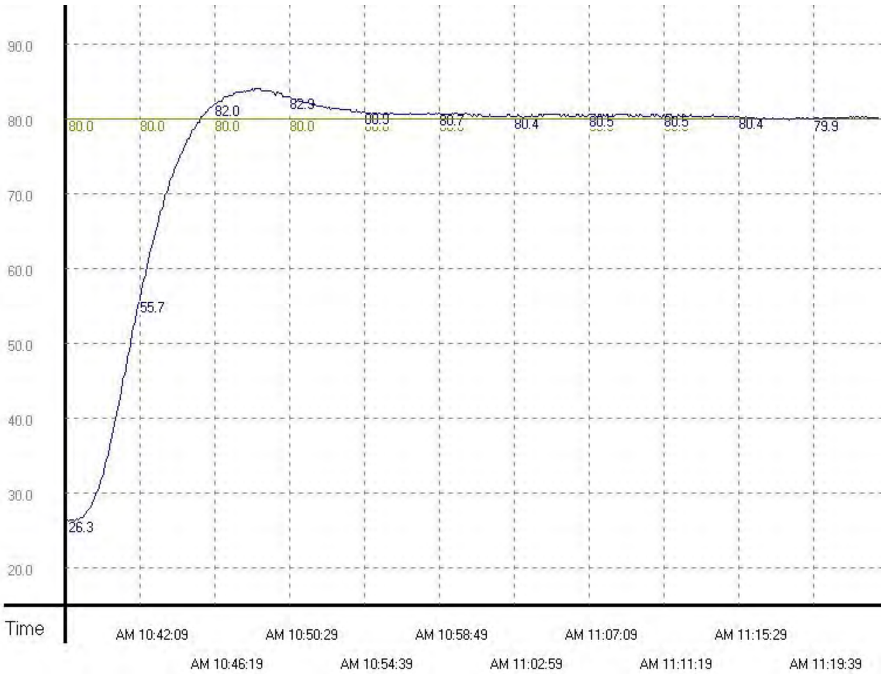


The experimental result of the automatic tuning function is shown below.

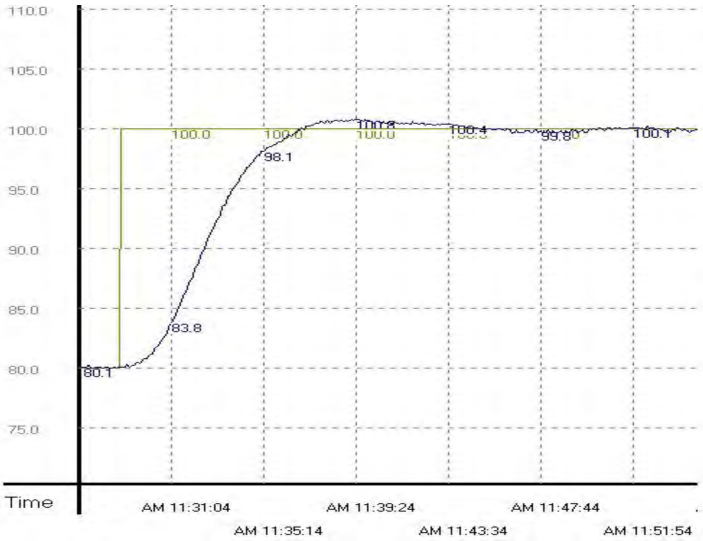




The experimental result of using the parameters which have been tuned to control the temperature is shown below.



As the diagam above shows, after the parameters are tuned automatically, users can get a good temperature control result. It only takes about twenty minutes to control the temperature. When the target temperature changes from 80°C to 100°C, the result is as below.



As the diagam above shows, when the target temperature changes from 80°C to 100°C, the parameters tuned previously still can be used to control the temperature. Besides, it does not take much time to control the temperature.

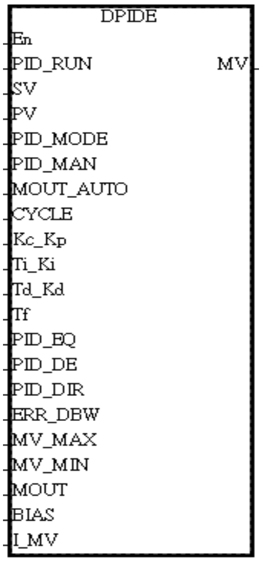
API	Instruction code		Operand	Function
0708	D	PIDE	PID_RUN, SV, PV, PID_MODE, PID_MAN, MOUT_AUTO, CYCLE, Kc_Kp, Ti_Ki, Td_Kd, Tf, PID_EQ, PID_DE, PID_DIR, ERR_DBW, MV_MAX, MV_MIN, MOUT, BIAS, I_MV, MV	PID algorithm

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
PID_RUN	●	●	●					●	●	●			●				
SV								●	●				●				●
PV								●	●				●				●
PID_MODE								●	●				●				
PID_MAN	●	●	●					●	●	●			●				
MOUT_AUTO	●	●	●					●	●	●			●				
CYCLE								●	●				●				
KC_Kp								●	●				●				
Ti_Ki								●	●				●				
Td_Kd								●	●				●				
Tf								●	●				●				
PID_EQ	●	●	●					●	●	●			●				
PID_DE	●	●	●					●	●	●			●				
PID_DIR	●	●	●					●	●	●			●				
ERR_DBW								●	●				●				●
MV_MAX								●	●				●				●
MV_MIN								●	●				●				●
MOUT								●	●				●				
BIAS								●	●				●				●
I_MV								●	●				●				
MV								●	●				●				

Pulse instruction	16-Bit instruction	32-Bit instruction (43 steps)
-	-	AH500

Symbol:

PID_RUN	:	Enabling the PID algorithm	Bit
SV	:	Target value (SV)	Double word
PV	:	Process value (PV)	Double word
PID_MODE	:	PID control mode	Double word
PID_MAN	:	PID A/M mode (PID_MAN)	Bit
MOUT_AUTO	:	MOUT_AUTO	Bit
CYCLE	:	Sampling time (CYCLE)	Double word
Kc_Kp	:	Proportional gain	Double word



Ti_Ki	:	Integral gain (second or 1/seccond)	Double word
Td_Kd	:	Derivative gain (second)	Double word
Tf	:	Derivative action time constant (second)	Double word
PID_EQ	:	Selection of a PID formula	Bit
PID_DE	:	Selection of the calculation of the PID derivative error	Bit
PID_DIR	:	PID forward/reverse direction (PID_DIR)	Bit
ERR_DBW	:	Range within which the error value is count as 0 (ERR_DBW)	Double word
MV_MAX	:	Maximum output value (MV_MAX)	Double word
MV_MIN	:	Minimum output value (MV_MIN)	Double word
MOUT	:	Manual output value (MOUT)	Double word
BIAS	:	Feedforward output value	Double word
I_MV	:	Accumulated integral value (I_MV)	Double word
MV	:	Output value (MV)	Double word

Example:

1. The instruction is used to implement the advanced PID algorithm. When the instruction is being executed by the PLC, the PID algorithm is implemented. PID stands for Proportional, Integral, Derivative. The PID control is widely applied to mechanical equipment, pneumatic equipment, and electronic equipment.
2. The setting of the parameters is as follows.

Device number	Function	Setting range	Description	Device number
PID_RUN	BOOL	Enabling the PID algorithm	True: The PID algorithm is implemented. False: The output value (MV) is reset to 0, and the PID algorithm is not implemented.	
SV	REAL	Range of single-precision floating-point numbers	Target value	Range of single-precision floating-point numbers
PV	REAL	Range of single-precision floating-point numbers	Process value	Range of single-precision floating-point numbers
PID_MODE	Double word /DINT	PID control mode	0: Automatic control When PID_MAN is switched from ON to OFF, the output value (MV) then is involved in the automatic algorithm. 1: The parameters are tuned automatically. When the tuning of the parameters is complete, the device is automatically set to 0, and is filled in with appropriate parameters	

Device number	Function	Setting range	Description	Device number
			Kc_Kp, Ti_K_i, Td_K_d and Tf.	
PID_MAN	BOOL	PID A/M mode	True: Manual The MV is output according to the MOUT, but it is still within the range between the MV_MIN and the MV_MAX. When PID_MODE is set to 1, the setting is ineffective. False: Automatic The MV is output according to the PID algorithm, and the output value is within the range between MV_MIN and MV_MAX.	
MOUT_AUTO	BOOL	MOUT automatic change mode	True: Automatic The MOUT varies with the MV. False: Normal The MOUT deos not vary with the MV.	
CYCLE	Double word/ DINT	Sampling time (T_S)	1~40,000 (unit: ms)	When the instruction is scanned, the PID algorithm is implmented according to the sampling time, and the MV is refreshed. (PLC will not use the setting value to determine the time or to operate automatically.) If T_S is less than 1, it will be counted as 1. If T_S is larger than 40,000, it will be counted as 40,000. When the instruction PID is used in the interval interrupt task, the sampling time is the same as the interval between the timed interrupt tasks.
Kc_Kp	REAL	Proportional gain (Kc or Kp) (The selection of Kc or Kp depends on the setting of the parameter PID_EQ.)	Range of positive single precision floating-point values	It is a proportional gain. If a proportional gain is less than 0, Kc_Kp will be count as 0. If Kc_Kp is equal to 0 when the

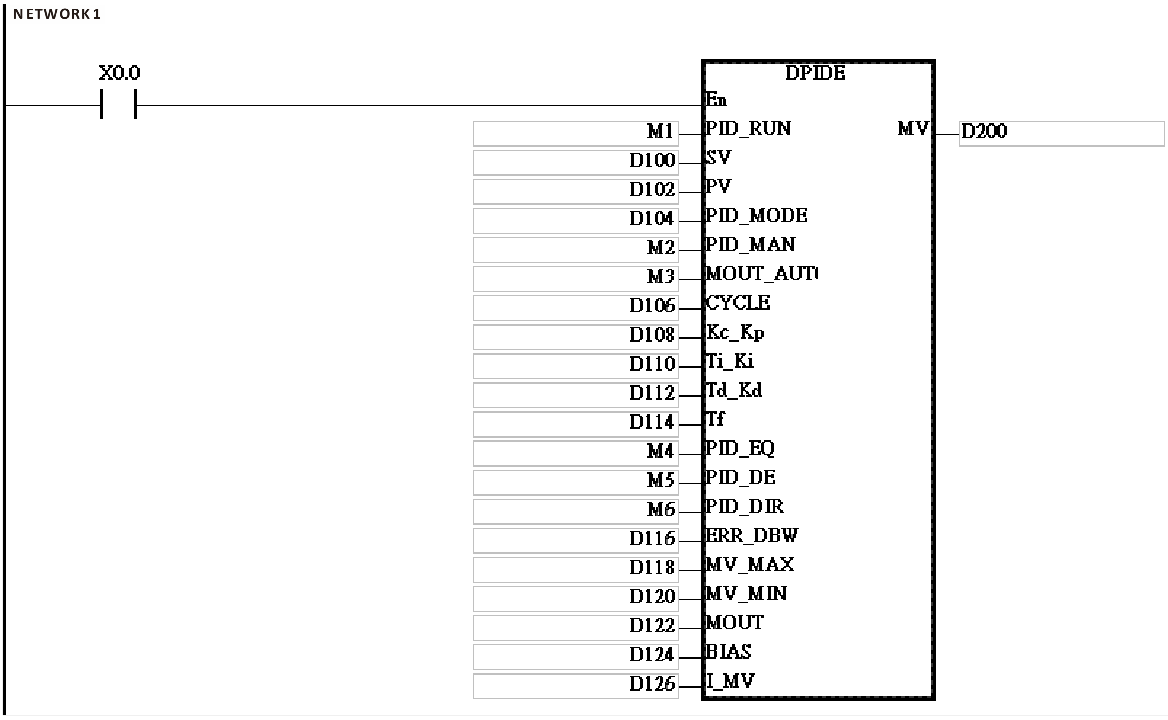
Device number	Function	Setting range	Description	Device number
				independent formula is used, the proportional control is not used.
Ti_Ki	REAL	Integral gain (Ti or Ki) (The selection of Ti or Ki depends on the setting of the parameter PID_EQ.)	Range of positive single precision floating-point values (Unit: Ti=Second; Ki=1/second)	It is an integral gain. If an integral gain is less than 0, Ti_Ki will be count as 0. If Ti_Ki is equal to 0, the integral control is not used.
Td_Kd	REAL	Derivative gain (Td or Kd) (The selection of Td or Kd depends on the setting of the parameter PID_EQ.)	Range of positive single precision floating-point values (Unit: Second)	It is a derivative gain. If a derivative gain is less than 0, Td_Kd will be count as 0. If Td_Kd is equal to 0, the derivative control is not used.
Tf	REAL	Derivative action time constant (Tf)	Range of positive single precision floating-point values (Unit: Second)	It the derivative action time constant. If the derivative action time constant is less than 0, Tf will be count as 0. If Tf is equal to 0, the derivative action time control is not used. (Derivative smoothing)
PID_EQ	BOOL	Selection of a PID formula	TRUE：Dependent Formula FALSE：Independent Formula	
PID_DE	BOOL	Selection of the calculation of the PID derivative error	True: Using the variations in the PV to calculate the control value of the derivative (Derivative of the PV) False: Using the variations in the error (E) to calculate the control value of the derivative (Derivative of the error)	
PID_DIR	BOOL	PID forward/reverse direction	True: Reverse action (E=SV-PV) False: Forward action (E=PV-SV)	
ERR_DBW	REAL	Range within which the error value is counted as 0	Range of single-precision floating-point numbers	An error (E) is equal to SV−PV or PV-SV. If the setting value is 0, the function will not be enabled, otherwise the CPU module will check whether the present error is

Device number	Function	Setting range	Description	Device number
				less than the absolute value of ERR_DBW, and check whether the present error meets the cross status condition. If the present error is less than the absolute value of ERR_DBW, and meets the cross status condition, the present error will be count as 0, and the PID algorithm will be implemented, otherwise the present error will be brought into the PID algorithm according to the normal processing.
MV_MAX	REAL	Maximum output value	Range of single-precision floating-point values	Example: After MV_MAX is set to 1,000, an MV will be 1,000 if it exceeds 1,000. MV_MAX has to be greater than MV_MIN, otherwise the maximum output value set and the minimum output value set will be interchanged.
MV_MIN	REAL	Minimum output value	Range of single-precision floating-point values	Example: After MV_MIN is set to - 1,000, an MV will be - 1,000 if it is less than than - 1,000. MV_MIN has to be lessthan MV_MAX, otherwise the maximum output value set and the minimum output value set will be interchanged.
MOUT	REAL	Manual output value	Range of single-precision floating-point	Mout and PID_MAN are used together. If

<table>
<tr><th>Device number</th><th>Function</th><th colspan="2">Setting range</th><th>Description</th><th>Device number</th></tr>
<tr><td></td><td></td><td colspan="2"></td><td>values</td><td>PID_MAN is set to true, the MV will be output according to the MOUT, but it will be still in the range of the MV_MIN to the MV_MAX.</td></tr>
<tr><td>BIAS</td><td>REAL</td><td colspan="2">Feedforward output value</td><td>Range of single-precision floating-point values</td><td>It is used for the PID feedforward.</td></tr>
<tr><td rowspan="5">I_MV (It occupies ten consecutive 32- bit devices.)</td><td rowspan="5">REAL</td><td>I_MV</td><td>Accumulated integral value temporarily stored</td><td>Range of single-precision floating-point values</td><td>An accumulated integral value is usually for reference. Users can still clear or modify it according to their needs. When the MV is greater than the MV_MAX, or when the MV is less than MV_MIN, the accumulated integral value in I_MV is unchanged.</td></tr>
<tr><td>I_MV +1</td><td>Previous error temporarily stored</td><td colspan="2">The system records the previous error</td></tr>
<tr><td>I_MV +2 ~ I_MV +5</td><td colspan="3">For system use only</td></tr>
<tr><td>I_MV +6</td><td colspan="3">The system records the previous PV.</td></tr>
<tr><td>I_MV +7 ~ I_MV +9</td><td colspan="3">For system use only</td></tr>
<tr><td>MV</td><td>REAL</td><td>MV</td><td colspan="3">The MV is in the range of the MV_MIN to the MV_MAX.</td></tr>
</table>

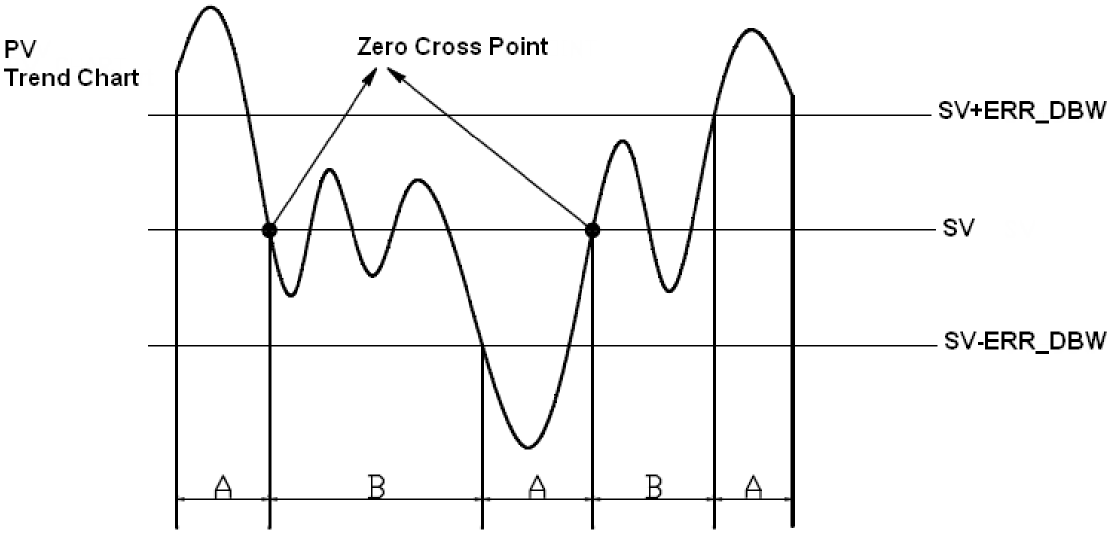
Example:

1. Before the instruction DPIDE is executed, the setting of the parameters should be complete.
2. When X0.0 is ON, the instruction is executed. When M1 is ON, the DPIDE algorithm is implemented. When M1 is OFF, the MV is 0, and the MV is stored in D200. When X0.0 is switched OFF, the instruction is not executed, and the previous data is unchanged.



Additional remark:

1. The instruction can be used several times, but the registers specified by I_MV~I_MV+9 cannot be the same.
2. I_MV occupies 20 word registers. I_MV used in the instruction DPIDE in the example above occupies D126~D145.
3. The instruction DPIDE can only be used in the cyclic task and the time interrupt. When the instruction DPIDE is used in the time interrupt, the sampling time is the same as the interval between the time interrupts.
4. When the instruction DPIDE is scanned, the PID algorithm is implmented according to the sampling time, and the MV is directly refreshed. Whether the scan time reaches the sampling time is not calculated automatically. When the instruction is used in the time interrupt, the sampling time is the same as the interval between the time interrupts. The PID algorithm is implemented according to the interval between the time interrupts.
5. Before the PID algorithm is implemented, the present value used in the instruction DPIDE has to be a stable value. When users need the input value in the module to implement the PID algorithm, they have to notice the time it takes for the analog input to be converted into the digital input.
6. If the PV is in the range indicated by ERR_DBW, the CPU module will bring the error into the PID algorithm until the PV reaches the SV. The cross status condition will not be met until the PV crosses the zero cross point indicated by the SV. If the cross status condition is met, the error will be count as 0 until the PV is out of the range indicated by ERR_DBW. If PID_DE is set to true, the variations in the PV will be used to calculate the control value of the derivative, and the CPU module will count the Delta PV as 0 after the cross status condition is met. (Delta PV=Current PV-Previous PV) In the PV trend chart shown below, the CPU module implements the PID algorithm normally in the A sections A. In the B sections, the CPU module counts the error or the Delta PV as 0 when it implements the PID algorithm.



PID algorithms:

1. When PID_MODE is set to 0, the PID control mode is the automatic control mode.

- **Independent Formula & Derivative of E**（**PID_EQ**=False & **PID_DE**=False）

$$CV = K_p E + K_i \int_0^t E dt + K_d \frac{dE}{dt} + BIAS$$

$$E = SV - PV \quad or \quad E = PV - SV$$

- **Independent Formula & Derivative of PV**（**PID_EQ**=False & **PID_DE**=Ture）

$$CV = K_p E + K_i \int_0^t E dt - K_d \frac{dPV}{dt} + BIAS$$

$$E = SV - PV$$

$$or$$

$$CV = K_p E + K_i \int_0^t E dt + K_d \frac{dPV}{dt} + BIAS$$

$$E = PV - SV$$

- **Dependent Formula & Derivative of E**（**PID_EQ**=True & **PID_DE**=False）

$$CV = K_c \left[E + \frac{1}{T_i} \int_0^t E dt + T_d \frac{dE}{dt} \right] + BIAS$$

$$E = SV - PV \quad or \quad E = PV - SV$$

- **Dependent Formula & Derivative of PV**（**PID_EQ**=True & **PID_DE**=True）

$$CV = K_c\left[E + \frac{1}{T_i}\int_0^t Edt - T_d\frac{dPV}{dt}\right] + BIAS$$

$$E = SV - PV$$

$$or$$

$$CV = K_c\left[E + \frac{1}{T_i}\int_0^t Edt + T_d\frac{dPV}{dt}\right] + BIAS$$

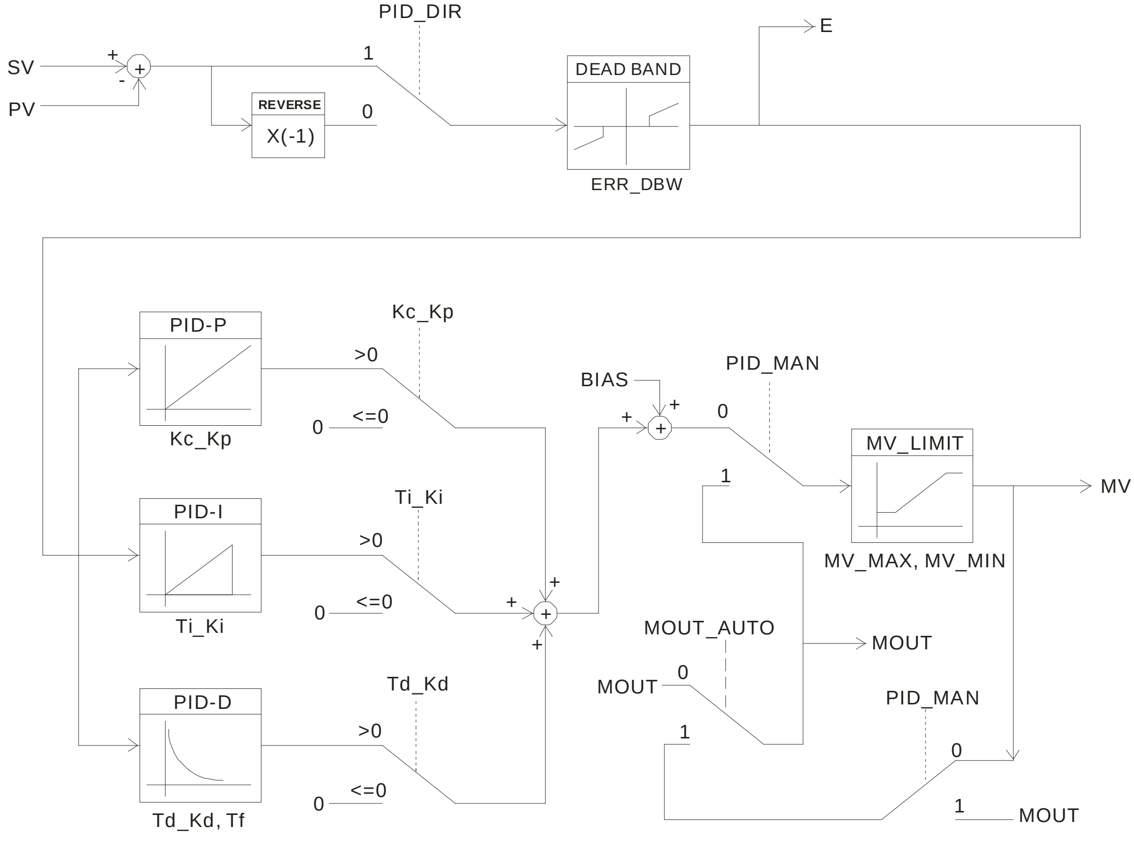
$$E = PV - SV$$

※The CV values in the formulas above are the MV used in DPIDE.

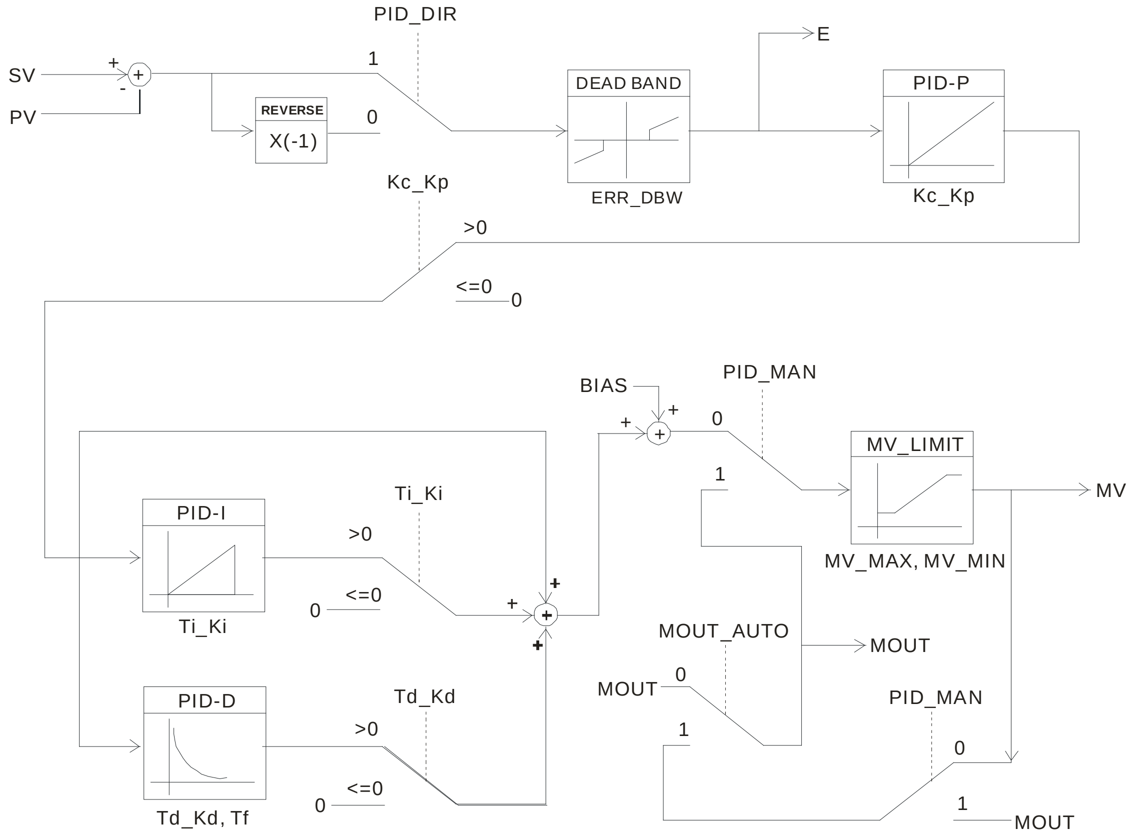
2. When PID_MODE is set to 1, the PID control mode is the automatic tuning mode. After the tuning of the parameter is complete, PID_MODE is set to 0. The PID control mode becomes the automatic control mode.

PID control diagrams:

PID Block Diagram (Independent)



PID Block Diagram (Dependent)



Suggestion:

1. Owing to the fact that the instruction DPIDE can be used in a lot of controlled environments, users have to select control functions appropriately. For example, the MV switches between the maximum output value and the minimum output value when PID_MODE is set to 1. Please do not use DPIDE in the environment controlled by a motor which reacts rapidly, otherwise the violent change of the system resulting from the automatic tuning of the parameters may hurt the staff or damage the system.
2. When users tune the parameters Kc_Kp, Ti_Ki, and Td_Kd (PID_MODE is set to 0), they have to tune Kc_Kp first (according to their experiences), and then set Ti_Ki and Td_Kd to 0. When the users can handle the control, they can increase Ti_Ki and Td_Kd. When Kc_Kp is 1, it means that the proportional gain is 100%. That is, the error is increased by a factor of one. When the proportional gain is less than 100%, the error is decreased. When the proportional gain is greater than 100%, the error is increased.
3. To prevent the parameters which have been tuned automatically from disappearing after a power cut, it is suggested that users should store the parameters in latching data registers if PID_MODE is set to 1. The parameters which have been tuned automatically are not necessarily suitable for every controlled environment. Therefore, the users can modify the parameters which have been tuned automatically. However, it is suggested that users only modify Ti_Ki or Td_Kd.
4. The action of the instruction depends on many parameters. To prevent improper control from occurring, please do not set parameters randomly.

6.9 Logic Instructions

6.9.1 List of Logic Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
0800	WAND	DAND	✓	Logical AND operation	7
0801	MAND	–	✓	Matrix AND operation	9
0802	WOR	DOR	✓	Logical OR operation	7
0803	MOR	–	✓	Matrix OR operation	9
0804	WXOR	DXOR	✓	Logical exclusive OR operation	7
0805	MXOR	–	✓	Matrix exclusive OR operation	9
0806	WXNR	DXNR	✓	Logical exclusive NOR operation	7
0807	MXNR	–	✓	Matrix exclusive NOR operation	9
0809	LD&	DLD&	–	S1&S2	5
0810	LD|	DLD|	–	S1|S2	5
0811	LD^	DLD^	–	S1^S2	5
0812	AND&	DAND&	–	S1&S2	5
0813	AND|	DAND|	–	S1|S2	5
0814	AND^	DAND^	–	S1^S2	5
0815	OR&	DOR&	–	S1&S2	5
0816	OR|	DOR|	–	S1|S2	5
0817	OR^	DOR^	–	S1^S2	5

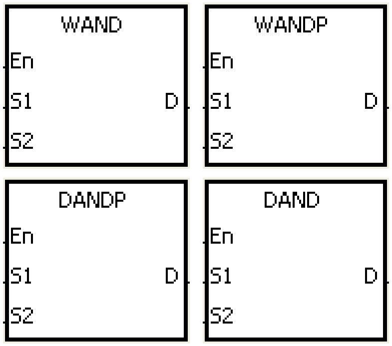
6.9.2 Explanation of Logic Instructions

API		Instruction code			Operand	Function
0800		W D	AND	P	**S_1, S_2, D**	Logical AND operation

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



S_1 : Data source 1 Word/Double word

S_2 : Data source 2 Word/Double word

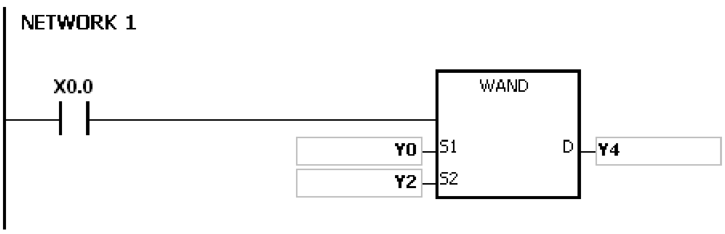
D : Operation result Word/Double word

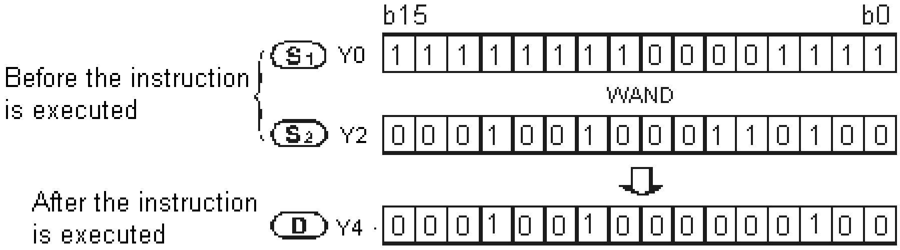
Explanation:

1. The logical operator AND takes the binary representations in **S_1** and **S_2**, and performs the logical AND operation on each pair of corresponding bits. The operation result is stored in **D**.
2. Only the instruction DAND can use the 32-bit counter.
3. The result in each position is 1 if the first bit is 1 and the second bit is 1. Otherwise, the result is 0.

Example 1:

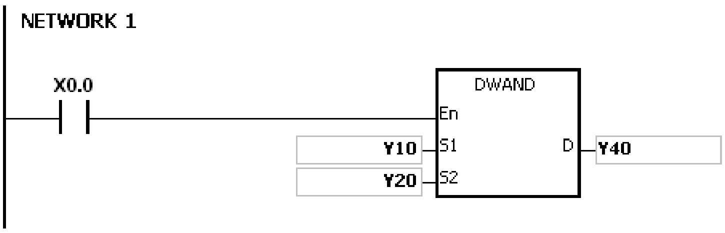
When X0.0 is ON, the logical operator AND takes the data in the 16-bit device Y0 and the 16-bit device Y2, and performs the logical AND operation on each pair of corresponding bits. The operation result is stored in Y4.

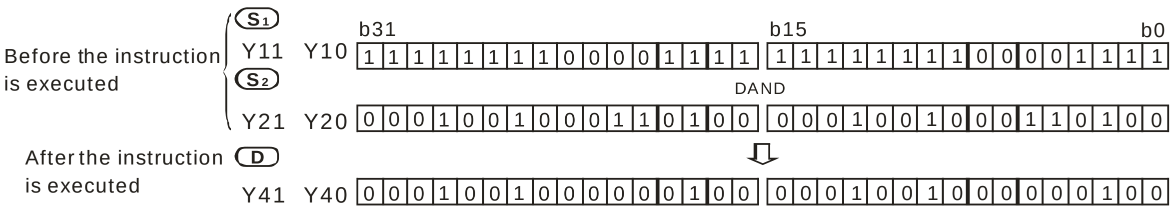




Example 2:

When X0.0 is ON, the logical operator AND takes the data in the 32-bit device (Y11, Y10) and the 32-bit device (Y21, Y20), and performs the logical AND operation on each pair of corresponding bits. The operation result is stored in (Y41, Y40).



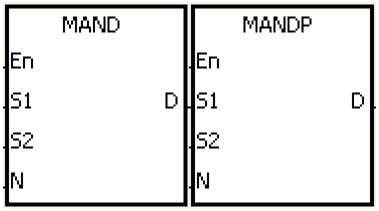


API	Instruction code		Operand	Function
0801	MAND	P	S_1, S_2, D, n	Matrix AND operation

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●		●				
S_2	●	●			●	●	●	●	●		●		●				
D	●	●			●	●	●	●	●				●				
n	●	●			●	●	●	●	●		●		●	○	○		

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



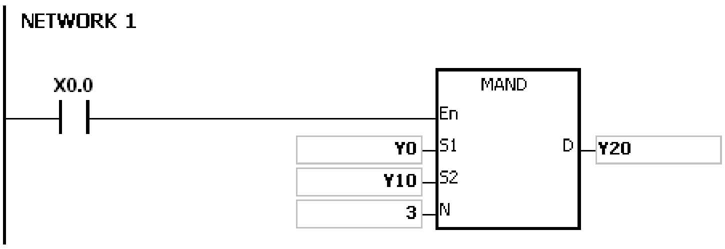
S_1	:	Matrix source 1	Word
S_2	:	Matrix source 2	Word
D	:	Operation result	Word
n	:	Length of the array	Word

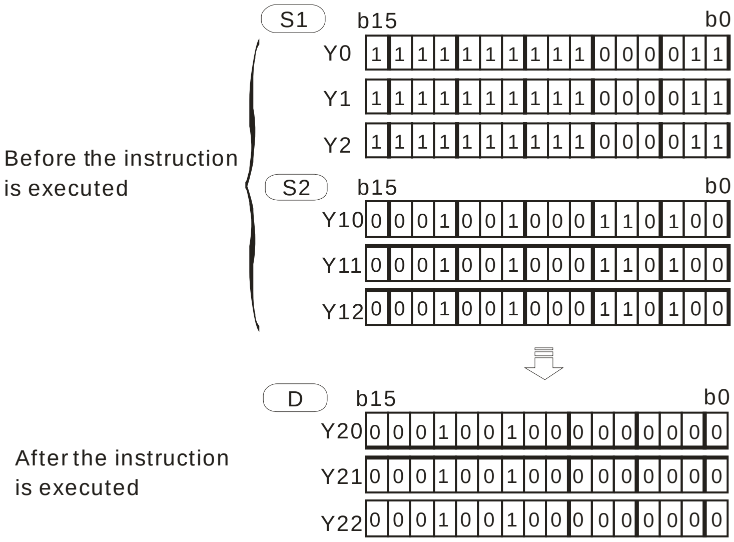
Explanation:

1. The operator AND takes the **n** rows of binary representations in **S_1** and the **n** rows of binary representations in **S_2**, and performs the matrix AND operation on each pair of corresponding bits. The operation result is stored in **D**.
2. The result in each position is 1 if the first bit is 1 and the second bit is 1. Otherwise, the result is 0.
3. The operand **n** should be within the range between 1 and 256.

Example:

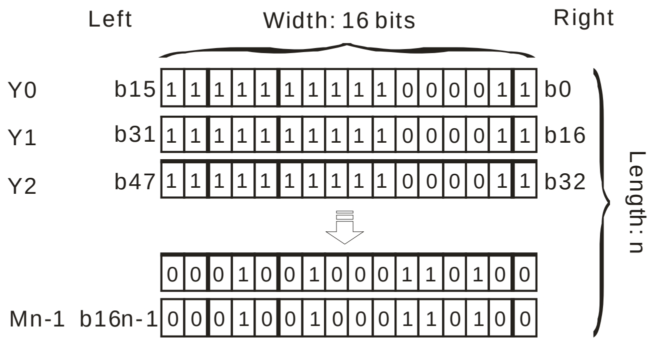
When X0.0 is ON, the operator AND takes the data in the 16-bit devices Y0~Y2 and the data in 16-bit devices Y10~Y12, and performs the matrix AND operation on each pair of corresponding bits. The operation result is stored in the 16-bit devices Y20~Y22.





Additional remark:

1. If S_1**+n-1**, S_2**+n-1**, or **D+n-1** exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. Explanation of matrix instructions:
   - A matrix is composed of more than one 16-bit register. The number of registers in a matrix is the length of the array **n**. There are 16×**n** bits in a matrix, and the matrix operation is performed on one bit at a time.
   - The matrix instruction takes the 16×**n** bits in a matrix as a string of bits, rather than takes them as values. The matrix operation is performed on one specified bit.
   - The matrix instruction mainly processes the one-to-many status or the many-to-many status, such as the moving, the copying, the comparing, and the searching. It is a handy and important applied instruction.
   - When the matrix instruction is executed, users need a 16-bit register to specify a certain bit among the 16**n** bits in the matrix for the operation. The 16-bit register is called the pointer, and is specified by users. The value in the register is within the range between 0 and 16**n**-1, and corresponds to the bit within the range between b0 and b16**n**-1.
   - The shift of the specified data, or the rotation of the specified data can be involved in the matrix operation. Besides, the bit number decreases from the left to the right, as illustrated below.



   - The width of the matrix (C) is 16 bits.
   - Pr represents the pointer. When the value in Pr is 15, b15 is specified.

     Example: The following matrix is composed of the three 16-bit devices Y0, Y1, and Y2. The data in Y0 is 16#AAAA, the data in Y1 is 16#5555, and the data in Y2 is 16#AAFF.

C_{15}	C_{14}	C_{13}	C_{12}	C_{11}	C_{10}	C_9	C_8	C_7	C_6	C_5	C_4	C_3	C_2	C_1	C_0	
1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	Y0
0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	Y1
1	0	1	0	1	0	1	0	1	1	1	1	1	1	1	1	Y2

Example: The following matrix is composed of the three 16-bit devices X 0, X 1, and X 2. The data in X 0 is 16#37, the data in X 1 is 16#68, and the data in X 2 is 16#45.

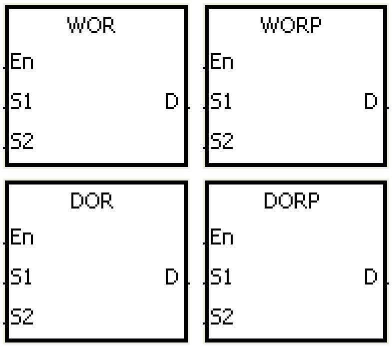
C_{15}	C_{14}	C_{13}	C_{12}	C_{11}	C_{10}	C_9	C_8	C_7	C_6	C_5	C_4	C_3	C_2	C_1	C_0	
0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	X0
0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	X1
0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	X2

API		Instruction code			運算元	Function
0802		W D	OR	P	**S₁, S₂, D**	Logical OR operation

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



S_1 : Data source 1 — Word/Double word

S_2 : Data source 2 — Word/Double word

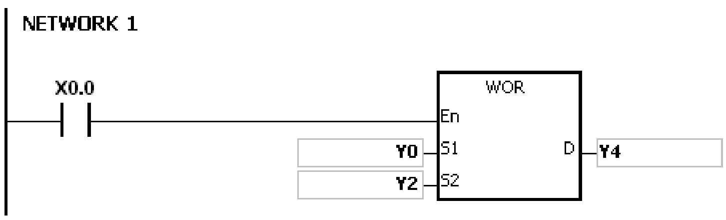
D : Operation result — Word/Double word

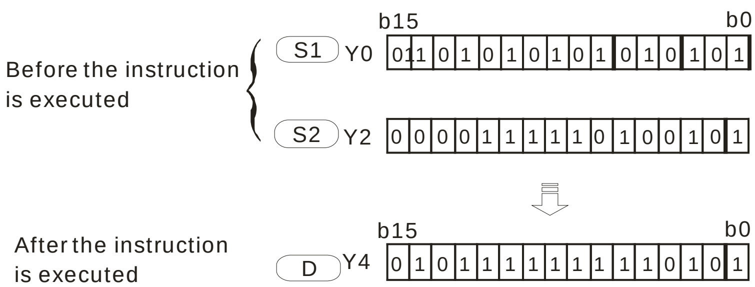
Explanation:

1. The logical operator OR takes the binary representations in **S_1** and **S_2**, and performs the logical inclusive OR operation on each pair of corresponding bits. The operation result is stored in **D**.
2. Only the instruction DOR can use the 32-bit counter.
3. The result in each position is 1 if the first bit is 1, the second bit is 1, or both bits are 1. Otherwise, the result is 0.

Example 1:

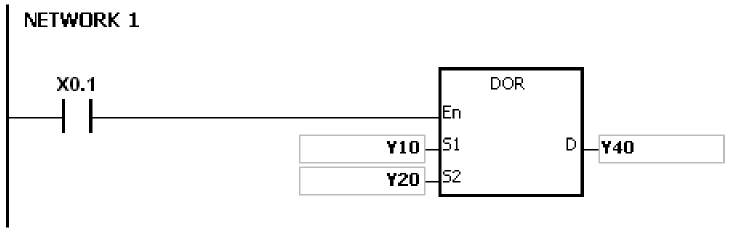
When X0.0 is ON, the logical operator OR takes the data in the 16-bit device Y0 and the 16-bit device Y2, and performs the logical inclusive OR operation on each pair of corresponding bits. The operation result is stored in Y4.





Example 2:

When X0.1 is ON, the logical operator OR takes the data in the 32-bit device (Y11, Y10) and the 32-bit device (Y21, Y20), and performs the logical inclusive OR operation on each pair of corresponding bits. The operation result is stored in (Y41, Y40).



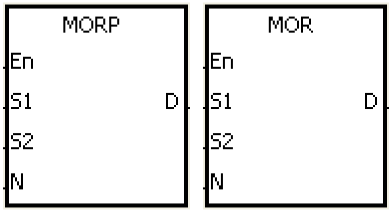
			b31 (bits 31–16)	b15 (bits 15–0) b0
Before the instruction is executed	S1	Y11 Y10	1 1 1 1 1 1 1 1 0 0 0 0 1 1 1 1	1 1 1 1 1 1 1 1 0 0 0 0 1 1 1 1
			DOR	
	S2	Y21 Y20	0 0 0 1 0 0 1 0 0 0 1 1 0 1 0 0	0 0 0 1 0 0 1 0 0 0 1 1 0 1 0 0
After the instruction is executed	D	Y41 Y40	1 1 1 1 1 1 1 1 0 0 1 1 1 1 1 1	1 1 1 1 1 1 1 1 0 0 1 1 1 1 1 1

API	Instruction code			Operand	Function
0803		MOR	P	S_1, S_2, D, n	Matrix OR operation

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●		●				
S_2	●	●			●	●	●	●	●		●		●				
D	●	●			●	●	●	●	●				●				
n	●	●			●	●	●	●	●		●		●	○	○		

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



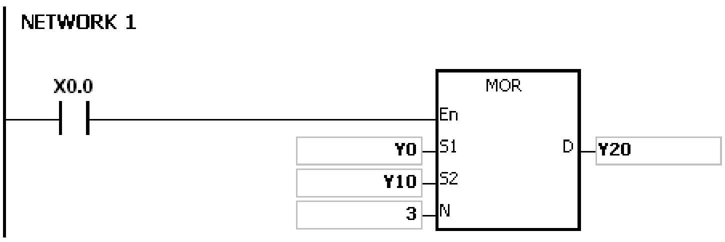
S_1	:	Matrix source 1	Word
S_2	:	Matrix source 2	Word
D	:	Operation result	Word
n	:	Length of the array	Word

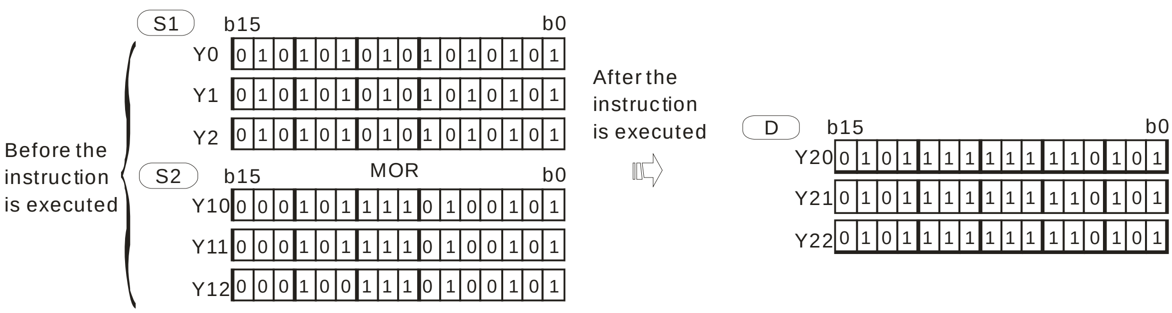
Explanation:

1. The operator OR takes the **n** rows of binary representations in S_1 and the **n** rows of binary representations in S_2, and performs the matrix OR operation on each pair of corresponding bits. The operation result is stored in **D**.
2. The result in each position is 1 if the first bit is 1, the second bit is 1, or both bits are 1. Otherwise, the result is 0.
3. The operand **n** should be within the range between 1 and 256.

Example:

When X0.0 is ON, the operator OR takes the data in the 16-bit devices Y0~Y2 and the data in 16-bit devices Y10~Y12, and performs the matrix OR operation on each pair of corresponding bits. The operation result is stored in the 16-bit devices Y20~Y22.





Additional remark:

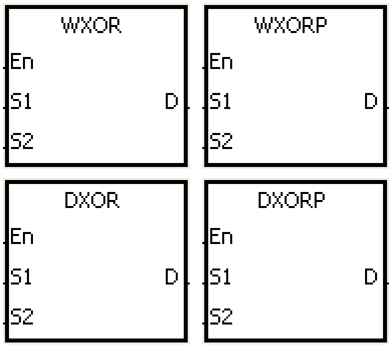
1. If **S_1+n-1**, **S_2+n-1**, or **D+n-1** exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
0804	W D	XOR	P	**S_1, S_2, D**	Logical exclusive OR operation

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



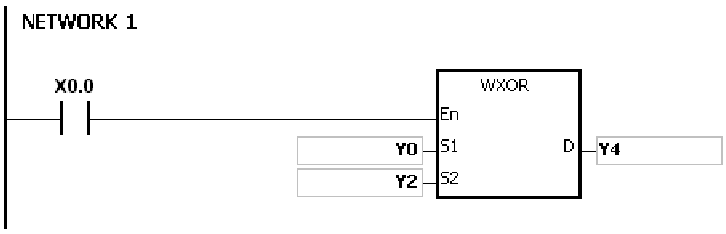
S_1	:	Data source 1	Word/Double word
S_2	:	Data source 2	Word/Double word
D	:	Operation result	Word/Double word

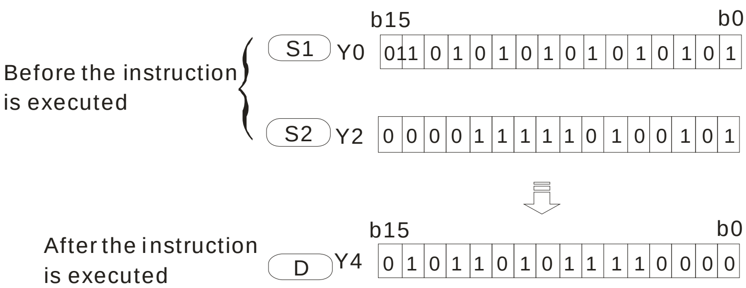
Explanation:

1. The logical operator XOR takes the binary representations in **S_1** and **S_2**, and performs the logical exclusive OR operation on each pair of corresponding bits. The operation result is stored in **D**.
2. Only the instruction DXOR can use the 32-bit counter.
3. The result in each position is 1 if the two bits are different, and 0 if they are the same.

Example 1:

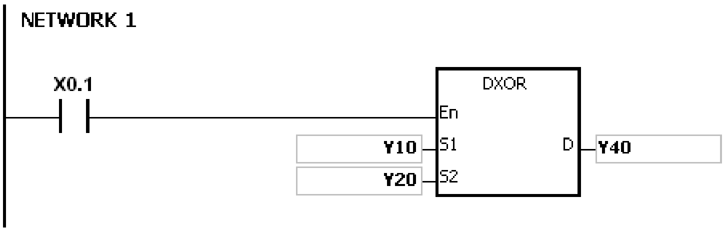
When X0.0 is ON, the logical operator XOR takes the data in the 16-bit device Y0 and the 16-bit device Y2, and performs the exclusive OR operation on each pair of corresponding bits. The operation result is stored in Y4.

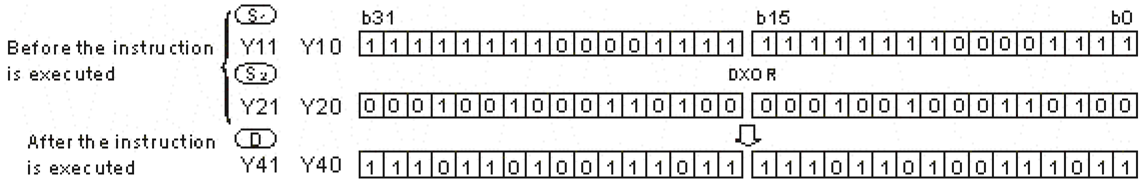




Example 2:

When X0.1 is ON, the logical operator XOR takes the data in the 32-bit device (Y11, Y10) and the 32-bit device (Y21, Y20), and performs the logical exclusive OR operation on each pair of corresponding bits. The operation result is stored in (Y41, Y40).





API	Instruction code			Operand	Function
0805		MXOR	P	S_1, S_2, D, n	Matrix exclusive OR operation

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●		●				
S_2	●	●			●	●	●	●	●		●		●				
D	●	●			●	●	●	●	●				●				
n	●	●			●	●	●	●	●		●		●	○	○		

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:

MXOR	MXORP
En, S1, S2, N, D	En, S1, S2, N, D

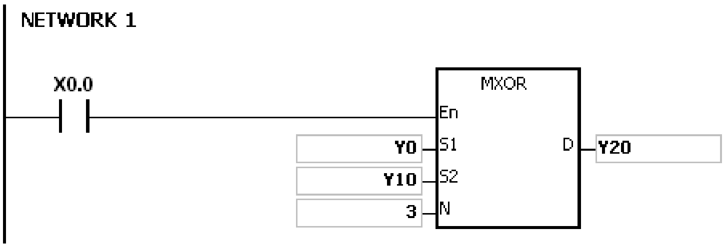
S_1	:	Matrix source 1	Word
S_2	:	Matrix source 2	Word
D	:	Operation result	Word
n	:	Length of the array	Word

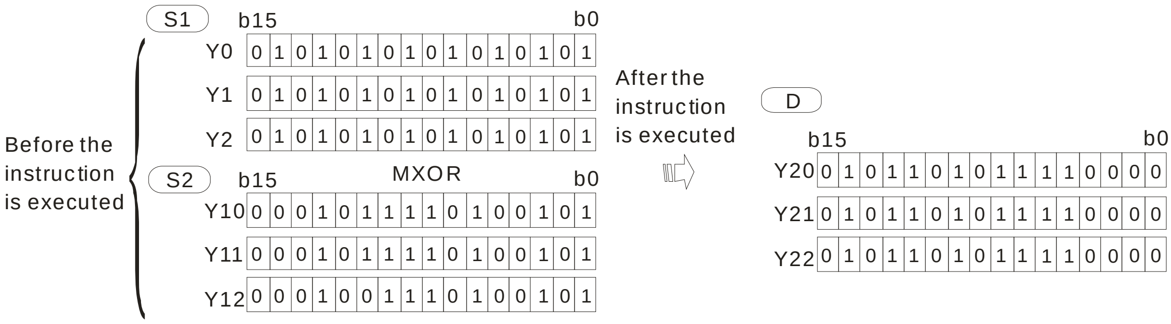
Explanation:

1. The operator XOR takes the **n** rows of binary representations in S_1 and the **n** rows of binary representations in of S_2, and performs the matrix exclusive OR operation on each pair of corresponding bits. The operation result is stored in **D**.
2. The result in each position is 1 if the two bits are different, and 0 if they are the same.
3. The operand **n** should be within the range between 1 and 256.

Example:

When X0.0 is ON, the operator XOR takes the data in the 16-bit devices Y0~Y2 and the data in 16-bit devices Y10~Y12, and performs the matrix exclusive OR operation on each pair of corresponding bits. The operation result is stored in the 16-bit devices Y20~Y22.





Additional remark:

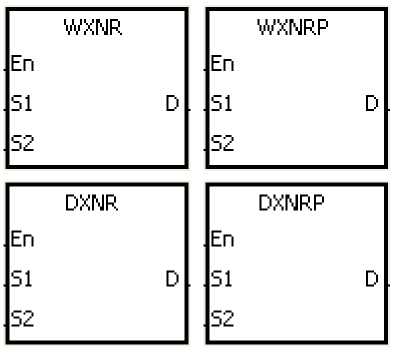
1. If **S_1+n-1**, **S_2+n-1**, or **D+n-1** exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
0806	WD	XNR	P	**S_1, S_2, D**	Logical exclusive NOR operation

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



S_1 : Data source 1 Word/Double word

S_2 : Data source 2 Word/Double word

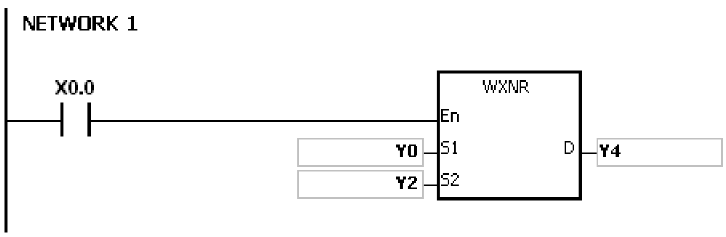
D : Operation result Word/Double word

Explanation:

1. The logical operator XNR takes the binary representations in **S_1** and **S_2**, and performs the logical exclusive NOR operation on each pair of corresponding bits. The operation result is stored in **D**.
2. Only the instruction DXNR can use the 32-bit counter.
3. The result in each position is 1 if the two bits are the same, and 0 if they are different.

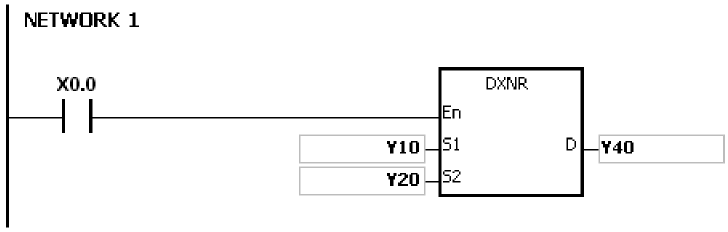
Example 1:

When X0.0 is ON, the logical operator XNR takes the data in the 16-bit device Y0 and the 16-bit device Y2, and performs the logical exclusive NOR operation on each pair of corresponding bits. The operation result is stored in Y4.



Example 2:

When X0.0 is ON, the logical operator XNR takes the data in the 32-bit device (Y11, Y10) and the 32-bit device (Y21, Y20), and performs the logical exclusive NOR operation on each pair of corresponding bits. The operation result is stored in (Y41, Y40).

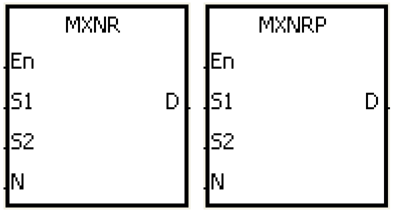


API	Instruction code			Operand	Function
0807		MXNR	P	**S_1, S_2, D, n**	Matrix exclusive NOR operation

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●	●			●	●	●	●	●		●		●				
S_2	●	●			●	●	●	●	●		●		●				
D	●	●			●	●	●	●	●				●				
n	●	●			●	●	●	●	●		●		●	○	○		

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



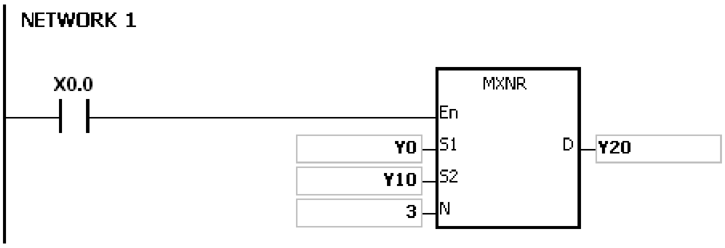
S_1	:	Matrix source 1	Word
S_2	:	Matrix source 2	Word
D	:	Operation result	Word
n	:	Length of the array	Word

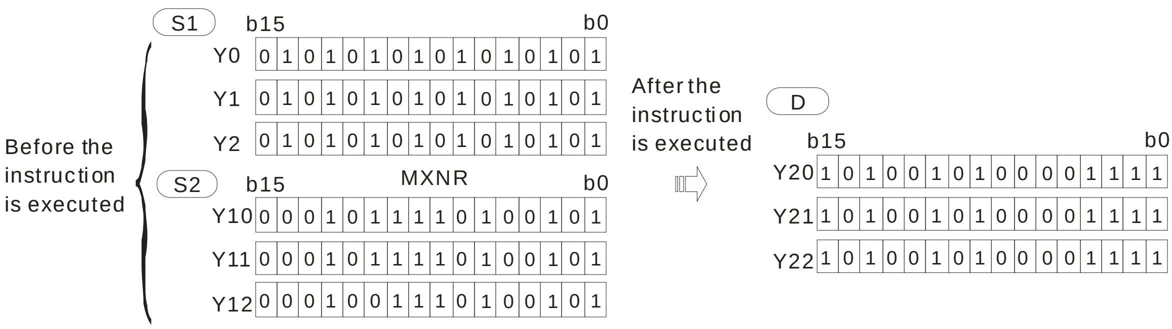
Explanation:

1. The operator XNR takes the **n** rows of binary representations in **S_1** and the **n** rows binary representations in of **S_2**, and performs the matrix exclusive NOR operation on each pair of corresponding bits. The operation result is stored in **D**.
2. The result in each position is 1 if the two bits are the same, and 0 if they are different.
3. The operand **n** should be within the range between 1 and 256.

Example:

When X0.0 is ON, the operator XNR takes the data in the 16-bit devices Y0~Y2 and the data in 16-bit devices Y10~Y12, and performs the matrix exclusive NOR operation on each pair of corresponding bits. The operation result is stored in the 16-bit devices Y20~Y22.





Additional remark:

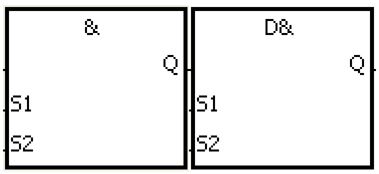
1. If **S_1+n-1**, **S_2+n-1**, or **D+n-1** exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
0809~ 0811	D	LD＃		S_1, S_2	Contact type of logical operation LD＃

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●				●	●	●	●		●	○	●	○	○		
S_2	●	●				●	●	●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
-	AH500	AH500

Symbol:



Taking LD& and DLD& for example

S_1 : Data source 1 Word/Double word

S_2 : Data source 2 Word/Double word

Explanation:

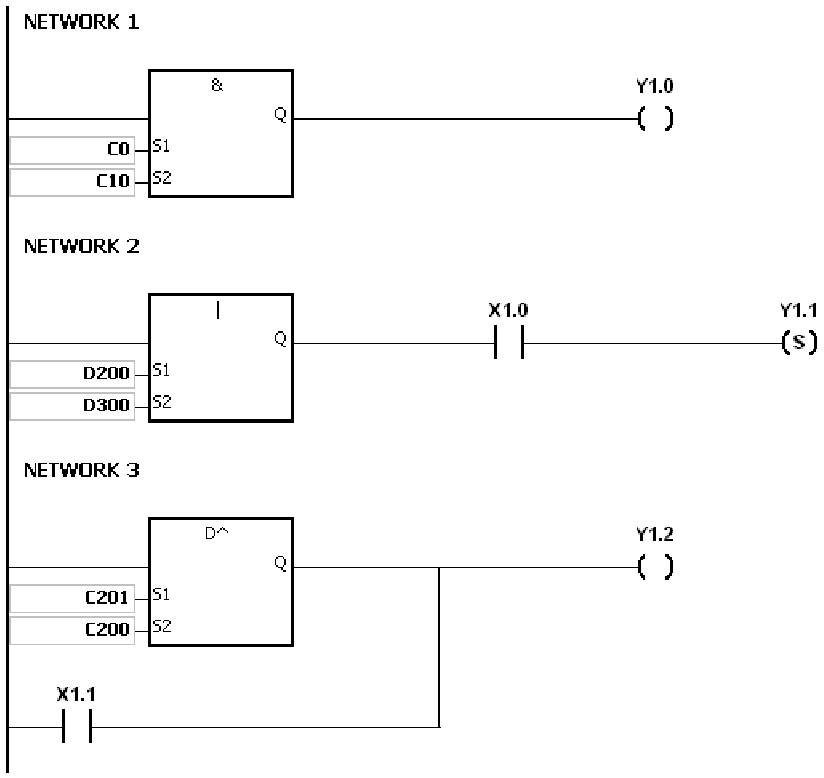
1. The instruction is used to compare the data in S_1 with that in S_2. When the comparison result is not 0, the condition of the instruction is met. When the comparison result is 0, the condition of the instruction is not met.
2. Only the instruction DLD＃ can use the 32-bit counter.
3. The instruction LD＃ can be connected to the mother line directly.

API No.	16-bit instruction	32-bit instruction	Comparison operation result	
			ON	OFF
0809	LD&	DLD&	S_1&S_2≠0	S_1&S_2=0
0810	LD|	DLD|	S_1|S_2≠0	S_1|S_2=0
0811	LD^	DLD^	S_1^S_2≠0	S_1^S_2=0

4. &: Logical AND operation
5. |: Logical OR operation
6. ^: Logical exclusive OR operation

Example:

1. The logical operator AND takes the data in C0 and C1, and performs the logical AND operation on each pair of corresponding bits. When the operation result is not 0, Y1.0 is ON.
2. The logical operator OR takes the data in D200 and D300, and performs the logical OR operation on each pair of corresponding bits. When the operation result is not 0 and X1.0 is ON, Y1.1 is ON.
3. The logical operator XOR takes the data in C201 and C200, and performs the logical exclusive OR operation on each pair of corresponding bits. When the operation result is not 0, or when X1.1 is ON, Y1.2 is ON.



Additional remark:

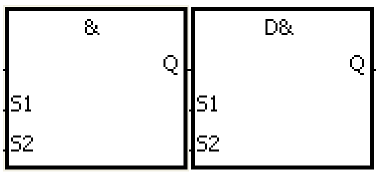
If $\mathbf{S_1}$ or $\mathbf{S_2}$ is illegal, the condition of the instruction is not met, SM0 is ON, and the error in SR0 is 16#2003.

API	Instruction code			Operand	Function
0812~0814	D	AND#		**S_1, S_2**	Contact type of logical operation AND#

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●				●	●	●	●		●	○	●	○	○		
S_2	●	●				●	●	●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
-	AH500	AH500

Symbol:



Taking AND& and DAND& for example

S_1 : Data source 1 — Word/Double word

S_2 : Data source 2 — Word/Double word

Explanation:

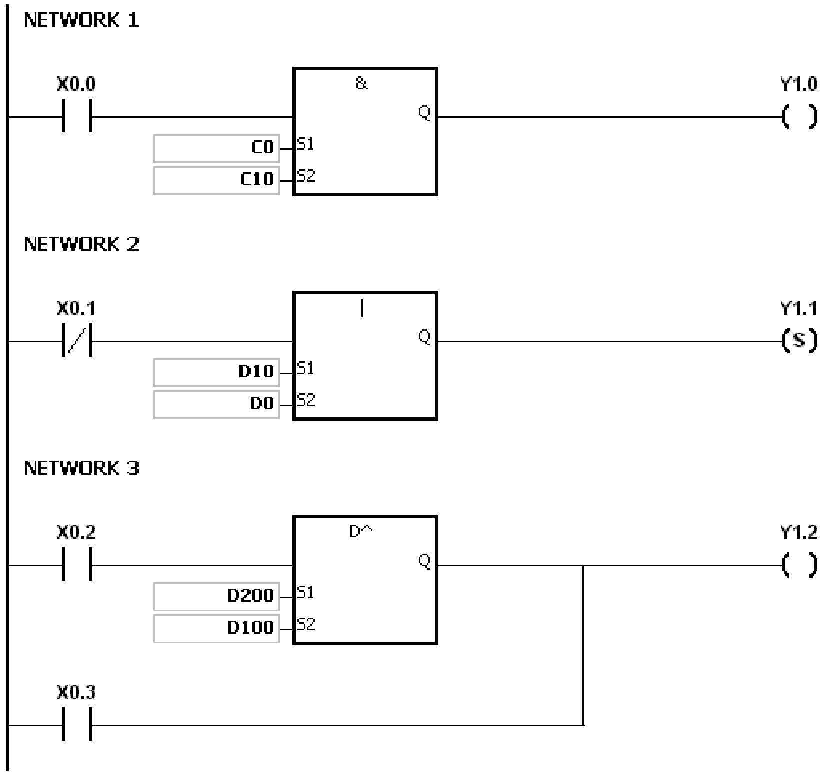
1. The instruction is used to compare the data in **S_1** with that in **S_2**. When the comparison result is not 0, the condition of the instruction is met. When the comparison result is 0, the condition of the instruction is not met.
2. Only the instruction DAND# can use the 32-bit counter.
3. The instruction AND# and the contact are connected is series.

API No.	16-bit instruction	32-bit instruction	Comparison operation result	
			ON	OFF
0812	AND&	DAND&	$S_1\&S_2 \neq 0$	$S_1\&S_2 = 0$
0813	AND|	DAND|	$S_1\|S \neq 0$	$S_1\|S_2 = 0$
0814	AND^	DAND^	S_1^$S_2 \neq 0$	S_1^$S = 0$

4. &: Logical AND operation
5. |: Logical OR operation
6. ^: Logical exclusive OR operation

Example:

1. When X0.0 is ON, the logical operator AND takes the data in C0 and C10, and performs the logical AND operation on each pair of corresponding bits. When the operation result is not 0, Y1.0 is ON.
2. When X0.1 is OFF, the logical operator OR takes the data in D10 and D0, and performs the logical OR operation on each pair of corresponding bits. When the operation result is not 0, Y1.1 keeps ON.
3. When X0.2 is ON, the logical operator XOR takes the data in the 32-bit register (D200, D201) and the data in the 32-bit register (D100, D101), and performs the logical exclusive OR operation on each pair of corresponding bits. When the operation result is not 0, or when X0.3 is ON, Y1.2 is ON.



Additional remark:

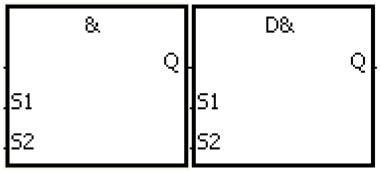
If $\mathbf{S_1}$ or $\mathbf{S_2}$ is illegal, the condition of the instruction is not met, SM0 is ON, and the error in SR0 is 16#2003.

API	Instruction code			Operand	Function
0815~ 0817	D	OR#		S_1, S_2	Contact type of logical operation OR#

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●				●	●	●	●		●	○	●	○	○		
S_2	●	●				●	●	●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
-	AH500	AH500

Symbol:



Taking OR& and DOR& for example

S_1 : Data source 1 Word/Double word

S_2 : Data source 2 Word/Double word

Explanation:

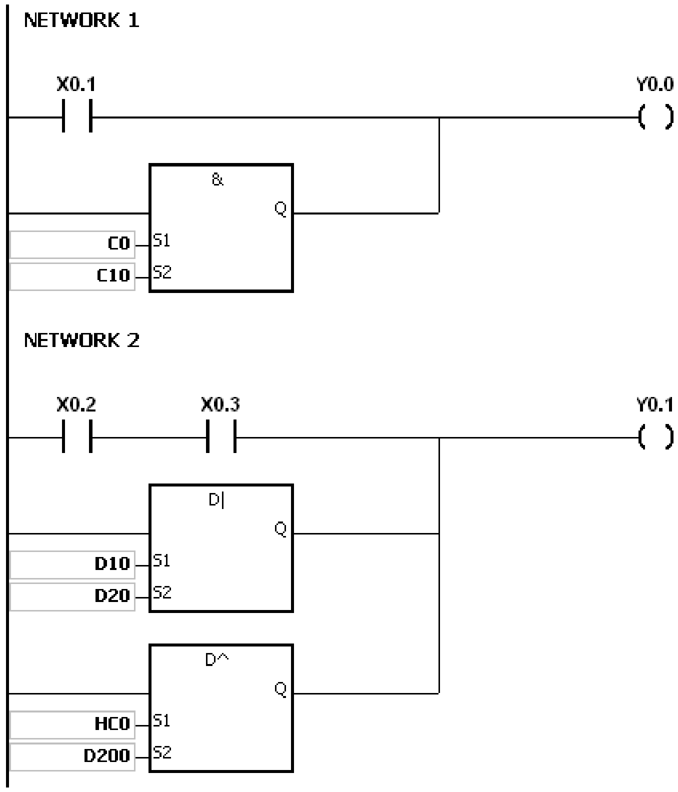
1. The instruction is used to compare the data in S_1 with that in S_2. When the comparison result is not 0, the condition of the instruction is met. When the comparison result is 0, the condition of the instruction is not met.
2. Only the instruction DOR# can use the 32-bit counter.
3. The instruction OR# and the contact are connected in parallel.

API No.	16-bit instruction	32-bit instruction	Comparison operation result	
			ON	OFF
0815	OR&	DOR&	S_1&S_2≠0	S_1&S_2=0
0816	OR|	DOR|	S_1|S_2≠0	S_1|S_2=0
0817	OR^	DOR^	S_1^S_2≠0	S_1^S_2=0

4. &: Logical AND operation
5. |: Logical OR operation
6. ^: Logical exclusive OR operation

Example:

1. When X0.1 is ON, Y0.0 is ON. Besides, when the logical operator AND performs the logical AND operation on each pair of corresponding bits in C0 and C10 and the operation result is not 0, Y0.0 is ON.
2. When X0.2 and X0.3 are ON, Y0.1 is ON. When the logical operator OR performs the logical OR operation on each pair of corresponding bits in the 32-bit register (D10, D11) and the 32-bit register (D20, D21) and the operation result is not 0, Y0.1 is ON. Besides, when the logical operator XOR performs the logical exclusive OR operation on each pair of corresponding bits in the 32-bit counter HC0 and the 32-bit register (D200, D201) and the operation result is not 0, Y0.1 is ON.



Additional remark:

If $\mathbf{S_1}$ or $\mathbf{S_2}$ is illegal, the condition of the instruction is not met, SM0 is ON, and the error in SR0 is 16#2003.

6.10 Rotation Instructions

6.10.1 List of Rotation Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
0900	ROR	DROR	✓	Rotating to the right	5
0901	RCR	DRCR	✓	Rotating to the right with the carry flag	5
0902	ROL	DROL	✓	Rotating to the left	5
0903	RCL	DRCL	✓	Rotating to the left with the carry flag	5
0904	MBR	–	✓	Rotating the matrix bits	7

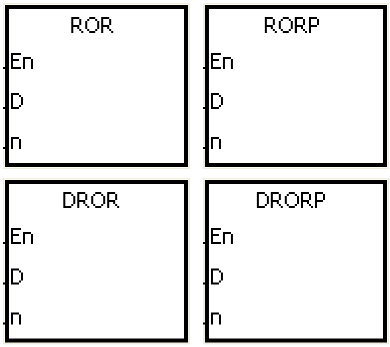
6.10.2 Explanation of Rotation Instructions

API		Instruction code			Operand	Function
0900		D	ROR	P	**D, n**	Rotating to the right

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●			●	●	●	●	●		●	○	●				
n	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



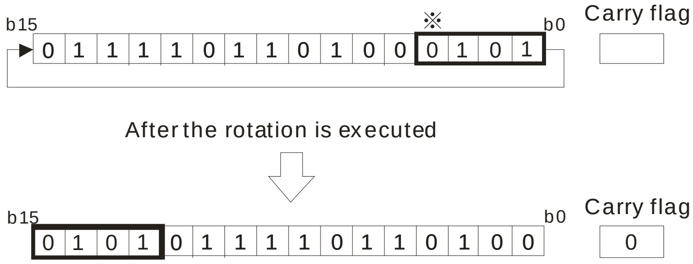
D	:	Device which is rotated	Word/Double word
n	:	Number of bits forming a group	Word/Double word

Explanation:

1. The values of the bits in the device specified by **D** are divided into groups (**n** bits as a group), and these groups are rotated to the right.
2. Only the instruction DROR can use the 32-bit counter.
3. The operand **n** used in the 16-bit instruction should be within the range between 1 and 16. The operand **n** used in the 32-bit instruction should be within the range between 1 and 32.
4. Generally, the pulse instructions RORP and DRORP are used.

Example:

When X0.0 is switched from OFF to ON, the values of the bits in D10 are divided into groups (four bits as a group), and these groups are rotated to the right. (The value of the bit marked ※ is transmitted to the carry flag SM602.)



Additional remark:

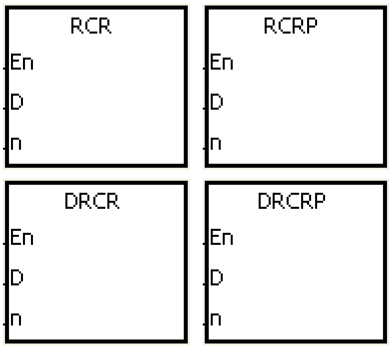
1. If the device exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
0901	D	RCR	P	**D, n**	Rotating to the right with the carry flag

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●			●	●	●	●	●		●	○	●				
n	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



D : Device which is rotated　　Word/Double word

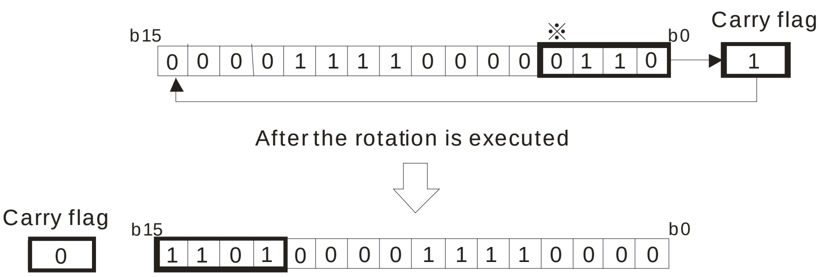
n : Number of bits forming a group　　Word/Double word

Explanation:

1. The values of the bits in the device specified by **D** are divided into groups (**n** bits as a group), and these groups are rotated to the right with the carry flag SM602.
2. Only the 32-bit instructions can use the 32-bit counter.
3. The operand **n** used in the 16-bit instruction should be within the range between 1 and 16. The operand **n** used in the 32-bit instruction should be within the range between 1 and 32.
4. Generally, the pulse instructions RCRP and DRCRP are used.

Example:

When X0.0 is switched from OFF to ON, the values of the bits in D10 are divided into groups (four bits as a group), and these groups are rotated to the right with the carry flag SM602. (The value of the bit marked ※ is transmitted to the carry flag SM602.)



Additional remark:

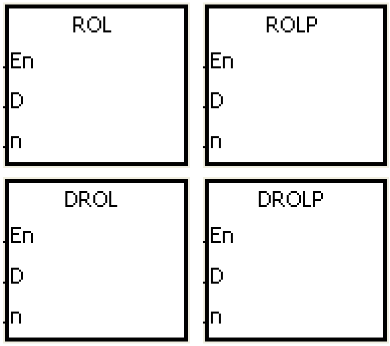
1. If the device exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API		Instruction code		Operand	Function
0902	D	ROL	P	D, n	Rotating to the left

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●			●	●	●	●	●		●	○	●				
n	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



D : Device which is rotated — Word/Double word

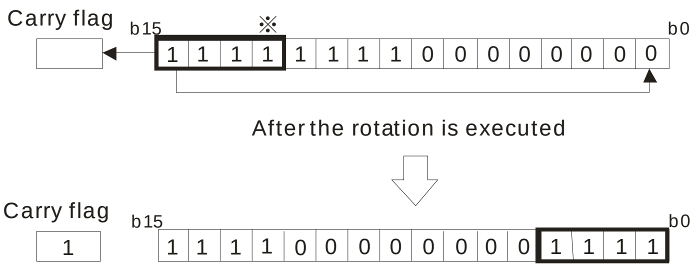
n : Number of bits forming a group — Word/Double word

Explanation:

1. The values of the bits in the device specified by **D** are divided into groups (**n** bits as a group), and these groups are rotated to the left.
2. Only the 32-bit instructions can use the 32-bit counter.
3. The operand **n** used in the 16-bit instruction should be within the range between 1 and 16. The operand **n** used in the 32-bit instruction should be within the range between 1 and 32.
4. Generally, the pulse instructions ROLP and DROLP are used.

Example:

When X0.0 is switched from OFF to ON, the values of the bits in D10 are divided into groups (four bits as a group), and these groups are rotated to the left. (The value of the bit marked ※ is transmitted to the carry flag SM602.)



Additional remark:

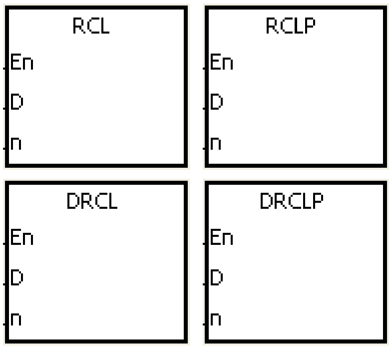
1. If the device exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
0903	D	RCL	P	**D, n**	Rotating to the left with the carry flag

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
D	●	●			●	●	●	●	●		●	○	●				
n	●	●						●	●		●		●	○	○		

Pulse instruction	32-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



D : Device which is rotated — Word/Double word

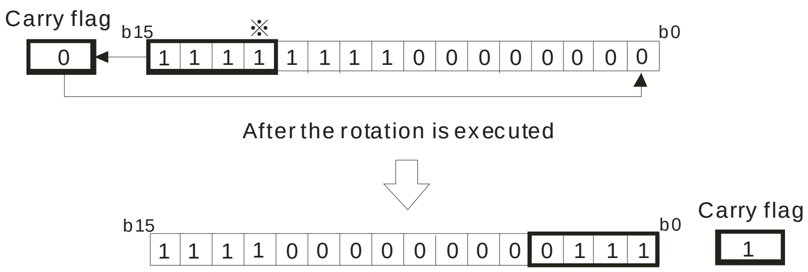
n : Number of bits forming a group — Word/Double word

Explanation:

1. The values of the bits in the device specified by **D** are divided into groups (**n** bits as a group), and these groups are rotated to the left with the carry flag SM602.
2. Only the 32-bit instructions can use the 32-bit counter.
3. The operand **n** used in the 16-bit instruction should be within the range between 1 and 16. The operand **n** used in the 32-bit instruction should be within the range between 1 and 32.
4. Generally, the pulse instructions RCLP and DRCLP are used.

Example:

When X0.0 is switched from OFF to ON, the values of the bits in D10 are divided into groups (four bits as a group), and these groups are rotated to the left with the carry flag SM602. (The value of the bit marked ※ is transmitted to the carry flag SM602.)



Additional remark:

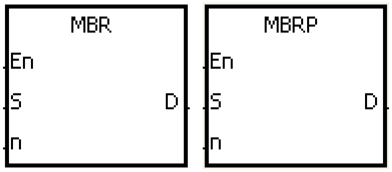
1. If the device exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
0904		MBR	P	**S, D, n**	Rotating the matrix bits

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●				
D	●	●			●	●		●	●				●				
n	●	●			●	●		●	●		●		●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



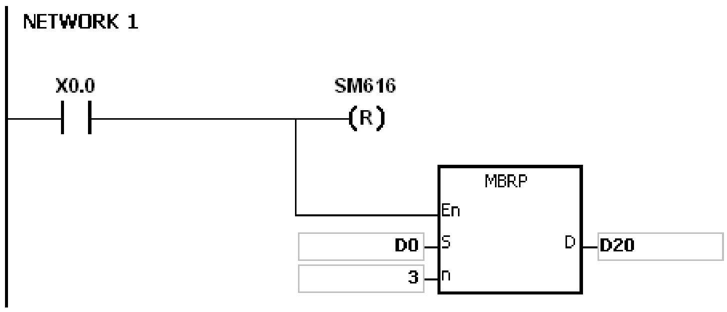
S	:	Matrix source	Word
D	:	Operation result	Word
n	:	Length of the array	Word

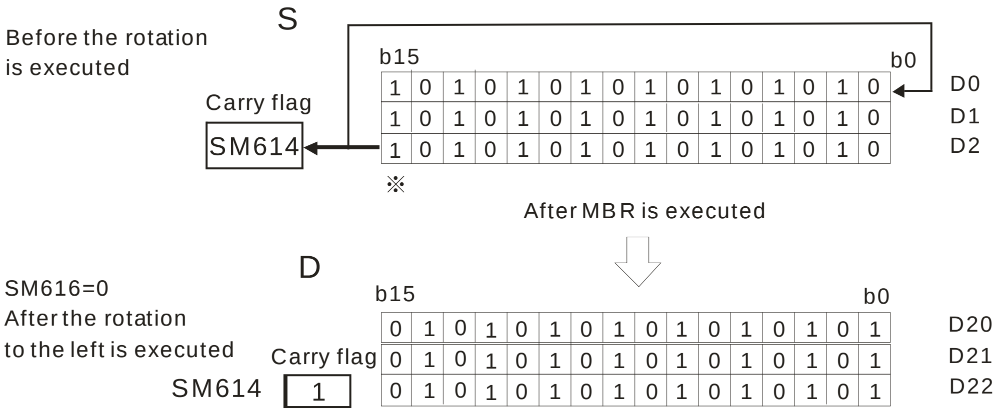
Explanation:

1. The values of the **n** rows of bits in **S** are rotated to the right or to the left. When SM616 is OFF, the values of the bits are rotated to the left. When SM616 is ON, the values of the bits are rotated to the right. The vacancy resulting from the rotation is filled by the value of the bit rotated last, and the operation result is stored in **D**. The value of the bit rotated last not only fills the vacancy, but also is transmitted to the carry flag SM614.
2. The operand **n** should be within the range between 1 and 256.
3. Generally, the pulse instruction MBRP is used.

Example 1:

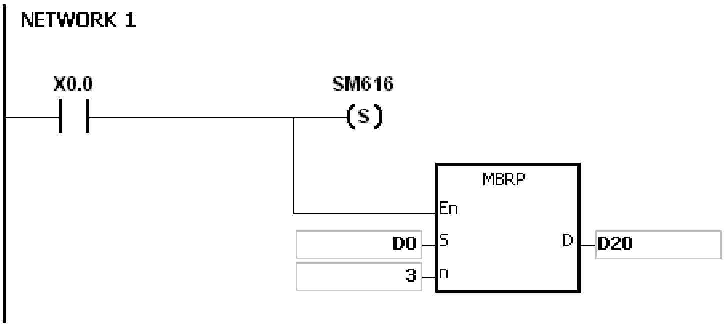
When X0.0 is ON, SM616 is OFF. The values of the bits in the 16-bit registers D0~D2 are rotated to the left, and the operation result is stored in the 16-bit registers D20~D22. The value of the bit marked ※ is transmitted to the carry flag SM614.

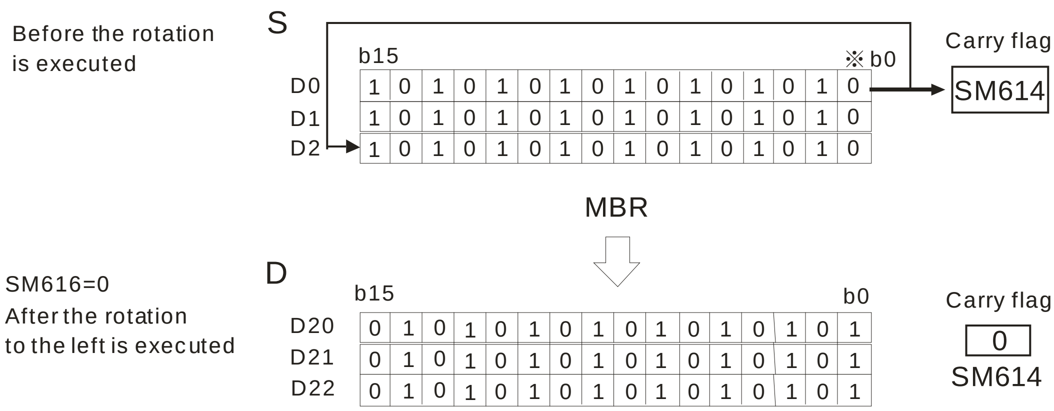




Example 2:

When X0.0 is ON, SM616 is ON. The values of the bits in the 16-bit registers D0~D2 are rotated to the right, and the operation result is stored in the 16-bit registers D20~D22. The value of the bit marked ※ is transmitted to the carry flag SM614.





Additional remark:

1. If **S**+**n**-1 or **D**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. The flags:
   SM614: It is the carry flag for the matrix rotation/shift/output.
   SM616: It is the direction flag for the matrix rotation/shift.

6.11 Timer and Counter Instructions

6.11.1 List of Timer and Counter Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
1000	RST	–	–	Resetting the contact or clearing the register	3
1001	TMR	–	–	16-bit timer	5
1002	TMRH	–	–	16-bit timer	5
1003	CNT	–	–	16-bit counter	5
1004	–	DCNT	–	32-bit counter	5

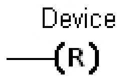
6.11.2 Explanation of Timer and Counter Instructions

API	Instruction code	Operand	Function
1000	RST	**D**	Resetting the contact or clearing the register

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
D	●	●	●	●	●	●	●	●	●	●	●	○	●				

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
-	AH500	-

Symbol:



D : Device which is reset Bit/Word

Explanation:

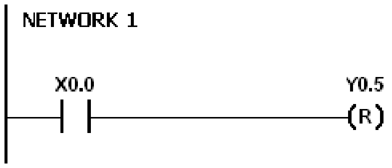
1. When the instruction RST is driven, the action of the device specified is as follows.

Device	status
Bit	The coil and the contact are set to OFF.
T, C, and HC	The timer and the counter are reset to 0, and the coil and the contact are set to OFF.
Word	The value is cleared to 0.

2. If the instruction RST is not executed, the status of the device specified is unchanged.
3. The instruction supports the direct output.

Example:

When X0.0 is ON, Y0.5 is set to OFF.

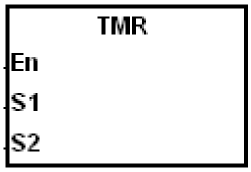


API		Instruction code		Operand	Function
1001		TMR		**S_1, S_2**	16-bit timer

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1					●												
S_2	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
-	AH500	-

Symbol:



S_1 : Timer number — Word

S_2 : Setting value of the timer — Word

Explanation:

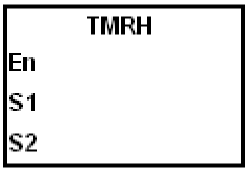
Please refer to the explanation of the instruction TMRH for more information.

API	Instruction code	Operand	Function
1002	TMRH	S_1, S_2	16-bit timer

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1					○												
S_2	○	○						○	○		○		○	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
-	AH500	-

Symbol:



S_1 : Timer number — Word

S_2 : Setting value of the timer — Word

Explanation:

1. The timer used in the instruction TMR takes 100 milliseconds as the timing unit, and the timer used in the instruction TMRH takes 1 millisecond as the timing unit.
2. The timers for the subroutine's exclusive use are T1920~T2047.
3. The values of the timers used in TMR and TMRH should be within the range between 0 and 32767.
4. If the same timer is used repeatedly in the program, including in the different instructions TMR and TMRH, the setting value is the one that the value of the timer matches first.
5. As long as users add the letter S in front of the device T, the timer used in the instruction TMR becomes the accumulative timer. When the conditional contact is OFF, the accumulative timer value is not reset. When the conditional contact is ON, the timer counts from the current value.
6. If the same timer is used repeatedly in the program, it is OFF when one of the conditional contacts is OFF.
7. If the same timer is used repeatedly as the timer for the subroutine's exclusive use and the accumulative timer in the program, it is OFF when one of the conditional contacts is OFF.
8. When the timer is switched from ON to OFF and the conditional contact is ON, the timer is reset and counts again.
9. When the instruction TMR is executed, the specified timer coil is ON and the timer begins to count. As the value of the timer matches the setting value, the state of the contact is as follows.

Normally open (NO) contact	ON
Normally closed (NC) contact	OFF

Example 1:

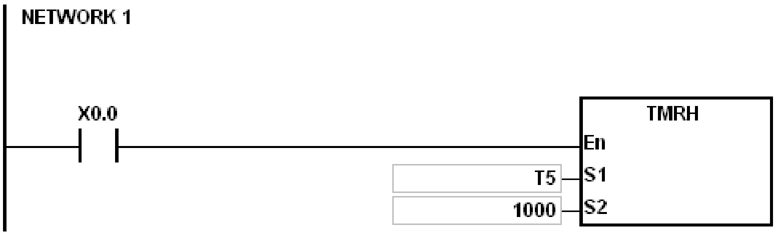
When X0.0 is ON, the setting value 50 is loaded to the timer T0. When the value of T0 matches 50, the contact of T0 is ON.

Example 2:

When X0.0 is ON, the setting value 50 is loaded to the timer T0. When the value of T0 is 25 and X0.0 is switched from OFF to ON, T0 counts up from 25 to 50, and the contact of T0 is ON.

Example 3:

When X0.0 is ON, the setting value 1000 is loaded to the timer T5. When the value of T5 ,matches 1000, the contact of T5 is ON.



Example 4:

When X0.0 is ON, the setting value 1000 is loaded to the timer T5. When the value of T5 is 500 and X0.0 is switched from OFF to ON, T0 counts up from 50 to 1000, and the contact of T5 is ON.

Additional remark:

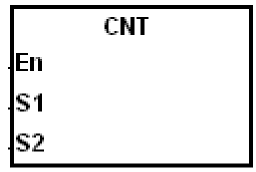
When declare the operand S1 via ISPSoft, the data type is TIMER.

API	Instruction code			Operand	Function
1003		CNT		S_1, S_2	16-bit counter

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1						○											
S_2	○	○						○	○		○		○	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
-	AH500	-

Symbol:



S_1 : Counter number Word

S_2 : Setting value of the counter Word

Explanation:

1. When the instruction CNT is executed, the coil of the counter is ON, and the value of the counter increases by one. When the value of the counter matches the setting value, the state of the contact is as follows.

Normally open (NO) contact	ON
Normally closed (NC) contact	OFF

2. After the value of the counter matches the setting value, if there is still a pulse input signal of the counter, the state of the contact and the value of the counter remain unchanged. If users want to clear the value of the counter, they can use the instruction RST.

Example:

When SM408 is ON for the first time, the setting value 10 is loaded to the counter C0, and C0 begins to count. After SM408 is switched from OFF to ON ten times, the value of C0 is 10, and the contact of C0 is ON.

After the contact of C0 is ON, the value of C0 does not increase although SM408 still truns from OFF to ON.

Additional remark:

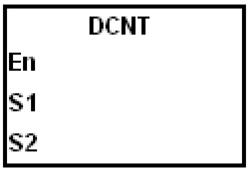
When declare the operand S1 via ISPSoft, the data type is COUNTER.

API	Instruction code			Operand	Function
1004		DCNT		S_1, S_2	32-bit counter

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1							○										
S_2	○	○						○	○		○		○	○	○		

Pulse instruction	16-bit instruction	32-bit instruction (5 steps)
-		AH500

Symbol:



S_1 : Counter value Double word

S_2 : Setting value of the counter Double word

Explanation:

1. The instruction DCNT can be used to enable the 32-bit counter within the range between HC0 and HC63.
2. When the instruction DCNT is executed, the switch between the 32-bit general-purpose addition counters and the 32-bit general-purpose subtraction counters depends on states of the special auxiliary relays SM621~SM684.
3. When the instruction DCNT is not executed, the counter stops counting, and the original value of the counter is not cleared. Users can use the instruction RST to clear the value of the counter and reset the contact.

Example:

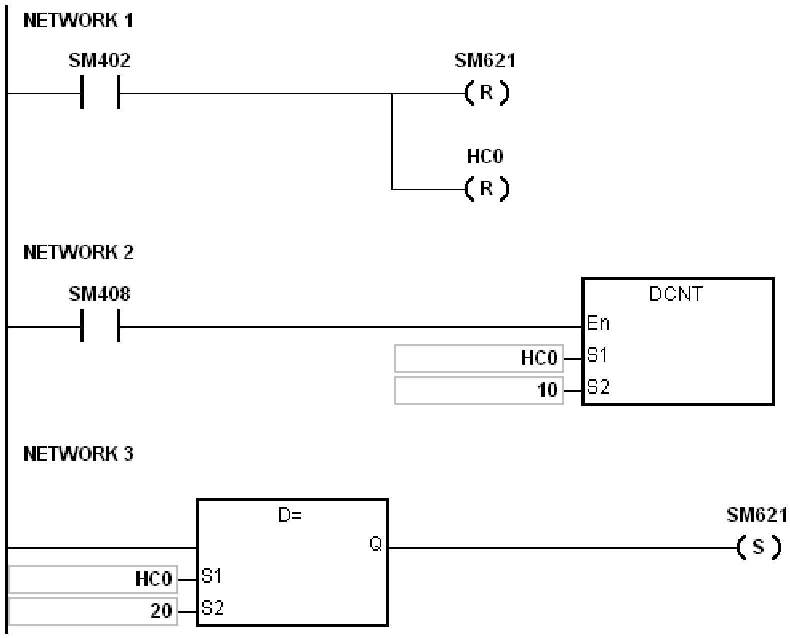
When the PLC runs, SM621 is OFF, and the value of HC0 is cleared. When SM408 is ON for the first time, the setting value 10 is loaded to HC0, and HC0 begins to count up.

After SM408 is switched from OFF to ON ten times, the value of HC0 is 10, and the contact of HC0 is ON.

After HC0 is ON, the value of HC0 keeps increasing because SM408 is still switched from OFF to ON.

When the value of HC0 is 20, SM621 is ON. After SM408 is switched from OFF to ON ten times, the contact of HC0 is OFF.

After the contact of HC0 is OFF, the value of HC0 keeps decreasing because SM408 is still switched from OFF to ON.



Additional remark:

1. Please refer to the usage of 32-bit counters in chapter 2 for more information related to SM621~SM684.
2. When declare the operand S1 via ISPSoft, the data type is COUNTER.

6.12 Shift Instructions

6.12.1 The List of Shift Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
1100	SFTR	–	✓	Shifting the states of the devices to the right	9
1101	SFTL	–	✓	Shifting the states of the devices to the left	9
1102	WSFR	–	✓	Shifting the data in the word devices to the right	9
1103	WSFL	–	✓	Shifting the data in the word devices to the left	9
1104	SFWR	–	✓	Shifting the data and writing it into the word device	7
1105	SFRD	–	✓	Shifting the data and reading it from the word device	7
1106	SFPO	–	✓	Reading the latest data from the data list	5
1107	SFDEL	–	✓	Deleting the data from the data list	7
1108	SFINS	–	✓	Inserting the data into the data list	7
1109	MBS	–	✓	Shifting the matrix bits	7
1110	SFR	–	✓	Shifting the values of the bits in the 16-bit registers by **n** bits to the right	5
1111	SFL	–	✓	Shifting the values of the bits in the 16-bit registers by **n** bits to the left	5
1112	BSFR	–	✓	Shifting the states of the **n** bit devices by one bit to the right	5
1113	BSFL	–	✓	Shifting the states of the **n** bit devices by one bit to the left	5
1114	NSFR	–	✓	Shifting **n** registers to the right	5
1115	NSFL	–	✓	Shifting **n** registers to the left	5

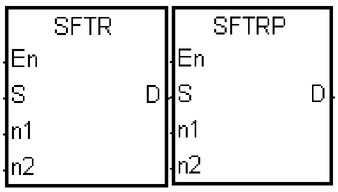
6.12.2 Explanation of Shift Instructions

API		Instruction code		Operand	Function
1100		SFTR	P	**S, D, n_1, n_2**	Shifting the states of the devices to the right

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●	●	●				●	●	●			●				
D	●	●	●	●				●	●	●			●				
n_1	●	●						●	●		●		●	○	○		
n_2	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



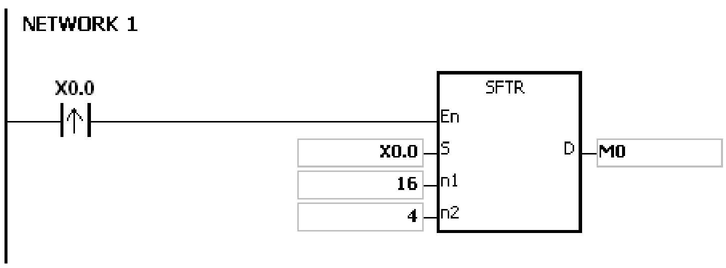
S	:	Initial device in which the value is shifted	Bit
D	:	Initial device in which the value is shifted	Bit
n_1	:	Length of the data which is shifted	Word
n_2	:	Number of bits forming a group	Word

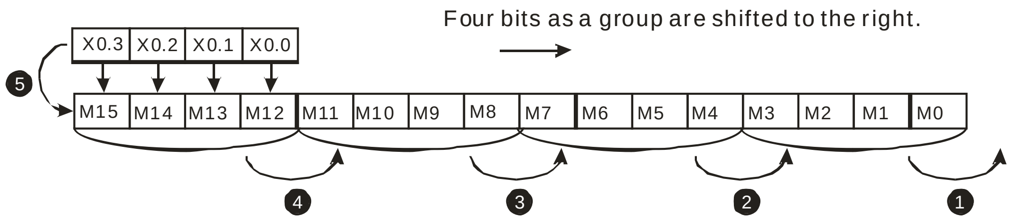
Explanation:

1. The states of the **n_1** bit devices starting from **D** are divided into groups (**n_2** bits as a group), and these groups are shifted to the right. The states of the **n_2** bit devices starting from **S** are shifted to the devices starting from **D** to fill the vacancy.
2. Generally, the pulse instruction SFTRP is used.
3. The operand **n_1** should be within the range between 1 and 1024. The operand **n_2** should be within the range between 1 and **n_1**.

Example 1:

1. When X0.0 is switched from OFF to ON, the states of the sixteen bit devices starting from M0 are divided into groups (four bits as a group), and these groups are shifted to the right.
2. The shift of the states of the bit devices to the right during a scan is illustrated as follows.
   - ❶ M3~M0 → Being carried
   - ❷ M7~M4 → M3~M0
   - ❸ M11~M8 → M7~M4
   - ❹ M15~M12 → M11~M8
   - ❺ X0.3~X0.0 → M15~M12

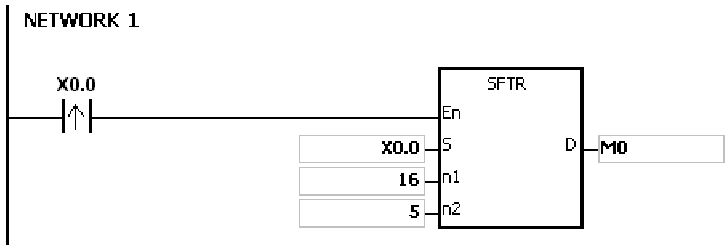


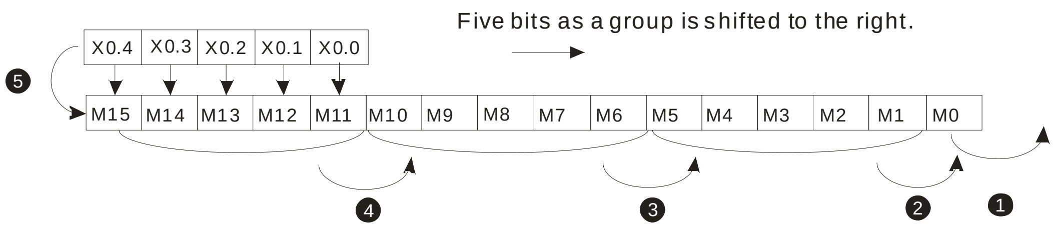


Example 2:

1. When X0.0 is switched from OFF to ON, the states of the sixteen bit devices starting from M0 are divided into groups (five bits as a group), and these groups are shifted to the right.
2. The shift of the states of the bit devices to the right during a scan is illustrated as follows.

   ❶ M0 → Being carried
   ❷ M5 → M0
   ❸ M10~M6 → M5~M1
   ❹ M15~M11 → M10~M6
   ❺ X0.4~X0.0 → M15~M11





Additional remark:

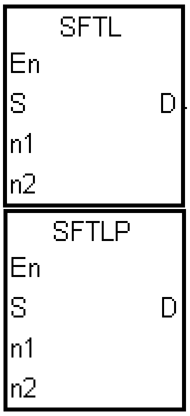
1. If **S**+**n₂**-1 or **D**+**n₁**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n₁** is less than 1, or if **n₁** is larger than 1024, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. If **n₂** is less than 1, or if **n₂** is larger than **n₁**, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code		Operand	Function
1101	SFTL	P	**S, D, n_1, n_2**	Shifting the states of the devices to the left

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●	●	●				●	●	●			●				
D	●	●	●	●				●	●	●			●				
n_1	●	●						●	●		●		●	○	○		
n_2	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Initial device in which the value is shifted — Bit

D : Initial device in which the value is shifted — Bit

n_1 : Length of the data which is shifted — Word

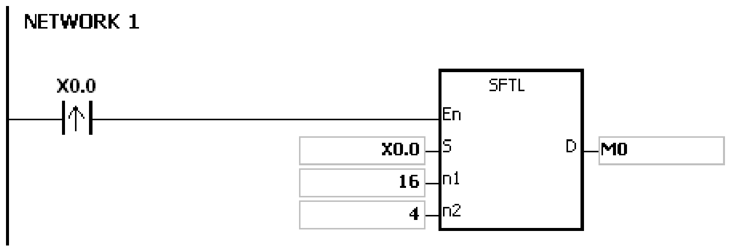
n_2 : Number of bits forming a group — Word

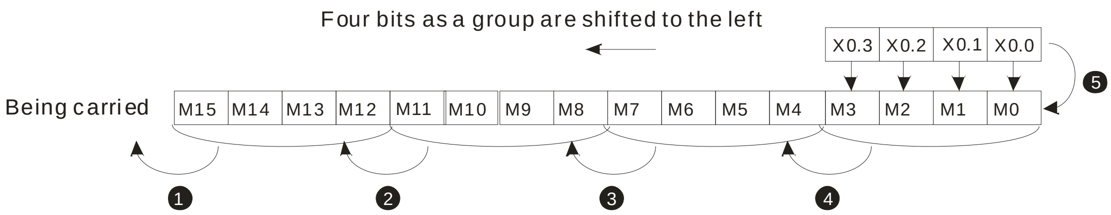
Explanation:

1. The states of the n_1 bit devices starting from **D** are divided into groups (n_2 bits as a group), and these groups are shifted to the left. The states of the n_2 bit devices starting from **S** are shifted to the devices starting from **D** to fill the vacancy.
2. Generally, the pulse instruction SFTLP is used.
3. The operand n_1 should be within the range between 1 and 1024. The operand n_2 should be within the range between 1 and n_1.

Example 1:

1. When X0.0 is switched from OFF to ON, the states of the sixteen bit devices starting from M0 are divided into groups (four bits as a group), and these groups are shifted to the left.
2. The shift of the states of the bit devices to the left during a scan is illustrated as follows.
   ❶ M15~M12 → Being carried
   ❷ M11~M8 → M15~M12
   ❸ M7~M4 → M11~M8
   ❹ M3~M0 → M7~M4
   ❺ X0.3~X0.0 → M3~M0

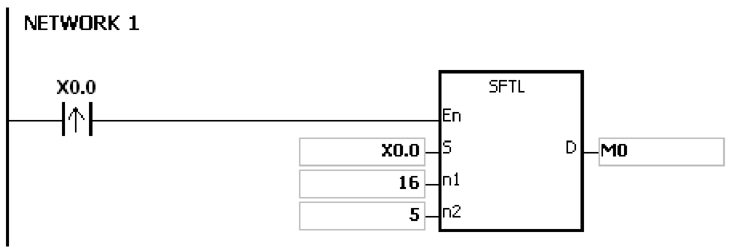


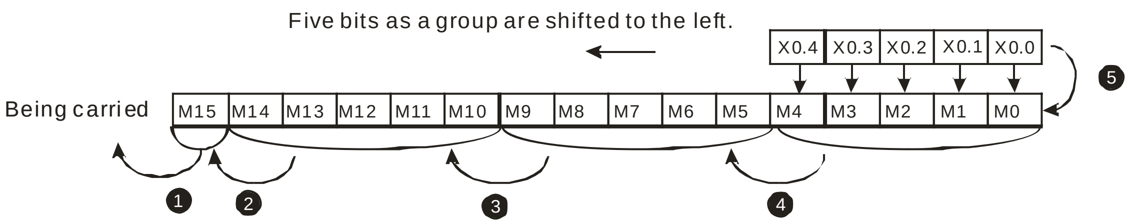


Example 2:

1. When X0.0 is switched from OFF to ON, the states of the sixteen bit devices starting from M0 are divided into groups (five bits as a group), and these groups are shifted to the left.
2. The shift of the states of the bit devices to the left during a scan is illustrated as follows.

❶ M15	→	Being carried
❷ M10	→	M15
❸ M9~M5	→	M14~M10
❹ M4~M0	→	M9~M5
❺ X0.4~X0.0	→	M4~M0





Additional remark:

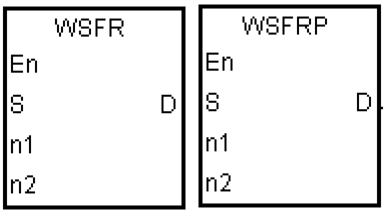
1. If **S**+$\mathbf{n_2}$-1 or **D**+$\mathbf{n_1}$-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If $\mathbf{n_1}$ is less than 1, or if $\mathbf{n_1}$ is larger than 1024, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. If $\mathbf{n_2}$ is less than 1, or if $\mathbf{n_2}$ is larger than $\mathbf{n_1}$, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code		Operand	Function
1102	WSFR	P	S, D, n_1, n_2	Shifting the data in the word devices to the right

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●				
D	●	●			●	●		●	●		●		●				
n_1	●	●						●	●		●		●	○	○		
n_2	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Initial device in which the value is shifted Word

D : Initial device in which the value is shifted Word

n_1 : Length of the data which is shifted Word

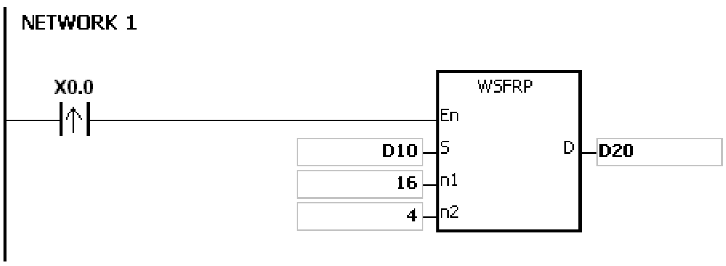
n_2 : Number of bits forming a group Word

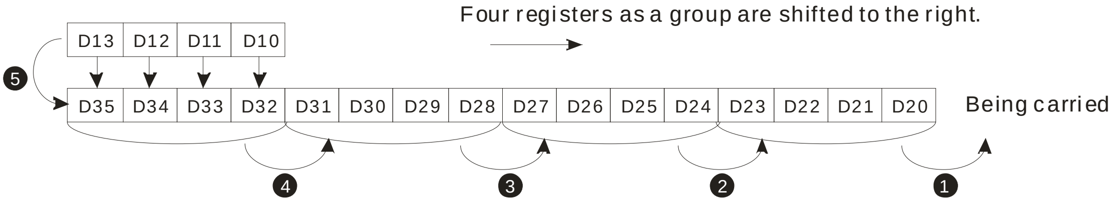
Explanation:

1. The data in the n_1 word devices starting from **D** is divided into groups (n_2 words as a group), and these groups are shifted to the right. The data in the n_2 word devices starting from **S** are shifted to the devices starting from **D** to fill the vacancy.
2. Generally, the pulse instruction WSFRP is used.
3. The operand n_1 should be within the range between 1 and 512. The operand n_2 should be within the range between 1 and n_1.

Example 1:

1. When X0.0 is switched from OFF to ON, the data in the sixteen word devices starting from D20 is divided into groups (four words as a group), and these groups are shifted to the right.
2. The shift of the data in the word devices to the right during a scan is illustrated as follows.
   - ❶ D23~D20 → Being carried
   - ❷ D27~D24 → D23~D20
   - ❸ D31~D28 → D27~D24
   - ❹ D35~D32 → D31~D28
   - ❺ D13~D10 → D35~D32

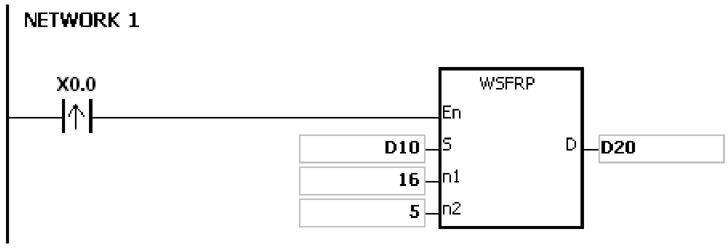


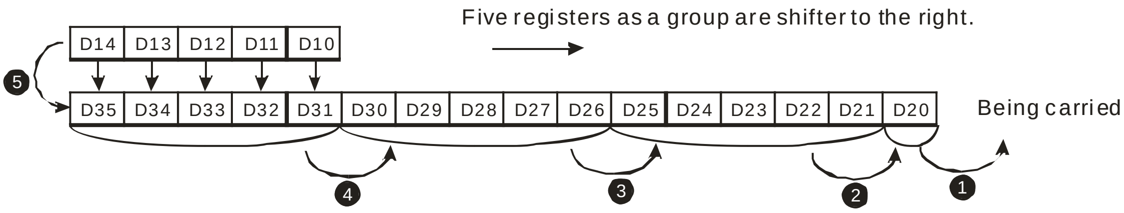


Example 2:

1. When X0.0 is switched from OFF to ON, the data in the sixteen word devices starting from D20 is divided into groups (five words as a group), and these groups are shifted to the right.
2. The shift of the data in the word devices to the right during a scan is illustrated as follows.

❶ D20	→	Being carried
❷ D25	→	D20
❸ D30~D26	→	D25~D21
❹ D35~D31	→	D30~D26
❺ D14~D10	→	D35~D31





Additional remark:

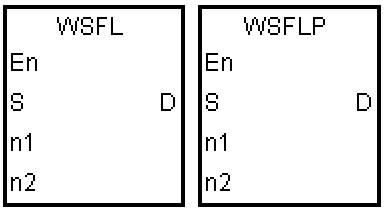
1. If **S**+$\mathbf{n_2}$-1 or **D**+$\mathbf{n_1}$-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If $\mathbf{n_1}$ is less than 1, or if $\mathbf{n_1}$ is larger than 512, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. If $\mathbf{n_2}$ is less than 1, or if $\mathbf{n_2}$ is larger than $\mathbf{n_1}$, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
1103		WSFL	P	**S, D, n_1, n_2**	Shifting the data in the word devices to the left

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●				
D	●	●			●	●		●	●		●		●				
n_1	●	●						●	●		●		●	○	○		
n_2	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S	:	Initial device in which the value is shifted	Word
D	:	Initial device in which the value is shifted	Word
n_1	:	Length of the data which is shifted	Word
n_2	:	Number of bits forming a group	Word

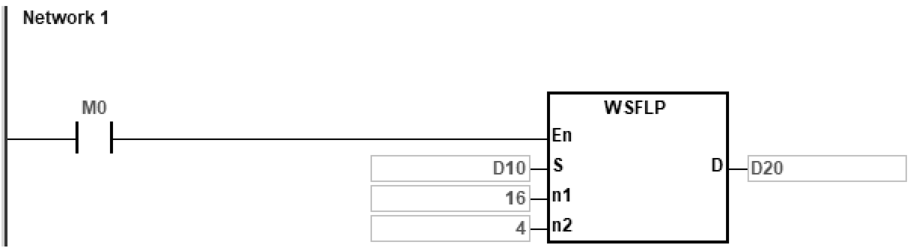
Explanation:

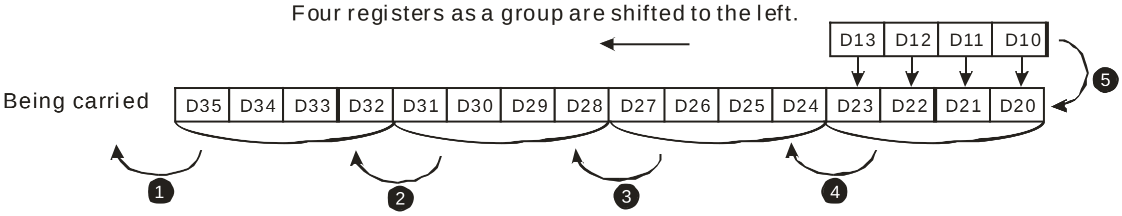
1. The data in the n_1 word devices starting from **D** is divided into groups (n_2 words as a group), and these groups are shifted to the left. The data in the n_2 word devices starting from **S** are shifted to the devices starting from **D** to fill the vacancy.
2. Generally, the pulse instruction WSFLP is used.
3. The operand n_1 should be within the range between 1 and 512. The operand n_2 should be within the range between 1 and n_1.

Example 1:

1. When M0 is switched from OFF to ON, the data in the sixteen word devices starting from D20 is divided into groups (four words as a group), and these groups are shifted to the left.
2. The shift of the data in the word devices to the left during a scan is illustrated as follows.

   ❶ D35~D32 → Being carried
   ❷ D31~D28 → D35~D32
   ❸ D27~D24 → D31~D28
   ❹ D23~D20 → D27~D24
   ❺ D13~D10 → D23~D20

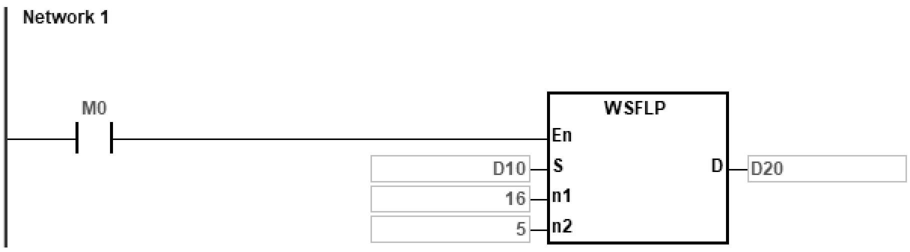


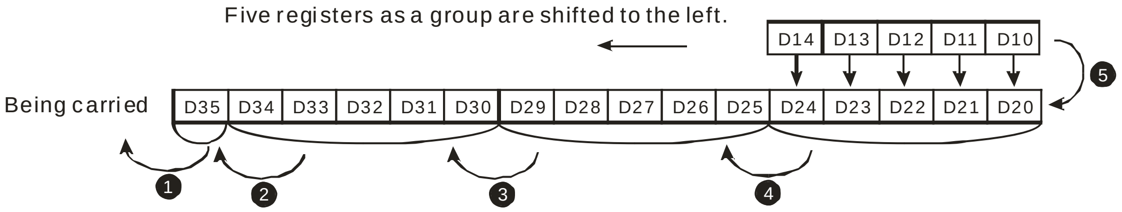


Example 2:

1. When M0 is switched from OFF to ON, the data in the sixteen word devices starting from D20 is divided into groups (five words as a group), and these groups are shifted to the left.
2. The shift of the data in the word devices to the left during a scan is illustrated as follows.

❶ D35 → Being carried
❷ D30 → D35
❸ D29~D25 → D34~D30
❹ D24~D20 → D29~D25
❺ D14~D10 → D24~D20





Additional remark:

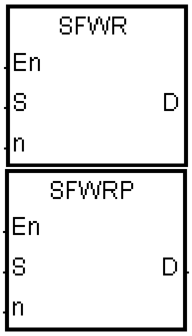
1. If **S**+$\mathbf{n_2}$-1 or **D**+$\mathbf{n_1}$-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If $\mathbf{n_1}$ is less than 1, or if $\mathbf{n_1}$ is larger than 512, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. If $\mathbf{n_2}$ is less than 1, or if $\mathbf{n_2}$ is larger than $\mathbf{n_1}$, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
1104		SFWR	P	**S, D, n**	Shifting the data and writing it into the word device

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●		●				
n	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Device in which the data is shifted — Word

D : Initial device — Word

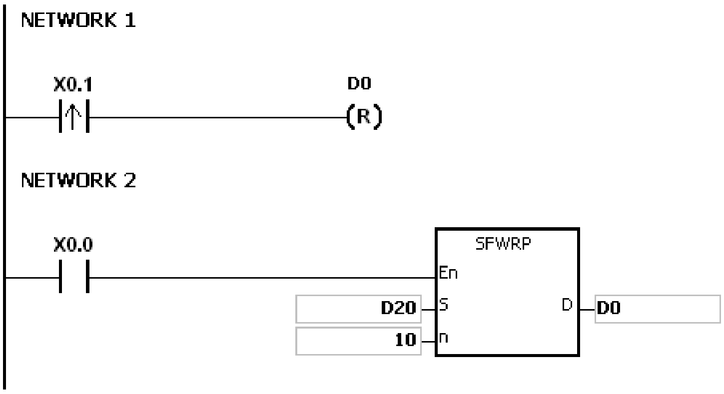
n : Data length — Word

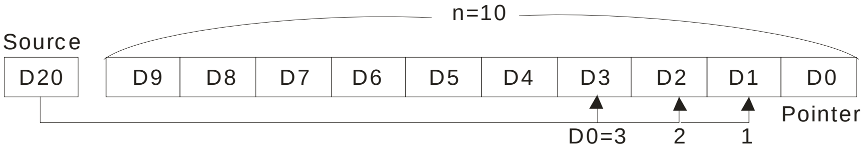
Explanation:

1. The data in the **n** word devices starting from the device specified by **D** is defined as a first in, first out data type, and the device specified by **D** is taken as a pointer. When the instruction is executed, the value of the pointer increases by one, and the data in the device specified by **S** is written into the device specified by the pointer. When the value of the pointer is larger than or equal to **n**-1, the instruction does not process the writing of the data, and the carry flag SM602 is ON.
2. Generally, the pulse instruction SFWRP is used.
3. The operand **n** should be within the range between 2 and 512.

Example:

1. The value of the pointer D0 is cleared to 0 first. When X0.0 is switched from OFF to ON, the data in D20 is written into D1, and the value in D0 becomes 1. When X0.0 is switched from OFF to ON again, the data in D20 is written to D2, and the value in D0 becomes 2.
2. The data in the word device is shifted and written in the following way.
   - The data in D20 is written into D1.
   - The value in D0 becomes 1.





Additional remark:

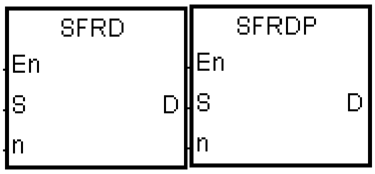
1. If the value in **D** is less than 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **D**+**n**-1 exceeds the device range, the instruction is not executed. SM0 is ON, and the error code in SR0 is 16#2003.
3. If **n** is less than 2, or if **n** is larger than 512, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
4. The instruction SFWR can be used with the instruction SFRD to write and read the data.

API	Instruction code		Operand	Function
1105	SFRD	P	**S, D, n**	Shifting the data and reading it from the word device

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●				
D	●	●			●	●		●	●		●	○	●				
n	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Initial device — Word

D : Device in which the data is shifted — Word

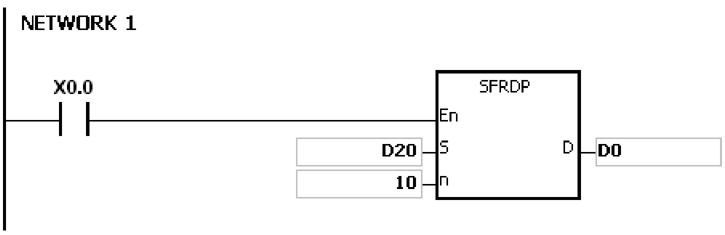
n : Data length — Word

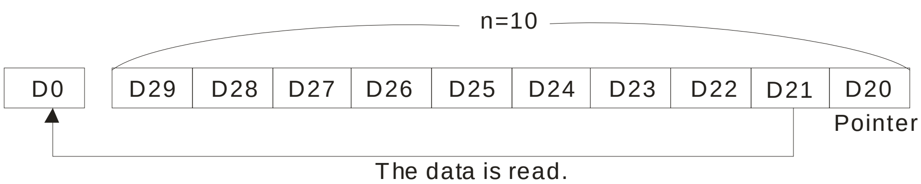
Explanation:

1. The data in the **n** word devices starting from the device specified by **S** is defined as a first in, first out data type, and the device specified by **S** is taken as a pointer. When the instruction is executed, the value in the device specified by **S** decreases by one, the data in the device specified by **S**+**1** is written into the device specified by **D**, the data in the devices specified by **S**+**n**-1~**S**+2 is shifted to the right, and the data in the device specified by **S**+**n**-1 is unchanged. When the value in the device specified by **S** is equal to 0, the instruction does not process the reading of the data, and the zero flag SM600 is ON.
2. Generally, the pulse instruction SFRDP is used.
3. The operand **n** should be within the range between 2 and 512.

Example:

1. When X0.0 is switched from OFF to ON, the data in D21 is written into D0, the data in D29~D22 is shifted to the right, the data in D29 is unchanged, and the value in D20 decreases by one.
2. The data in the word device is shifted and read in the following way.
   - The data in D21 is read and shifted to D0.
   - The data in D29~D22 is shifted to the right.
   - The value in D20 decreases by one.





Additional remark:

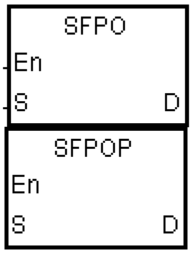
1. If the value in **S** is less than 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **S**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If **n** is less than 2, or if **n** is larger than 512, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
4. The instruction SFWR can be used with the instruction SFRD to write and read the data.

API	Instruction code			Operand	Function
1106		SFPO	P	S, D	Reading the latest data from the data list

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●		●	●		●		●				
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Initial device — Word

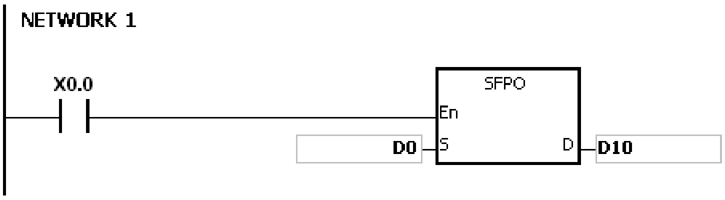
D : Device in which the data is stored — Word

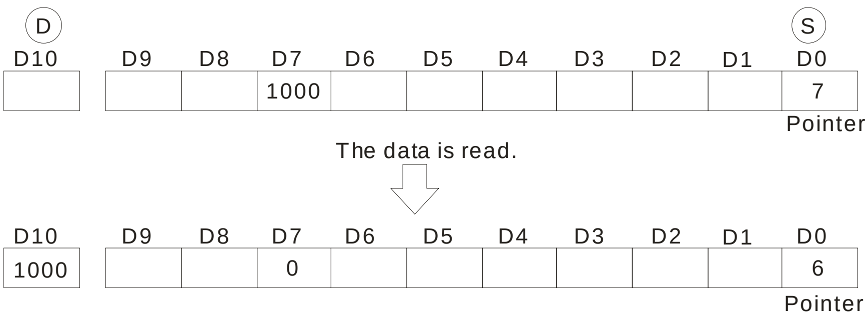
Explanation:

1. The device specified by **S** is taken as a pointer. When the instruction is executed, the data in the device specified by the value of the pointer is written into the device specified by **D** and cleared to 0, and the value in the device specified by **S** decreases by one. When the value in the device specified by **S** is equal to 0, the instruction does not process the reading of the data, and the zero flag SM600 is ON.
2. Generally, the pulse instruction SFPOP is used.

Example:

When X0.0 is ON, the data in the device specified by the value in D0 is written into D10. After the data is shifted, the data in the device specified by the value in D0 is cleared to 0, and the value in D0 increases by one.





Additional remark:

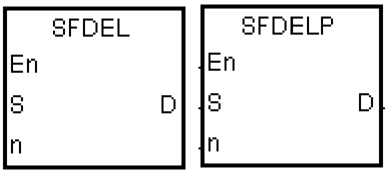
1. If the value in **S** is less than 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **S**+(The value in **S**) exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code		Operand	Function
1107	SFDEL	P	**S, D, n**	Deleting the data from the data list

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●		●	●		●		●				
D	●	●			●	●		●	●		●	○	●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Initial device — Word

D : Device in which the data is stored — Word

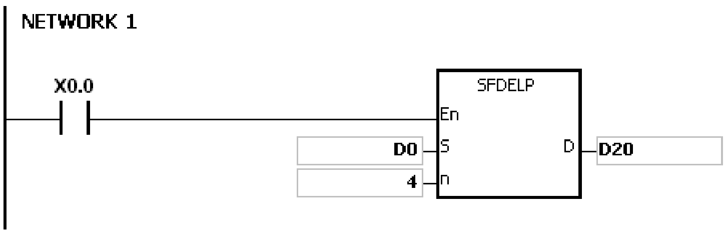
n : Device in which the data is deleted — Word

Explanation:

1. The value in the device specified by **S** indicates the length of the data, and the data is in the devices specified by **S**+1~**S**+(The value in **S**). When the instruction is executed, the data in the device specified by **S**+**n** is stored in **D** and deleted, the data in the devices specified by **S**+**n**+**1**~**S**+(The value in **S**) is shifted to the right, the data in the device specified by **S**+(The value in **S**) is cleared to 0, and the value in the device specified by **S** decreases by one. When the value in the device specified by **S** is equal to 0, the instruction does not process the deleting of the data, and the zero flag SM600 is ON.
2. Generally, the pulse instruction SFDELP is used.
3. The operand **n** should be within the range between 1 and 32767.

Example:

Suppose the value in D0 is 9, and **n** is 4. When X0.0 is ON, the data in D4 is stored in D20. After the data in D4 is deleted, the data in D5~D9 is shifted to the right, and the value in D0 decreases by one.



D (D20), n=4, S (D0)

D20	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	4712	857	123	100	111	22	48	5	799	9

The length of the data

The data is deleted.

D20	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
22	0	4712	857	123	100	111	48	5	799	8

The length of the data

Additional remark:

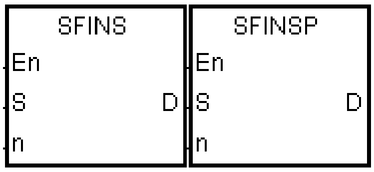
1. If the value in **S** is less than 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **S**+**n** exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If **S**+(The value in **S**) exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If **n** is larger than the value in **S**, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
5. If **n** is less than 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code		Operand	Function
1108	SFINS	P	S, D, n	Inserting the data into the data list

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●				
D	●	●			●	●		●	●		●	○	●	○	○		
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Initial device — Word

D : Data which is inserted — Word

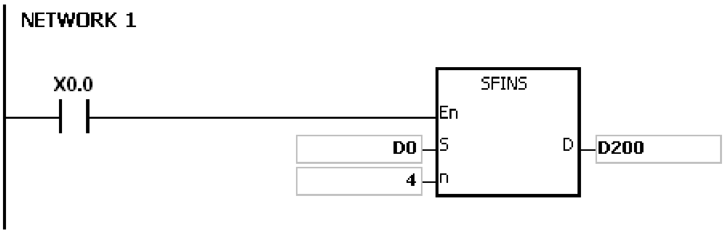
n : Device into which the data is inserted — Word

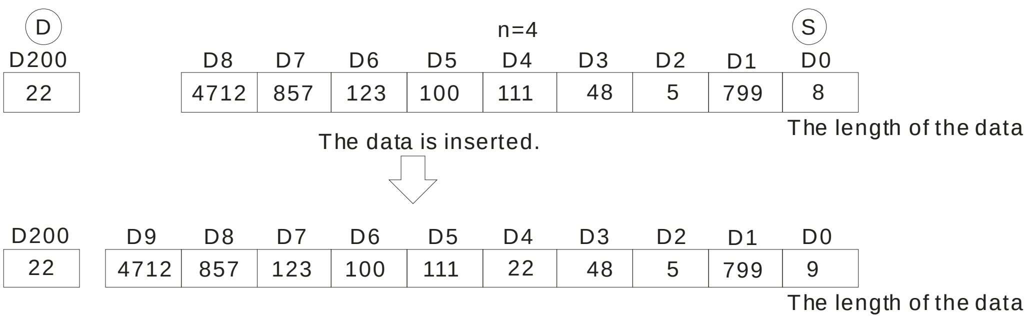
Explanation:

1. The value in the device specified by **S** indicates the length of the data, and the data is in the devices specified by **S**+1~**S**+(The value in **S**). When the instruction is executed, the data in **D** is inserted into **S**+**n**, the original data in the devices specified by **S**+**n**~**S**+(The value in **S**) is shifted to the left, and the value in the device specified by **S** increases by one. When the value in the device specified by **S** is equal to 32767, the instruction does not process the writing of the data, the value in the device specified by **S** does not increase, and the carry flag SM602 is ON.
2. Generally, the pulse instruction SFINSP is used.
3. The operand **n** should be within the range between 1 and 32767.

Example:

Suppose the value in D0 is 8, and **n** is 4. When X0.0 is ON, the data in D200 is inserted into D4, the original data in D4~D8 is shifted to D5~D9, and the value in D0 increases by one.





Additional remark:

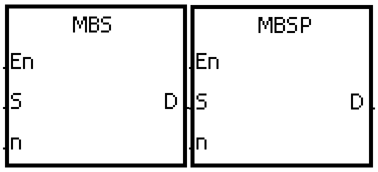
1. If the value in **S** is less than 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **S**+**n** exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003
3. If **S**+(The value in **S**)+1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If **n** is larger than the value in **S**, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
5. If **n** is less than 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
1109		MBS	P	**S, D, n**	Shifting the matrix bits

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●		●				
D	●	●			●	●	●	●	●				●				
n	●	●			●	●	●	●	●		●		●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Matrix source Word

D : Operation result Word

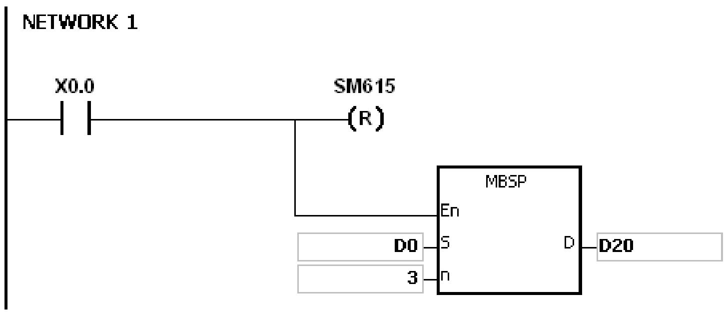
n : Length of the array Word

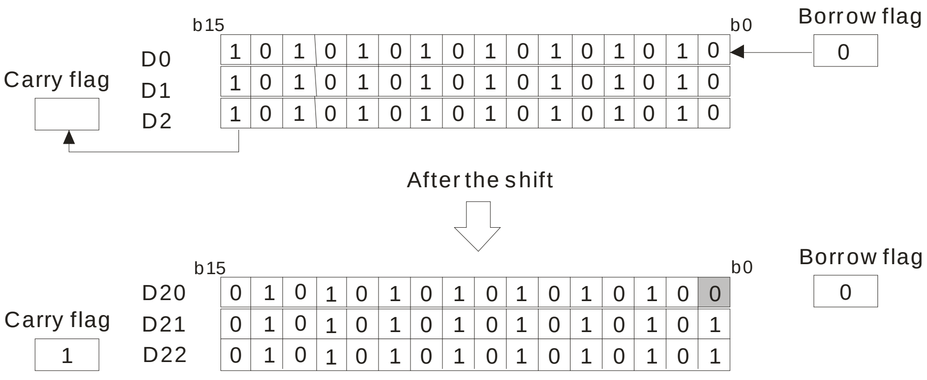
Explanation:

1. The values of the **n** rows of bits in **S** are shifted to the right or to the left. When SM616 is OFF, the values of the bits are shifted to the left. When SM616 is ON, the values of the bits are shifted to the right. The vacancy resulting from the shift is filled by the state of the borrow flag SM615, the value of the bit shifted last is transmitted to the carry flag SM614, and the operation result is stored in **D**.
2. The operand **n** should be within the range between 1 and 256.
3. Generally, the pulse instruction MBSP is used.

Example 1:

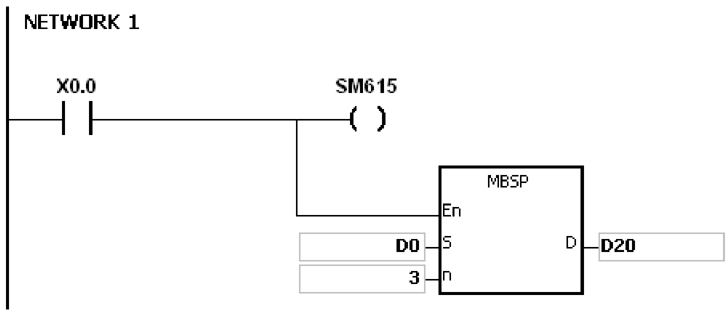
When X0.0 is ON, SM616 is OFF. The values of the bits are shifted to the left. Suppose SM615 is OFF. After the values of the bits in the 16-bit registers D0~D2 are shifted to the left, the operation result is stored in the 16-bit registers D20~D22, and SM614 is ON.

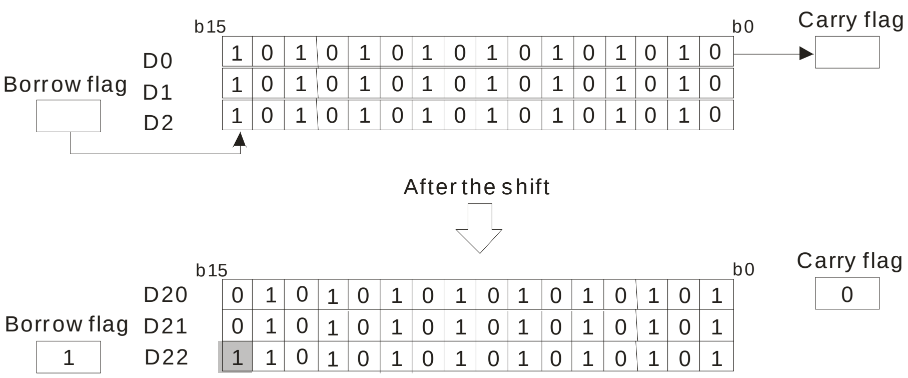




Example 2:

When X0.0 is ON, SM616 is ON. The values of the bits are shifted to the right. Suppose SM615 is ON. After the values of the bits in the 16-bit registers D0~D2 are rotated to the right, the operation result is stored in the 16-bit registers D20~D22, and SM614 is OFF.





Additional remark:

1. If **S**+**n**-1 or **D**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. The flags:

   SM614: It is the carry flag for the matrix rotation/shift/output.

   SM615: It is the borrow flag for the matrix shift/output.

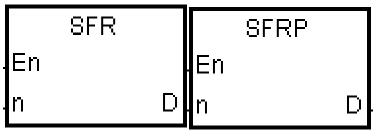
   SM616: It is the direction flag for the matrix rotation/shift.

API	Instruction code			Operand	Function
1110		SFR	P	**D, n**	Shifting the values of the bits in the 16-bit registers by **n** bits to the right

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●			●	●		●	●		●	○	●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



D : Device involved in the shift Word

n : Number of bits Word

Explanation:

1. The values of the bits in **D** are shifted by **n** bits to the right. The vacancies (b15~b15-**n**+1) resulting from the shift is filled by 0, and the value of b**n**-1 is transmitted to SM602.
2. The operand **n** should be within the range between 1 and 16.
3. Generally, the pulse instruction SFRP is used.

Example:

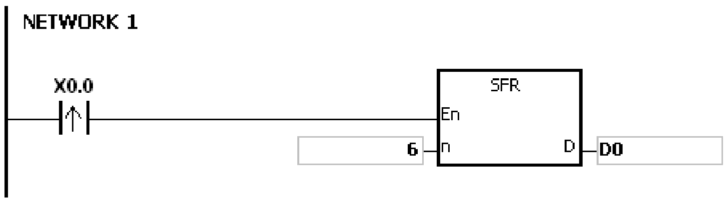
When X0.0 is ON, the values of b0~b15 in D0 are shifted by 6 bits to the right, and the value of b5 is transmitted to SM602. The values of b10~b15 are cleared to 0 after the shift.

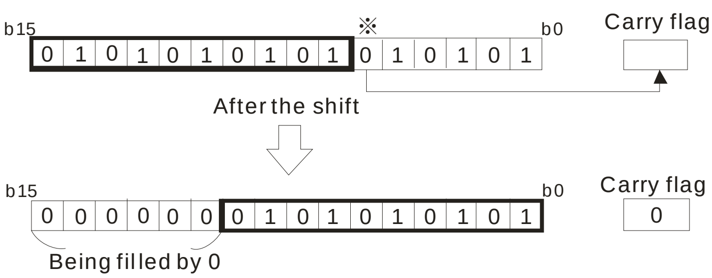
The shift of the values of the bits to the right during a scan is illustrated as follows.

❶ b5~b0 → Being carried (The value of b5 is transmitted to SM602.)

❷ b15~b6 → b9~b0

❸ 0 → b15~b10





Additional remark:

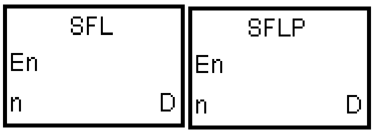
If **n** is less than 0, or if **n** is larger than 16, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code		Operand	Function
1111	SFL	P	D, n	Shifting the values of the bits in the 16-bit registers by **n** bits to the left

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
D	●	●			●	●		●	●		●	○	●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



D : Device involved in the shift — Word

n : Number of bits — Word

Explanation:

1. The values of the bits in **D** are shifted by **n** bits to the left. The vacancies (b0~b**n**-1) resulting from the shift is filled by 0, and the value of b16-**n** is transmitted to SM602.
2. The operand **n** should be within the range between 1 and 16.
3. Generally, the pulse instruction SFLP is used.

Example:

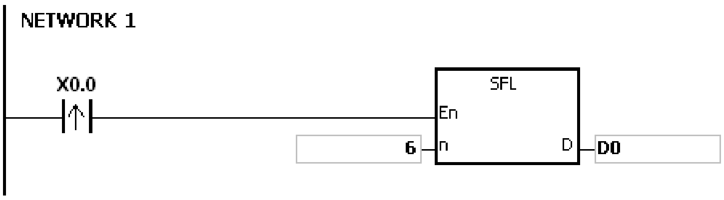
When X0.0 is ON, the values of b0~b15 in D0 are shifted by 6 bits to the right, and the value of b10 is transmitted to SM602. The values of b0~b5 are cleared to 0 after the shift.

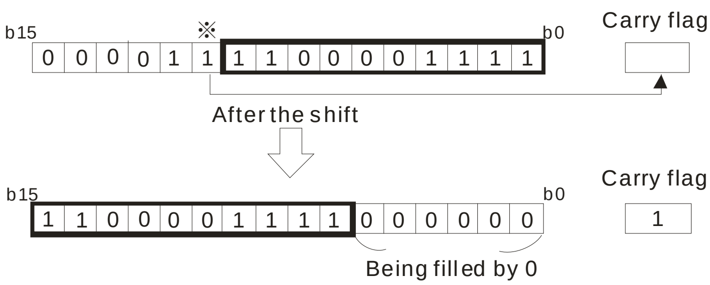
The shift of the values of the bits to the left during a scan is illustrated as follows.

❶ b15~b10 → Being carried (The value of b10 is transmitted to SM602.

❷ b9~b0 → b15~b6

❸ 0 → b5~b0





Additional remark:

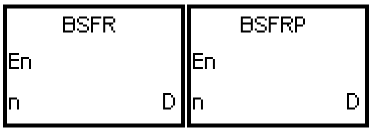
If **n** is less than 0, or if **n** is larger than 16, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
1112		BSFR	P	**D, n**	Shifting the states of the **n** bit devices by one bit to the right

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●	●	●				●	●	●			●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



D : Initial device involve in the shift — Bit

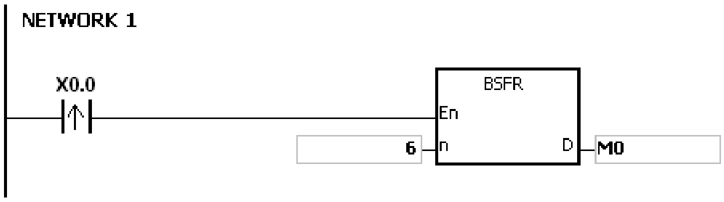
n : Data length — Word

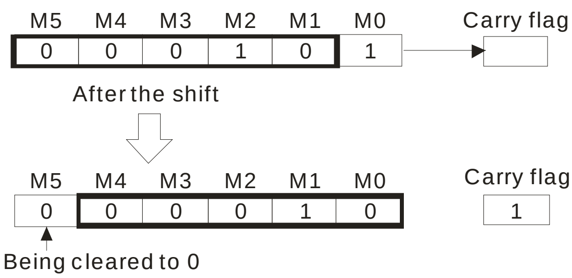
Explanation:

1. The states of the **n** bit devices starting from **D** are shifted by one bit to the right. The state of **D**+**n**-1 is cleared to 0, and the state of **D** is transmitted to the carry flag SM602.
2. Generally, the pulse instruction BSFRP is used.
3. The operand **n** should be within the range between 1 and 1024.

Example:

When X0.0 is ON, the states of M0~M5 are shifted by one bit to the right, the state of M5 is cleared to 0, and the state of M0 is transmitted to the carry flag SM602.





Additional remark:

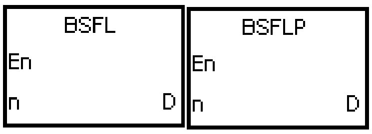
1. If **D**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 1024, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code		Operand	Function
1113	BSFL	P	D, n	Shifting the states of the **n** bit devices by one bit to the left

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●	●	●				●	●	●			●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



D : Initial device involve in the shift — Bit

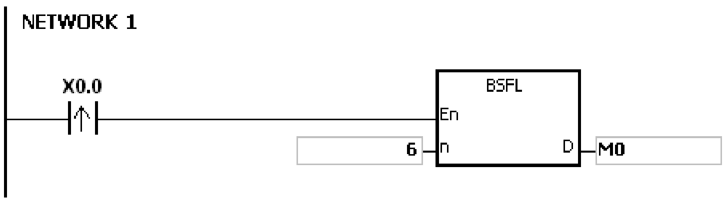
n : Data length — Word

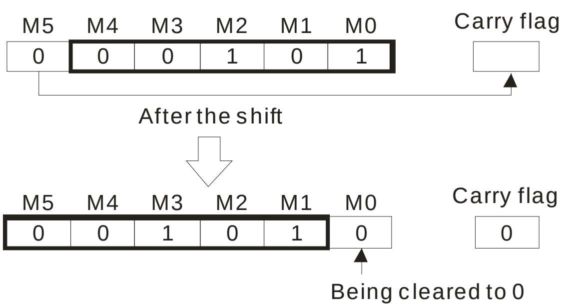
Explanation:

1. The states of the **n** bit devices starting from **D** are shifted by one bit to the left. The state of **D** is cleared to 0, and the state of **D**+**n**-1 is transmitted to the carry flag SM602.
2. Generally, the pulse instruction BSFLP is used.
3. The operand **n** should be within the range between 1 and 1024.

Example:

When X0.0 is ON, the states of M0~M5 are shifted by one bit to the left, the state of M0 is cleared to 0, and the state of M5 is transmitted to the carry flag SM602.





Additional remark:

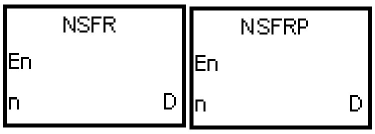
1. If **D**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 1024, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
1114		NSFR	P	**D, n**	Shifting **n** registers to the right

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
D	●	●			●	●		●	●		●	○	●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



D : Initial device involve in the shift Word

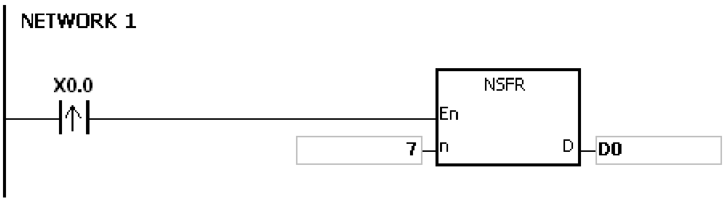
n : Data length Word

Explanation:

1. The data in the **n** registers starting from **D** is shifted to the right, and the data in **D**+**n**-1 is cleared to 0.
2. Generally, the pulse instruction NSFRP is used.
3. The operand **n** should be within the range between 1 and 512.

Example:

When X0.0 is ON, the data in D1~D6 is shifted to the right, and the data in D6 is cleared to 0.



D6	D5	D4	D3	D2	D1	D0
30	2235	9578	754	28	423	11

After the shift

D6	D5	D4	D3	D2	D1	D0
0	30	2235	9578	754	28	423

Being cleared to 0

Additional remark:

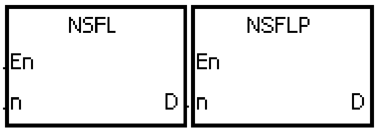
1. If **D**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 512, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code		Operand	Function
1115	NSFL	P	D, n	Shifting **n** registers to the left

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●			●	●		●	●		●	○	●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



D : Initial device involve in the shift — Word

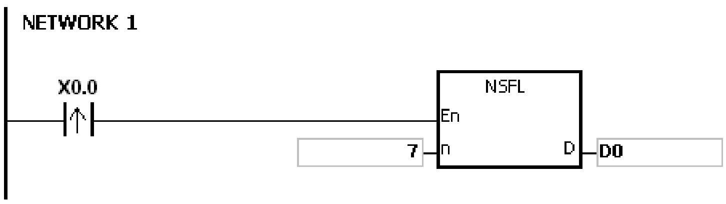
n : Data length — Word

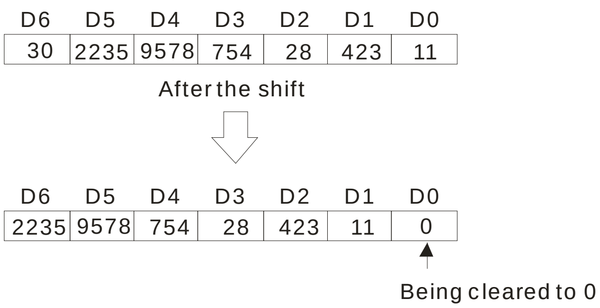
Explanation:

1. The data in the **n** registers starting from **D** is shifted to the left, and the data in **D** is cleared to 0.
2. Generally, the pulse instruction NSFLP is used.
3. The operand **n** should be within the range between 1 and 512.

Example:

When X0.0 is ON, the data in D0~D5 is shifted to the left, and the data in D0 is cleared to 0.





Additional remark:

1. If **D**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 512, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

6.13 Data Processing Instructions

6.13.1 List of Data Processing Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
1200	SER	DSER	✓	Searching the data	9
1201	SUM	DSUM	✓	Number of bits whose states are ON	5
1202	DECO	–	✓	Decoder	7
1203	ENCO	–	✓	Encoder	7
1204	SEGD	–	✓	Seven-segment decoding	5
1205	SORT	DSORT	–	Sorting the data	11
1206	ZRST	–	✓	Resetting the zone	5
1207	BON	DBON	✓	Checking the state of the bit	7
1208	MEAN	DMEAN	✓	Mean	7
1209	CCD	–	✓	Sum check	7
1210	ABS	DABS	✓	Absolute value	3
1211	MINV	–	✓	Inverting the matrix bits	7
1212	MBRD	–	✓	Reading the matrix bit	7
1213	MBWR	–	✓	Writing the matrix bit	7
1214	MBC	–	✓	Counting the bits with the value 0 or 1	7
1215	DIS	–	✓	Disuniting the 16-bit data	7
1216	UNI	–	✓	Uniting the 16-bit data	7
1217	WSUM	DWSUM	✓	Getting the sum	7
1218	BSET	–	✓	Setting the bit in the word device to ON	5
1219	BRST	–	✓	Resetting the bit in the word device	5
1220	BKRST	–	✓	Resetting the specified zone	5
1221	LIMIT	DLIMIT	✓	Confining the value within the bounds	9
1222	BAND	DBAND	✓	Deadband control	9
1223	ZONE	DZONE	✓	Controlling the zone	9

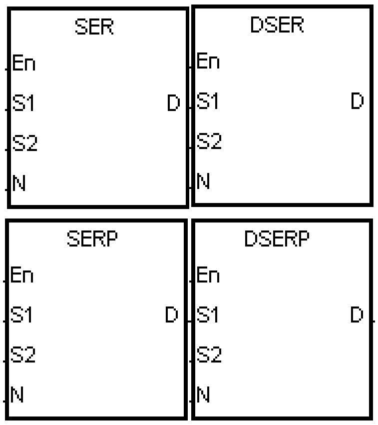
6.13.2 Explanation of Data Processing Instructions

API	Instruction code			Operand	Function
1200	D	SER	P	**S₁, S₂, D, n**	Searching the data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S₁	●	●			●	●	●	●	●		●		●				
S₂	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●				●				
n	●	●			●	●	●	●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction (9 steps)
AH500	AH500	AH500

Symbol:



S_1	:	Initial device involved in the comparison	Word/Double word
S_2	:	Compared data	Word/Double word
D	:	Initial device in which the comparison result is stored	Word/Double word
n	:	Data length	Word/Double word

Explanation:

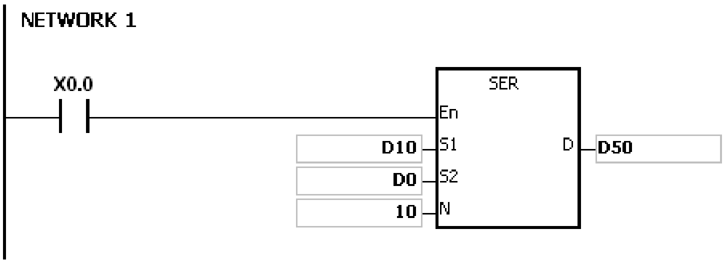
1. **n** singed decimal values in the registers starting from the register specified by S_1 are compared with the singed decimal value in the register specified by S_2, and the comparison results are stored in the registers **D**~**D**+4.

Device	Description
D	Number of equal values
D+1	Data number of the first equal value
D+2	Data number of the last equal value
D+3	Data number of the minimum value
D+4	Data number of the maximum value

2. The operand **n** used in the 16-bit instruction should be within the range between 1 and 256. The operand **n** used in the 32-bit instruction should be within the range between 1 and 128.
3. Only the 32-bit instructions can use the 32-bit counter.

Example:

1. When X0.0 is ON, the values in D10~D19 are compared with the value in D0, and the comparison results are stored in D50~D54. When the equal value does not exist, the values in D50~D52 are 0.
2. The data number of the minimum value is stored in D53, and the data number of the maximum value is stored in D54. If there is more than one minimum value or maximum value, the data number which is bigger is stored.



n

S_1	Value	Compared data	Data number	Result
D10	88	S_2 D0=100	0	
D11	100		1	Equal
D12	110		2	
D13	150		3	
D14	100		4	Equal
D15	300		5	
D16	100		6	Equal
D17	5		7	Minimum
D18	100		8	Equal
D19	500		9	Maximum

D	Value	Description
D50	4	Number of equal values
D51	1	Data number of the first equal value
D52	8	Data number of the last equal value
D53	7	Data number of the minimum value
D54	9	Data number of the maximum value

Additional remark:

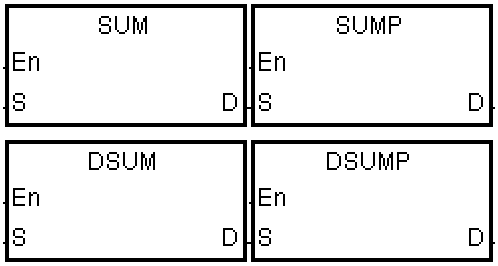
1. If $\mathbf{S_1}$+**n**-1 or **D**+4 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the operand **n** used in the 16-bit instruction is less than 1 or larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. If the operand **n** used in the 32-bit instruction is less than 1 or larger than 128, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
4. If the operand **D** used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [5] of WORD/INT.
5. If the operand **D** used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [5] of DWORD/DINT.

API	Instruction code			Operand	Function
1201	D	SUM	P	**S, D**	Number of bits whose states are ON

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Source device Word/Double word

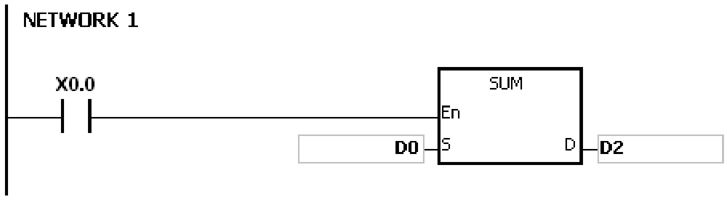
D : Destination device Word/Double word

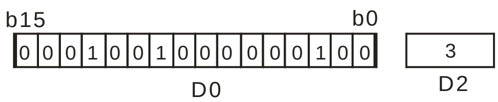
Explanation:

1. The number of bits whose values are 1 in **S** is stored in **D**.
2. When the values of the bits in the source device specified by S are 0, the zero flag SM600 is ON.
3. Only the 32-bit instructions can use the 32-bit counter.

Example:

When X0.0 is ON, the number of bits whose values are 1 in D0 is stored in D2.





Additional remark:

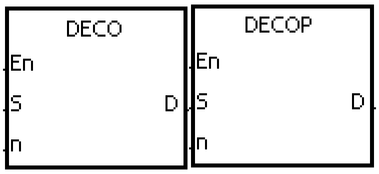
If the device exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code		Operand	Function
1202	DECO	P	**S, D, n**	Decoder

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●	●	●	●	●		●	●	●	●	○	●	○	○		
D	●	●	●	●	●	●		●	●	●	●	○	●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



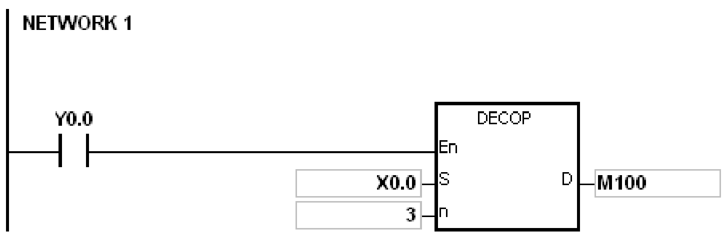
S	:	Source device	Bit/Word
D	:	Device in which the decoded values are stored	Bit/Word
n	:	Number of bits whose values are decoded	Word

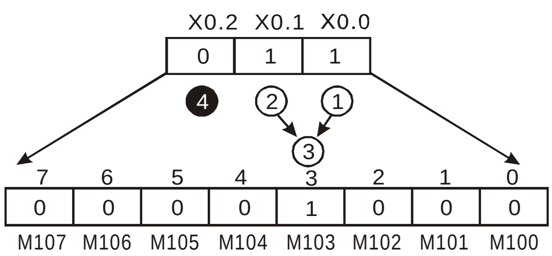
Explanation:

1. The values of the lower **n** bits in the source device specified by **S** are decoded as the values of the lower 2^n bits in **D**.
2. When **D** is a bit device, **n** is within the range between 1 and 8. When **n** is 8, the values of the 8 bits is decoded as the values of the 256 bits. (Please note that the devices in which the decoded values are stored can not be used repeatedly.)
3. When **D** is a word device, **n** is within the range between 1 and 4. When **n** is 4, the values of the 4 bits is decoded as the values of the 16 bits.
4. Generally, the pulse instruction DECOP is used.

Example 1:

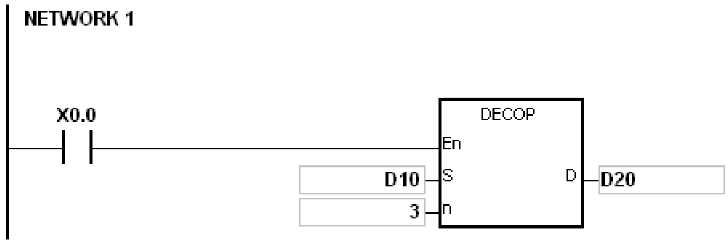
1. When Y0.0 is switched from OFF to ON, the instruction DECO decodes the values of the 3 bits in X0.0~X0.2 as the values of the 8 bits in M100~M107.
2. After the values of the 3 bits in X0.0~X0.2 are added up, the value 3 is gotten. The third bit in M10~M1007, that is, the bit in M103, is set to 1.
3. After the instruction DECO is executed and Y0.0 is switched OFF, the values of the 8 bits in M100~M107 are unchanged.

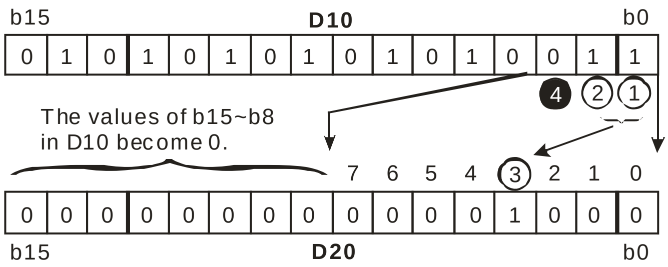




Example 2:

1. When X0.0 is switched from OFF to ON, the instruction DECO decodes the values of b2~b0 in D10 as the values of b7~b0 in D20, and the values of b15~b8 in D10 become 0.
2. The values of the lower 3 bits in D10 is decoded as the values of the lower 8 bits in D20. The values of the higher 8 bits are 0.
3. After the instruction DECO is executed and X0.0 is switched OFF, the data in D20 is unchanged.





Additional remark:

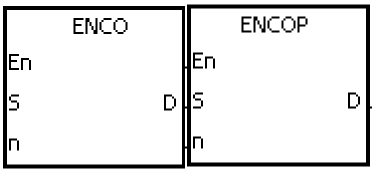
1. Suppose **D** is a bit device. If **n** is less than 1, or if **n** is larger than 8, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
2. Suppose **D** is a word device. If **n** is less than 1, or if **n** is larger than 4, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. Suppose **S** is a bit device. If **S**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. Suppose **D** is a bit device. If **D**+(2^**n**)-**1** exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code		Operand	Function
1203	ENCO	P	**S, D, n**	Encoder

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●	●	●	●	●		●	●	●	●	○	●				
D	●	●			●	●		●	●			○	●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



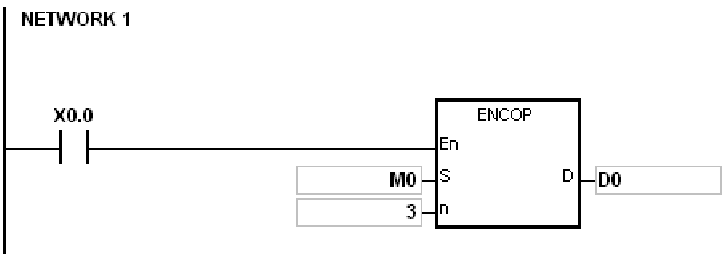
S	:	Source device	Bit/Word
D	:	Device in which the encoded values are stored	Word
n	:	Number of bits whose values are encoded	Word

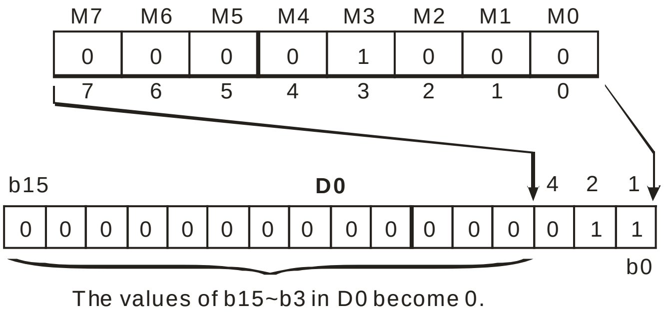
Explanation:

1. The values of the lower 2^n bits in the source device specified by **S** are encoded as the values of the lower **n** bits in **D**.
2. If there are many bits whose values are 1 in the source device specified by **S**, the first bit with the value 1 from the left is processed.
3. When **S** is a bit device, **n** is within the range between 1 and 8. When **n** is 8, the values of the 256 bits is encoded as the values of the 8 bits.
4. When **S** is a word device, **n** is within the range between 1 and 4. When **n** is 4, the values of the 16 bits is encoded as the values of the 4 bits.
5. Generally, the pulse instruction ENCOP is used.

Example 1:

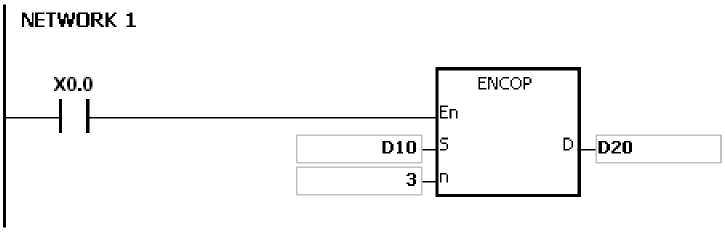
1. When X0.0 is switched from OFF to ON, the instruction ENCO encodes the values of the 8 bits in M0~M7 as the values of the lower 3 bits in D0, and the values of b15~b3 in D0 become 0.
2. After the instruction ENCO is executed and X0.0 is switched OFF, the data in **D** is unchanged.

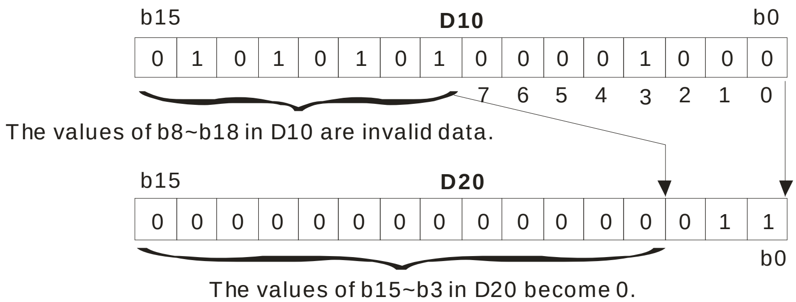




Example 2:

1. When X0.0 is switched from OFF to ON, the instruction ENCO encodes the values of b0~b7 in D10 as the values of b2~b0 in D20, and the values of b15~b3 in D20 become 0. (The values of b8~b18 in D10 are invalid data.)
2. After the instruction ENCO is executed and X0.0 is switched OFF, the data in **D** is unchanged.





Additional remark:

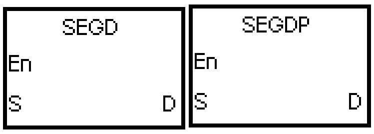
1. If there is no bit whose value is 1 in the source device specified by S, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. Suppose **S** is a bit device. If **n** is less than 1, or if **n** is larger than 8, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. Suppose **S** is a word device. If **n** is less than 1, or if **n** is larger than 4, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
4. Suppose **S** is a bit device. If **S**+(2^**n**)-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
5. Suppose **D** is a bit device. If **D**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
1204		SEGD	P	**S, D**	Seven-segment decoding

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Source device — Word

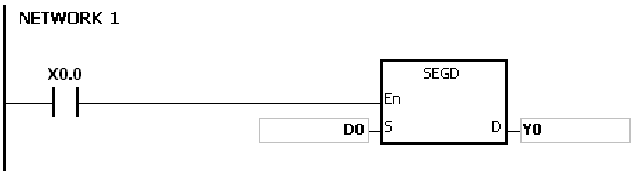
D : Device in which the seven-segment data is stored — Word

Explanation:

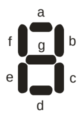
The values of the lower 4 bits (b0~b3) in the source device specified by **S** are decoded as the seven-segment data stored in **D**.

Example:

When X0.0 is ON, the values of b0~b3 in D0 are decoded as the seven-segment data stored in Y0.0~Y0.15. If the data in the source device exceeds four bits, the values of the lower 4 bits are decoded.



The relation between the seven-segment data and the bit pattern of source data is presented in the following table.

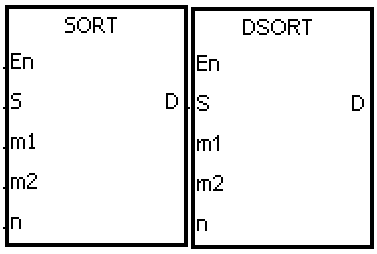
Hex	Bit pattern	Assignment of segments	Segment state							Display
			B0(a)	B1(b)	B2(c)	B3(d)	B4(e)	B5(f)	B6(g)	
0	0000		ON	ON	ON	ON	ON	ON	OFF	
1	0001		OFF	ON	ON	OFF	OFF	OFF	OFF	
2	0010		ON	ON	OFF	ON	ON	OFF	ON	
3	0011		ON	ON	ON	ON	OFF	OFF	ON	
4	0100		OFF	ON	ON	OFF	OFF	ON	ON	
5	0101		ON	OFF	ON	ON	OFF	ON	ON	
6	0110		ON	OFF	ON	ON	ON	ON	ON	
7	0111		ON	ON	ON	OFF	OFF	ON	OFF	
8	1000		ON	ON	ON	ON	ON	ON	ON	
9	1001		ON	ON	ON	ON	OFF	ON	ON	
A	1010		ON	ON	ON	OFF	ON	ON	ON	
B	1011		OFF	OFF	ON	ON	ON	ON	ON	
C	1100		ON	OFF	OFF	ON	ON	ON	OFF	
D	1101		OFF	ON	ON	ON	ON	OFF	ON	
E	1110		ON	OFF	OFF	ON	ON	ON	ON	
F	1111		ON	OFF	OFF	OFF	ON	ON	ON	

API	Instruction code			Operand	Function
1205	D	SORT		**S, m_1, m_2, D, n**	Sorting the data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●		●				
m_1	●	●			●	●	●	●	●		●	○	●	○	○		
m_2	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●				●				
n	●	●			●	●	●	●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (11 steps)	32-bit instruction (11 steps)
-	AH500	AH500

Symbol:



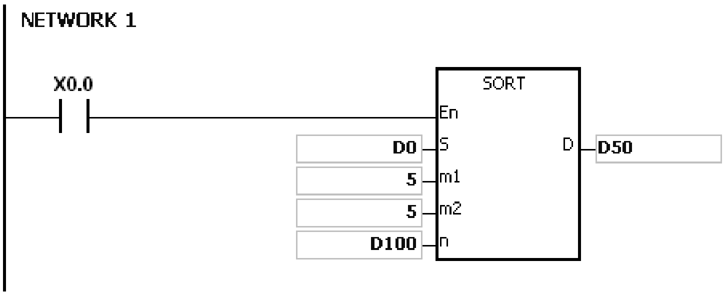
S	:	Initial device in which the original data is stored	Word/Double word
m_1	:	Number of rows of data	Word/Double word
m_2	:	Number of columns of data	Word/Double word
D	:	Initial device in which the sorted data is stored	Word/Double word
n	:	Reference value involved in the sorting of the data	Word/Double word

Explanation:

1. The data which is sorted is stored in the m1×m2 registers starting from the register specified by **D**. If **S** and **D** specify the same register, the sorted data is the same as the original data in the register specified by **S**.
2. The operand **m_1** should be within the range between 1 and 32. The operand **m_2** should be within the range between 1 and 6. The operand **n** should be within the range between 1 and **m_2**.
3. When SM604 is OFF, the data is sorted in ascending order. When SM604 is ON, the data is sorted in descending order.
4. Only the 32-bit instruction can use the 32-bit counter.

Example:

1. Suppose SM604 is OFF. When X0.0 is switched from OFF to ON, the data is sorted in ascending order.



2. The data which will be sorted is shown below.

m2 columns of data

Row \ Column	1 Student number	2 Chinese	3 English	4 Math	5 Physics
1	(D0) 1	(D5) 90	(D10) 75	(D15) 66	(D20) 79
2	(D1) 2	(D6) 55	(D11) 65	(D16) 54	(D21) 63
3	(D2) 3	(D7) 80	(D12) 98	(D17) 89	(D22) 90
4	(D3) 4	(D8) 70	(D13) 60	(D18) 99	(D23) 50
5	(D4) 5	(D9) 95	(D14) 79	(D19) 75	(D24) 69

m1 rows of data

3. When the value in D100 is 3, the data is sorted as follows.

m2 columns of data

Row \ Column	1 Student number	2 Chinese	3 English	4 Math	5 Physics
1	(D50) 4	(D55) 70	(D60) 60	(D65) 99	(D70) 50
2	(D51) 2	(D56) 55	(D61) 65	(D66) 54	(D71) 63
3	(D52) 1	(D57) 90	(D62) 75	(D67) 66	(D72) 79
4	(D53) 5	(D58) 95	(D63) 79	(D68) 75	(D73) 69
5	(D54) 3	(D59) 80	(D64) 98	(D69) 89	(D74) 90

m1 rows of data

4. When the value in D100 is 5, the data is sorted as follows.

m_2 columns of data

Row \ Column	1 Student number	2 Chinese	3 English	4 Math	5 Physics
1	(D50) 4	(D55) 70	(D60) 60	(D65) 99	(D70) 50
2	(D51) 2	(D56) 55	(D61) 65	(D66) 54	(D71) 63
3	(D52) 5	(D57) 95	(D62) 79	(D67) 75	(D72) 69
4	(D53) 1	(D58) 90	(D63) 75	(D68) 66	(D73) 79
5	(D54) 3	(D59) 80	(D64) 98	(D69) 89	(D74) 90

m_1 rows of data

Additional remark:

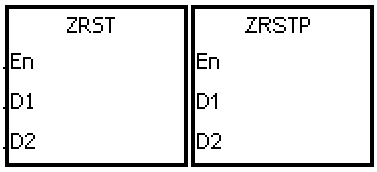
1. If the device exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **m_1**, **m_2**, or **n** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
1206		ZRST	P	**D_1, D_2**	Resetting the zone

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
D_1	●	●	●	●	●	●	●	●	●	●		○					
D_2	●	●	●	●	●	●	●	●	●	●		○					

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



D_1 : Initial device which is reset   Bit/Word

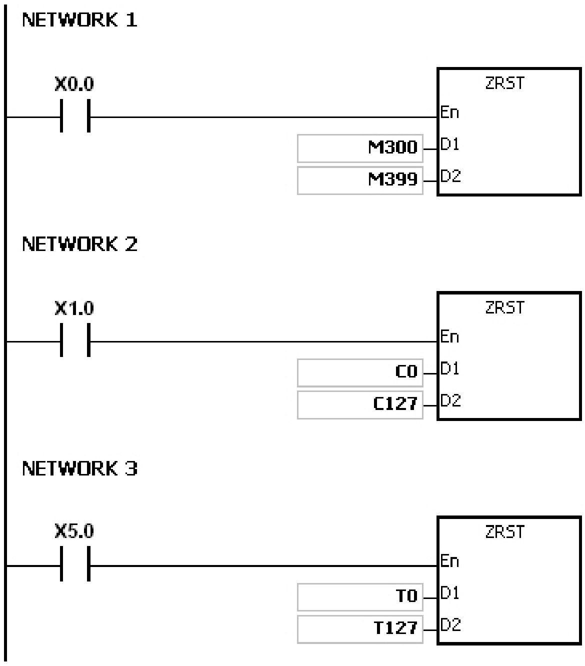
D_2 : Final device which is reset   Bit/Word

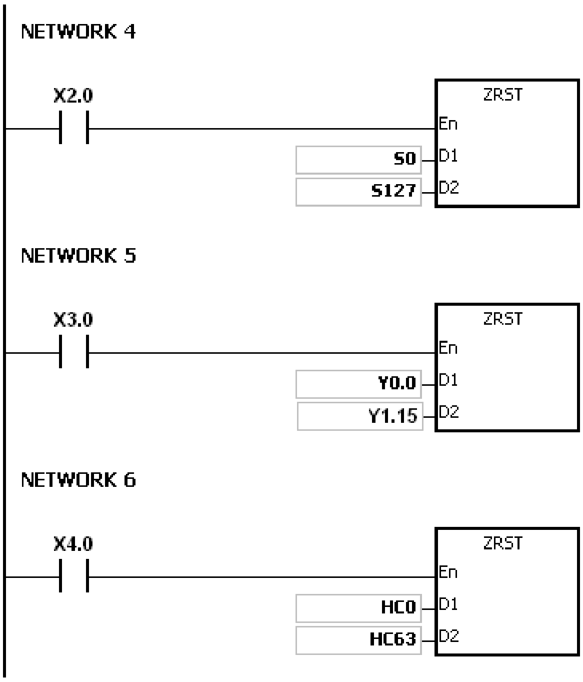
Explanation:

1. When the instruction is executed, the values in **D_1~D_2** are cleared.
2. When the device number of **D_1** is larger than the device number of **D_2**, only **D_2** is reset.

Example:

1. When X0.0 is ON, the auxiliary relays M300~M399 are reset to OFF.
2. When X1.0 is ON, the 16-bit counters C0~C127 are reset. (The values of C0~C127 are cleared to 0, and the contact and the coil are reset to OFF.)
3. When X5.0 is ON, the timers T0~T127 are reset. (The values of T0~T127 are cleared to 0. and the contact and the coil are reset to OFF.)
4. When X2.0 is ON, the stepping relays S0~S127 are reset to OFF.
5. When X3.0 is ON, the output relays Y0.0~Y1.15 are reset to OFF.
6. When X4.0 is ON, the 32-bit counters HC0~HC63 are reset. (The values of HC0~HC63 are cleared to 0, and the contact and the coil are reset to OFF.)





Additional remark:

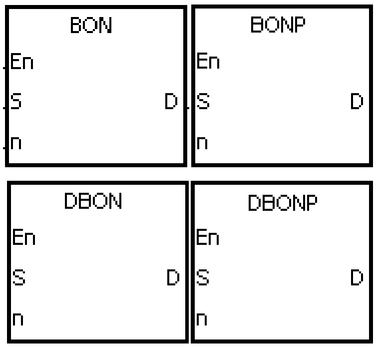
1. If $\mathbf{D_1}$ and $\mathbf{D_2}$ are different types of devices, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2007.
2. If $\mathbf{D_1}$ and $\mathbf{D_2}$ contain different formats of data, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2007.

API	Instruction code			Operand	Function
1207	D	BON	P	**S, D, n**	Checking the state of the bit

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●	○		○	○		
D	●	●	●	●	●	●		●	●	●			●				
n	●	●			●	●	●	●	●		●	○		○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



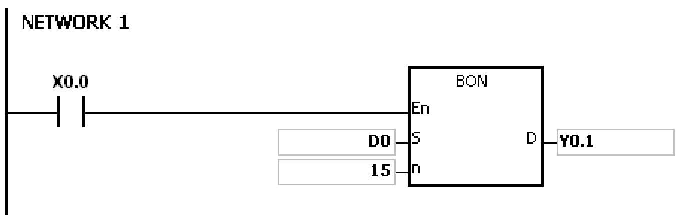
S	:	Source device	Word/Double word
D	:	Device in which the check result is stored	Bit
n	:	Bit whose state is judged	Word/Double word

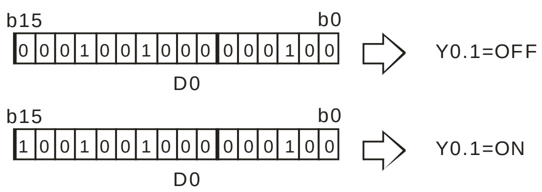
Explanation:

1. The state of the **n**th bit in **S** is checked, and the result is stored in **D**.
2. The operand **n** used in the 16-bit instruction should be within the range between 0 and 15, and the operand **n** used in the 32-bit instruction should be within the range between 0 and 31.
3. Only the 32-bit instructions can use the 32-bit counter.

Example:

1. When X0.0 is ON, Y0.1 is ON if the value of the 15th bit in D0 is 1. When X0.0 is ON, Y0.1 is OFF if the value of the 15th bit in D0 is 0.
2. When X0.0 is switched OFF, the state of Y0.1 remains the same as before X0.0 turned OFF.





Additional remark:

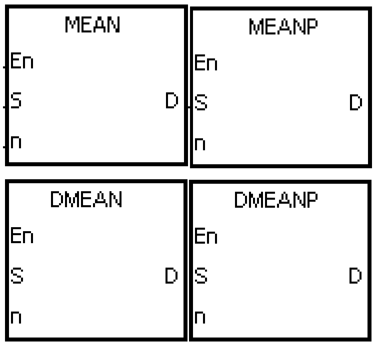
If **n** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
1208	D	MEAN	P	**S, D, n**	Mean

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●		●				
D	●	●			●	●	●	●	●		●	○	●				
n	●	●			●	●	●	●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



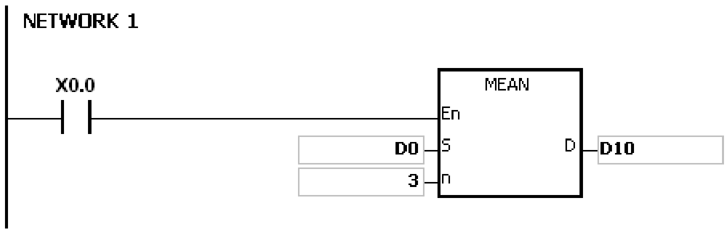
S	:	Initial device	Word/Double word
D	:	Device in which the mean is stored	Word/Double word
n	:	Number of devices	Word/Double word

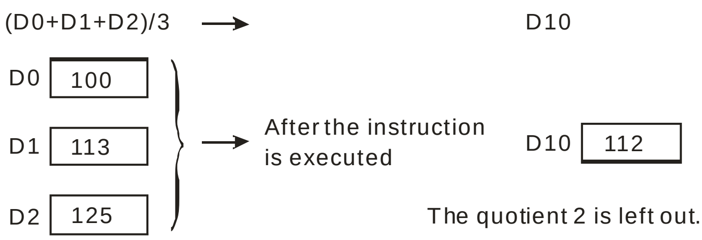
Explanation:

1. After the values in the **n** devices starting from the device specified by **S** are added up, the mean of the sum is stored in **D**.
2. If a remainder appears in the calculation, it is left out.
3. The operand **n** used in the 16-bit instruction should be within the range between 1 and 256, and the operand **n** used in the 32-bit instruction should be within the range between 1 and 128.
4. Only the 32-bit instructions can use the 32-bit counter.

Example:

When X0.0 is ON, the values in the three registers starting from D0 are added up. After the values are added up, the sum is divided by 3. The quotient is stored in D10, and the remainder is left out.





Additional remark:

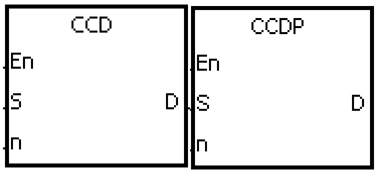
1. If the operand **n** used in the 16-bit instruction is less than 1 or larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
2. If the operand **n** used in the 32-bit instruction is less than 1 or larger than 128, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. If **S**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code		Operand	Function
1209	CCD	P	**S, D, n**	Sum check

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●				
D	●	●			●	●		●	●		●		●				
n	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Initial device — Word

D : Device in which the sum is stored — Word

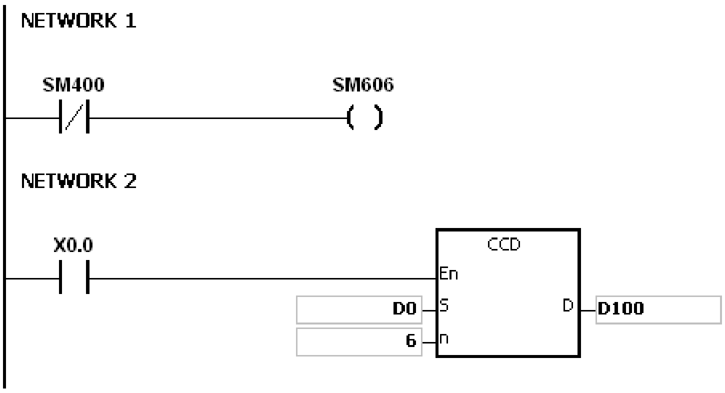
n : Number of pieces of data — Word

Explanation:

1. In communication, the sum check is used to compare checksums on the same data on different occasions or on different representations of the data in order to verify the data integrity.
2. The 16-bit conversion mode: When SM606 is OFF, the working mode of the instruction is the 16-bit conversion mode. The **n** pieces of data in the registers starting from the register specified by **S** (eight bits as a group) are added up. The sum is stored in the register specified by **D**, and the values of the parity bits are stored in **D**+1.
3. The 8-bit conversion mode: When SM606 is ON, the working mode of the instruction is the 8-bit conversion mode. The **n** pieces of data in the registers starting from the register specified by **S** (Eight bits forms a group, and only low eight bits are valid.) are added up. The sum is stored in the register specified by **D**, and the values of the parity bits are stored in **D**+1.
4. The operand **n** should be within the range between 1 and 256.

Example 1:

1. When SM606 is OFF, the working mode of the instruction is the 16-bit conversion mode.
2. When X0.0 is ON, the six pieces of data in D0~D2 (eight bits as a group) are added up. The sum is stored in D100, and the values of the parity bits are stored in D101.



S	Data
D0 Low	100 = 0 1 1 0 0 1 0 0
D0 High	111 = 0 1 1 0 1 1 1 1
D1 Low	120 = 0 1 1 1 1 0 0 0
D1 High	202 = 1 1 0 0 1 0 1 0
D2 Low	123 = 0 1 1 1 1 0 1 1
D2 High	211 = 1 1 0 1 0 0 1 1
D100	867
D101	0 0 0 1 0 0 0 1

Sum

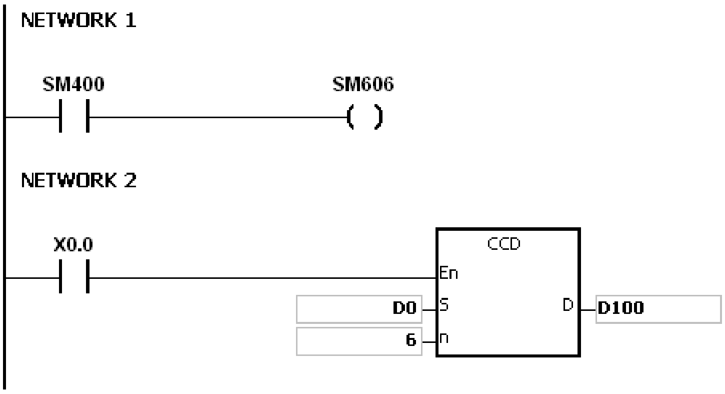
The parity bit is set to 1 if the number of ones is odd.
The parity bit is set to 0 if the number of ones is even.

D100	0	0	0	0	0	0	1	1	0	1	1	0	0	0	1	1
D101	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1

Parity bits

Example 2:

1. When SM606 is ON, the working mode of the instruction is the 8-bit conversion mode.
2. When X0.0 is ON, the six pieces of data in D0~D5 (eight bits as a group) are added up. The sum is stored in D100, and the values of the parity bits are stored in D101.



S	Data
D0 Low	100 = 0 1 1 0 0 1 0 0
D1 Low	111 = 0 1 1 0 1 1 1 1
D2 Low	120 = 0 1 1 1 1 0 0 0
D3 Low	202 = 1 1 0 0 1 0 1 0
D4 Low	123 = 0 1 1 1 1 0 1 1
D5 Low	211 = 1 1 0 1 0 0 1 1
D100	867
D101	0 0 0 1 0 0 0 1

Sum

The parity bit is set to 1 if the number of ones is odd.
The parity bit is set to 0 if the number of ones is even.

D100	0	0	0	0	0	0	1	1	0	1	1	0	0	0	1	1
D101	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1

Parity bits

Additional remark:

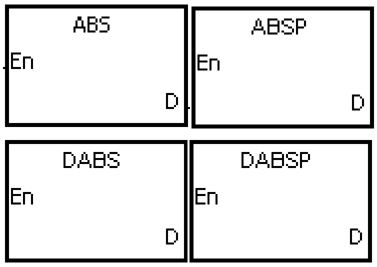
1. Suppose SM606 is ON. If **S**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. Suppose SM606 is OFF. If **S**+**n**/2-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If **n** is less than 1, or if **n** is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
4. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [2] of WORD/INT.

API	Instruction code			Operand	Function
1210	D	ABS	P	**D**	Absolute value

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction (3 steps)
AH500	AH500	AH500

Symbol:



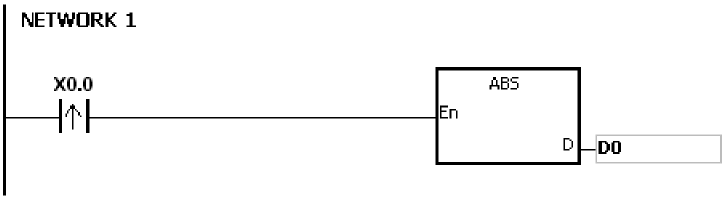
D : Device involved in the getting of the absolute value — Word/Double word

Explanation:

1. When the instruction ABS is executed, the absolute value of the value in the device specified by **D** is gotten.
2. Generally, the pulse instruction ABSP is used.
3. Only the 32-bit instructions can use the 32-bit counter.

Example:

Suppose the value in D0 before the execution of the instruction is -1234. When X0.0 is switched from OFF to ON, the absolute value of -1234 in D0 is gotten. That is, the value in D0 becomes 1234 after the instruction is executed.

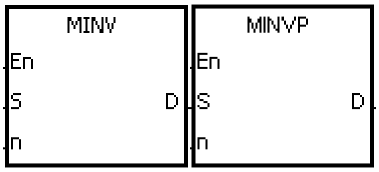


API	Instruction code			Operand	Function
1211		MINV	P	**S, D, n**	Inverting the matrix bits

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●				
D	●	●			●	●		●	●				●				
n	●	●			●	●		●	●		●		●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Matrix source — Word

D : Operation result — Word

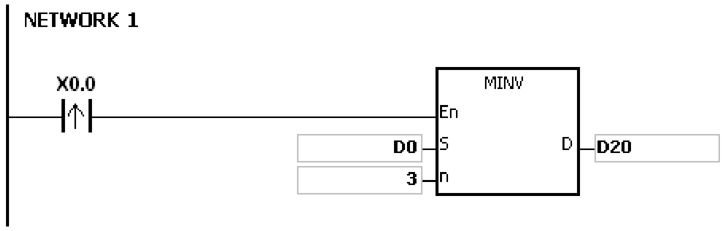
n : Length of the array — Word

Explanation:

1. The bits in the **n** devices starting from the device specified by **S** are inverted, and the inversion result is stored in **D**.
2. The operand n should be within the range between 1 and 256.

Example:

When X0.0 is ON, the bits in the three 16-bit registers D0~D2 are inverted, and the inversion result is stored in the 16-bit registers D20~D22.



	b15															b0
D0	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
D1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
D2	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

⇩ After the instruction is executed

	b15															b0
D20	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
D21	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
D22	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0

Additional remark:

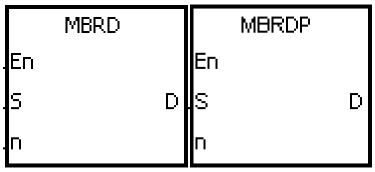
1. If **S**+**n**-1 or **D**+**n**-1 exceeds the device range, the instruction is not execute, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
1212		MBRD	P	**S, n, D**	Reading the matrix bit

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●		●	●		●		●				
n	●	●			●	●		●	●		●		●	○	○		
D	●	●			●	●		●	●		●		●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Matrix source Word

n : Length of the array Word

D : Pointer Word

Explanation:

1. When the instruction is executed, the state of SM613 is checked. If SM613 is ON, the value of the pointer **D** is cleared to 0. The value of the bit specified by the value of the pointer **D** is read into SM614. After the value of the bit is read, the state of SM612 is checked. If SM612 is ON, the value of the pointer **D** increases by one.
2. When the value of the last bit is read, SM608 is ON, and the bit number is recorded in the pointer **D**.
3. The operand **n** should be within the range between 1 and 256.
4. The value of the pointer is specified by users. The values range from 0 to 16**n**–1, and correspond to the range from b0 to b16**n**–1. If the value of the pointer exceeds the range, SM611 is set to 1, and the instruction is not executed.

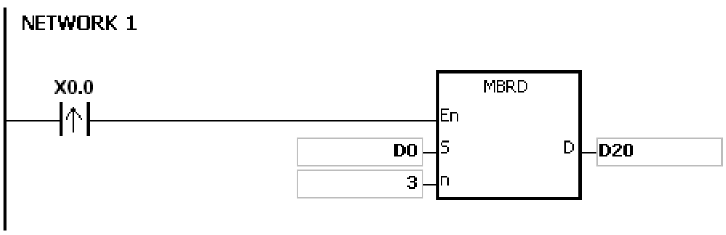
Example:

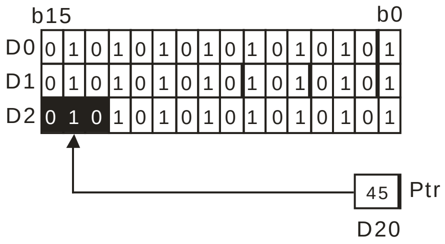
1. Suppose SM613 is OFF and SM612 is ON when X0.0 is switched from OFF to ON.
2. Suppose the current value in D20 is 45. When X0.0 is switched from OFF to ON three times, users can get the following execution results.

   ❶ The value in D20 is 46, SM614 is OFF, and SM608 is OFF.

   ❷ The value in D20 is 47, SM614 is ON, and SM608 is OFF.

   ❸ The value in D20 is 47, SM614 is OFF, and SM608 is ON.





Additional remark:

1. If **S**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. The flags:

   SM608: The matrix comparison comes to an end. When the last bits are compared, SM608 is ON.

   SM611: It is the matrix pointer error flag. When the value of the pointer exceeds the comparison range, SM611 is ON.

   SM612: It is the matrix pointer increasing flag. The current value of the pointer increases by one.

   SM613: It is the matrix pointer clearing flag. The current value of the pointer is cleared to zero.

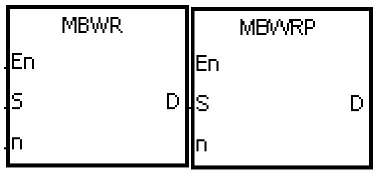
   SM614: It is the carry flag for the matrix rotation/shift/output.

API	Instruction code			Operand	Function
1213		MBWR	P	**S, n, D**	Writing the matrix bit

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●		●	●				●				
n	●	●			●	●		●	●		●		●	○	○		
D	●	●			●	●		●	●		●		●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Matrix source — Word

n : Length of the array — Word

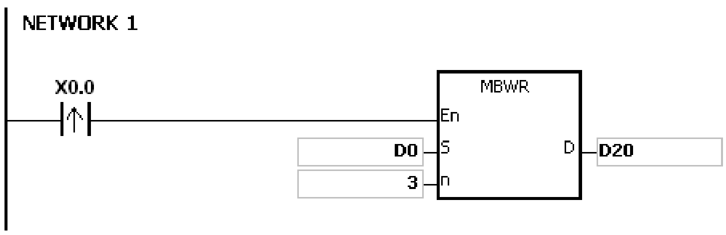
D : Pointer — Word

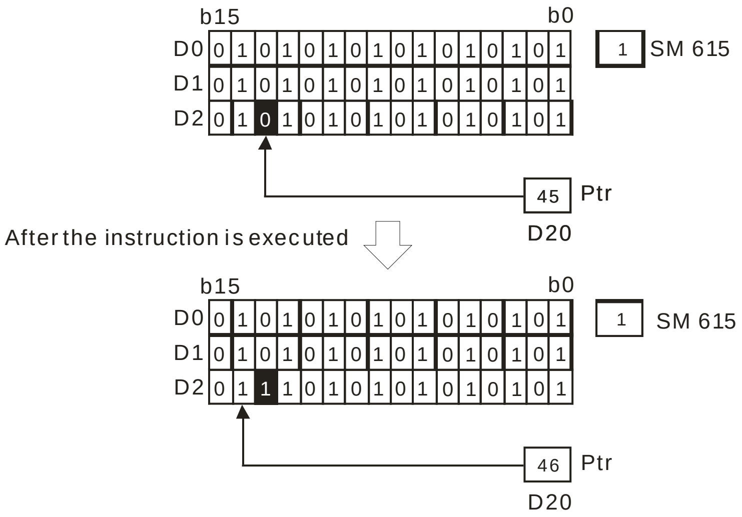
Explanation:

1. When the instruction is executed, the state of SM613 is checked. If SM613 is ON, the value of the pointer **D** is cleared to 0. The state of SM615 is written into the bit specified by the value of the pointer **D**. After the state of SM615 is written into the bit, the state of SM612 is checked. If SM612 is ON, the value in the pointer **D** increases by one.
2. When the state of SM615 is written into the last bit, SM608 is ON, and the bit number is recorded in the pointer **D**. If value of the pointer **D** exceeds the range, SM611 is ON.
3. The operand **n** should be within the range between 1 and 256.
4. The value of the pointer is specified by users. The values range from 0 to 16**n**–1, and correspond to the range from b0 to b16**n**–1. If the value of the pointer exceeds the range, SM611 is set to 1, and the instruction is not executed.

Example:

1. Suppose SM613 is OFF and SM612 is ON when X0.0 is switched from OFF to ON.
2. Suppose the current value in D20 is 45. When X0.0 is switched from OFF to ON one time, users can get the execution result shown below. When the value in D20 is 45, SM615 is OFF, and SM608 is OFF.





Additional remark:

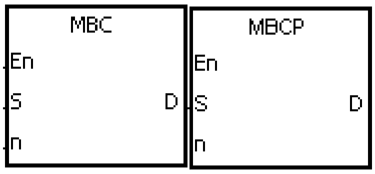
1. If **S**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. The flags:
   - SM608: The matrix comparison comes to an end. When the last bits are compared, SM608 is ON.
   - SM611: It is the matrix pointer error flag. When the value of the pointer exceeds the comparison range, SM611 is ON.
   - SM612: It is the matrix pointer increasing flag. The current value of the pointer increases by one.
   - SM613: It is the matrix pointer clearing flag. The current value of the pointer is cleared to zero.
   - SM615: It is the borrow flag for the matrix shift/output.

API	Instruction code		Operand	Function
1214	MBC	P	**S, n, D**	Counting the bits with the value 0 or 1

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●				
n	●	●			●	●		●	●		●		●	○	○		
D	●	●			●	●		●	●		●		●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Matrix source — Word

n : Length of the array — Word

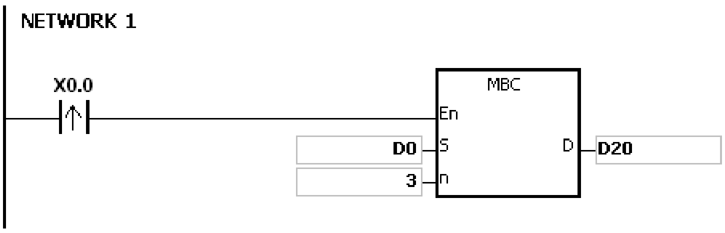
D : Operation result — Word

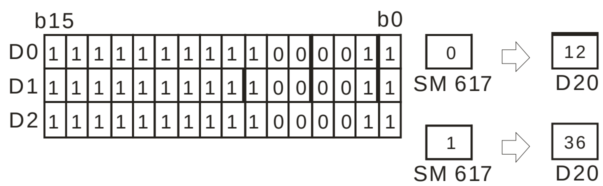
Explanation:

1. The instruction is used to count the bits with the value 1 or 0 in the **n** devices starting from the device specified by **S**. The operation result is stored in **D**.
2. When SM617 is ON, the bits with the value 1 is counted. When SM617 is OFF, the bits with the value 0 is counted. When the operation result is 0, SM618 is ON.
3. The operand **n** should be within the range between 1 and 256.

Example:

Suppose SM617 is ON. When X0.0 is ON, the bits with the value 1 are counted, and the operation result is stored in D20. Suppose SM617 is OFF. When X0.0 is ON, the bits with the value 0 are counted, and the operation result is stored in D20.





Additional remark:

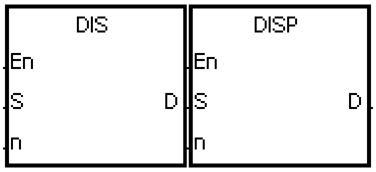
1. If **S**+**n**-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. The flags:
   SM617: The bits with the value 0 or 1 are counted.
   SM618: It is ON when the matrix counting result is 0.

API	Instruction code			Operand	Function
1215		DIS	P	S, n, D	Disuniting the 16-bit data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●				
n	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



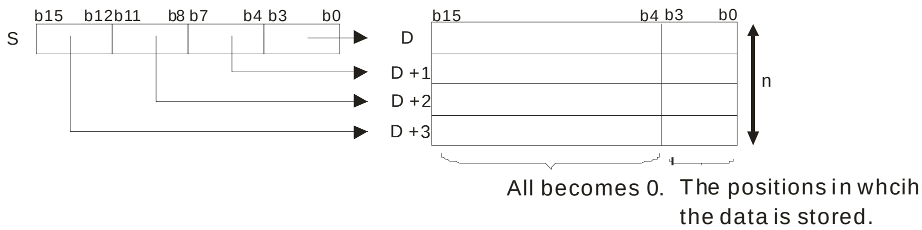
S : Data source — Word

n : Number of devices — Word

D : Operation result — Word

Explanation:

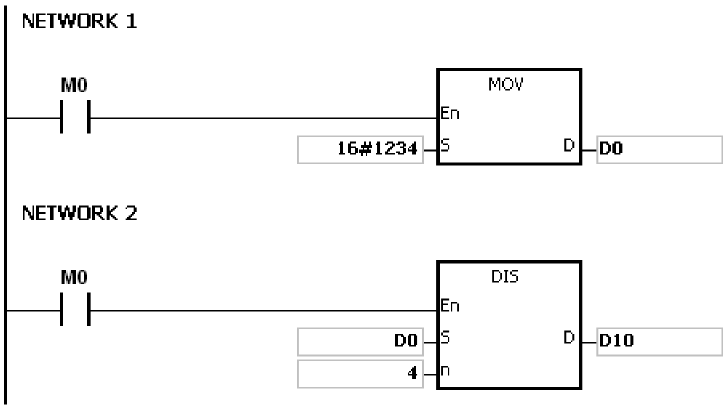
1. The 16-bit value in the register specified by **S** is divided into four groups (four bits as a group), and these groups are stored in the low four bits in every register (The registers range from **D** to **D**+(**n**-1).).

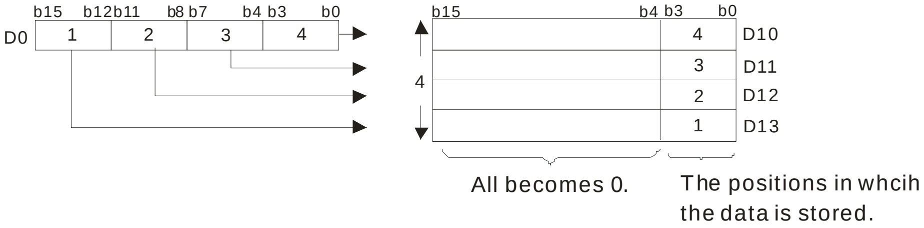


2. The operand **n** should be within the range between 1 and 4.

Example:

Suppose the value in D0 is 16#1234. When M0 is enabled, the instruction DIS is executed. The value in D0 is divided into four groups (four bits as a group), and these groups are stored in the low four bits in every register (The registers range from D10 to D13.).





Additional remark:

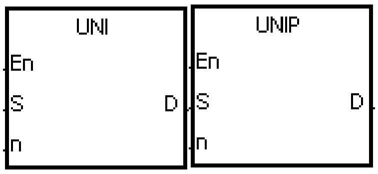
1. If **D**~**D**+(**n-1**) exceed the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 4, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
1216		UNI	P	S, n, D	Uniting the 16-bit data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●				
n	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●		●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



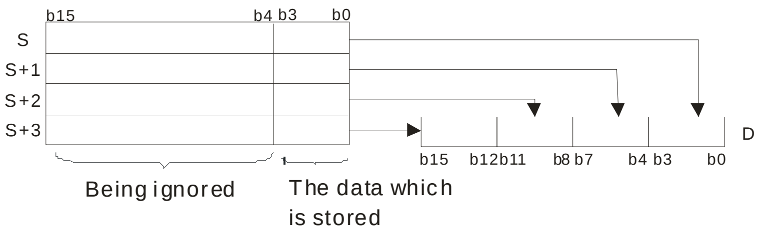
S : Data source Word

n : Data length Word

D : Operation result Word

Explanation:

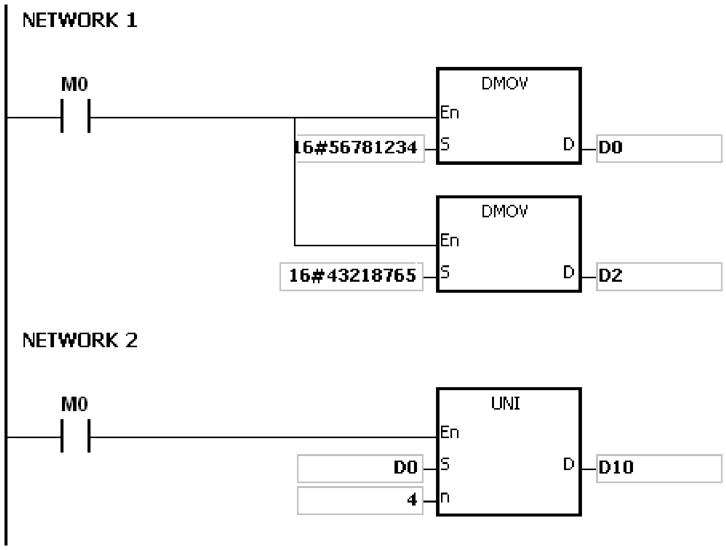
1. The 16-bit values in the registers specified by **S**~**S**+(**n**-1) are divided into groups (four bits as a group), and every group which is composed of b0~b3 is stored in the register specified by **D**.

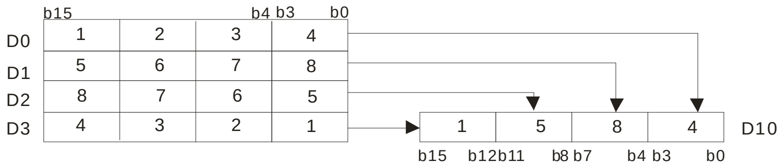


2. The operand **n** should be within the range between 1 and 4.

Example:

Suppose the values in D0~D3 are 16#1234, 16#5678, 16#8765, and 16#4321 respectively. When M0 is enabled, the instruction UNI is executed. The values in D0~D3 are divided into groups (four bits as a group), and every group which is composed of b0~b3 is stored in D10.





Additional remark:

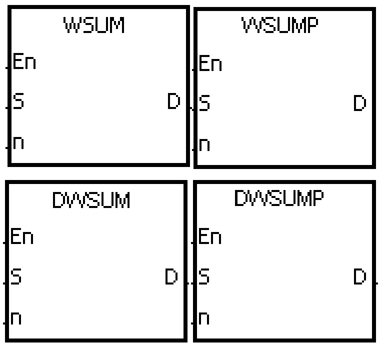
1. If **S**~**S**+(**n**-1) exceed the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 1, or if **n** is larger than 4, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
1217	D	WSUM	P	**S, n, D**	Getting the sum

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●		●				
n	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

Symbol:



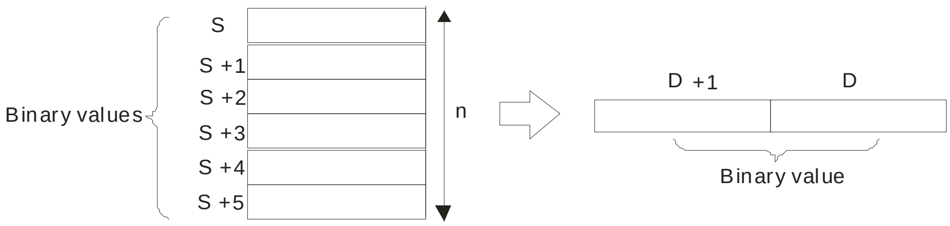
S : Data source Word/Double word

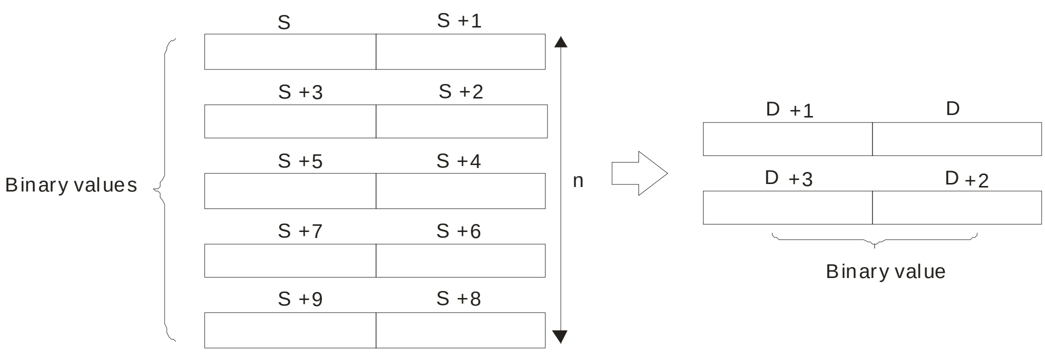
n : Data length Word/Double word

D : Operation result Double word/Long word

Explanation:

1. The signed decimal values in **S**~**S**+**n**-1 are added up, and the sum is stored in the register specified by **D**.

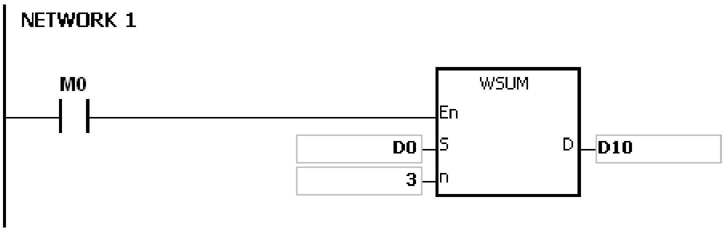


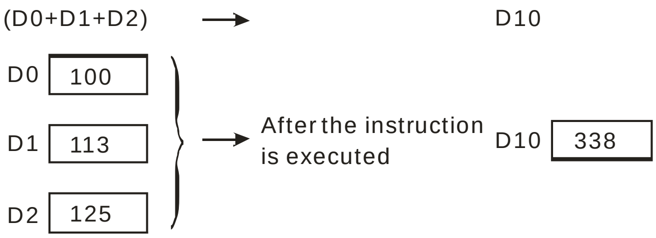


2. The operand **n** used in the 16-bit instruction should be within the range between 1 and 256, and the operand **n** used in the 32-bit instruction should be within the range between 1 and 128.
3. Only the 32-bit instructions can use the 32-bit counter.

Example:

When the instruction WSUM is executed, the values in D0~D2 are added up, and the sum is stored in D10.





Additional remark:

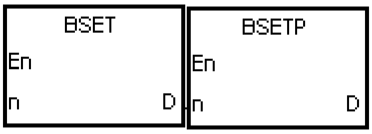
1. If **n** used in the 16-bit instruction is less than 1 or larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
2. If **n** used in the 32-bit instruction is less than 1 or larger than 128, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
3. If **S**+**n**-1 or **D** exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code		Operand	Function
1218	BSET	P	D, n	Setting the bit in the word device to ON

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●			●	●		●	●		●	○	●				
n	●	●			●	●		●	●		●		●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



D : Device number Word

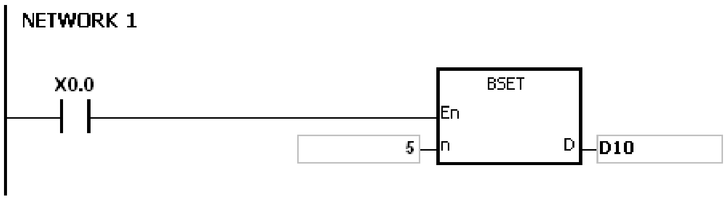
n : Bit number Word

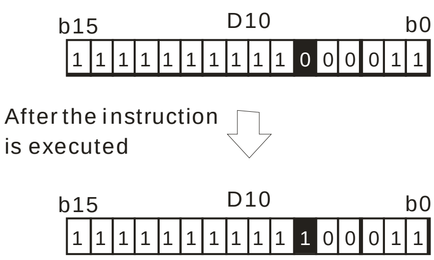
Explanation:

1. The instruction is used to set the **n**th bit in the register specified by **D** to 1.
2. When the instruction BSET is driven, the specified bit is set to ON. No matter the instruction BSET is still driven or not, the bit keeps ON. Users can use the instruction BRST to set the bit OFF.
3. The operand **n** should be within the range between 0 and 15.

Example:

When X0.0 is ON, the fifth bit in D10 is set to 1.





Additional remark:

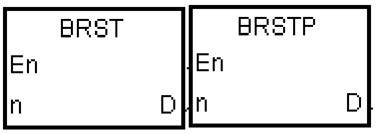
If **n** is less than 0, or if **n** is larger than 15, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
1219		BRST	P	**D, n**	Resetting the bit in the word device

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
D	●	●			●	●		●	●		●	○	●				
n	●	●			●	●		●	●		●		●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



D : Device number Word

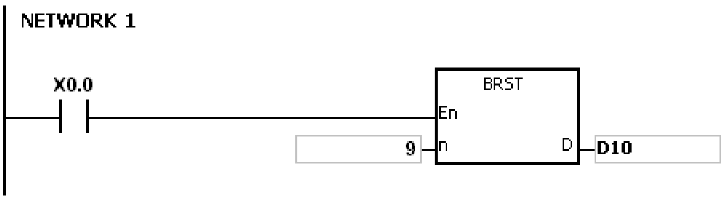
n : Bit number Word

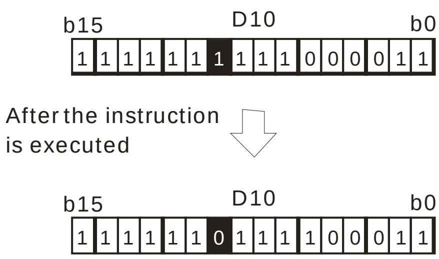
Explanation:

1. The instruction is used to set the **n**th bit in the register specified by **D** to 0.
2. When the instruction BRST is driven, the specified bit is set to OFF.
3. The operand **n** should be within the range between 0 and 15.

Example:

When X0.0 is ON, the ninth bit in D10 is set to 0.





Additional remark:

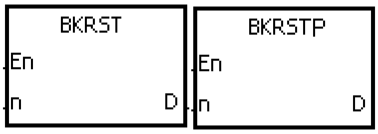
If **n** is less than 0, or if **n** is larger than 15, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
1220		BKRST	P	**D, n**	Resetting the specified zone

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●			●	●		●	●			○	●				
n	●	●	●	●	●	●	●	●	●	●	●	○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



D : Device number — Bit/Word

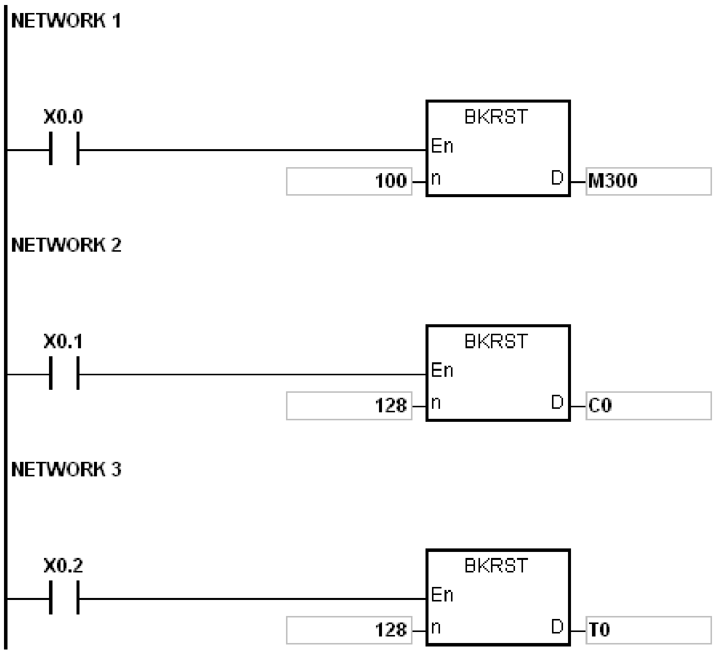
n : Length — Word

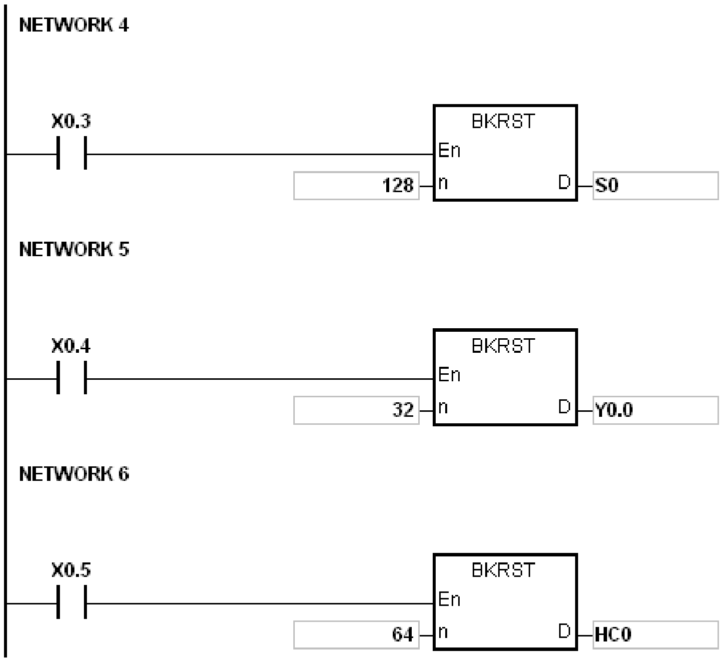
Explanation:

1. The instruction is used to clear the values in **D**~**D**+(**n**-1).
2. The operand **n** should be within the range between 1 and 1024.

Example:

1. When X0.0 is ON, the auxiliary relays M300~M399 are reset to OFF.
2. When X0.1 is ON, the counters C0~C127 are reset. (The values of C0~C127 are cleared to 0, and the contact and the coil are reset to OFF.)
3. When X0.2 is ON, the timers T0~T127 are reset. (The values of T0~T127 are cleared to 0. and the contact and the coil are reset to OFF.)
4. When X0.3 is ON, the stepping relays S0~S127 are reset to OFF.
5. When X0.4 is ON, the output relays Y0.0~Y1.15 are reset to OFF.
6. When X0.5 is ON, the counters HC0~HC63 are reset. (The values of HC0~HC63 are cleared to 0, and the contact and the coil are reset to OFF.)





Additional remark:

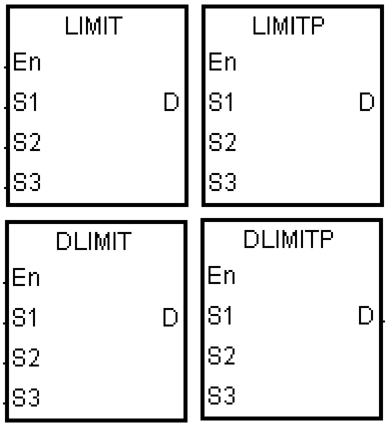
1. If **D**~**D**+(**n**-1) exceed the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **n** is less than 0, or if **n** is larger than 1024, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.

API	Instruction code			Operand	Function
1221	D	LIMIT	P	**S_1, S_2, S_3, D**	Confining the value within the bounds

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
S_3	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction (9 steps)
AH500	AH500	AH500

Symbol:



S_1 : Minimum output value — Word/Double word

S_2 : Maximum output value — Word/Double word

S_3 : Input value — Word/Double word

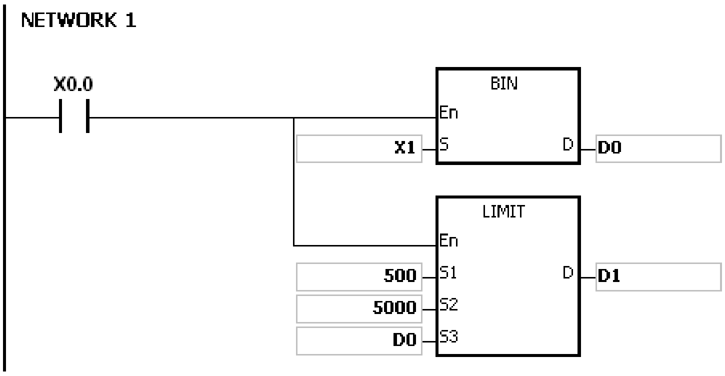
D : Output value — Word/Double word

Explanation:

1. The input value in **S_3** is compared with the minimum output value in **S_1** and the maximum output value in **S_2**, and the comparison result is stored in **D**.
   If the minimum output value in **S_1** is larger than the input value in **S_3**, the output value stored in **D** is equal to the minimum output value in **S_1**.
   If the maximum output value in **S_2** is less than the input value in **S_3**, the output value stored in **D** is equal to the maximum output value in **S_2**.
   If the input value in **S_3** is within the range between the minimum output value in **S_1** and the maximum output value in **S_2**, the output value stored in **D** is equal to the input value in **S_3**.
   If the minimum output value in **S_1** is larger than the maximum output value in **S_2**, the instruction is not executed.
2. Only the 32-bit instructions can use the 32-bit counter.

Example:

- When X0.0 is ON, the state of X1 is converted into the binary value, and the conversion result is stored in D0. Besides, the value stored in D0 is compared with 500 and 5000, and the comparison result is stored in D1.



Minimum output value	Maximum output value	Output value in D0	Function	Output value in D1
500	5000	499	D0<500	500
		5001	D0>5000	5000
		600	500≦D0≦5000	600

Additional remark:

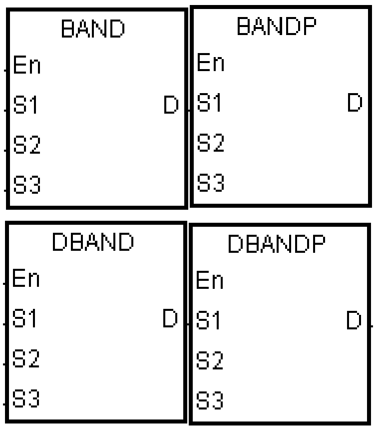
If the minimum output value in $\mathbf{S_1}$ is larger than the maximum output value in $\mathbf{S_2}$, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
1222	D	BAND	P	S_1, S_2, S_3, D	Deadband control

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●	○	●	○	○		
S_2	●	●			●	●	●	●	●		●	○	●	○	○		
S_3	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction (9 steps)
AH500	AH500	AH500

Symbol:



S_1 :	Minimum value of the deadband	Word/Double word
S_2 :	Maximum value of the deadband	Word/Double word
S_3 :	Input value	Word/Double word
D :	Output value	Word/Double word

Explanation:

1. The minimum value of the deadband in S_1 or the maximum value of the deadband in S_2 is subtracted from the input value in S_3, and the difference is stored in **D**.

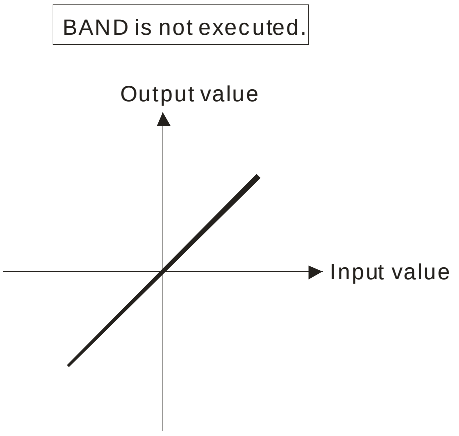
   If the minimum value of the deadband in S_1 is larger than the input value in S_3, the minimum value of the deadband in S_1 is subtracted from the input value in S_3, and the difference is stored in **D**.

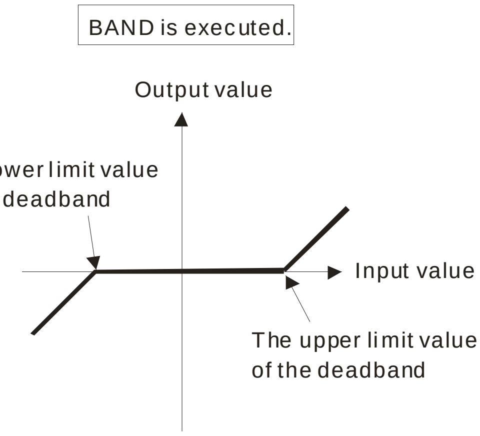
   If the maximum value of the deadband in S_2 is less than the input value in S_3, the maximum value of the deadband in S_2 is subtracted from the input value in S_3, and the difference is stored in **D**.

   If the input value in S_3 is within the range between the minimum of the deadband in S_1 and the maximum value of the deadband in S_2, the output value stored in **D** is 0.

   If the minimum value of the deadband in S_1 is larger than the maximum value of the deadband in S_2, the instruction is not executed.
2. Only the 32-bit instructions can use the 32-bit counter.

3. The figures:





4. The minimum value of the deadband in $\mathbf{S_1}$, the maximum value of the deadband in $\mathbf{S_2}$, the input value in $\mathbf{S_3}$, and the output value in **D** should be within the range described below.
   - If the instruction BAND is executed, the minimum value of the deadband in $\mathbf{S_1}$, the maximum value of the deadband in $\mathbf{S_2}$, the input value in $\mathbf{S_3}$, and the output value in **D** is within the range between -32768 and 32767. Suppose the minimum value of the deadband in $\mathbf{S_1}$ is 10 and the maximum value of the deadband in $\mathbf{S_3}$ is -32768. The output value in **D** is calculated as follows.

     Output value in **D**=-32768-10=16#8000-16#000A=16#7FF6=32758
   - If the instruction DBAND is executed, the minimum value of the deadband in $\mathbf{S_1}$, the maximum value of the deadband in $\mathbf{S_2}$, the input value in $\mathbf{S_3}$, and the output value in **D** is within the range between -2147483648 and 2147483647. Suppose the minimum value of the deadband in ($\mathbf{S_1}$+1, $\mathbf{S_1}$) is 1000 and the maximum value of the deadband in ($\mathbf{S_3}$+1, $\mathbf{S_3}$) is -2147483648. The output value in (**D**+1, **D**) is calculated as follows.

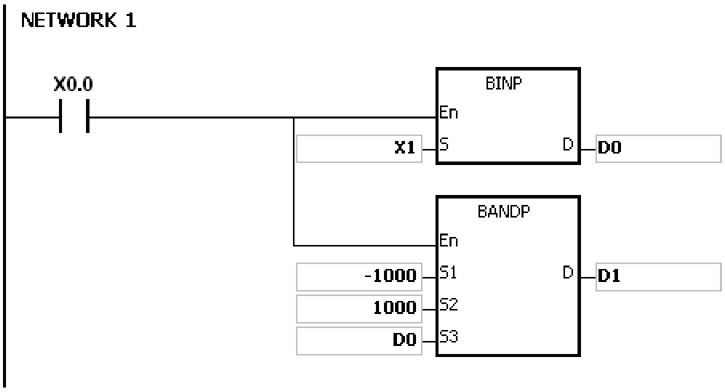
     Output value in (**D**+1, **D)**

     =-2147483648-1000=16#80000000-16#000003E8=16#7FFFFC18

     =2147482648

Example 1:

When X0.0 is ON, -1000 or 1000 is subtracted from the binary-coded decimal value in X1, and the difference is stored in D1.

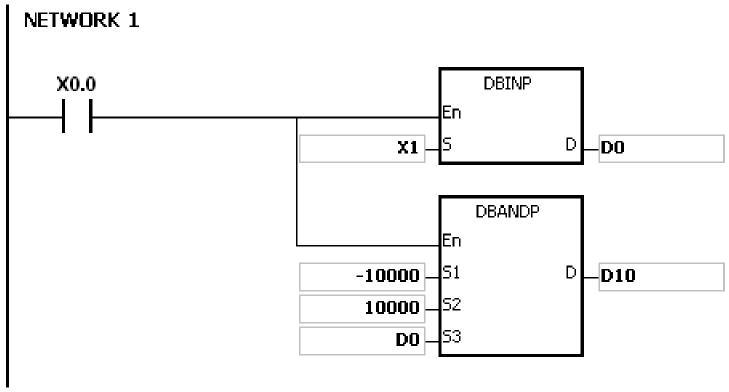


The execution results:

Minimum value of the deadband	Maximum value of the deadband	Input value in D0	Function	Output value in D1
-1000	1000	-1200	D0<-1000=>D1=D0-(-1000)	-200
		1200	D0>1000=>D1=D0-1000	200
		500	-1000≦D0≦1000=>D0=0	0

Example 2:

When X0.0 is ON, -10000 or 10000 is subtracted from the binary-coded decimal value in (X2, X1), and the difference is stored in (D11, D10).



The execution results:

Minimum value of the deadband	Maximum value of the deadband	Input value in (D1, D0)	Function	Output value in (D11, D10)
		-12000	(D1, D0)<-10000 =>(D11,D10) =(D1, D0)-(-10000)	-2000
-10000	10000	12000	(D1, D0)>10000 =>(D11, D10) =(D1, D0)-10000	2000
		5000	-10000≦(D1, D0)≦10000 =>(D1, D0)=0	0

Additional remark:

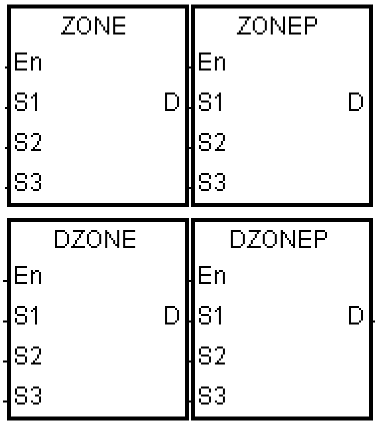
If the minimum value of the deadband in $\mathbf{S_1}$ is larger than the maximum value of the deadband in $\mathbf{S_2}$, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
1223	D	ZONE	P	**S_1, S_2, S_3, D**	Controlling the zone

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●			○	●	○	○		
S_2	●	●			●	●	●	●	●			○	●	○	○		
S_3	●	●			●	●	●	●	●			○	●	○	○		
D	●	●			●	●	●	●	●			○	●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction (9 steps)
AH500	AH500	AH500

Symbol:



S_1 : Negative deviation — Word/Double word

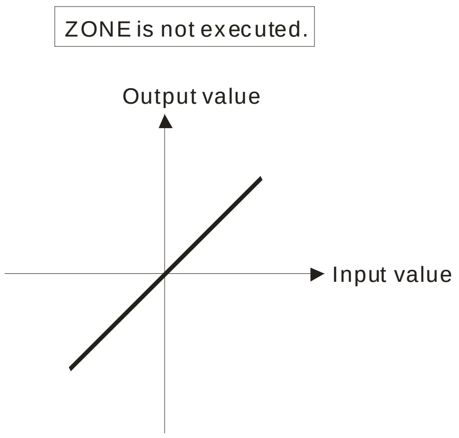
S_2 : Positive deviation — Word/Double word

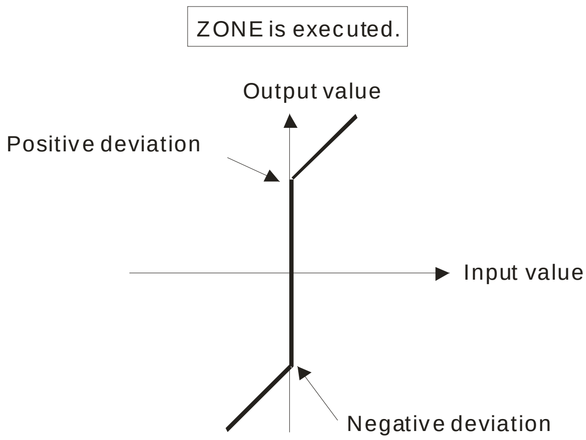
S_3 : Input value — Word/Double word

D : Output value — Word/Double word

Explanation:

1. The negative deviation in **S_1** or the positive deviation in **S_2** is added to the input value in **S_3**, and the sum is stored in **D**.
   If the input value in **S_3** is less than 0, the negative deviation in **S_1** is added to the input value in **S_3**, and the sum is stored in **D**.
   If the input value in **S_3** is larger than 0, the positive deviation in **S_2** is added to the input value in **S_3**, and the sum is stored in **D**.
   If the input value in **S_3** is equal to 0, the output value stored in **D** is 0.
2. The figures:





3. Only the 32-bit instructions can use the 32-bit counter.

4. The negative deviation in $\mathbf{S_1}$, the positive deviation in $\mathbf{S_2}$, the input value in $\mathbf{S_3}$, and the output value in **D** should be within the range described below.
   - If the instruction ZONE is executed, the negative deviation in $\mathbf{S_1}$, the positive deviation in $\mathbf{S_2}$, the input value in $\mathbf{S_3}$, and the output value in **D** is within the range between -32768 and 32767. Suppose the negative deviation in $\mathbf{S_1}$ is -100 and the input value in $\mathbf{S_3}$ is -32768. The output value in **D** is calculated as follows.

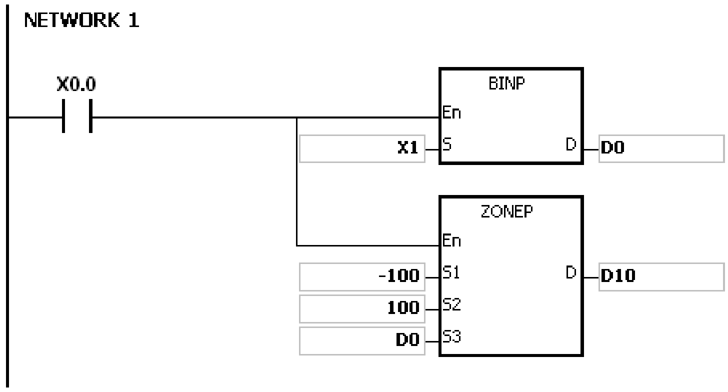
     Output value in **D**=(-32768)+(-100)=16#8000+16#FF9C=16#7F9C=32668
   - If the instruction DZONE is executed, the negative deviation in $\mathbf{S_1}$, the positive deviation in $\mathbf{S_2}$, the input value in $\mathbf{S_3}$, and the output value in **D** is within the range between -2147483648 and 2147483647. Suppose the negative deviation in ($\mathbf{S_1}$+1, $\mathbf{S_1}$) is -1000 and the input value in ($\mathbf{S_3}$+1, $\mathbf{S_3}$) is -2147483648. The output value in (**D**+1, **D**) is calculated as follows.

     Output value in (**D**+1, **D)**

     =-2147483648+(-1000)=16#80000000+16#FFFFFC18=16#7FFFFC18=2147482648

Example 1:

When X0.0 is ON, -100 or 100 is added to the binary-coded decimal value in X1, and the sum is stored in D10.

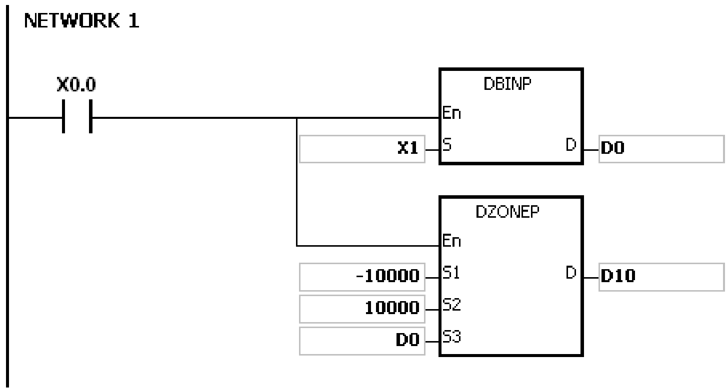


The execution results:

Negative deviation	Positive deviation	Input value in D0	Function	Output value in D10
-100	100	-10	D0<0=>D10=(-10)+(-100)	-110
		0	D0=0=>D10=0	0
		50	D0>0=>D10=50+100	150

Example 2:

When X0.0 is ON, -10000 or 10000 is added to the binary-coded decimal value in (X2, X1), and the sum is stored in (D11, D10).



Negative deviation	Positive deviation	Input value in (D1, D0)	Function	Output value in (D11, D10)
-10000	10000	-10	(D1, D0)<0 =>(D11, D10) =(-10)+(-10000)	-10010
		0	(D1, D0)=0 =>(D11, D10)=0	0
		50	(D1, D0)>0 =>(D11, D10)=50+10000	10050

6.14 Structure Creation Instructions

6.14.1 List of Structure Creation Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
1300	FOR	–	–	Start of the nested loop	3
1301	NEXT	–	–	End of the nested loop	1
1302	BREAK	–	✓	Terminating the FOR-NEXT loop	5

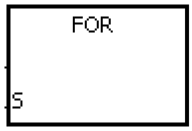
6.14.2 Explanation of Structure Creation Instructions

API		Instruction code		Operand	Function
1300		FOR		**S**	Start of the nested loop

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●	○	○		

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
-	AH500	-

Symbol:

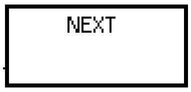


S : Number of times the loop is executed repeatedly — Word

API	Instruction code	Operand	Function
1301	NEXT	-	End of the nested loop

Pulse instruction	16-bit instruction (1 step)	32-bit instruction
-	AH500	-

Symbol:

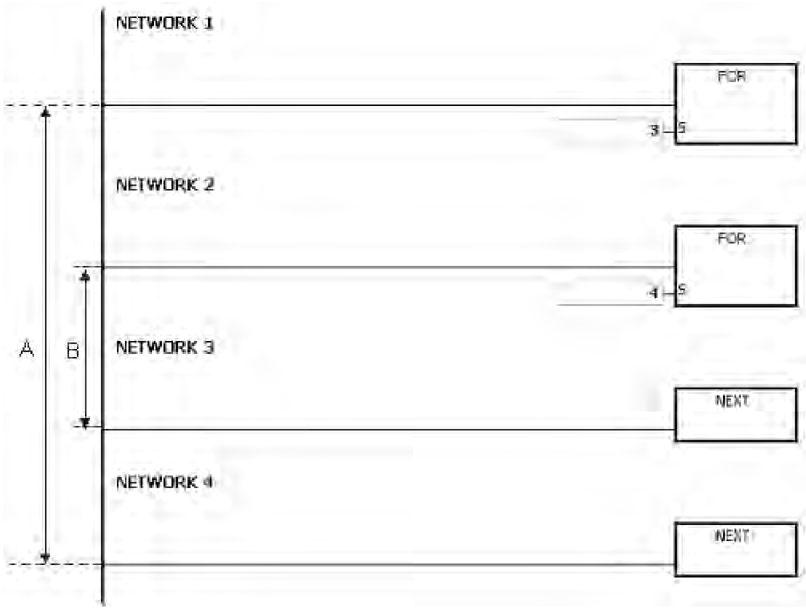


Explanation:

1. The program between FOR and NEXT is executed N times. After the program between FOR and NEXT is executed N times, the program follows NEXT is executed. The instruction FOR specifies the number of times the program between FOR and NEXT is executed.
2. N should be within the range between 1 and 32,767. If N is less than 1, it is count as 1.
3. If the program between FOR and NEXT is not executed, it can be skipped by the use of the instruction CJ.
4. The following conditions result in errors.
   - The instruction NEXT is prior to the instruction FOR.
   - The instruction FOR exists, but the instruction NEXT does not exist.
   - The instruction NEXT follows the instruction FEND or END.
   - The number of times the instruction FOR is used is different from the number of times the instruction NEXT is used.
5. FOR/NEXT supports the nested program structure. There are at most 32 levels of nested program structures. If the loop is executed many times, it takes more time for the program in the PLC to be scanned, and the watchdog timer error will occur. Users can use the instruction WDT to resolve the problem.

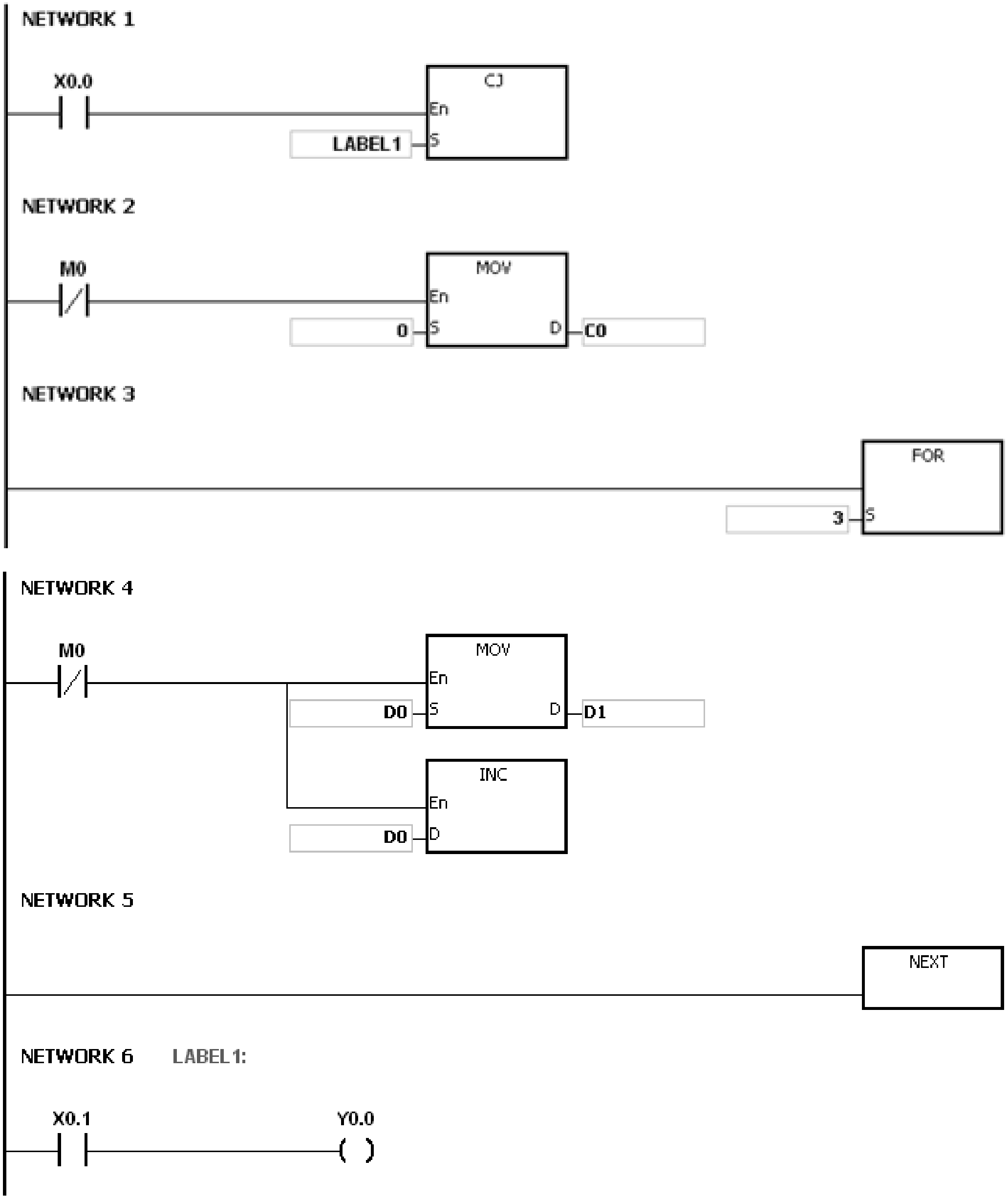
Example 1:

After program A is executed three times, the program follows the instruction NEXT is executed. Program B is executed four times every time program is executed. Therefore, program B is executed twelve times in total.



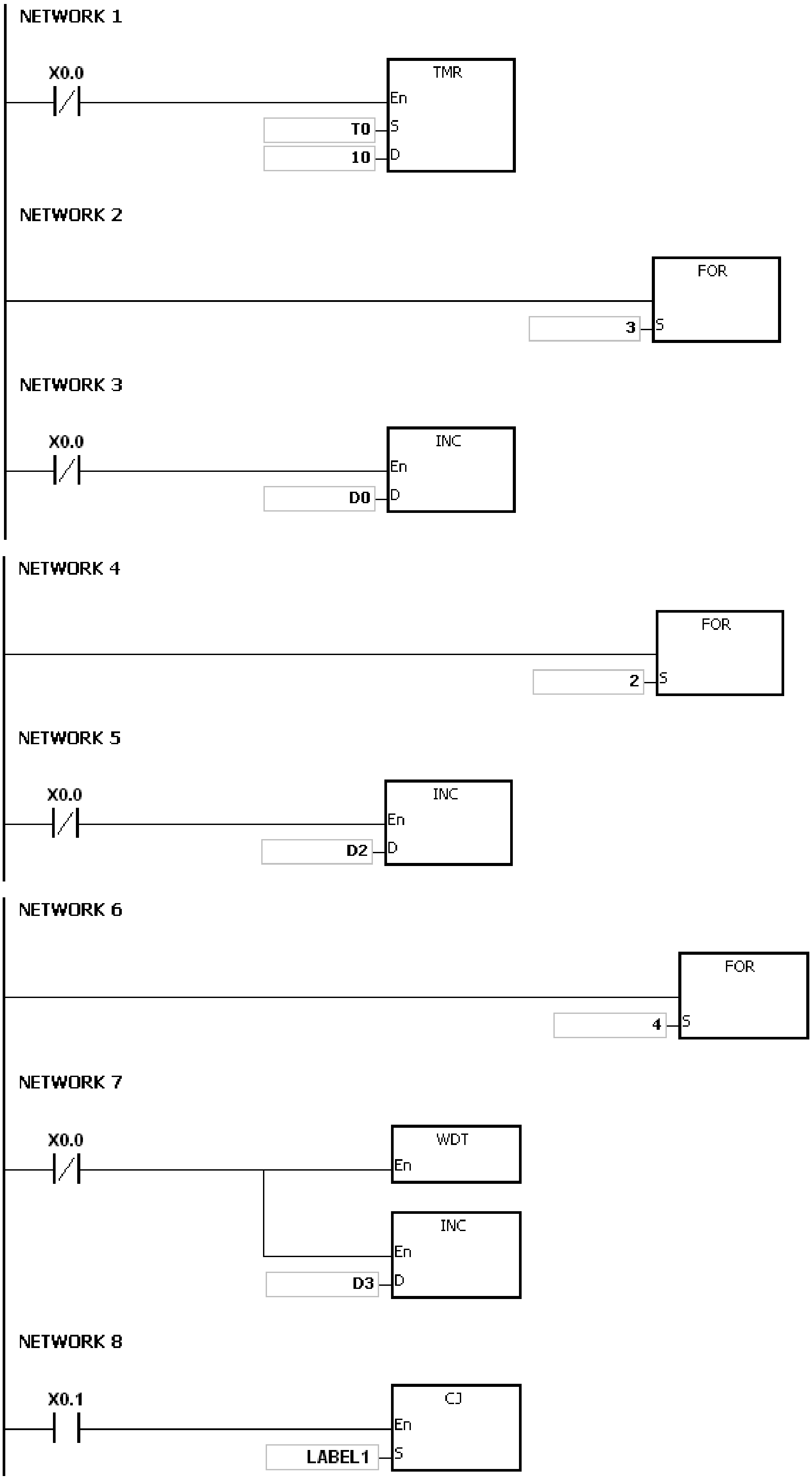
Example 2:

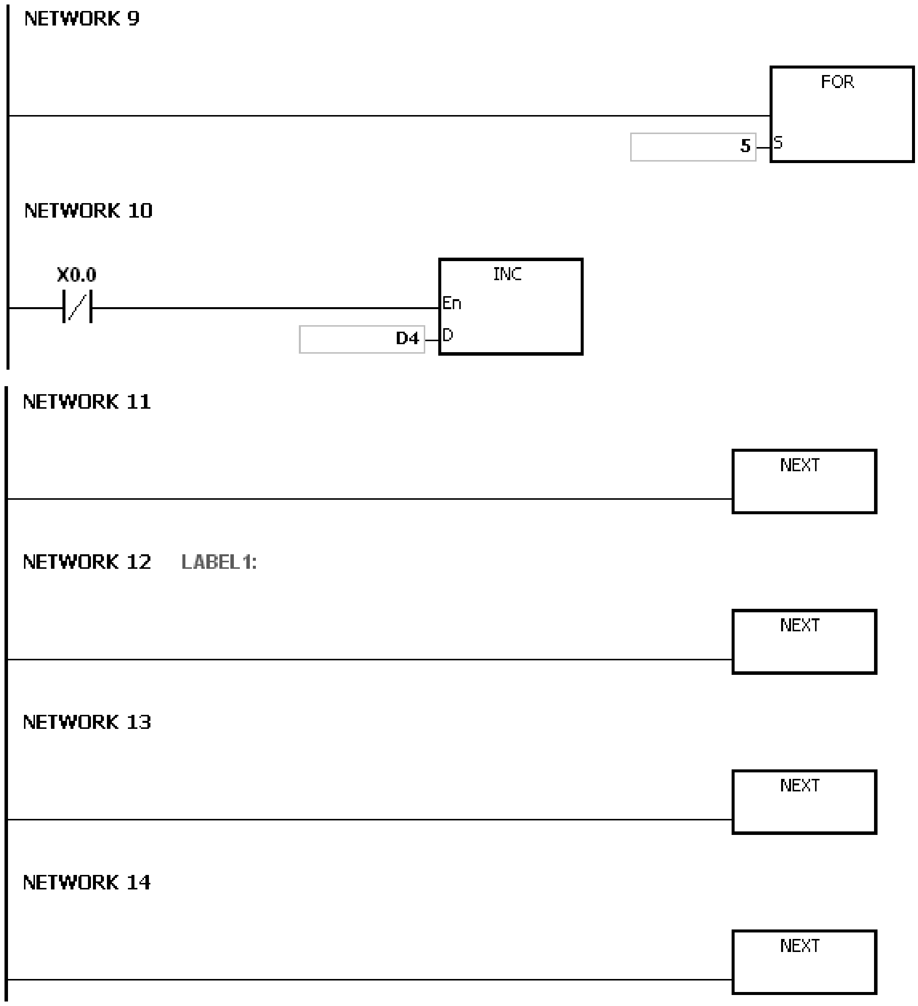
When X0.0 is OFF, the program between FOR and NEXT is executed. When X0.0 is ON, the instruction CJ is executed. The execution of the program jumps to LABEL 1:, i.e. network 6, and network 4~network 5 are not executed.



Example 3:

If the program between FOR and NEXT is not executed, it can be skipped by the use of the instruction CJ. When X0.1 in network 8 is ON, the instruction CJ is executed. The execution of the program jumps to LABEL 1:, i.e. network 12, and network 9~network 11 are not executed.





Additional remark:

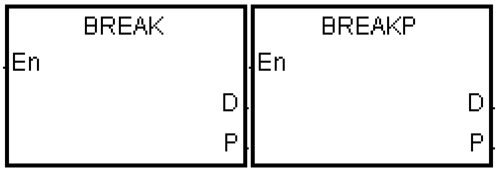
Please refer to ISPSoft User Manual for more information related to the usage of the label.

API	Instruction code		Operand	Function
1302	BREAK	P	**D, P**	Terminating the FOR-NEXT loop

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●			●	●		●	●		●	○	●				
P																	

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
AH500	AH500	-

Symbol:



D : Device in which the remaining number of times the loop can be executed is stored — Word

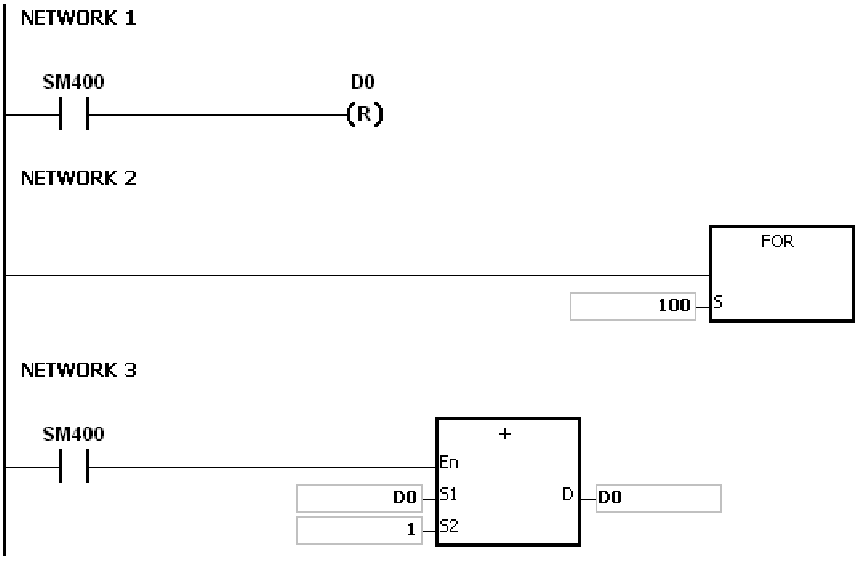
P : Pointer — Pointer

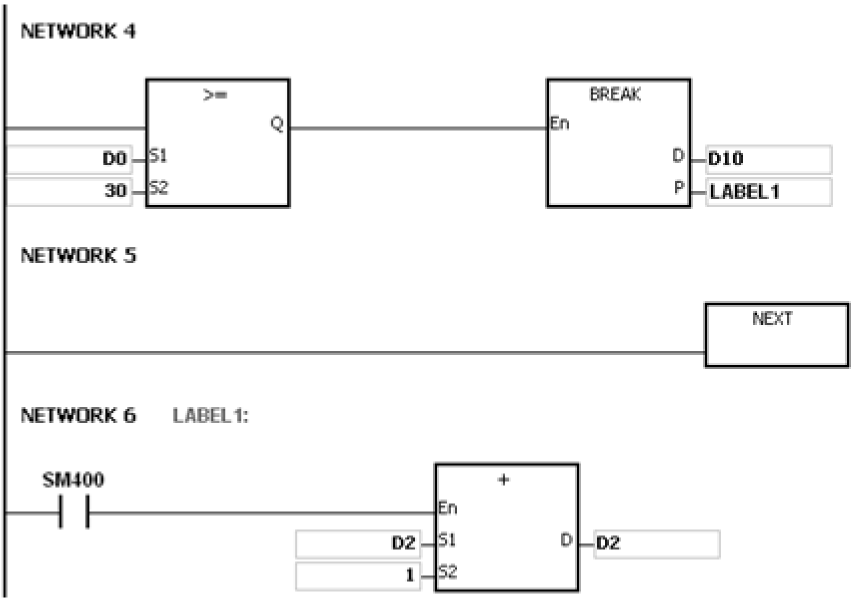
Explanation:

1. The instruction BREAK is used to terminate the FOR/NEXT loop. The remaining number of times the FOR/NEXT loop can be repeated is stored in **D**, and the execution of the program jumps to the part of program specified by the pointer
2. When the instruction BREAK is executed, the remaining number of times the FOR/NEXT loop can be repeated is stored in **D**, including this time the instruction BREAK is executed.

Example:

When the FOR/NEXT loop is executed, 1 is added to the value in D0. When the value in D0 is equal to 30, the FOR/NEXT loop is terminated, and the remaining number of times the FOR/NEXT loop can be repeated, i.e. 71, is stored in D10. The execution of the program jumps to LABEL 1:, i.e. network 6, and 1 is added to the value in D2.





Additional remark:

1. If the part of the program specified by the pointer in the instruction BREAK does not exist, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2004.
2. If the instruction BREAK is outside the FOR/NEXT loop, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2017.
3. Please refer to ISPSoft User Manual for more information related to the usage of the label.

6.15 Module Instructions

6.15.1 List of Module Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
1400	FROM	DFROM	✓	Reading the data from the control register in the special module	13
1401	TO	DTO	✓	Writing the data into the control register in the special module	13

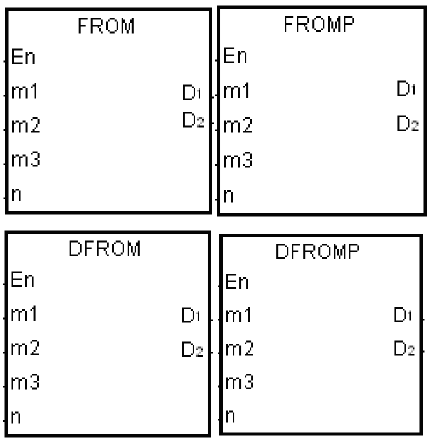
6.15.2 Explanation of Module Instructions

API	Instruction code			Operand	Function
1400	D	FROM	P	**m_1, m_2, m_3, D_1, D_2, n**	Reading the data from the control register in the special module

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
m1	●	●			●	●	●	●	●				●	○	○		
m2	●	●			●	●	●	●	●				●	○	○		
m3	●	●			●	●	●	●	●				●	○	○		
D_1	●	●			●	●	●	●	●				●				
D_2	●	●			●	●	●	●	●				●				
n	●	●			●	●	●	●	●				●	○	○		

Pulse instruction	16-bit instruction (13 steps)	32-bit instruction (13 steps)
AH500	AH500	AH500

Symbol:



m_1 : Rack code — Word/Double word

m_2 : Slot code — Word/Double word

m_3 : Control register number — Word/Double word

D_1 : Device in which the data is stored — Word/Double word

D_2 : Device in which the error code is stored — Word/Double word

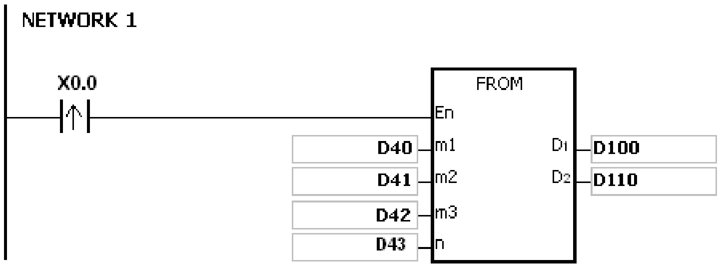
n : Data length — Word/Double word

Explanation:

1. Users can use this instruction to read the data from the control register in the special module into the AH500 series PLC.
2. The operand **m_1** should be within the range between 1 and 8. 1 represents a main rack, and 2~8 represent extension racks.
3. The operand **m_2** should be within the range between 0 and 11. If the rack code is 1, the slot code should be within the range between 0 and 11. If the rack code is within the range between 2 and 8, the slot code should be within the range between 0 and 7.
4. The operand **m_3** specifies the control register number.
5. When the instruction FROM is executed, **D_2** is set to 0. When an error occurs, **D_2** is not set to 0. Please refer to the additional remark below for more information about the error codes.
6. The operand **n** used in the 16-bit instruction should be within the range between 1 and 256, and the operand **n** used in the 32-bit instruction should be within the range between 1 and 128.
7. Only the 32-bit instructions can use the 32-bit counter.
8. Please refer to the regulation of the operands in the instruction TO for more information about the numbering of the special modules.
9. Special modules include analog I/O modules, network I/O modules, and position I/O modules.

Example:

Suppose the first special module at the right side of the CPU module is AH50010SCM-A5. When X0.0 is switched from OFF to ON, the instruction FROM is executed. The mode of the data exchange through COM1 on AH50010SCM-5A stored in CR#7 is read into D100. Owing to the fact that no error occurs, the code stored in D110 is 16#0000.



The use of the parameters:

- The module is placed on the main rack. Therefore, the rack code stored in D40 is 16#0001.
- The module is inserted in the first slot. Therefore, the slot code stored in D41 is 16#0000.
- The mode of the data exchange through COM1 is stored in CR#7. Therefore, the control register number stored in D42 is 16#0007.
- Owing to the fact that the mode of the data exchange through COM1 occupies one register, the value in D43 is 1.
- The data which is read from CR#7 is stored in D100.

Additional remark:

1. If the values in $\mathbf{m_1}$ and $\mathbf{m_2}$ exceed the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If $\mathbf{D_1}$~$\mathbf{D_1}$+**n**-1 exceed the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in **n** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
4. Due to the fact that the use of the instruction FROM decreases the execution efficiency of the CPU module and that of the I/O module, users should use it less often.
5. The descriptions of the error codes:

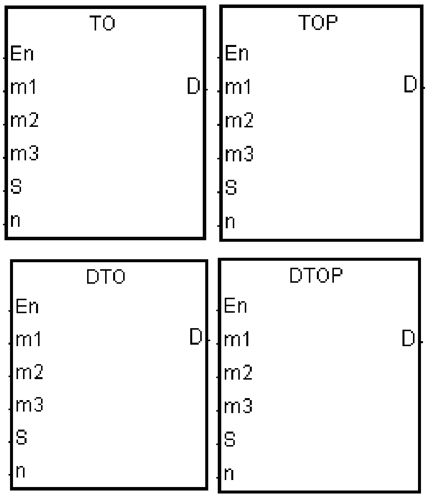
Error code	Description
16#2003	Please refer to point 1 and point 2 in the additional remark.
16#200B	Please refer to point 3 in the additional remark.
16#1400	An error occurs when the data is accessed through the auxiliary processor.
16#1401	An error occurs when the data in the I/O module is accessed.
16#1402	The arrangement of the I/O modules is not consistent with the module table.
16#1407	A communication error occurs when the data is accessed through the auxiliary processor.

API	Instruction code			Operand	Function
1401	D	TO	P	**m_1, m_2, m_3, S, D, n**	Writing the data into the control register in the special module

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
m_1	●	●			●	●	●	●	●				●	○	○		
m_2	●	●			●	●	●	●	●				●	○	○		
m_3	●	●			●	●	●	●	●				●	○	○		
S	●	●			●	●	●	●	●				●	○	○		
D	●	●			●	●	●	●	●				●				
n	●	●			●	●	●	●	●				●	○	○		

Pulse instruction	16-bit instruction (13 steps)	32-bit instruction (13 steps)
AH500	AH500	AH500

Symbol:



m_1	:	Rack code	Word/Double word
m_2	:	Slot code	Word/Double word
m_3	:	Control register number	Word/Double word
S	:	Data which is written into the control register	Word/Double word
D	:	Device in which the error code is stored	Word/Double word
n	:	Data length	Word/Double word

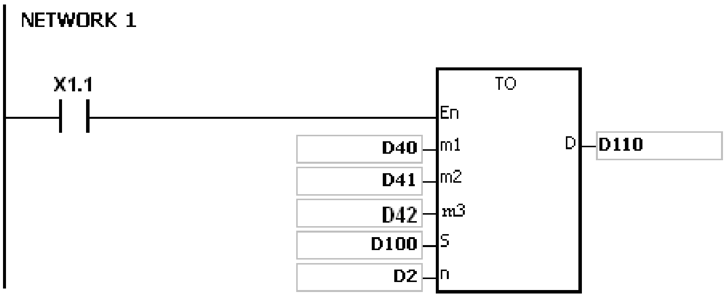
Explanation:

1. Users can use this instruction to write the data in the AH500 series PLC into the control register in the special module.
2. The operand **m_1** should be within the range between 1 and 8. 1 represents a main rack, and 2~8 represent extension racks.
3. The operand **m_2** should be within the range between 0 and 11. If the rack code is 1, the slot code should be within the range between 0 and 11. If the rack code is within the range between 2 and 8, the slot code should be within the range between 0 and 7.
4. The operand **m_3** specifies the control register number.
5. When the instruction TO is executed, **D** is set to 0. When an error occurs, **D** is not set to 0. Please refer to the additional remark below for more information about the error codes.
6. The operand **n** used in the 16-bit instruction should be within the range between 1 and 256, and the operand **n** used in the 32-bit instruction should be within the range between 1 and 128.
7. Only the 32-bit instructions can use the 32-bit counter.
8. Special modules include analog I/O modules, network I/O modules, and position I/O modules.
9. When **S** is a decimal value or a hexadecimal value, **n** decimal values or **n** hexadecimal values are transmitted to the I/O module. Suppose **S** is 16#0001 and **n** is 3. Three 16#0001s are transmitted to the I/O module.

10. When using the redundancy system, AHCPU560-EN2, it is suggested to use API2901, RCS instruction along with this instruction to write the data into the control register in the special module. Or after the system is switched over, the module parameters may not be consistent. You can use RCS instruction to read the PLC ID to see if there is a switchover. If there is a switchover, you can use RCS instruction to set the system ID and redundant system data to ensure the parameters of the redundancy system are correct.

Example:

Suppose the first special module at the right side of the CPU module is AH50010SCM-A5. When X1.1 is switched from OFF to ON, the instruction TO is executed. The mode of the data exchange through COM1 on AH50010SCM-5A stored in CR#7 changes from being disabled to being enabled. Owing to the fact that no error occurs, the code stored in D110 is 16#0000.

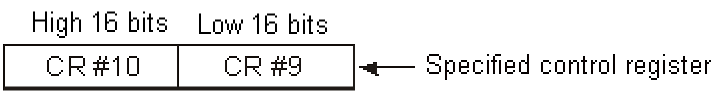


The use of the parameters:

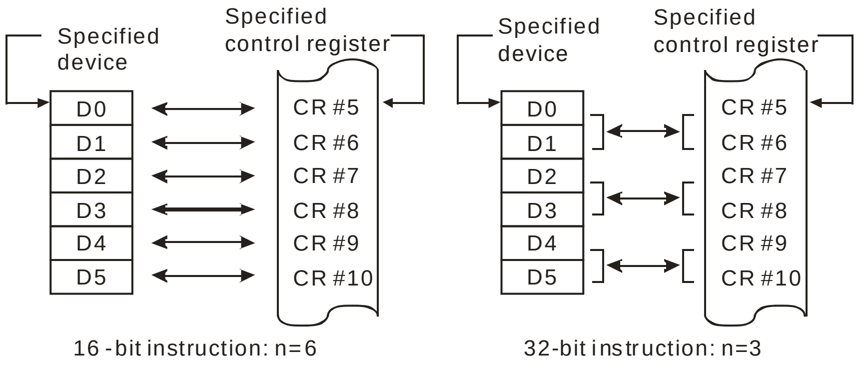
- The module is placed on the main rack. Therefore, the rack code stored in D40 is 16#0001.
- The module is inserted in the first slot. Therefore, the slot code stored in D41 is 16#0000.
- The mode of the data exchange through COM1 is stored in CR#7. Therefore, the control register number stored in D42 is 16#0007.
- Owing to the fact that the mode of the data exchange through COM1 occupies one register, the value in D2 is 1.
- The data which is written into CR#7 is stored in D100. Therefore, the value in D100 is 16#0002.

The regulation of the operands in the instruction:

- The operand $\mathbf{m_1}$ specifies the rack code. It should be within the range between 1 and 8. 1 represents a main rack, and 2~8 represent extension racks.
- The operand $\mathbf{m_2}$ specifies the slot code. It should be within the range between 0 and 11. If the rack code is 1, the slot code should be within the range between 0 and 11. If the rack code is within the range between 2 and 8, the slot code should be within the range between 0 and 7.
- The operand $\mathbf{m_3}$ specifies the control register number. The 16-bit memories built in the special modules are called the control registers. The control register numbers are decimal numbers #0~#N, and the number of control registers varies with the module. The operating conditions of the special module and the setting values are stored in the control registers.
- At most 68 special modules can be placed on the rack, and they do not occupy inputs/outputs.
- If the instruction FROM/TO is used, one control register is taken as a unit for the reading/writing of the data. If the instruction DFROM/DTO is used, two control registers are taken as a unit for the reading/writing of the data.



- The **n** which is 2 in the 16-bit instruction has the same meaning as the **n** which is 1 in the 32-bit instruction.



Additional remark:

1. If the values in $\mathbf{m_1}$ and $\mathbf{m_2}$ exceed the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **S**~**S**+**n**-1 exceed the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in **n** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
4. Due to the fact that the use of the instruction TO decreases the execution efficiency of the CPU module and that of the I/O module, users should use it less often.
5. The descriptions of the error codes:

Error code	Description
16#2003	Please refer to point 1 and point 2 in the additional remark.
16#200B	Please refer to point 3 in the additional remark.
16#1400	An error occurs when the data is accessed through the auxiliary processor.
16#1401	An error occurs when the data in the I/O module is accessed.
16#1402	The arrangement of the I/O modules is not consistent with the module table.
16#1407	A communication error occurs when the data is accessed through the auxiliary processor.

6.16 Floating-point Number Instructions

6.16.1 List of Floating-point Number Instructions

API	Instruction code			Pulse instruction	Function	Step
	16-bit	32-bit	64-bit			
1500	–	FSIN	DFSIN	✓	Sine of the floating-point number	5-6
1501	–	FCOS	DFCOS	✓	Cosine of the floating-point number	5-6
1502	–	FTAN	DFTAN	✓	Tangent of the floating-point number	5-6
1503	–	FASIN	DFASIN	✓	Arcsine of the floating-point number	5-6
1504	–	FACOS	DFACOS	✓	Arccosine of the floating-point number	5-6
1505	–	FATAN	DFATAN	✓	Arctangent of the floating-point number	5-6
1506	–	FSINH	DFSINH	✓	Hyperbolic sine of the floating-point number	5-6
1507	–	FCOSH	DFCOSH	✓	Hyperbolic cosine of the floating-point number	5-6
1508	–	FTANH	DFTANH	✓	Hyperbolic tangent of the floating-point number	5-6
1509	–	FRAD	DFRAD	✓	Converting the degree to the radian	5-6
1510	–	FDEG	DFDEG	✓	Converting the radian to the degree	5-6
1511	SQR	DSQR	–	✓	Square root of the binary number	5
1512	–	FSQR	DFSQR	✓	Square root of the floating-point number	5-6
1513	–	FEXP	DFEXP	✓	Exponent of the floating-point number	5-6
1514	–	FLOG	DFLOG	✓	Logarithm of the floating-point number	7-9
1515	–	FLN	DFLN	✓	Natural logarithm of the binary floating-point number	5-6
1516	–	FPOW	DFPOW	✓	Power of the floating-point number	7-9
1517	RAND	–	–	✓	Random number	7
1518	BSQR	DBSQR	–	✓	Square root of the binary-coded decimal number	5
1519	–	BSIN	–	✓	Sine of the binary-coded decimal number	5
1520	–	BCOS	–	✓	Cosine of the binary-coded decimal number	5
1521	–	BTAN	–	✓	Tangent of the binary-coded decimal number	5
1522	–	BASIN	–	✓	Arcsine of the binary-coded decimal number	5
1523	–	BACOS	–	✓	Arccosine of the binary-coded decimal number	5
1524	–	BATAN	–	✓	Arctangent e of the binary-coded decimal number	5

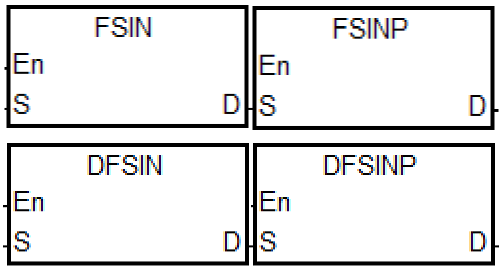
6.16.2 Explanation of Floating-point Number Instructions

API	Instruction code			Operand	Function
1500	D	FSIN	P	**S, D**	Sine of the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:



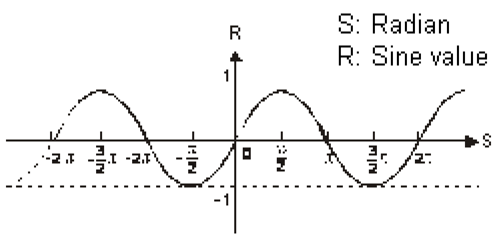
S : Source value Double word / Long word

D : Sine value Double word / Long word

Explanation:

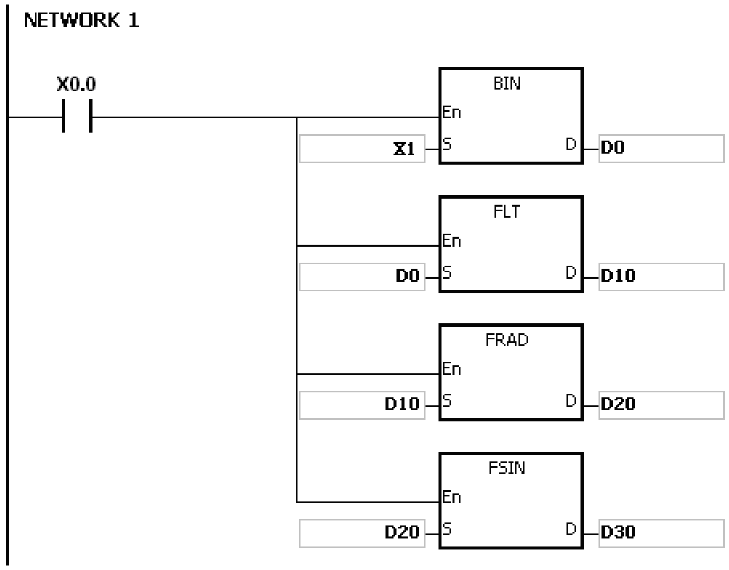
1. Whether the source value specified by **S** is a radian or a degree depends on the state of SM695.
2. If SM695 is OFF, the source value specified by **S** is a radian. Radian=Degree×π/180.
3. If SM695 is ON, the source value specified by **S** is a degree.

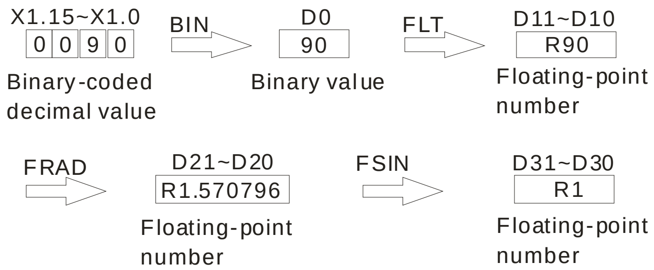
   Degree=Radian×180/π. ($0^o \leqq$ Degree $\leqq 360^0$)
4. If the conversion result is 0, SM600 is ON.
5. The sine of the source value specified by **S** is stored in the register specified by **D**.
6. The relation between radians and sine values are shown below.



Example:

When X0.0 is ON, the binary-coded decimal value in X1.15~X1.0 is converted into the binary value, and the conversion result is stored in D0. The binary value in D0 is converted into the floating-point number, and the conversion result is stored in (D11, D10). The floating-point number in (D11, D10) is converted into the radian, and the conversion result is stored in (D21, D20). The sine of the radian in (D21, D20) is stored in (D31, D30), and the sine value is the floating-point number.





Additional remark:

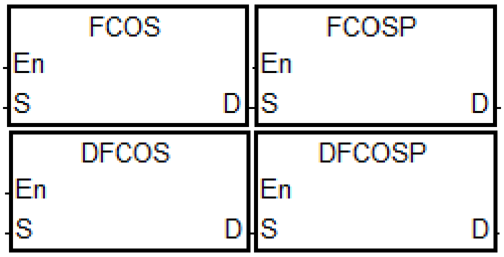
1. If the value in **S** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.
2. If SM695 is ON, and the value in S is less than 0 or larger than 360, the instruction is not executed, SM0 is ON, and the error code is 16#2003.
3. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1501	D	FCOS	P	**S, D**	Cosine of the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:



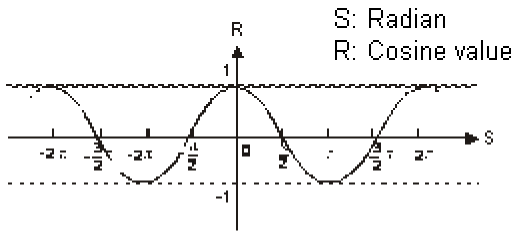
S : Source value Double word / Long word

D : Cosine value Double word / Long word

Explanation:

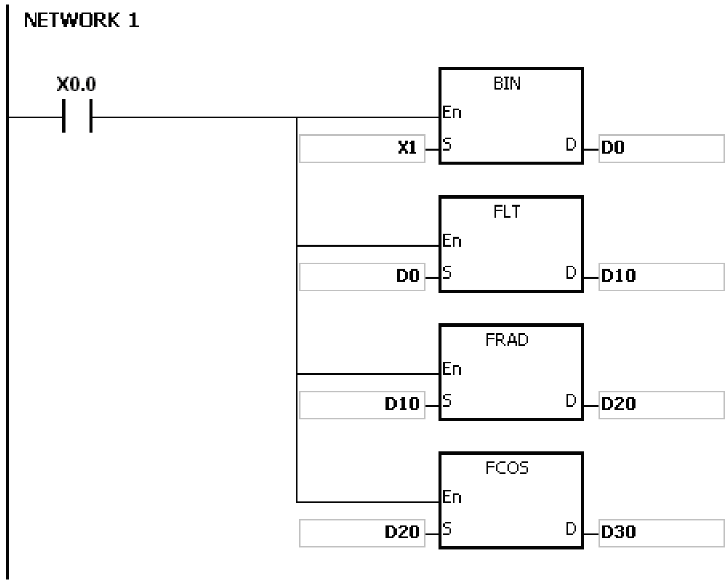
1. Whether the source value specified by **S** is a radian or a degree depends on the state of SM695.
2. If SM695 is OFF, the source value specified by **S** is a radian. Radian=Degree×π/180.
3. If SM695 is ON, the source value specified by **S** is a degree.

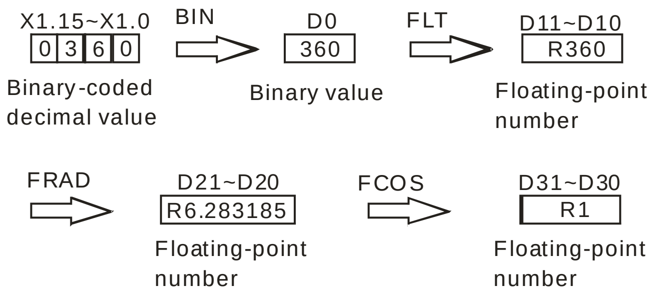
   Degree=Radian×180/π. (0^o≦Degree≦360^0)
4. If the conversion result is 0, SM600 is ON.
5. The cosine of the source value specified by **S** is stored in the register specified by **D**.
6. The relation between radians and cosine values are shown below.



Example:

When X0.0 is ON, the binary-coded decimal value in X1.15~X1.0 is converted into the binary value, and the conversion result is stored in D0. The binary value in D0 is converted into the floating-point number, and the conversion result is stored in (D11, D10). The floating-point number in (D11, D10) is converted into the radian, and the conversion result is stored in (D21, D20). The cosine of the radian in (D21, D20) is stored in (D31, D30), and the cosine value is the floating-point number.





Additional remark:

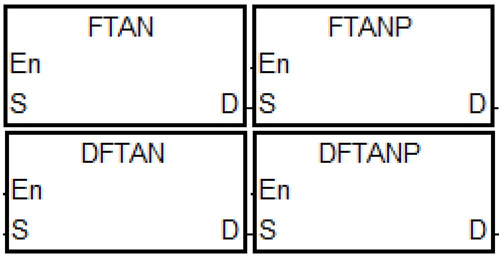
1. If the value in **S** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.
2. If SM695 is ON, and the value in S is less than 0 or larger than 360, the instruction is not executed, SM0 is ON, and the error code is 16#2003.
3. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1502	D	FTAN	P	**S, D**	Tangent of the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:



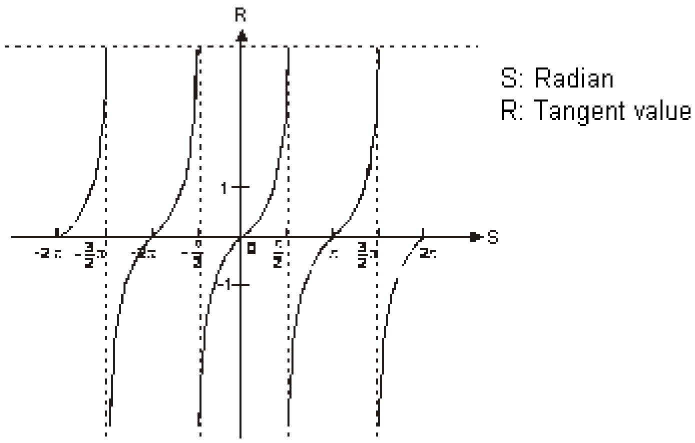
S : Source value Double word / Long word

D : Tangent value Double word / Long word

Explanation:

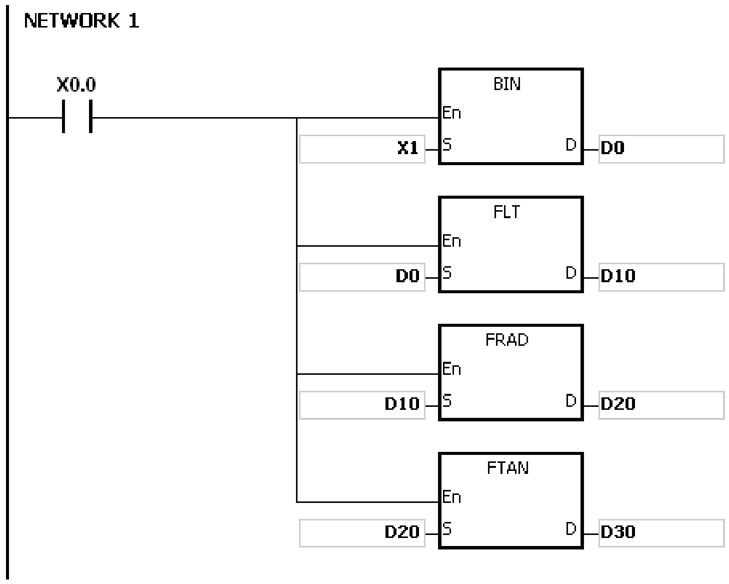
1. Whether the source value specified by **S** is a radian or a degree depends on the state of SM695.
2. If SM695 is OFF, the source value specified by **S** is a radian. Radian=Degree×π/180.
3. If SM695 is ON, the source value specified by **S** is a degree.

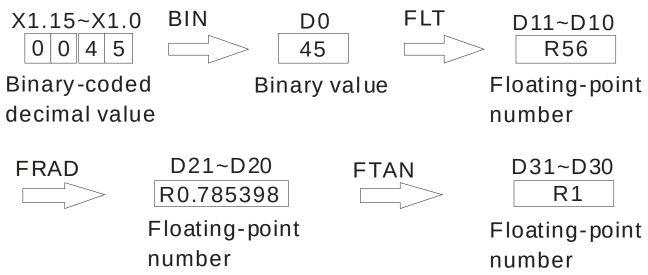
   Degree=Radian×180/π. ($0^o \leqq$Degree$\leqq 360^0$)
4. If the conversion result is 0, SM600 is ON.
5. The tangent of the source value specified by **S** is stored in the register specified by **D**.
6. The relation between radians and tangent values are shown below.



Example:

When X0.0 is ON, the binary-coded decimal value in X1.15~X1.0 is converted into the binary value, and the conversion result is stored in D0. The binary value in D0 is converted into the floating-point number, and the conversion result is stored in (D11, D10). The floating-point number in (D11, D10) is converted into the radian, and the conversion result is stored in (D21, D20). The tangent of the radian in (D21, D20) is stored in (D31, D30), and the tangent value is the floating-point number.





Additional remark:

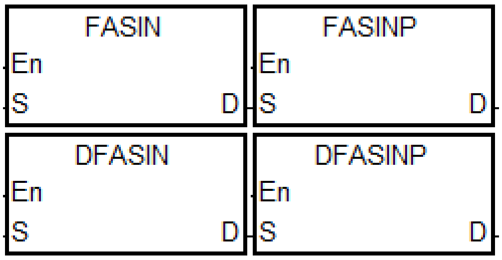
1. If the value in **S** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.
2. If SM695 is ON, and the value in S is less than 0 or larger than 360, the instruction is not executed, SM0 is ON, and the error code is 16#2003.
3. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1503	D	FASIN	P	**S, D**	Arcsine of the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:



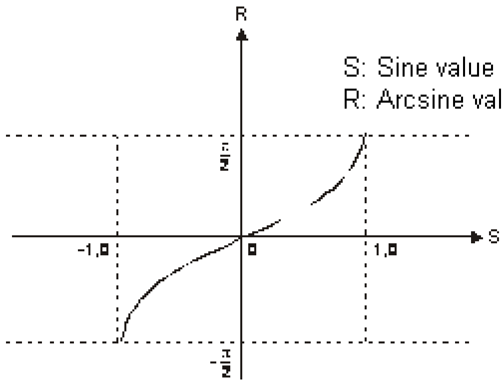
S : Source value Double word / Long word

D : Arcsine value Double word / Long word

Explanation:

1. Arcsine value=$\sin^{-1}$

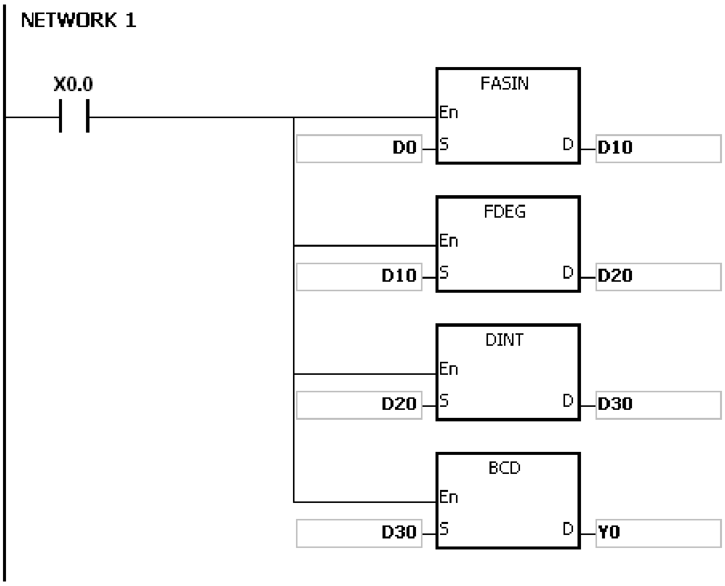
   The relation between sine values and arcsine values are shown below.

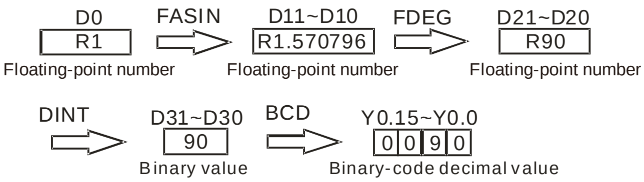


2. If the conversion result is 0, SM600 is ON.

Example:

When X0.0 is ON, the arcsine of the floating-point number in (D1, D0) is stored in (D11, D10). The arcsine value in (D11, D10) is converted into the degree, and the conversion result is stored in (D21, D20). The degree in (D21, D20) is converted into the integer, and the conversion result is stored in (D31, D30). The integer in (D31, D30) is converted into the binary-coded decimal value, and the conversion result is stored in Y0.15~Y0.0.





Additional remark:

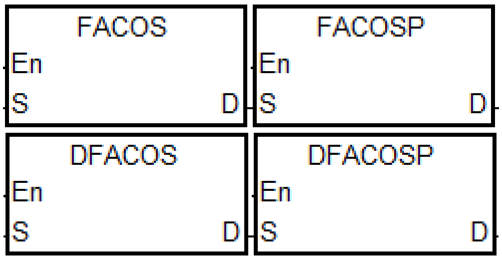
1. The floating-point number specified by the operand **S** should be within the range between –1.0 and +1.0. If the floating-point number is not within the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the value in **S** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.
3. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1504	D	FACOS	P	S, D	Arccosine of the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:



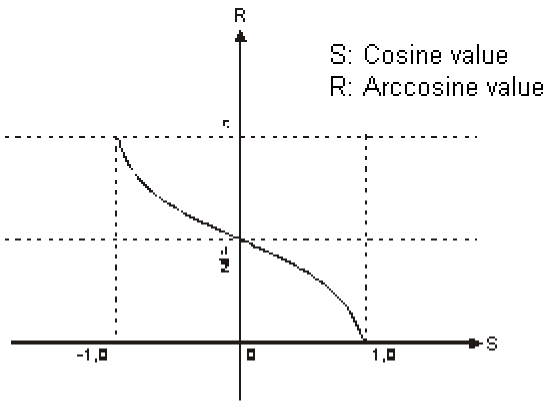
S : Source value Double word / Long word

D : Arccosine value Double word / Long word

Explanation:

1. Arccosine value=cos^{-1}

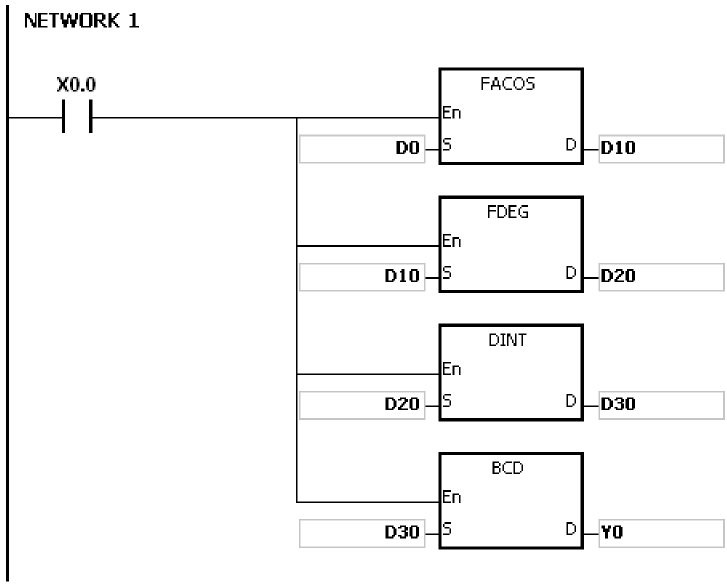
   The relation between cosine values and arccosine values are shown below.

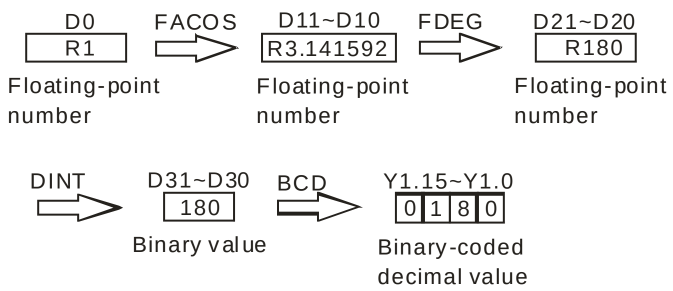


2. If the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, SM602 is ON.
3. If the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, SM601 is ON.
4. If the conversion result is 0, SM600 is ON.

Example:

When X0.0 is ON, the arccosine of the floating-point number in (D1, D0) is stored in (D11, D10). The arccosine value in (D11, D10) is converted into the degree, and the conversion result is stored in (D21, D20). The degree in (D21, D20) is converted into the integer, and the conversion result is stored in (D31, D30). The integer in (D31, D30) is converted into the binary-coded decimal value, and the conversion result is stored in Y0.15~Y0.0.





Additional remark:

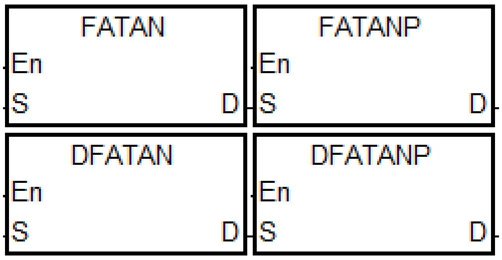
1. The floating-point number specified by the operand **S** should be within the range between –1.0 and +1.0. If the floating-point number is not within the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the value in **S** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.
3. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1505	D	FATAN	P	**S, D**	Arctangent of the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:

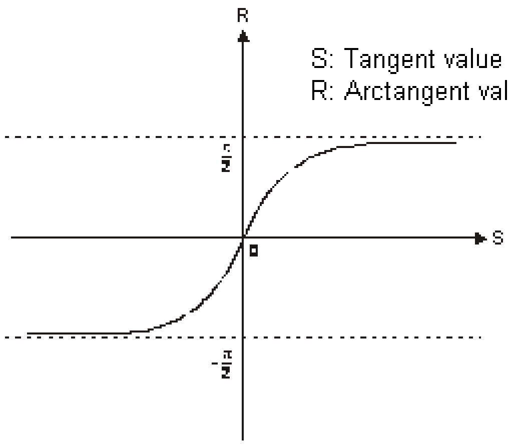


S : Source value Double word / Long word

D : Arctangent value Double word / Long word

Explanation:

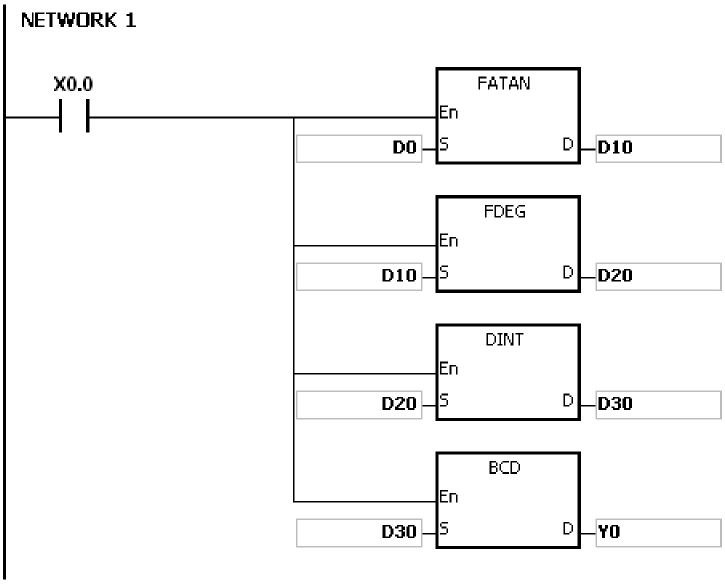
1. Arctangent value=$\tan^{-1}$
2. The relation between tangent values and arctangent values are shown below.

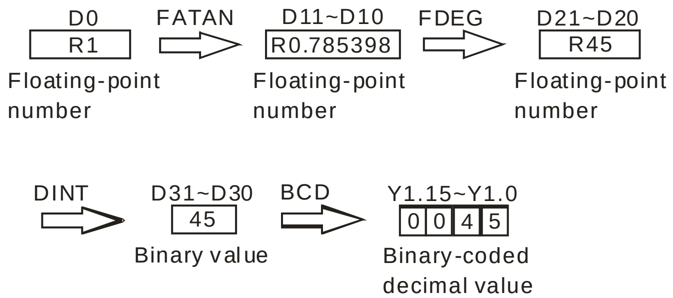


3. If the conversion result is 0, SM600 is ON.

Example:

When X0.0 is ON, the arctangent of the floating-point number in (D1, D0) is stored in (D11, D10). The arctangent value in (D11, D10) is converted into the degree, and the conversion result is stored in (D21, D20). The degree in (D21, D20) is converted into the integer, and the conversion result is stored in (D31, D30). The integer in (D31, D30) is converted into the binary-coded decimal value, and the conversion result is stored in Y0.15~Y0.0.





Additional remark:

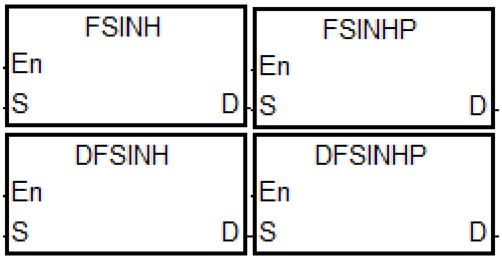
1. If the value in **S** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.
2. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1506	D	FSINH	P	**S, D**	Hyperbolic sine of the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:



S : Source value Double word / Long word

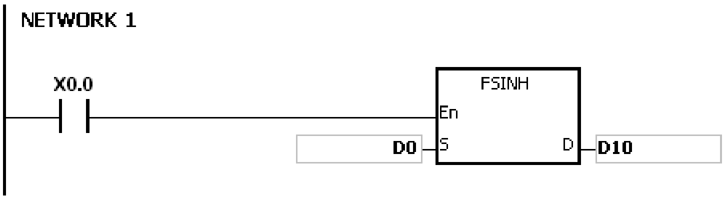
D : Hyperbolic sine value Double word / Long word

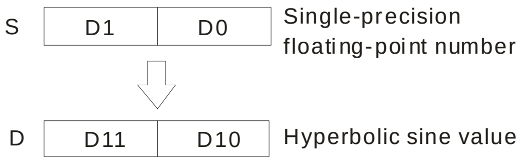
Explanation:

1. Hyperbolic sine value=$(e^{s}-e^{-s})/2$.
2. For its 32-bit single-precision floating-point instruction:
   If the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16# FF800000, and SM601 is ON.
   If the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7F800000, and SM602 is ON.
3. For its 64-bit double-precision floating-point instruction:
   If the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16#FFF0000000000000, and SM601 is ON.
   If the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7FF0000000000000, and SM602 is ON.
4. If the conversion result is 0, SM600 is ON.

Example:

1. When X0.0 is ON, the hyperbolic sine of the floating-point number in (D1, D0) is stored in (D11, D10). The hyperbolic sine value in (D11, D10) is the floating-point number.





2. If the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, SM602 is ON.
3. If the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, SM601 is ON.
4. If the conversion result is 0, SM600 is ON.

Additional result:

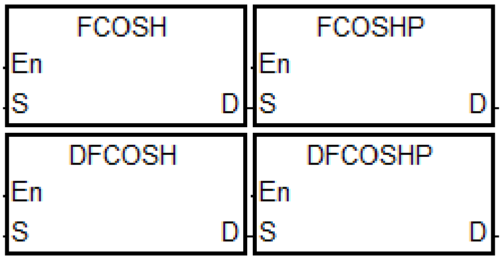
1. If the value in **S** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.
2. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1507	D	FCOSH	P	**S, D**	Hyperbolic cosine of the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:



S : Source value — Double word / Long word

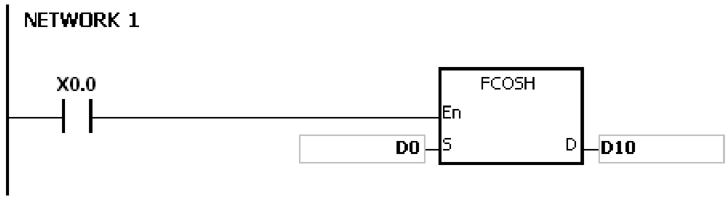
D : Hyperbolic cosine value — Double word / Long word

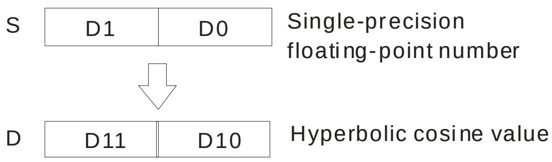
Explanation:

1. Hyperbolic cosine value=(e^{s}+e^{-s})/2.
2. For its 32-bit single-precision floating-point instruction:
   If the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16# FF800000, and SM601 is ON.
   If the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7F800000, and SM602 is ON.
3. For its 64-bit double-precision floating-point instruction:
   If the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16#FFF0000000000000, and SM601 is ON.
   If the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7FF0000000000000, and SM602 is ON.
4. If the conversion result is 0, SM600 is ON.

Example:

1. When X0.0 is ON, the hyperbolic cosine of the floating-point number in (D1, D0) is stored in (D11, D10). The hyperbolic cosine value in (D11, D10) is the floating-point number.





2. If the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, SM602 is ON.
3. If the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, SM601 is ON.
4. If the conversion result is 0, SM600 is ON.

Additional remark:

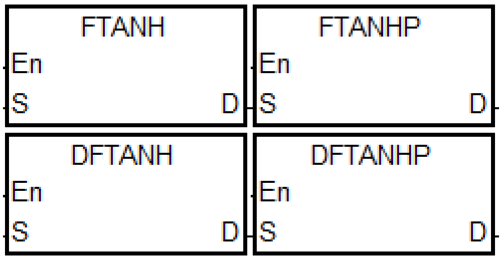
1. If the value in **S** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.
2. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1508	D	FTANH	P	**S, D**	Hyperbolic tangent of the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:



S : Source value — Double word / Long word

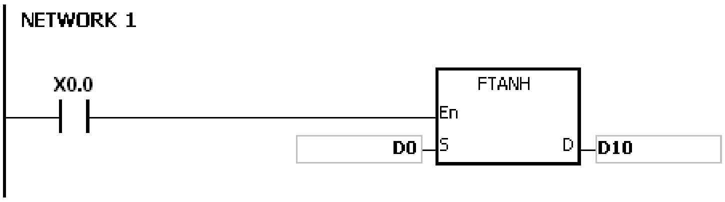
D : Hyperbolic tangent value — Double word / Long word

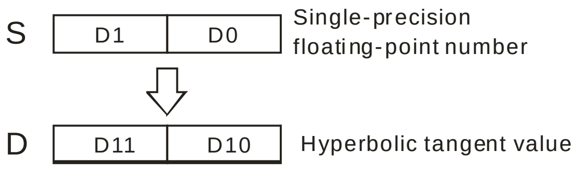
Explanation:

1. Hyperbolic tangent value=$(e^{s}-e^{-s})/(e^{s}+e^{-s})$.
2. If the conversion result is 0, SM600 is ON.

Example:

1. When X0.0 is ON, the hyperbolic tangent of the floating-point number in (D1, D0) is stored in (D11, D10). The hyperbolic tangent value in (D11, D10) is the floating-point number.





2. If the conversion result is 0, SM600 is ON.

Additional remark:

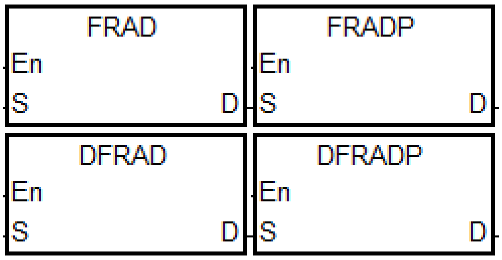
1. If the value in **S** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.
2. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1509	D	FRAD	P	**S, D**	Converting the degree to the radian

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:



S : Data source (degree) Double word / Long word

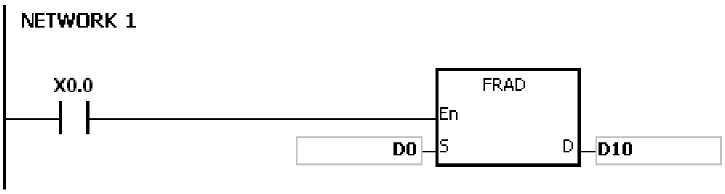
D : Conversion result (radian) Double word / Long word

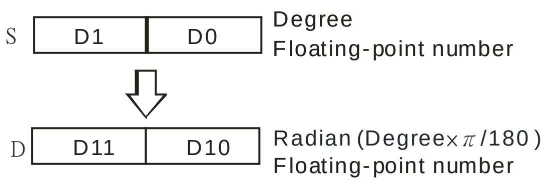
Explanation:

1. The equation below is used to convert degrees into radians.
2. Radian = Degree×(π/180).
3. If the conversion result is 0, SM600 is ON.

Example:

When X0.0 is ON, the degree in (D1, D0) is converted into the radian, and the conversion result is stored in (D11, D10). The radian in (D11, D10) is the floating-point number.





Additional remark:

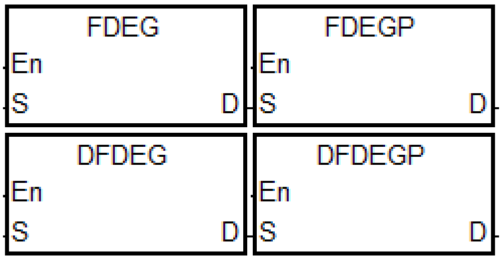
1. If the value in **S** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.
2. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1510	D	FDEG	P	**S, D**	Converting the radian to the degree

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:



S : Data source (radian) — Double word / Long word

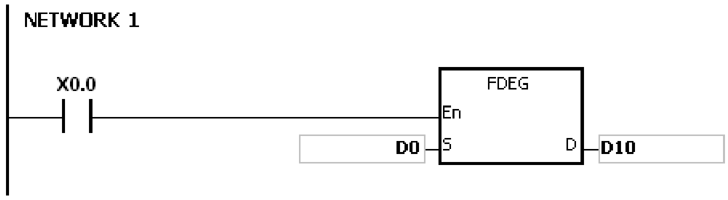
D : Conversion result (Degree) — Double word / Long word

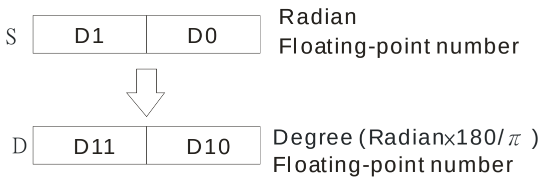
Explanation:

1. The equation below is used to convert radians into degrees.
2. Degree = Radian×(180/π).
3. For its 32-bit single-precision floating-point instruction:
   If the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16# FF7FFFFF.
   If the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7F7FFFFF.
4. For its 64-bit double-precision floating-point instruction:
   If the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16#F FFEFFFFFFFFFFFFF.
   If the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7FEFFFFFFFFFFFFF, and SM602 is ON.
5. If the conversion result is 0, SM600 is ON.

Example:

When X0.0 is ON, the radian in (D1, D0) is converted into the degree, and the conversion result is stored in (D11, D10). The degree in (D11, D10) is the floating-point number.





Additional remark:

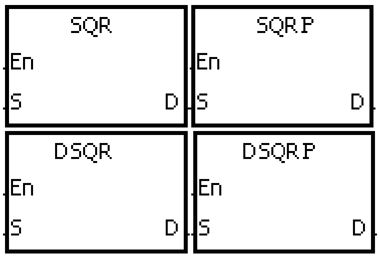
1. If the value in **S** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.
2. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1511	D	SQR	P	**S, D**	Square root of the binary number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●		●	○	○		
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Source value Word/Double word

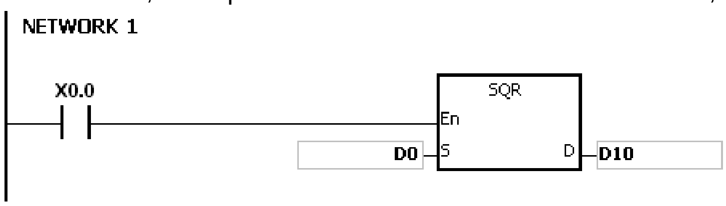
D : Device in which the result is stored Word/Double word

Explanation:

1. The square root of the value in the device specified by **S** is calculated, and the result is stored in the device specified by **D**.
2. The operation result stored in **D** is an integer. If the floating-point number is rounded down to the nearest whole digit, SM601 is ON.
3. If the operation result stored in **D** is 0, SM600 is ON.

Example:

When X0.0 is ON, the square root of the value in D0 is calculated, and the result is stored in D10.



Additional remark:

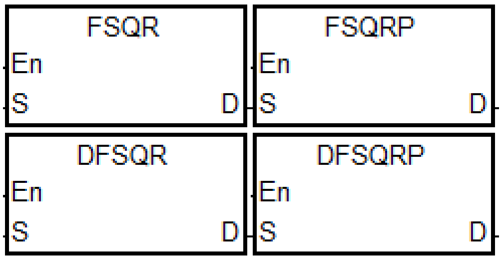
1. The value in the device specified by **S** only can be a positive value. If the value in the device specified by **S** is a negative value, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
1512	D	FSQR	P	**S, D**	Square root of the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:



S : Source value — Double word / Long word

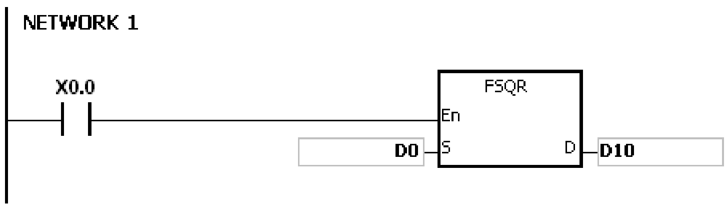
D : Device in which the result is stored — Double word / Long word

Explanation:

1. The square root of the floating-point number in the register specified by **S** is calculated, and the result is stored in the register specified by **D**.
2. If the operation result stored in **D** is 0, SM600 is ON.

Example 1:

When X0.0 is ON, the square root of the floating-point number in (D1, D0) is calculated, and the result is stored in (D11, D10).



Additional remark:

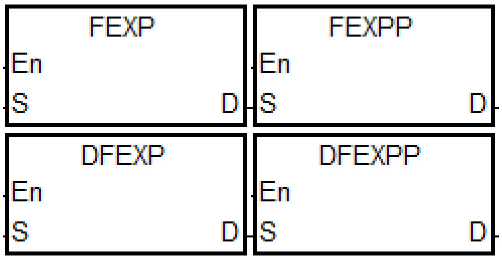
1. The value in the device specified by **S** only can be a positive value. If the value in the device specified by **S** is a negative value, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1513	D	FEXP	P	**S, D**	An exponent of the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:



S : Source value — Double word / Long word

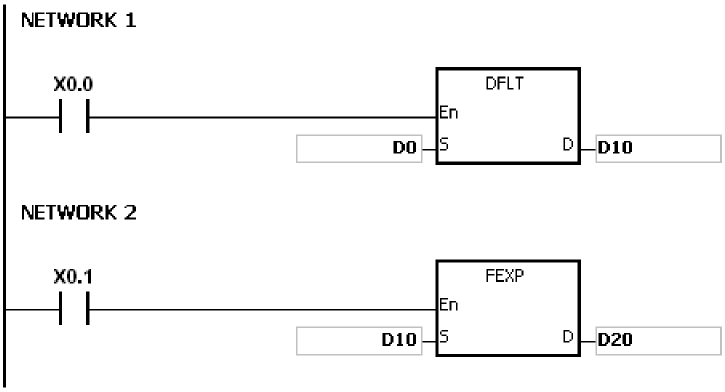
D : Device in which the operation result is stored — Double word / Long word

Explanation:

1. Exponentiation involves two numbers, the base e which represents 2.71828, and the exponent in the device specified by **S**.
2. EXP[**D**+1, **D**]=[**S**+1, **S**].
3. The number in the device specified by **S** can be a positive number or a negative number. The number in the device specified by **S** should be a floating-point number.
4. The value in the register specified by **D** is e^{S}. (e is 2.71828, and **S** represents the source data.)
5. For its 32-bit single-precision floating-point instruction:
   If the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7F800000, and SM602 is ON.
6. For its 64-bit double-precision floating-point instruction:
   If the absolute value of the conversion result is larger than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7FF0000000000000, and SM602 is ON.
7. If the operation result stored in **D** is 0, SM600 is ON.

Example:

1. When X0.0 is ON, the value in (D1, D0) is converted into the floating-point number, and the conversion result is stored in (D11, D10).
2. When X0.1 is ON, the exponentiation with the value in (D11, D10) as the exponent is performed. The result is a floating-point number, and is stored in (D21, D20).



Additional remark:

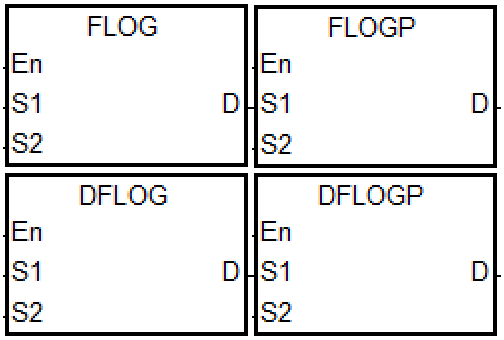
1. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1514	D	FLOG	P	S_1, S_2, D	Logarithm of the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●		●				○
S_2	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (7 steps)	64-bit instruction (7-9 steps)
AH500	AH500	AH500

Symbol:



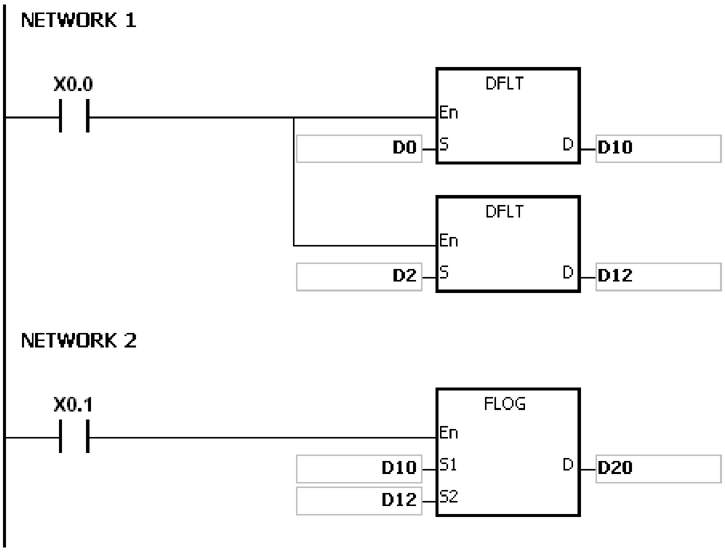
S_1	:	Device in which the base is stored	Double word / Long word
S_2	:	Source device	Double word / Long word
D	:	Device in which the operation result is stored	Double word / Long word

Explanation:

1. The logarithm of the value in S_2 with respect to the value in S_1 is calculated, and the operation result is stored in **D**.
2. The values in S_1 and S_2 only can be positive values. The values in S_1 and S_2 should be floating-point numbers.
3. $S_1^D = S_2 \rightarrow D = \mathrm{Log}_{S_1} S_2$.
4. Example: Suppose the values in S_1 and S_2 are 5 and 125 respectively. Find $\log_5 125$.
5. $S_1^D = S_2 \rightarrow 5^D = 125 \rightarrow D = \log_5 125 = 3$.
6. If the operation result stored in **D** is 0, SM600 is ON.

Example:

1. When X0.0 is ON, the values in (D1, D0) and (D3, D2) are converted into the floating-point numbers, and the conversion results are stored in (D11, D10) and (D13, D12) respectively.
2. When X0.1 is ON, the logarithm of the floating-point number in (D13, D12) with respect to the floating-point number in (D11, D10) is calculated, and the operation result is stored in (D21, D20).



Additional remark:

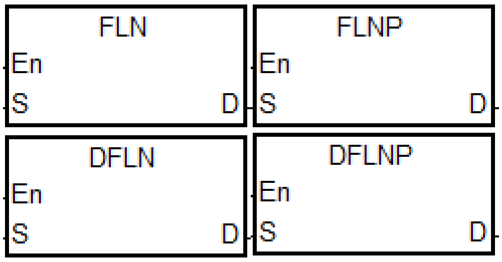
1. If the value in **S_1** is less than or equal to 1, or if the value in **S_2** is less or equal to 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1515	D	FLN	P	**S, D**	Natural logarithm of the binary floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (5 steps)	64-bit instruction (5-6 steps)
AH500	AH500	AH500

Symbol:



S : Source value — Double word / Long word

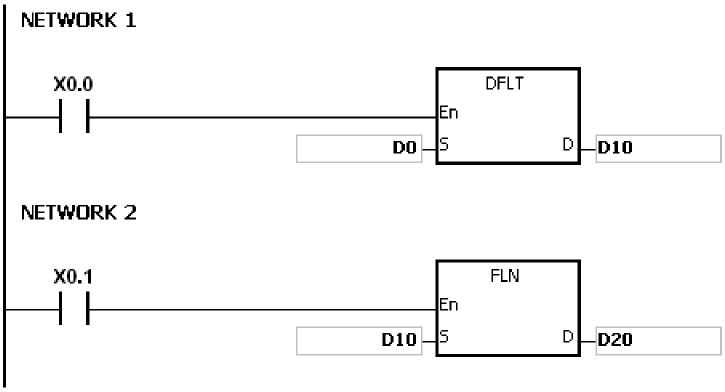
D : Device in which the operation result is stored — Double word / Long word

Explanation:

1. The natural logarithm of the operand **S** is calculated.
2. LN[**S**+1, S]=[**S**+1, D]
3. The value in **S** only can be a positive value. The value in **S** should be a floating-point number.
4. e^{D}=**S**.→The value in **D**=ln**S**. (**S** represents the source data.)
5. If the operation result stored in **D** is 0, SM600 is ON.

Example:

1. When X0.0 is ON, the value in (D1, D0) is converted into the floating-point number, and the conversion result is stored in (D11, D10).
2. When X0.1 is ON, the natural logarithm of the floating-point number in (D11, D10) is calculated, and the operation result is stored in (D21, D20).



Additional remark:

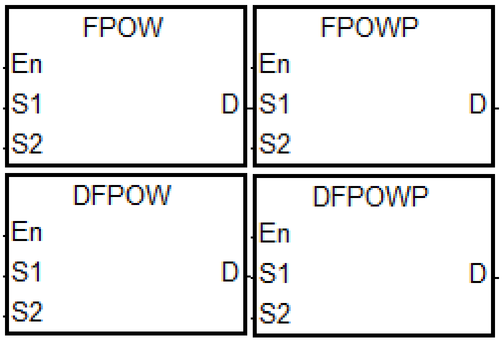
1. If the value in S is less than or equal to 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1516	D	FPOW	P	S_1, S_2, D	A power of the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●	●	●	●		●		●				○
S_2	●	●			●	●	●	●	●		●		●				○
D	●	●			●	●	●	●	●		●		●				

Pulse instruction	32-bit instruction (7 steps)	64-bit instruction (7-9 steps)
AH500	AH500	AH500

Symbol:



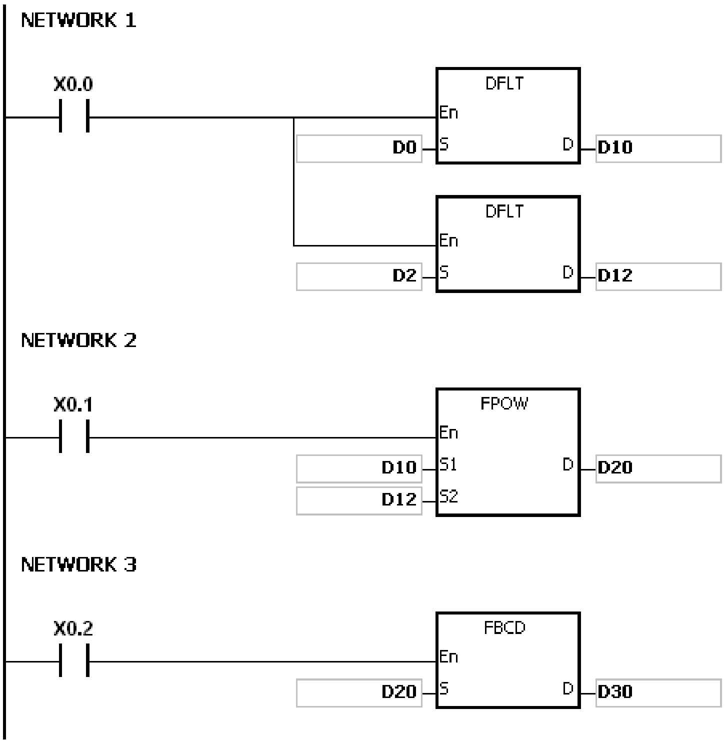
S_1	:	Device in which the base is stored	Double word / Long word
S_2	:	Device in which the power is stored	Double word / Long word
D	:	Device in which the operation result is stored	Double word / Long word

Explanation:

1. The floating-point number in $\mathbf{S_1}$ is raised to the power of the value in $\mathbf{S_2}$, and the operation result is stored in **D**.
2. **D**=POW[$\mathbf{S_1}$+1, $\mathbf{S_1}$]$^{[\mathbf{S2}+1,\ \mathbf{S2}]}$
3. The value in $\mathbf{S_1}$ only can be a positive value, whereas the value in $\mathbf{S_2}$ can be a positive value or a negative value. The values in $\mathbf{S_1}$ and $\mathbf{S_2}$ should be floating-point numbers.
4. $\mathbf{S_1}^{\mathbf{S2}}$**=D**
   Suppose the values in $\mathbf{S_1}$ and $\mathbf{S_2}$ are 5 and 3 respectively. D=5^3=125.
5. For its 32-bit single-precision floating-point instruction:
   If the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16#7 FF7FFFFF.
   If the absolute value of the conversion result is large than the value which can be represented by the maximum floating-point number, the value in **D** is 16#7F7FFFFF.
5. For its 64-bit double-precision floating-point instruction:
   If the absolute value of the conversion result is less than the value which can be represented by the minimum floating-point number, the value in **D** is 16#FFEFFFFFFFFFFFFF
   If the absolute value of the conversion result is large than the value which can be represented by the maximum floating-point number, the value in **D** is D=16#7FEFFFFFFFFFFFFF.
6. If the operation result stored in **D** is 0, SM600 is ON.

Example:

1. When X0.0 is ON, the values in (D1, D0) and (D3, D2) are converted into the floating-point numbers, and the conversion results are stored in (D11, D10) and (D13, D12) respectively.
2. When X0.1 is ON, the floating-point number in (D11, D10) is raised to the power of the floating-point number in (D13, D12), and the operation result is stored in (D21, D20).
3. When X0.2 is ON, the binary floating-point number in (D21, D20) is converted into the binary-coded decimal floating-point number, and the conversion result is stored in (D31, D30).



Additional remark:

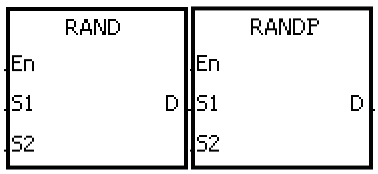
1. If the value in **S_1** is less than 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. Its 64-bit double-precision floating-point instruction is only available for AHCPU5x1-EN FW V2.01 or later as well as AHCPU5x1-RS2 FW V1.03 or later.

API	Instruction code			Operand	Function
1517		RAND	P	S_1, S_2, D	Random number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●	●			●	●		●	●		●	○	●	○	○		
S_2	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1 : Minimum value — Word

S_2 : Maximum value — Word

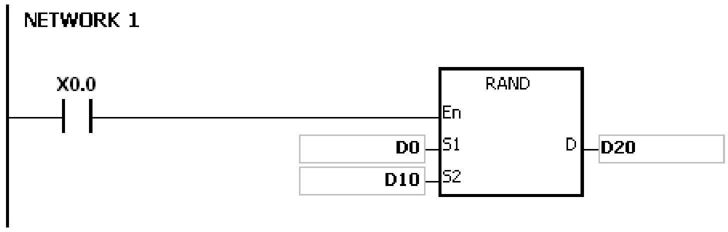
D : Device in which the result is stored — Word

Explanation:

1. The instruction is used to generate the random number within the range between the minimum value in S_1 and the maximum value in S_2, and the result is stored in **D**.
2. If the value in S_1 is larger than the value in S_2, the values in S_1 and S_2 are taken as the maximum value and the minimum value respectively when the instruction is executed.

Example:

When X0.0 is ON, the random number within the range between the minimum value in D0 and the maximum value in D10 is generated, and the result is stored in D20.



Additional remark:

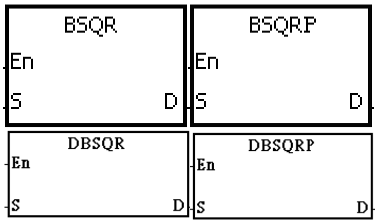
The values in S_1 and S_2 should be within the range between 0 and 0~32767. If the value in S_1 or S_2 exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
1518	D	BSQR	P	**S, D**	Square root of the binary-coded decimal number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●	●	●	●		●	○	●	○	○		
D	●	●			●	●	●	●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:



S : Source device — Word / Double word

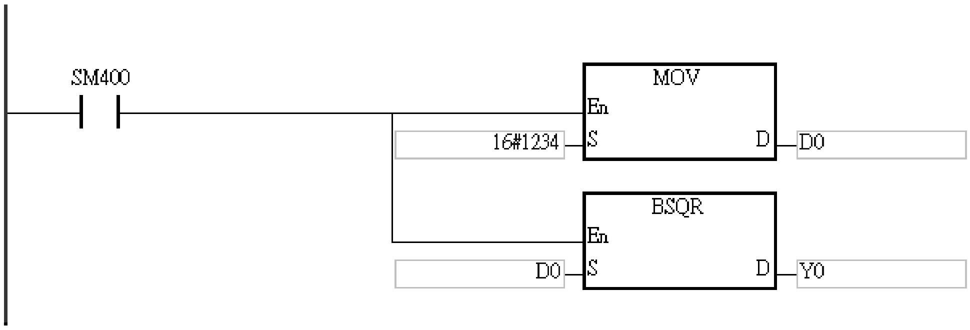
D : Device in which the result is stored — Word / Double word

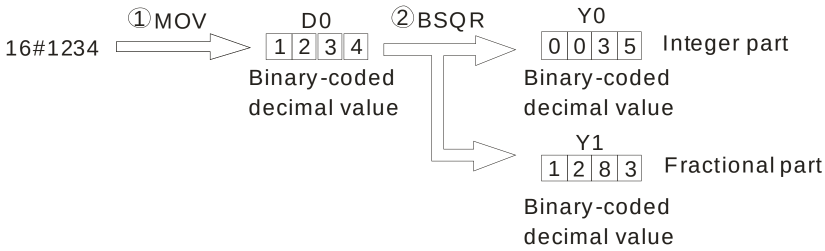
Explanation:

1. After the square root of the value in the device specified by **S** is calculated, the integer part is stored in the device specified by **D**, and the fractional part is stored in the device specified by **D+1**.
2. The 16-bit value in **S** should be within the range between 0 and 9,999, and the 32-bit value in **S** should be within the range between 0 and 99,999,999.
3. If the instruction BSQR is used, the square root is rounded down to the fourth decimal place.
4. If the instruction DBSQR is used, the square root is rounded down to the eighth decimal place.
5. If the operation result stored in **D** is 0, SM600 is ON.

Example 1:

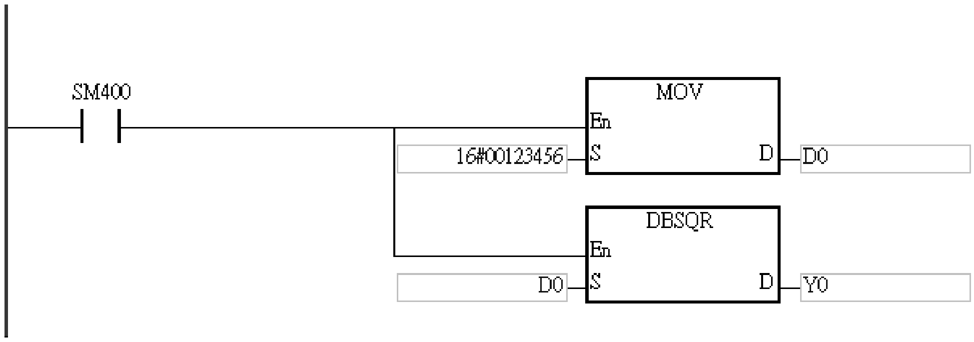
After the square root of the value in D0 is calculated, the integer part is stored in Y0, and the fractional part is stored in Y1.

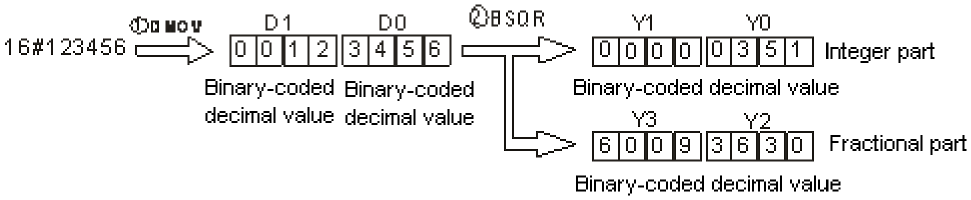




Example 2:

After the square root of the value in D0 is calculated, the integer part is stored in Y0, and the fractional part is stored in Y1.





Additional remark:

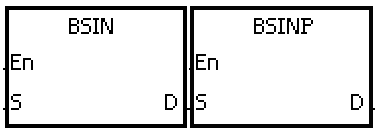
1. If the value in **S** is not a binary-coded decimal value (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.), the operation error occurs, SM0 is ON, and the error code in SR0 is 16#200D.
2. If the operand **D** used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of WORD/INT.
3. If the operand **D** used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of DWORD/DINT.

API	Instruction code		Operand	Function
1519	BSIN	P	**S, D**	Sine of the binary-coded decimal number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



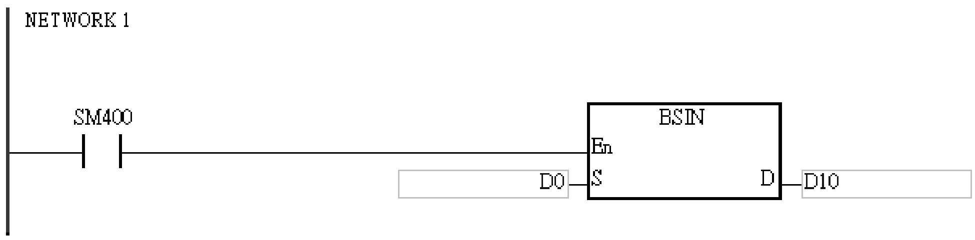
S	:	Source value	Word
D	:	Result	Word

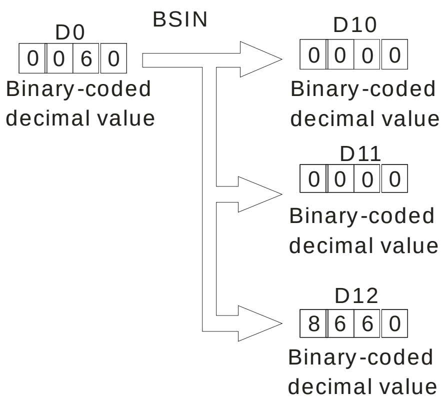
Explanation:

1. The source value specified by **S** is a degree, and the instruction is used to get the sine of the source value specified by **S**. After the sine value is gotten, the sign is stored in **D**, the integer part is stored in **D**+1, and the fractional part is stored in **D**+2.
2. The range of degrees: 0°≦Degree < 360°
3. The operation result is rounded off to the fifth decimal place.
4. If the conversion result is 0, SM600 is ON.

Example:

The instruction is used to get the sine of the value in D0. After the sine value is gotten, the sign is stored in D10, the integer part is stored in D11, and the fractional part is stored in D12.





Additional remark:

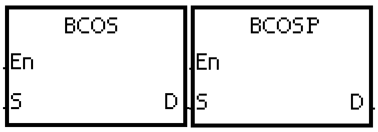
1. If the value in **S** is not a binary-coded decimal value (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.), the operation error occurs, SM0 is ON, and the error code in SR0 is 16#200D.
2. If the value in **S** is not within the range between 0° and 360°, the operation error occurs, SM0 is ON, and the error code in SR0 is 16#2003.
3. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [3] of WORD/INT.

API	Instruction code		Operand	Function
1520	BCOS	P	**S, D**	Cosine of the binary-coded decimal number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Source value   Word

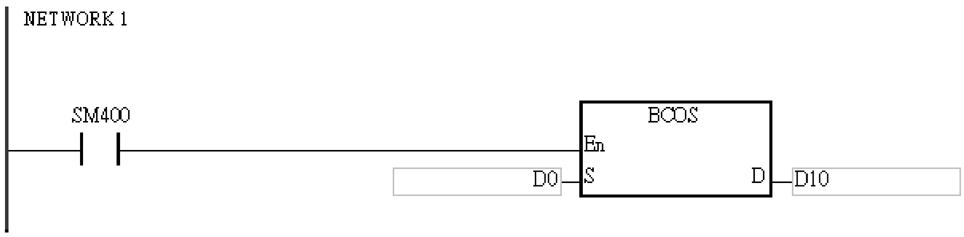
D : Result   Word

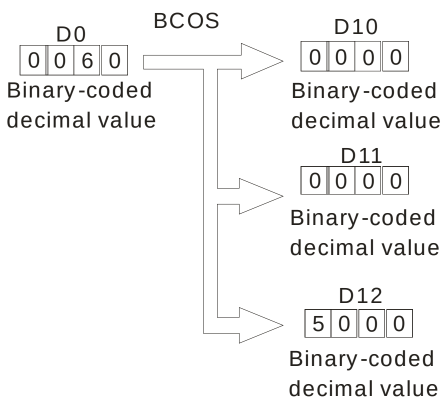
Explanation:

1. The source value specified by **S** is a degree, and the instruction is used to get the cosine of the source value specified by **S**. After the cosine value is gotten, the sign is stored in **D**, the integer part is stored in **D**+1, and the fractional part is stored in **D**+2.
2. The range of degrees: 0°≦Degree < 360°
3. The operation result is rounded off to the fifth decimal place.
4. If the conversion result is 0, SM600 is ON.

Example:

The instruction is used to get the cosine of the value in D0. After the cosine value is gotten, the sign is stored in D10, the integer part is stored in D11, and the fractional part is stored in D12.





Additional remark:

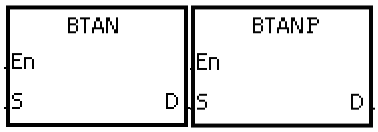
1. If the value in **S** is not a binary-coded decimal value (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.), the operation error occurs, SM0 is ON, and the error code in SR0 is 16#200D.
2. If the value in **S** is not within the range between 0° and 360°, the operation error occurs, SM0 is ON, and the error code in SR0 is 16#2003.
3. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [3] of WORD/INT.

API	Instruction code			Operand	Function
1521		BTAN	P	S, D	Tangent of the binary-coded decimal number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Source value Word

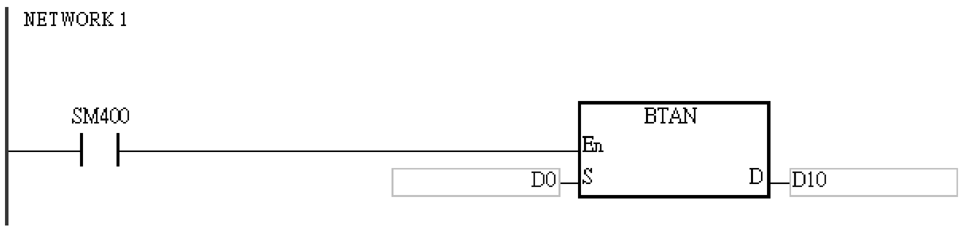
D : Result Word

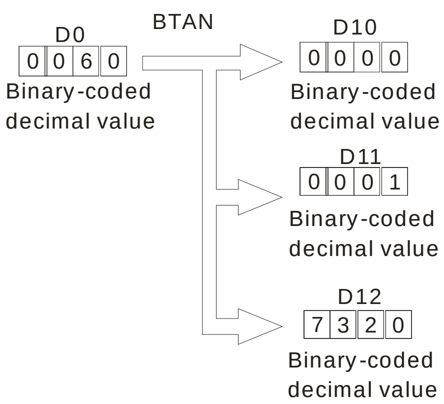
Explanation:

1. The source value specified by **S** is a degree, and the instruction is used to get the tangent of the source value specified by **S**. After the tangent value is gotten, the sign is stored in **D**, the integer part is stored in **D**+1, and the fractional part is stored in **D**+2.
2. The range of degrees: 0°≦Degree < 360°
3. The operation result is rounded off to the fifth decimal place.
4. If the conversion result is 0, SM600 is ON.

Example:

The instruction is used to get the tangent of the value in D0. After the tangent value is gotten, the sign is stored in D10, the integer part is stored in D11, and the fractional part is stored in D12.





Additional remark:

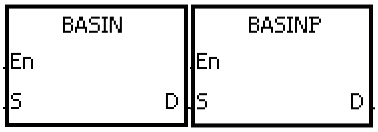
1. If the value in **S** is not a binary-coded decimal value (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.), the operation error occurs, SM0 is ON, and the error code in SR0 is 16#200D.
2. If the value in **S** is not within the range between 0° and 360°, the operation error occurs, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in **S** is equal to 90° or 270°, the operation error occurs, SM0 is ON, and the error code in SR0 is 16#2003.
4. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [3] of WORD/INT.

API	Instruction code			Operand	Function
1522		BASIN	P	S, D	Arcsine of the binary-coded decimal number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●				
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Source value Word

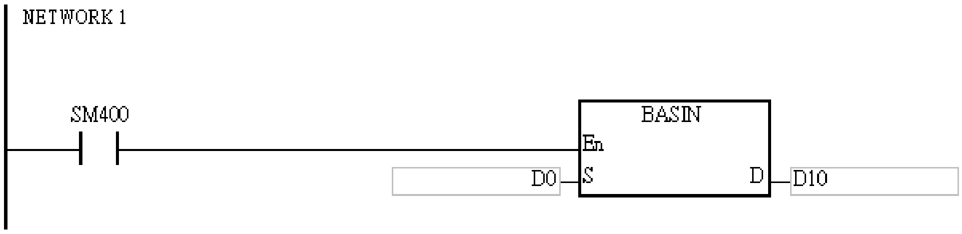
D : Arcsine value Word

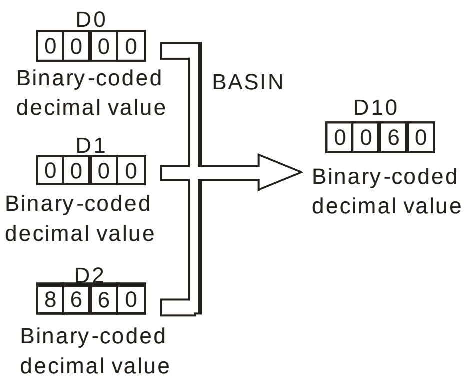
Explanation:

1. The source value specified by **S** is a binary-coded decimal value, and the instruction is used to get the arcsine of the source value specified by **S**. The operation result (the degree) is stored in **D**.
2. The value in **S** represents the sign, i.e. 0 represents the positive sign, and 1 represents the negative sign. The integer part is stored in **S**+1, and the fractional part is stored in **S**+2.
3. The operation result is rounded off to the nearest whole digit.
4. The operation result is a binary-coded decimal value (the degree) wiithin the range between 0° and 90°, or within the range between 270° and 360°.

Example:

The value in D0 represents the sign, the integer part is stored in D1, and the fractional part is stored in D2. After the instruction BASIN is executed, the arcsine value is rounded off to the nearest whole digit, and the result is stored in D10.





Additional remark:

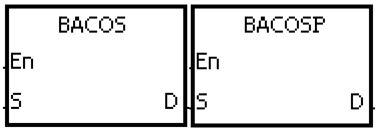
1. Take 0.5 for example. When it is entered, users need to enter 0, 0, and 16#5000 into **S**, **S**+1, **S**+2 respectively.
2. If the value in **S** is not a binary-coded decimal value (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.), the operation error occurs, SM0 is ON, and the error code in SR0 is 16#200D.
3. The value specified by the operand **S** should be within the range between –1.0 and +1.0. If the value specified by the operand **S** is not within the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If users declare the operand **S** in ISPSoft, the data type will be ARRAY [3] of WORD/IN.

API	Instruction code			Operand	Function
1523		BACOS	P	**S, D**	Arccosine of the binary-coded decimal number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●				
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Source value Word

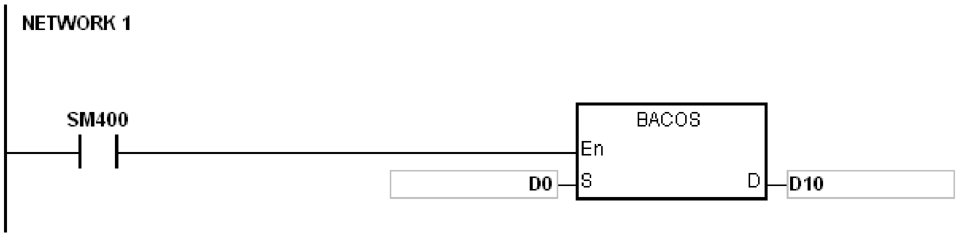
D : Arccosine value Word

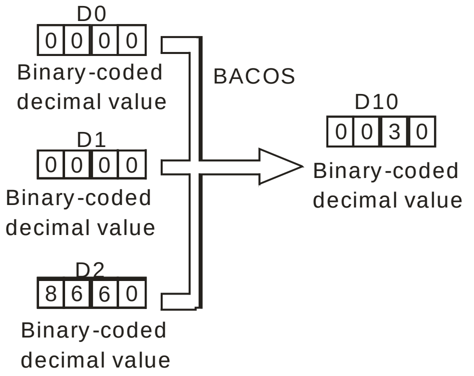
Explanation:

1. The source value specified by **S** is a binary-coded decimal value, and the instruction is used to get the arccosine of the source value specified by **S**. The operation result (the degree) is stored in **D**.
2. The value in **S** represents the sign, i.e. 0 represents the positive sign, and 1 represents the negative sign. The integer part is stored in **S**+1, and the fractional part is stored in **S**+2.
3. The operation result is rounded off to the nearest whole digit.
4. The operation result is a binary-coded decimal value (the degree) wiithin the range between 0° and 180°.

Example:

The value in D0 represents the sign, the integer part is stored in D1, and the fractional part is stored in D2. After the instruction BACOS is executed, the arccosine value is rounded off to the nearest whole digit, and the result is stored in D10.





Additional remark:

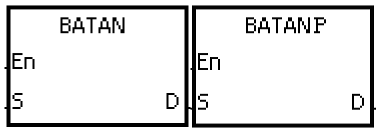
1. Take 0.5 for example. When it is entered, users need to enter 0, 0, and 16#5000 into **S**, **S**+1, **S**+2 respectively.
2. If the value in **S** is not a binary-coded decimal value (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.), the operation error occurs, SM0 is ON, and the error code in SR0 is 16#200D.
3. The value specified by the operand **S** should be within the range between –1.0 and +1.0. If the value specified by the operand **S** is not within the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If users declare the operand **S** in ISPSoft, the data type will be ARRAY [3] of WORD/IN.

API	Instruction code		Operand	Function
1524	BATAN	P	S, D	Arctangent of the binary-coded decimal number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●		●	●		●	○	●				
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Source value Word

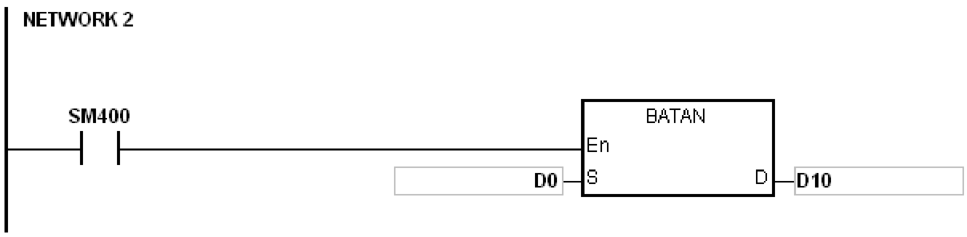
D : Arctangent value Word

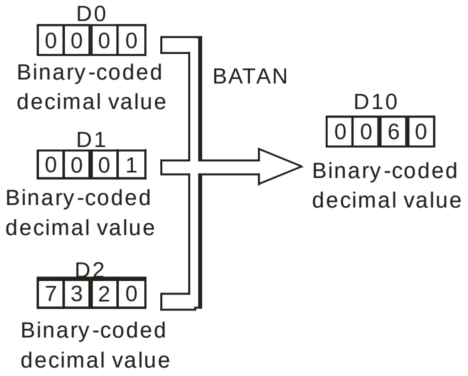
Explanation:

1. The source value specified by **S** is a binary-coded decimal value, and the instruction is used to get the arctangent of the source value specified by **S**. The operation result (the degree) is stored in **D**.
2. The value in **S** represents the sign, i.e. 0 represents the positive sign, and 1 represents the negative sign. The integer part is stored in **S**+1, and the fractional part is stored in **S**+2.
3. The operation result is rounded off to the nearest whole digit.
4. The operation result is a binary-coded decimal value (the degree) wiithin the range between 0° and 90°, or within the range between 270° and 360°.

Example:

The value in D0 represents the sign, the integer part is stored in D1, and the fractional part is stored in D2. After the instruction BATAN is executed, the arctangent value is rounded off to the nearest whole digit, and the result is stored in D10.





Additional remark:

1. Take 0.5 for example. When it is entered, users need to enter 0, 0, and 16#5000 into **S**, **S**+1, **S**+2 respectively.
2. If the value in **S** is not a binary-coded decimal value (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.), the operation error occurs, SM0 is ON, and the error code in SR0 is 16#200D.
3. If users declare the operand **S** in ISPSoft, the data type will be ARRAY [3] of WORD/INT.

6.17 Real-time Clock Instructions

6.17.1 List of Real-time Clock Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
1600	TRD	–	✓	Reading the time	3
1601	TWR	–	✓	Writing the time	3
1602	T+	–	✓	Adding the time	7
1603	T-	–	✓	Subtracting the time	7
1604	HOUR	DHOUR	–	Running-time meter	7
1605	TCMP	–	✓	Comparing the time	11
1606	TZCP	–	✓	Time zone comparison	9
1607	DST	–	✓	Daylight saving time	15

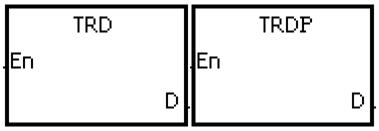
6.17.2 Explanation of Real-time Clock Instructions

API		Instruction code		Operand	Function
1600		TRD	P	D	Reading the time

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
AH500	AH500	-

Symbol:



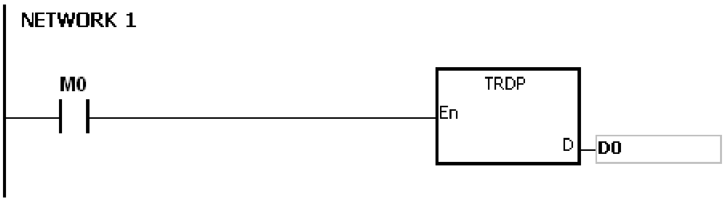
D : Device in which the result is stored Word

Explanation:

1. **D**: The device in which the current time is stored
2. The operand **D** occupies seven consecutive devices.
3. The built-in real-time clock in the CPU module provides the data relating to the year, the week, the moth, the day, the minute, and the second. The data is stored in SR391~SR397. The instruction TRD is used to read the current time into the seven registers.
4. The last two digits of the year number for A.D. are stored in SR391.

Example:

When M0 is ON, the current time is read from the real-time clock into D0~D6. The value 1 in SR397 represents Monday, the value 2 represents Tuesday, and by analogy, the value 7 represents Sunday.



Special data register	Item	Value		General data register	Item
SR391	Year (A.D.)	00~99	→	D0	Year (A.D.)
SR392	Month	1~12	→	D1	Month
SR393	Day	1~31	→	D2	Day
SR394	Hour	0~23	→	D3	Hour
SR395	Minute	0~59	→	D4	Minute
SR396	Second	0~59	→	D5	Second
SR397	Week	1~7	→	D6	Week

Additional remark:

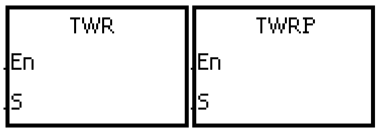
1. If **D**+6 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. When SM220 is ON, the real-time clock is calibrated within ±30 seconds. If the value of the second in the real-time clock is within the range between 0 and 29, the value of the second is cleared to zero. If the value of the second in the real-time clock is within the range between 30 and 59, the value of the minute increases by one, and the value of the second is cleared to zero.
3. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [7] of WORD/INT.

API	Instruction code			Operand	Function
1601		TWR	P	**S**	Writing the time

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
AH500	AH500	-

Symbol:



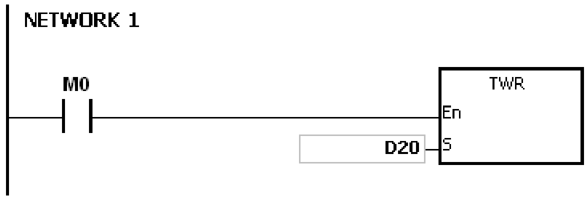
S : Data source Word

Explanation:

1. **S**: The device into which the setting value is written
2. The operand **S** occupies seven consecutive devices.
3. When users want to adjust the built-in real-time clock in the CPU module, they can use the instruction to write the correct current time into the built-in real-time clock.
4. When the instruction is executed, the new setting time is instantly written into the real-time clock in the PLC. Therefore, when the instruction is executed, users have to make sure that the new setting time is consistent with the time when the new setting time is written into the real-time clock.

Example:

When M0 is ON, the correct current time is written into the built-in real-time clock in the PLC.



New setting time

General data register	Item	Value		Special data register	Item
D20	Year (A.D.)	00~99	→	SR391	Year (A.D.)
D21	Month	1~12	→	SR392	Month
D22	Day	1~31	→	SR393	Day
D23	Hour	0~23	→	SR394	Hour
D24	Minute	0~59	→	SR395	Minute
D25	Second	0~59	→	SR396	Second
D26	Week	1~7	→	SR397	Week

Real time clock

Additional remark:

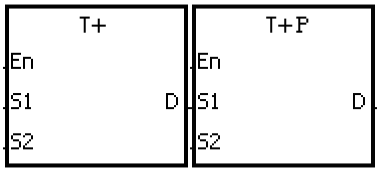
1. If the value in **S** exceeds the range, the operation error occurs, the instruction is not executed, SM is ON, and the error code in SR is 16#2003.
2. If **S**+6 exceeds the device range, the operation error occurs, the instruction is not executed, SM is ON, and the error code in SR is 16#2003.
3. If users declare the operand **S** in ISPSoft, the data type will be ARRAY [7] of WORD/INT.

API		Instruction code		Operand	Function
1602		T+	P	S_1, S_2, D	Adding the time

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●	○	●				
S_2	●	●			●	●		●	●		●	○	●				
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1 : Source device — Word

S_2 : Source device — Word

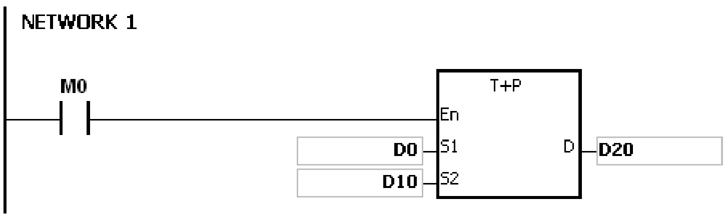
D : Device in which the result is stored — Word

Explanation:

1. The value of the hour, the value of the minute, and the value of the second in the real-time clock specified by **S_2** are added to the value of the hour, the value of the minute, and the value of the second in the real-time clock specified by **S_1**, and the sum is stored in the register specified by **D**.
2. The operands **S_1**, **S_2**, and **D** each occupy three consecutive devices.
3. If the sum is larger than or equal to 24 hours, SM602 is ON, and the result gotten from the subtraction of 24 hours from the sum is stored in **D**.
4. If the sum is 0 (0 hour 0 minute 0 second), SM600 is ON.

Example:

When M0 is ON, the instruction T+ is executed. The alue of the hour, the value of the minute, and the value of the second in D10~D12 are added to the value of the hour, the value of the minute, and the value of the second in D0~D2, and the sum is stored in D20~D22.



D0 8 (Hour)	+	D10 6 (Hour)	→ D20 14 (Hour)
D1 10 (Minute)		D11 40 (Minute)	D21 50 (Minute)
D2 20 (Second)		D12 6 (Second)	D22 26 (Second)
8 hour 10 minute 20 second		6 hour 40 minute 6 second	14 hour 50 minute 26 second

Additional remark:

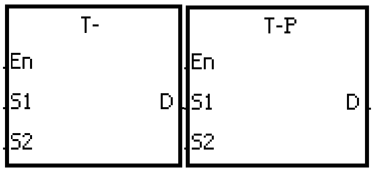
1. If the value in $\mathbf{S}_1$ or $\mathbf{S}_2$ exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If $\mathbf{S}_1$+2, $\mathbf{S}_2$+2, or **D**+2 exceeds the device range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If users declare the operand $\mathbf{S}_1$ in ISPSoft, the data type will be ARRAY [3] of WORD/INT.
4. If users declare the operand $\mathbf{S}_2$ in ISPSoft, the data type will be ARRAY [3] of WORD/IN.
5. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [3] of WORD/INT.

API	Instruction code			Operand	Function
1603		T-	P	**S1, S2, D**	Subtracting the time

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●	○	●				
S_2	●	●			●	●		●	●		●	○	●				
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1 : Source device — Word

S_2 : Source device — Word

D : Device in which the result is stored — Word

Explanation:

1. The value of the hour, the value of the minute, and the value of the second in the real-time clock specified by **S_2** are subtracted from the value of the hour, the value of the minute, and the value of the second in the real-time clock specified by **S_1**, and the difference is stored in the register specified by **D**.
2. The operands **S_1**, **S_2**, and **D** all occupy three consecutive devices.
3. If the difference is a negative, SM601 is ON, and the result gotten from the addition of 24 hours to the difference is stored in **D**.
4. If the difference is 0 (0 hour 0 minute 0 second), SM600 is ON.

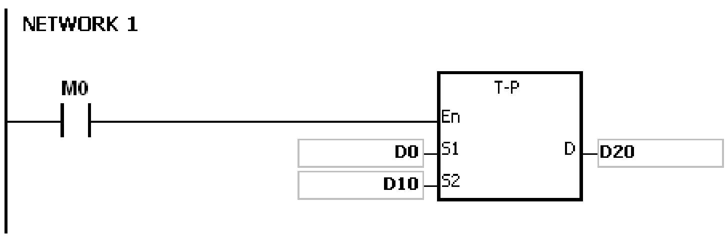
Example:

1. When M0 is ON, the instruction T- is executed. The value of the hour, the value of the minute, and the value of the second in D10~D12 are subtracted from the value of the hour, the value of the minute, and the value of the second in D0~D2, and the difference is stored in D20~D22.

D0 20 (Hour)		D10 14 (Hour)		D20 5 (Hour)
D1 20 (Minute)	-	D11 30 (Minute)	→	D21 49 (Minute)
D2 5 (Second)		D12 8 (Second)		D22 57 (Second)
20 hour 20 minute 50 second		14 hour 30 minute 8 second		5 hour 49 minute 57 second

2. If the difference is a negative, SM601 is ON.

5 (Hour)		19 (Hour)		10 (Hour)
20 (Minute)	-	11 (Minute)	→	9 (Minute)
30 (Second)		15 (Second)		15 (Second)
5 hour 20 minute 30 second		19 hour 11 minute 15 second		10 hour 9 minute 15 second



Additional remark:

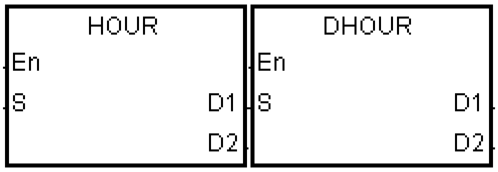
1. If the value in $\mathbf{S}_1$ or $\mathbf{S}_2$ exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If $\mathbf{S}_1$+2, $\mathbf{S}_2$+2, or **D**+2 exceeds the device range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If users declare the operand $\mathbf{S}_1$ in ISPSoft, the data type will be ARRAY [3] of WORD/INT.
4. If users declare the operand $\mathbf{S}_2$ in ISPSoft, the data type will be ARRAY [3] of WORD/INT.
5. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [3] of WORD/INT.

API	Instruction code			Operand	Function
1604	D	HOUR		**S, D_1, D_2**	Running-time meter

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●	●	●	●		●	○	●	○	○		
D_1	●	●						●	●		●	○	●				
D_2	●	●	●	●				●	●	●			●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
-	AH500	AH500

Symbol:



S	:	Time after which the output device is ON	Word/Double word
D_1	:	Current time	Word/Double word
D_2	:	Output device	Bit

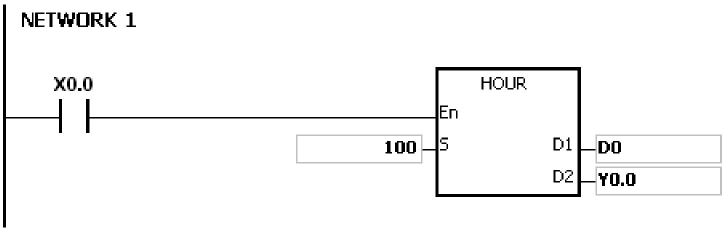
Explanation:

1. **S**: The time after which the output device is ON (Unit: Hour)
   D_1: The current time (Unit: Hour)
   D_2: The output device
2. **S**: The time after which the output device is ON (Unit: Hour)
   The operand **S** used in the 16-bit instruction should be within the range between 1 and 32,767.
   The operand **S** used in the 32-bit instruction should be within the range between 1 and 2,147,483,647.
3. The instruction HOUR:
   D_1: The current time (Unit: Hour)
   The value in **D_1** should be within the range between 0 and 32,767.
   D_1+1: The current time which is less than one hour (Unit: Second)
   The value in **D_1**+1 should be within the range between 0 and 3,599.
   D1+2 is for system use only. The value in it can not be altered when the instruction is executed. Otherwise, an error will occur.
   When the current time is 32,767 hour 3,599 second, the timer stops counting. After the values in **D_1** and **D_1**+1 are cleared to 0, the timer starts to count again.
4. The instruction DHOUR：
   (**D_1**+1, **D_1**): The current time (Unit: Hour)
   The value in (**D_1**+1, **D_1**) should be within the range between 0 and 2,147,483,647.
   D_1+2: The current time which is less than one hour (Unit: Second)
   The value in **D_1**+1 should be within the range between 0 and 3,599.
   D_1+3 is for system use only. The value in it can not be altered when the instruction is executed. Otherwise, an error will occur.
   When the current time is 2,147,483,647 hour 3,599 second, the timer stops counting. After the values in **D_1**, **D_1**+1, and **D_1**+2 are cleared to 0, the timer starts to count again.

5. When the time for which the input contact has been ON reaches the setting time, the ouput device is ON. When the time for which the input contact has been ON does not reach the setting time, the ouput device is not ON. This function allows users to manage the running time of the machine and the maintenance.
6. After the output device is ON, the timer countinues to count.
7. When the on-line editing is used, please reset the conditional contact to initialize the instruction.

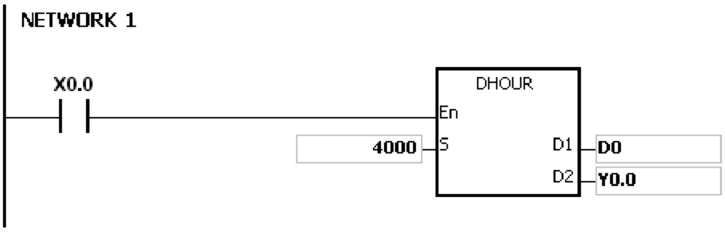
Example 1:

The 16-bit instruction HOUR: When X0.0 is ON, the timer starts to count. When the time for which X0.0 has been ON reaches 100 hours, Y0.0 is ON. The current time is recorded in D0, and the current time which is less than one hour is recorded in D1. D2 is for system use. The value in it can not be altered. Otherwise, an error will occur.



Example 2:

The 32-bit instruction DHOUR: When X0.0 is ON, the timer starts to count. When the time for which X0.0 has been ON reaches 4000 hours, Y0.0 is ON. The current time is recorded in (D1, D0), and the current time which is less than one hour is recorded in D2. D3 is for system use. The value in it can not be altered. Otherwise, an error will occur.



Additional remark:

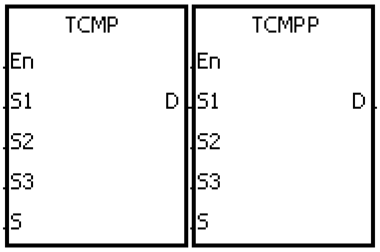
1. When **S** is less than or equal to 0, the instruction is not executed, and the state of the output device is unchanged.
2. If the value in $\mathbf{D}_1$ used in the instruction HOUR is less than 0, the state of the output device is unchanged.
3. If $\mathbf{D}_1$+2 used in the instruction HOUR exceeds the device range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If the value in ($\mathbf{D}_1$+1, $\mathbf{D}_1$) used in the instruction DHOUR is less than 0, the state of the output device is unchanged.
5. If $\mathbf{D}_1$+3 used in the instruction DHOUR exceeds the device range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
6. If the operand $\mathbf{D}_1$ used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [3] of WORD/INT.
7. If the operand $\mathbf{D}_1$ used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of DWORD/DINT.

API	Instruction code		Operand	Function
1605	TCMP	P	**S_1, S_2, S_3, S, D**	Comparing the time

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●	●			●	●		●	●		●	○	●	○	○		
S_2	●	●			●	●		●	●		●	○	●	○	○		
S_3	●	●			●	●		●	●		●	○	●	○	○		
S	●	●			●	●		●	●		●	○	●				
D	●	●	●	●				●	●	●			●				

Pulse instruction	16-bit instruction (11 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1 : Hour of the setting time — Word

S_2 : Minute of the setting time — Word

S_3 : Second of the setting time — Word

S : Current time — Word

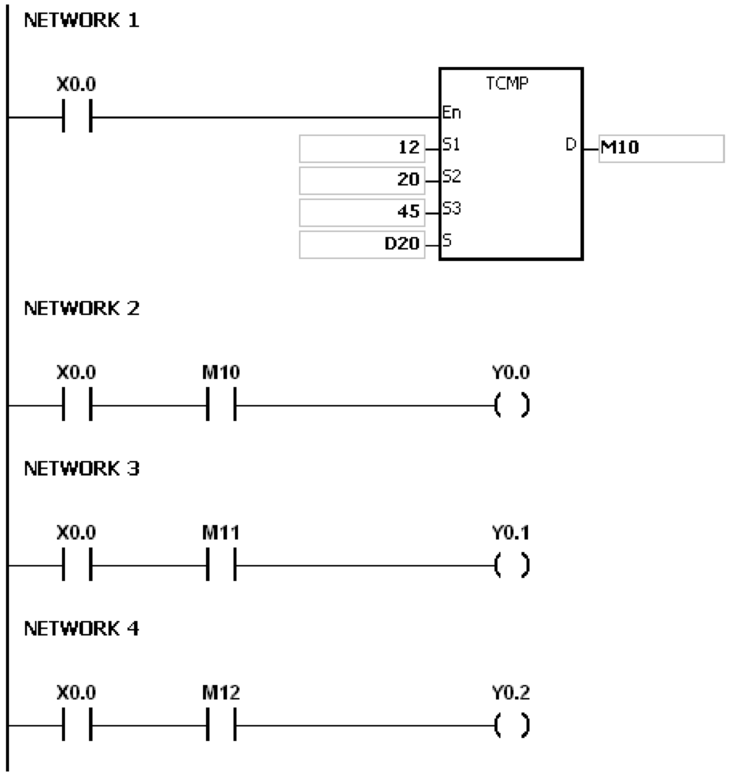
D : Comparison result — Bit

Explanation:

1. The value of the hour, the value of the minute, and the value of the second specified by **S_1**~**S_3** are compared with the value of the hour, the value of the minute, and the value of the second in the devices starting from the device specified by **S**, and the comparison result is stored in **D**.
2. The hour of the current time is in the device specified by **S**, and the value of the hour should be within the range between 0 and 23. The minute of the current time is in the device specified by **S**+1, and the value of the minute should be within the range between 0 and 59. The second of the current time is in the device specified by **S**+2, and the value of the second should be within the range between 0 and 59.
3. The operand **D** occupies three consecutive devices. The comparison result is stored in **D**, **D**+1, and **D**+2.
4. Users generally use the instruction TRD to read the current time from the real-time clock first, and then they use the instruction TCMP to compare the time.
5. If the setting time in **S_1**~**S_3** is larger than the current time in **S**, **D** is ON, **D**+1 is OFF, and **D**+2 is OFF.
6. If the setting time in **S_1**~**S_3** is equal to the current time in **S**, **D** is OFF, **D**+1 is ON, and **D**+2 is OFF.
7. If the setting time in **S_1**~**S_3** is less than the current time in **S**, **D** is OFF, **D**+1 is OFF, and **D**+2 is ON.

Example:

1. When X0.0 is ON, the instruction is executed. The setting time 12 hour 20 minute 45 second is compared with the current time in D20~D22, and the comparison result is stored in M10~M12. When X0.0 is switched from ON to OFF, the instruction is not executed. Besides, the state of M10, the state of M11, and the state of M12 remain the same as those before X0.0’s being ON.
2. If users want to get the comparison result ≧, ≦, or ≠, they can connect M10~M12 is series or in parallel.



Additional remark:

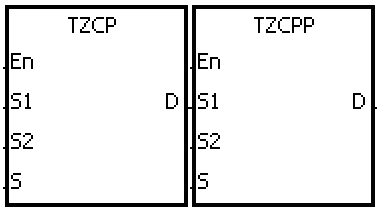
1. If **S**+2 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **D**+2 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in **S** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If the values in **S**$_1$~**S**$_3$ exceed the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
5. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [3] of BOOL.

API	Instruction code		Operand	Function
1606	TZCP	P	**S_1, S_2, S, D**	Time zone comparison

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●	●			●	●		●	●		●	○	●				
S_2	●	●			●	●		●	●		●	○	●				
S	●	●			●	●		●	●		●	○	●				
D	●	●	●	●				●	●	●			●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1 : Lower limit time — Word

S_2 : Upper limit time — Word

S : Current time — Word

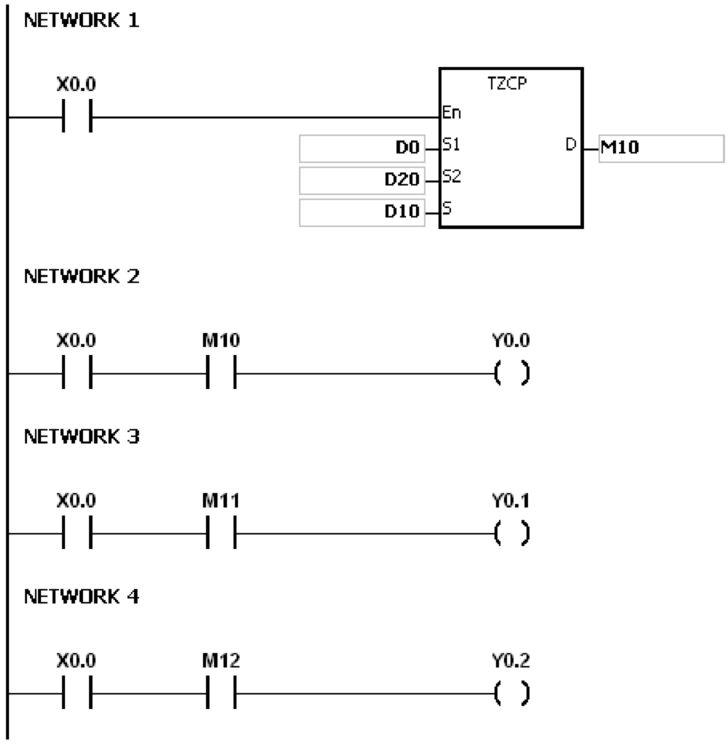
D : Comparison result — Bit

Explanation:

1. The instruction is used to compare the current time specified by **S** with the lower limit time specified by **S_1**, and compare the current time specified by **S** with the upper limit time specified by **S_2**, and the comparison result is stored in **D**.
2. The hour of the lower limit time is in the device specified by **S_1**, the minute of the lower limit time e is in the device specified by **S_1**+1, and the second of the lower limit time is in the device specified by **S_1**+2.
3. The hour of the upper limit time is in the device specified by **S_2**, the minute of the upper limit time e is in the device specified by **S_2**+1, and the second of the upper limit time is in the device specified by **S_2**+2.
4. The hour of the current time is in the device specified by **S**, the minute of the current time e is in the device specified by **S**+1, and the second of the current time is in the device specified by **S**+2.
5. The time in the device specified by **S_1** must be less than the time in the device specified by **S_2**. If the time in the device specified by **S_1** is larger than the time in the device specified by **S_2**, the time in the device specified by **S_1** will be taken as the upper/lower limit time during the execution of the instruction TZCP.
6. Users generally use the instruction TRD to read the current time from the real-time clock first, and then they use the instruction TZCP to compare the time.
7. If the current time in the device specified by **S** is less than the lower limit time in the device specified by **S_1**, and is less than the upper limit time in the device specified by **S_2**, **D** is ON. If the current time in the device specified by **S** is larger than the lower limit time in the device specified by **S_1**, and is larger than the upper limit time in the device specified by **S_2**, **D**+2 is ON. In other conditions, **D**+1 is ON.

Example:

When X0.0 is ON, the instruction TZCP is executed. M10, M11, or M12 is ON. When X0.0 is OFF, the instruction TZCP is not executed, the state of M10, the state of M11, and the state of M12 remain the same as those before X0.0's being ON.



Additional remark:

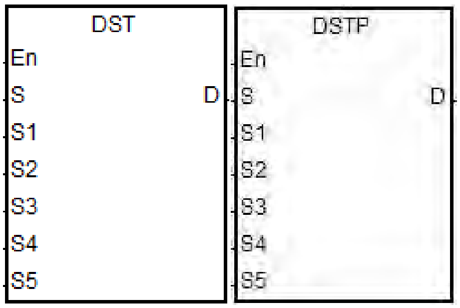
1. If **S**$_1$+2, **S**$_2$+2, **S**+2, or **D**+2 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the values in **S**$_1$, **S**$_2$, and **S** exceed the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003
3. If users declare the operand **S**$_1$ in ISPSoft, the data type will be ARRAY [3] of WORD/INT.
4. If users declare the operand **S**$_2$ in ISPSoft, the data type will be ARRAY [3] of WORD/INT.
5. If users declare the operand **S** in ISPSoft, the data type will be ARRAY [3] of WORD/INT.
6. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [3] of WORD/INT.

API	Instruction code		Operand	Function
1607	DST	P	**S, S_1, S_2, S_3, S_4, S_5, D**	Daylight saving time

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S					●	●		●					○	○			
S_1					●	●		●					○	○			
S_2					●	●		●					○	○			
S_3					●	●		●					○	○			
S_4					●	●		●					○	○			
S_5					●	●		●					○	○			
D		●	●	●				●									

Pulse instruction	16-bit instruction (15 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Daylight saving time function codes

S_1 : Month of the daylight saving start time

S_2 : Date of the daylight saving start time

S_3 : Month of the daylight saving end time

S_4 : Date of the daylight saving end time

S_5 : Change due to daylight saving time (minutes)

D : The state of the daylight saving function

Explanation:

Explanation

1. Operands used in this instruction are described below:

   S: Daylight saving time function codes

Function codes	Description
0	Disable daylight saving time
1	Enable daylight saving time mode 1
2	Read daylight saving time
3	Enable daylight saving time mode 1
4	Disable daylight saving time (set by the system)
5	Daylight saving time mode 1 enabled (set by the system)
7	Daylight saving time mode 2 enabled (set by the system)
6, 8~	Reserved or viewed as reading daylight saving time

Note 1: When the code in **S** is 4, 5 or 7, the execution of instruction is of no use.

Note 2: Read more for information on the various modes in the following sections.

S_1: setting for the month to start daylight saving time

S_2: setting for the date to start daylight saving time

S=1 (daylight saving time mode 1 enabled), **S_2:** settings for the date to start daylight saving time

S=3 (daylight saving time mode 2 enabled), **S_2:** settings for the week to start daylight saving time, **S_2**+1: on which weekday of **S_2**

S_3: setting for the month to end daylight saving time

S_4: settings for the date to end daylight saving time

S=1 (daylight saving time mode 1 enabled), **S_4:** settings for the date to end daylight saving time

S=3 (daylight saving time mode 2 enabled), **S_4:** settings for the week to end daylight saving time, **S_2**+1: on which weekday of **S_4**

S_5: settings for the change due to daylight saving time; unit: minute

D: stores the state of the daylight saving time; when the value in **D** is OFF, daylight saving time is disabled. When the value in **D** is ON, daylight saving time is enabled.

6

2. Descriptions on the value in function code S for daylight saving time functions

D.S.T State	S Function Code	Description
Disabled	0	Disabled daylight saving time function
Enabled	1, 3	Enabled daylight saving time function
Read	2	Read the daylight saving time setting

- **Disabled daylight saving time function (refer to example 1 below)**
  When the operand **S** is 0, the function of daylight saving time is disabled. When **S** is set to disable the daylight saving time, the values in **S_1–S_5** are irrelevant and the operand D shows the daylight saving time state as OFF.

- **Enabled daylight saving time function (refer to example 2 and 3)**
  When the value in S is 1 or 3, daylight saving time function is enabled: **S_1 and S_2**: setting for the month to start daylight saving time; **S_3 and S_4**: setting for the month to end daylight saving time; **S_5**: settings for the change due to daylight saving time; unit: minute; the operand D shows the daylight saving time state. When the function of daylight saving time is enabled and the system runs for the first time during the start time (**S_1**, **S_2**), the system time adds the value set in **S_5** once. When the function of daylight saving time is disabled

and the system runs for the first time during the end time (**S_1**, **S_2**), the system time subtracts the value set in **S_5** once.

Modes for daylight saving

Mode 1 (S=1): enabled by month and date (refer to example 2)

Operand	Description
S_1	The month to start daylight saving time Range: 1-12
S_2	The date to start daylight saving time Range: 1-31
S_3	The month to end daylight saving time Range: 1-12
S_4	The date to end daylight saving time Range: 1-31
S_5	Time that changed due to daylight saving time; unit: minute Range: 1-1439 (within 1 day)

Note 1: If this function is enabled, the value in **D** is ON.

Note 2: If the date is set incorrectly, the daylight saving function cannot be enabled. The SM0 is ON, and the error code in SR0 is 16#200B. For example if a non-existed date is set, such as April 31, or the starting date is set smaller than the ending date in a calendar year, for example starting date is October 1 and ending date is April 01.

Note 3: If **S_5** is set out of range, the daylight saving function cannot be enabled. The SM0 is ON, and the error code in SR0 is 16#200B.

Mode 2 (S=3): enabled by week and weekday (refer to example 3)

Operand	Description
S_1	The month to start daylight saving time Range: 1-12
S_2 **S_2**+1	**S_2**: settings for the week to start daylight saving time; range: 1-4 **S_2**+1: on which weekday of the **S_2**; range: 1-7 (Monday: 1, Tuesday: 2…, Sunday: 7)
S_3	The month to end daylight saving time Range: 1-12
S_4 **S_4**+1	**S_4**: settings for the week to end daylight saving time; range: 1-4 **S_4**+1: on which weekday of the **S_4**; range: 1-7 (Monday: 1, Tuesday:

	2…, Sunday: 7)
S_5	Time that changed due to daylight saving time; unit: minute Range: 1-1439 (within 1 day)

Note 1: If this function is enabled, the value in **D** is ON.

Note 2: The setting range for **S_2** and **S_4** is 1— 4 or -1— -4. The value -1 indicates the last week of the month and -2 indicates the last 2^{nd} week. If the value in **S_2** is -2 and **S_2**+1 is 7, it indicates the last 2 Sunday of the month. If the date is set incorrectly, the daylight saving function cannot be enabled. The SM0 is ON, and the error code in SR0 is 16#200B.

Note 3: If the value in **S_2**+1 / **S_4**+1 is out of range, the default setting value is 7, indicating Sunday.

Note 4: If **S_5** is set out of range, the daylight saving function cannot be enabled. The SM0 is ON, and the error code in SR0 is 16#200B.

Note 5: If the device for operand **S_2** and **S_4** is K or 16#, the values are not saved, the SM0 is ON, and the error code in SR0 is 16#2003.

- **Read the daylight saving time function (refer to example 1-3)**

When the operand **S** is 2, the function of daylight saving time is being read. **S_1 and S_2**: setting for the month to start daylight saving time; **S_3 and S_4**: setting for the month to end daylight saving time; **S_5**: settings for the change due to daylight saving time; unit: minute. When **S** is set to read the state of the daylight saving function and the output state of **D** is ON, the PLC saves the setting values in the operands **S_1**–**S_5**. The device is set to **D** while **S** is set to read. If the device is set to K or 16#, the values are not saved, the SM0 is ON, and the error code in SR0 is 16#2003.

Adds 4 to the function codes in **S**, after the daylight saving state is read. For example, after the daylight saving state is read, the function codes 0, 1, 3 become 4, 5 and 7.

When the DST state is OFF, the operand and descriptions are shown below.

Operand	Description
S	Function code is 4, indicating the DST state is OFF.
S_1- S_5	Invalid operand
D	DST state is OFF.

When the DST state is ON and in mode 1, the operand and descriptions are shown below.

Operand	Description
S	Function code is 5, indicating the DST state is ON and in mode 1.
S_1	The month to start daylight saving time
S_2	The date to start daylight saving time
S_3	The month to end daylight saving time
S_4	The date to end daylight saving time
S_5	Time that changed due to daylight saving time; unit: minute
D	The DST state is ON (enabled).

When the DST state is ON and in mode 2, the operand and descriptions are shown below.

Operand	Description
S	Function code is 7, indicating the DST state is ON and in mode 2.
S_1	The month to start daylight saving time
S_2 **S_2**+1	**S_2**: settings for the week to start daylight saving time **S_2**+1: on which weekday of the **S_2**
S_3	The month to end daylight saving time
S_4 **S_4**+1	**S_4**: settings for the week to end daylight saving time **S_4**+1: on which weekday of the **S_4**
S_5	Time that changed due to daylight saving time; unit: minute
Operand	The DST state is ON (enabled).

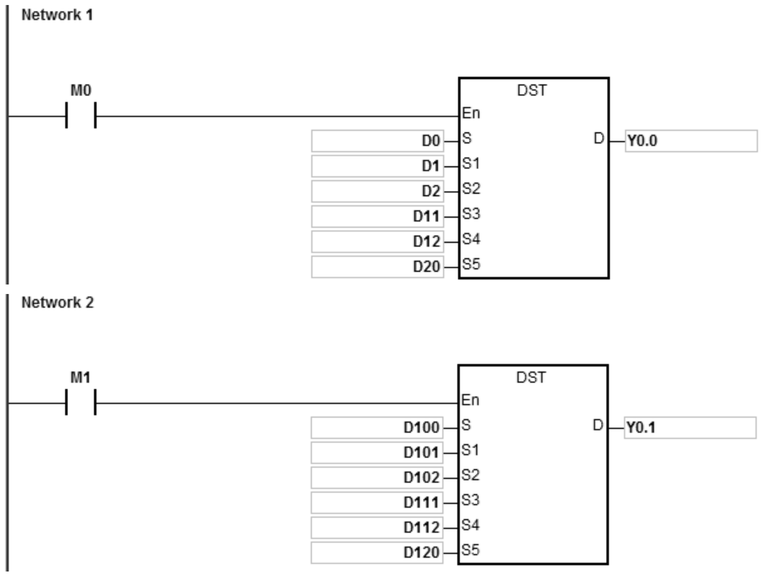
3. This instruction is to enable / disable the daylight saving time function. Whether the contact is normally open or close will not affect the daylight saving time setting. (refer to example 2 for more details on how to switch the contact M0 OFF=>ON) You can reset the daylight saving time by executing the instruction again. There is no need to disable and then enable this function to reset the daylight saving time.
4. When setting the daylight saving time to start on April 1st and to end on September 1st, and the duration is 60 minutes; the real-time clock goes like below.

Daylight saving time function disabled	Daylight saving time function enabled
1st March, 3 o'clock	1st March, 3 o'clock
31st March, 3 o'clock	31st March, 3 o'clock
1st April, 3 o'clock	1st April, 4 o'clock
1st May, 3 o'clock	1st May, 4 o'clock
1st June, 3 o'clock	1st June, 4 o'clock

1st July, 3 o'clock,	1st July, 4 o'clock
1st August, 3 o'clock	1st August, 4 o'clock,
31st August, 3 o'clock	31st August, 4 o'clock
1st September, 3 o'clock	1st September, 3 o'clock

Example 1

Disable DST function and read the DST state.



Setting values and descriptions:

Device	Setting Value	Description
D0	0	Disable DST function
D1	X	Invalid operand
D2	X	Invalid operand
D11	X	Invalid operand
D12	X	Invalid operand
D20	X	Invalid operand

Enable contact M0

Y0.0=OFF, indicating DST function is disabled.

D100=K2, indicating DST state is being read.

Enable contact M1

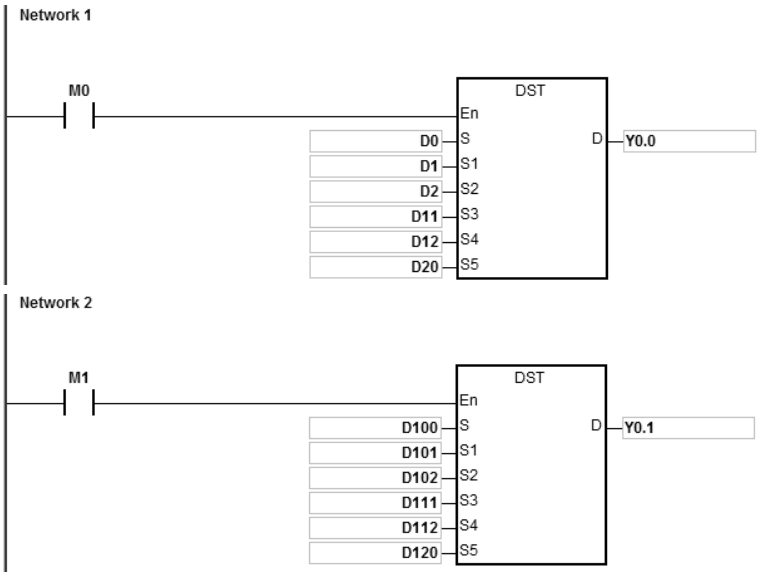
Setting values and descriptions:

Device	Setting Value	Description
D100	4	After firmware V1.04 (V1.04 included), function code is 4, indicating the DST state is OFF.
D101	X	Invalid operand
D102	X	Invalid operand
D111	X	Invalid operand
D112	X	Invalid operand
D120	X	Invalid operand
Y0.1	OFF	Node state is OFF.

Example 2

Enable DST function and read the DST state.

Set the DST to start on 1st April and to end on 3rd September and the duration is 60 minutes.



Setting values and descriptions:

Device	Setting Value	Description
D0	1	The DST state is ON and in mode 1.
D1	4	Starting month: April
D2	1	Starting date: the 1st
D11	9	Ending month: September
D12	3	Ending date: the 3rd
D20	60	Duration: 60 minutes

Enable contact M0

Y0.0=ON, indicating DST function is enabled.

The PLC system time adds 60 minutes when the date April 1st arrives, and subtracts 60 minutes when the date September 3rd arrives to end daylight saving time.

D100=K2, indicating DST state is being read.

Enable contact M1

Setting values and descriptions:

Device	Setting Value	Description
D100	5	Function code is 5, indicating the DST state is ON and in mode 1.
D101	4	Starting month: April
D102	1	Starting date: the 1st
D111	9	Ending month: September
D112	3	Ending date: the 3rd
D120	60	Duration: 60 minutes
Y0.1	ON	Node state is ON.

Enable the contact M0 OFF=>ON again; this act has no impact on the DST. The DST does not reset.

Setting values and descriptions:

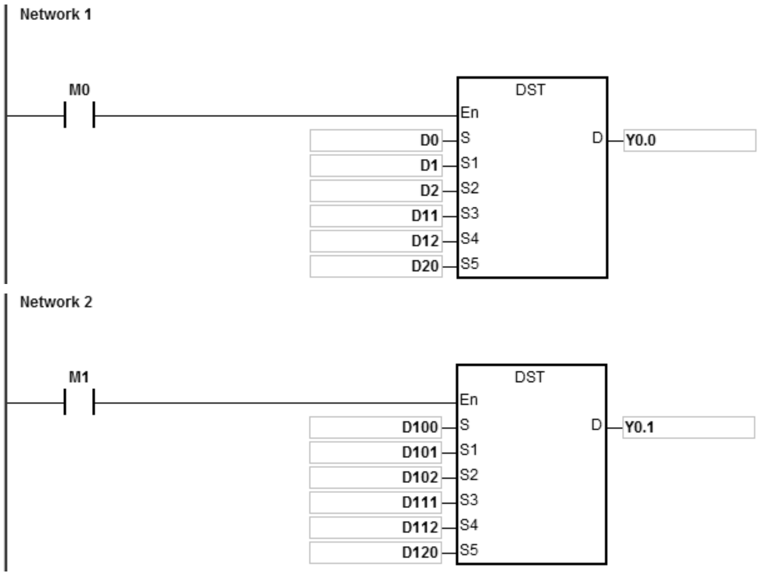
Device	Setting Value	Description
D100	5	Function code is 5, indicating the DST state is ON and in mode 1.
D101	4	Starting month: April
D102	1	Starting date: the 1st
D111	9	Ending month: September
D112	3	Ending date: the 3rd
D120	60	Duration: 60 minutes
Y0.1	ON	Node state is ON.

If the daylight saving time starts from 3 o'clock of 1st April, 60 minutes is added; the real-time clock shows 4 o'clock of 1st April. No matter how many times the contact M0 is disabled or enabled, the real-time clock keeps the same daylight saving time.

Example 3

Enable DST function and in mode 2.

Set the DST to start from the 2nd Wednesday of May and to end on 3rd Friday of September and the duration is 60 minutes.



Setting values and descriptions:

Device	Setting Value	Description
D0	3	The DST state is ON and in mode 2.
D1	5	Starting month: May
D2	2	Starting week number: the 2nd week
D3	3	Starting day: Wednesday
D11	9	Ending month: September
D12	3	Ending week number: the 3rd week
D13	5	Ending day: Friday
D20	60	Duration: 60 minutes

Enable contact M0

Y0.0=ON, indicating DST function is enabled.

For the year 2017, the 2nd Wednesday of May is 10th May and the 3rd Friday of September is 15th September. The PLC system time adds 60 minutes when the date May 10th arrives and subtracts 60 minutes when the date September 15th arrives to end daylight saving time.

D100=K2, indicating DST state is being read.

Enable contact M1

Setting values and descriptions:

Device	Setting Value	Description
D100	7	Function code is 4, indicating the DST state is ON and in mode 2.
D101	5	Starting month: May
D102	2	Starting week number: the 2nd week
D103	3	Starting day: Wednesday
D111	9	Ending month: September
D112	3	Ending week number: the 3rd week
D113	5	Ending day: Friday
D120	60	Duration: 60 minutes
Y0.1	ON	Node state is ON.

Additional remark:

DST instruction is available for the followings:

- AHCPU5X1-EN V2.01 or later
- AHCPU5X1-RS2 V1.03 or later
- AHCPU560-EN2 V1.10 or later

6.18 Peripheral Instructions

6.18.1 List of Peripheral Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
1700	TKY	DTKY	–	Ten-key keypad	7
1701	HKY	DHKY	–	Sixteen-key keypad	9
1702	DSW	–	–	DIP switch	9
1703	ARWS	–	–	Arrow keys	9
1704	SEGL	–	–	Seven-segment display with latches	7

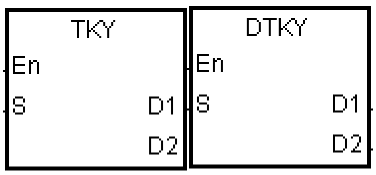
6.18.2 Explanation of Peripheral Instructions

API	Instruction code			Operand	Function
1700	D	TKY		**S, D_1, D_2**	Ten-key keypad

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●	●	●				●	●				●				
D_1	●	●			●	●		●	●		●	○	●				
D_2		●	●	●				●	●				●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
-	AH500	AH500

Symbol:



S : Initial device — Bit

D_1 : Device in which the value is stored — Word/Double word

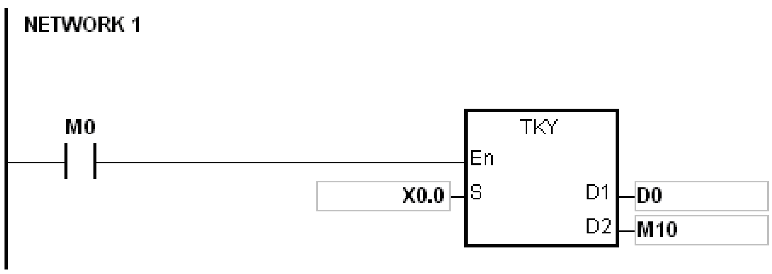
D_2 : Output signal — Bit

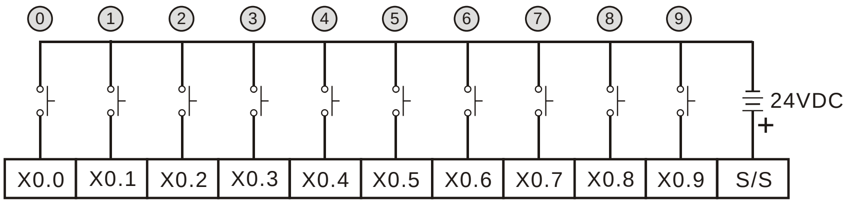
Explanation:

1. The ten external inputs starting from the input specified by **S** represents 0~9 in the decimal system. They are connected to ten keys. Users can enter a four-digit decimal value or an eight-digit decimal value by pressing the keys in order. The decimal value is stored in **D_1**, and the output signals are stored in **D_2**.
2. The operand **S** occupies ten bits.
3. The operand **D_2** occupies eleven bits. Please do not change the states of the bits during the execution of the instruction.
4. When the conditional contact is not enabled, the eleven bits starting from the bit specified by **D_2** is OFF.
5. When the on-line editing is used, please reset the conditional contact to initialize the instruction.

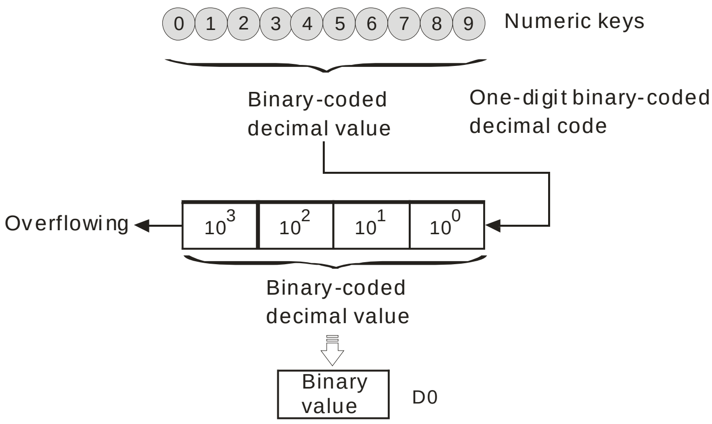
Example:

1. The ten external inputs starting from X0.0 is connected to ten keys which represent 0~9 in the decimal system. When M0 is ON, the instruction is executed. The value that users enter is stored as a binary value in D0, and the output signals are stored in M10~M19.

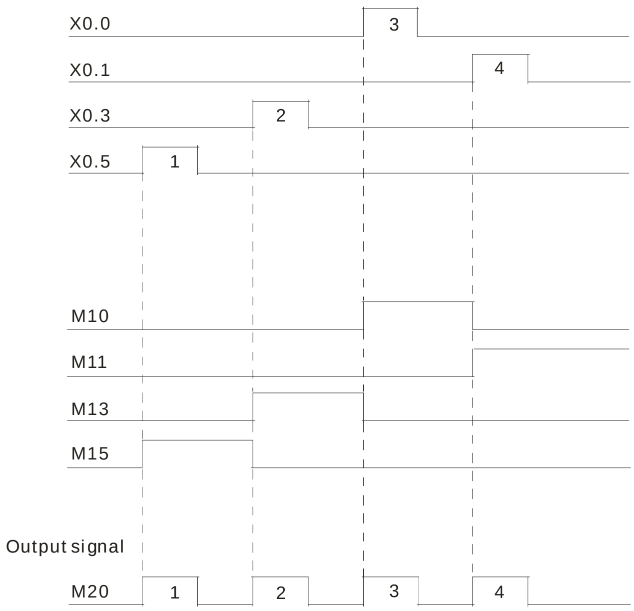




Note: The digital input module AH16AM10N-5A is used in this example.



2. If the keys connected to X0.5, X0.3, X0.0, and X0.1 are pressed in the order shown in the timing chart, the result 5,301 is stored in D0. The maximum value which can be stored in D0 is 9,999. If the value exceeds four digits, the first digit from the left overflows.
3. After the key connected to the X0.2 is pressed and before other keys are pressed, M12 is ON. The same applies to other keys.
4. When a key connected to the input within the range between X0.0 and X0.9 is pressed, the corresponding output within the range between M10 and M19 is ON.
5. When one of the keys is pressed, M20 is ON.
6. When the conditional contact M0 is switched OFF, the value which was stored in D0 is unchanged. However, M10~M20 are switched OFF.



Additional remark:

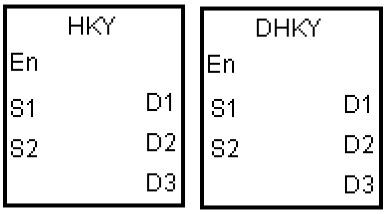
1. If users declare the operand **S** in ISPSoft, the data type will be ARRAY [10] of BOOL.
2. If users declare the operand **D**$_2$ in ISPSoft, the data type will be ARRAY [11] of BOOL.

API	Instruction code			Operand	Function
1701	D	HKY		**S, D$_1$, D$_2$, D$_3$**	Sixteen-key keypad

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S$_1$	●																
S$_2$	●	●			●	●		●	●				●				
D$_1$		●															
D$_2$	●	●			●	●		●	●		●	○	●				
D$_3$		●	●	●				●	●				●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction (9 steps)
-	AH500	AH500

Symbol:



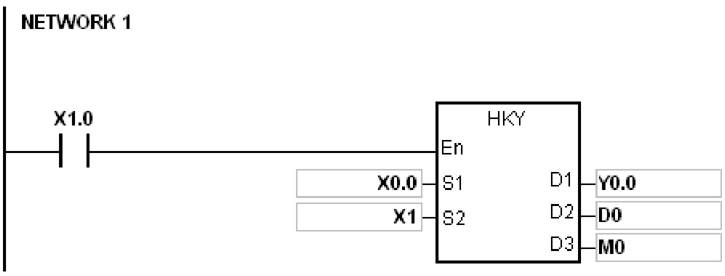
S$_1$	:	Initial input device	Bit
S$_2$	:	For system use only	Word
D$_1$	:	Initial output device	Bit
D$_2$	:	Device in which the value is stored	Word/Double word
D$_3$	:	Output signal	Bit

Explanation:

1. The four external inputs starting from the input specified by **S** are connected to the four external outputs starting from the output specified by **D$_1$** to form a 16-key keypad. The value that users enter by pressing the keys is stored in **D$_2$**, and the output signals are stored in **D$_3$**. If several keys are pressed simultaneously, the value which is smaller is stored.
2. The value that users enter by pressing the keys is temporarily stored in **D$_2$**. If the 16-bit instruction HKY is executed, the maximum value which can be stored in **D$_2$** is 9,999. If the value exceeds four digits, the first digit from the left overflows. If the 32-bit instruction DHKY is executed, the maximum value which can be stored in **D$_2$** is 9,999. If the value exceeds eight digits, the first digit from the left overflows.
3. After the execution of the instruction is complete, SM692 is ON. That is to say, SM692 is ON for a scan cycle after the execution of the matrix scan is complete.

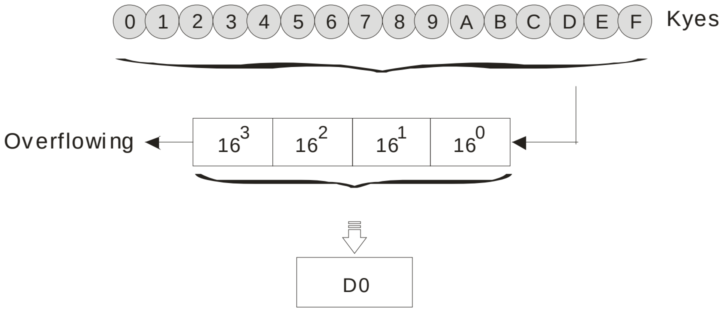
Example:

1. The four external inputs X0.0~X0.3 are connected to the four external outputs Y0.0~Y0.3 to form a 16-key keypad. When X1.0 is ON, the instruction is executed. The value that users enter is stored as a binary value in D0, and the output signals are stored in M0~M7.

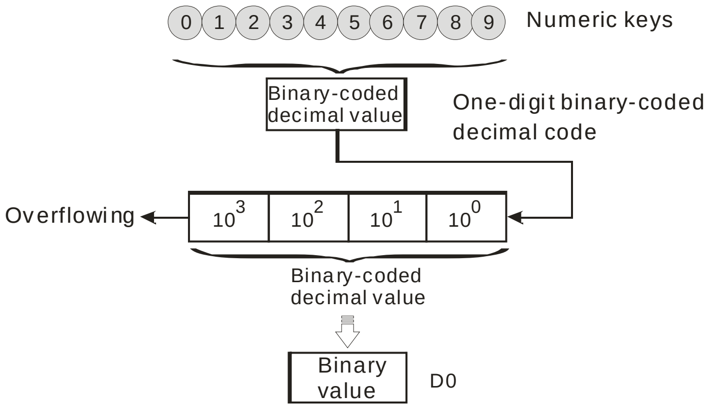


The function of SM691:

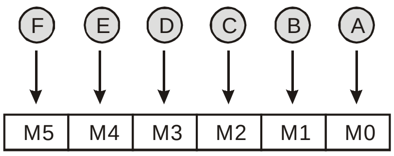
- If SM691 is ON, 0~F are taken as hexadecimal values in the execution of the instruction HKY.
    - ■ Numeric keys:



- If SM691 is OFF, A~F are taken as function keys in the execution of the instruction HKY.
    - ■ Numeric keys:

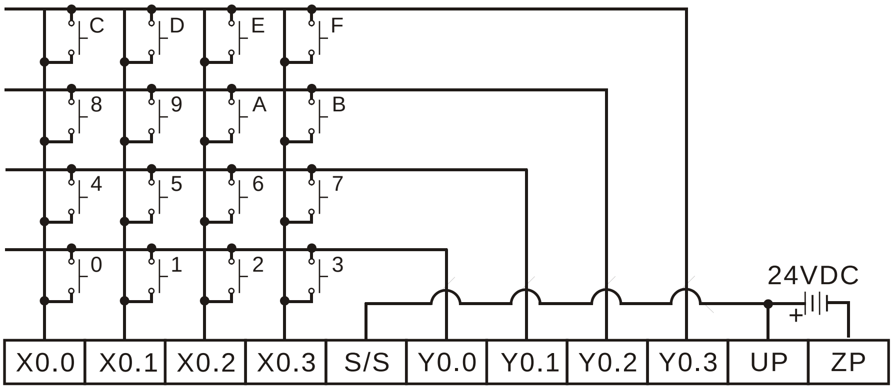


    - ■ Function keys:
        - ◆ When A is pressed, M0 keeps ON. When D is pressed, M0 is switched OFF, and M3 keeps ON.
        - ◆ If several function keys are pressed, the key which is pressed first has priority.



2. Output signals:
    - When a key within the range between A and F is pressed, M6 is ON.
    - When a key within the range between 0 and 9 is pressed, M7 is ON.
3. When the conditional contact X1.0 is switched OFF, the value which was stored in D0 is unchanged. However, M0~M7 are switched OFF.

4. The external wiring:



Note: The transistor output module AH16AP11T-5A is used in this example.

Additional remark:

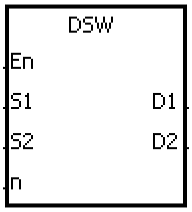
1. If users declare the operand **S** in ISPSoft, the data type will be ARRAY [4] of BOOL.
2. If users declare the operand $\mathbf{D_1}$ in ISPSoft, the data type will be ARRAY [4] of BOOL.
3. If users declare the operand $\mathbf{D_3}$ in ISPSoft, the data type will be ARRAY [8] of BOOL.

API	Instruction code	Operand	Function
1702	DSW	**S, D_1, D_2, n**	DIP switch

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●																
S_2	●	●			●	●		●	●				●				
D_1		●															
D_2	●	●			●	●		●	●				●				
n	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
-	AH500	-

Symbol:



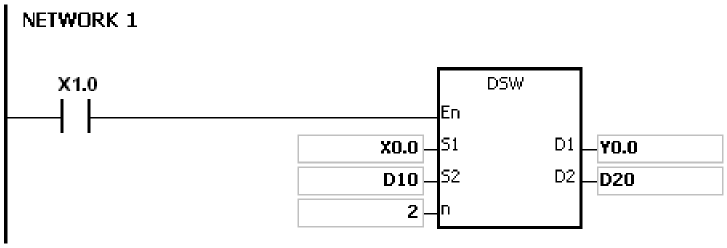
S_1	:	Initial input device	Bit
S_2	:	For system use only	Word
D_1	:	Initial output device	Bit
D_2	:	Device in which the value is stored	Word
n	:	Number of DIP switches	Word

Explanation:

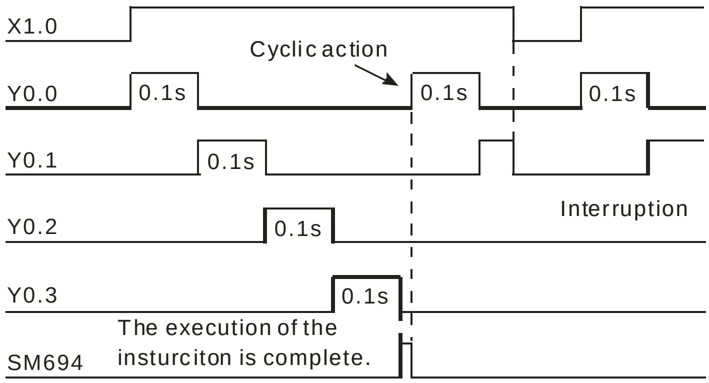
1. The four or eight external inputs starting from the input specified by **S_1** are connected to the four external outputs starting from the output specified by **D_1** to form a four-digit DIP switch or two four-digit DIP switches. The value that users enter by pressing the DIP switch is stored in **D_2**. Whether there is one four-digit DIP switch or two four-digit DIP switches depends on **n**.
2. If **n** is 1, the operand **D_2** occupies one register. If **n** is 2, the operand **D_2** occupies two registers.
3. **S_2** and **S_2**+1, which are for system use only, occupy two devices. Please do not alter the values in these devices.
4. After the execution of the instruction is complete, SM694 is ON for a scan cycle.
5. When the conditional contact is not enabled, the four external outputs starting from the output specified by **D_1** keep OFF.
6. When the on-line editing is used, please reset the conditional contact to initialize the instruction.

Example:

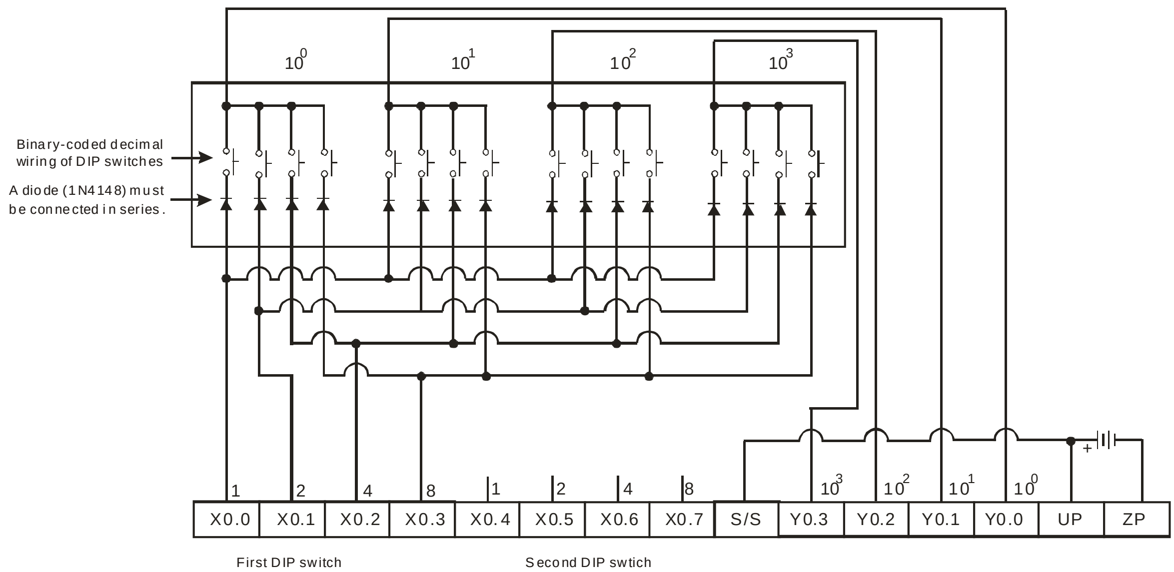
1. X0.0~X0.3 are connected to Y0.0~Y0.3 to form the first DIP switch, and X0.4~X0.7 are connected to Y0.4~Y0.7 to form the second DIP switch. When X1.0 is ON, the instruction is executed. The value that users enter by pressing the first DIP switch is converted into the binary value, and the conversion result is stored in D20. The value that users enter by pressing the second DIP switch is converted into the binary value, and the conversion result is stored in D21.



2. When X1.0 is ON, Y0.0~Y0.3 are ON cyclically. After the execution of the instruction is complete, SM694 is ON for a scan cycle.
3. The outputs Y0.0~Y0.3 must be transistors.



4. The DIP switches:



Note: The transistor output module AH16AP11T-5A is used in this example.

Additional remark:

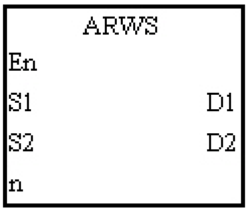
1. If **n** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
2. If users declare the operand $\mathbf{D_1}$ in ISPSoft, the data type will be ARRAY [4] of BOOL.

API	Instruction code	Operand	Function
1703	ARWS	**S, D_1, D_2, n**	Arrow keys

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●	●	●	●				●	●				●				
S_2	●	●			●	●		●	●				●				
D_1	●	●			●	●		●	●			○	●				
D_2		●															
n	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
-	AH500	-

Symbol:



S_1 : Initial input device — Bit

S_2 : For system use only — Word

D_1 : Device in which the setting value is stored — Word

D_2 : Initial output device — Bit

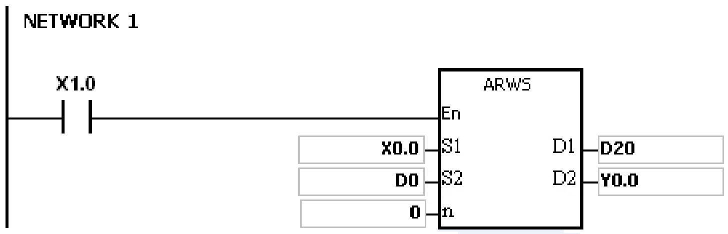
n : Positive/Negative logic — Word

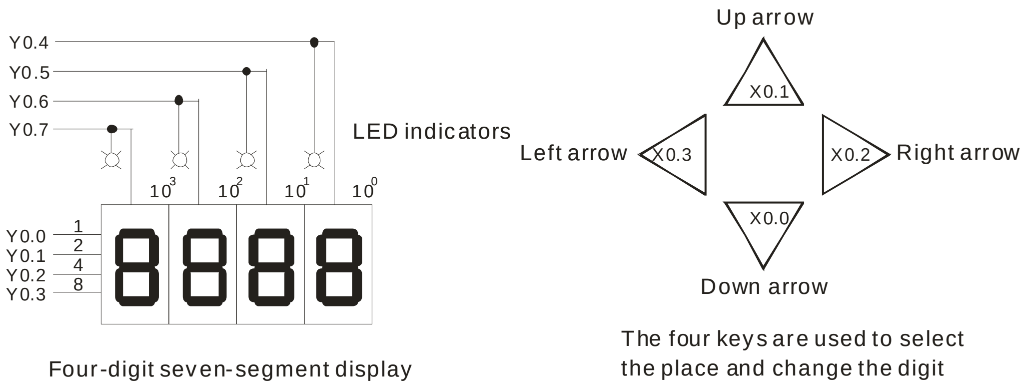
Explanation:

1. If the instruction is executed, **S_1** is defined as the down arrow, **S_1**+1 is defined as the up arrow, **S_1**+2 is defined as the right arrow, and **S_1**+3 is defined as the left arrow. The setting value is stored in **D_1**, and it should be within the range between 0 and 9,999.
2. The operand **S_1** occupies four consecutive bit devices.
3. **S_2** is for system use only. Please do not alter the value in it.
4. The operand **D_2** occupies eight consecutive bit devices.
5. When the conditional contact is not enabled, the eight bit devices starting from the bit device specified by **D_2** keep OFF.
6. The operand n should be within the range between 0 and 3. Please refer to the additional remark on the instruction SEGL for more information.
7. When the on-line editing is used, please reset the conditional contact to initialize the instruction.

Example:

1. If the instruction is executed, X0.0 is defined as the down arrow, X0.1 is defined as the up arrow, X0.2 is defined as the right arrow, and X0.3 is defined as the left arrow. The setting value is stored in D20, and it should be within the range between 0 and 9,999.
2. When X1.0 is ON, the digit in the place 10^3 is selected. If the left arrow is pressed, the places are selected in sequence ($10^3 \rightarrow 10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$).
3. If the right arrow is pressed, the places are selected in sequence ($10^3 \rightarrow 10^2 \rightarrow 10^1 \rightarrow 10^0 \rightarrow 10^3 \rightarrow 10^2$). The LED indicators with the corresponding places are connected to Y0.4~Y0.7. When the digits in the places are selected in sequence, the LED indicators are ON in sequence.
4. If the up arrow is pressed, the digit in the place selected changes (0→1→2→…8→9→0→1). If the down arrow is pressed, the digit in the place selected changes (0→9→8→…1→0→9). The new digit is shown on seven-segment display.





Additional remark:

1. If **n** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
2. If users declare the operand $\mathbf{S_1}$ in ISPSoft, the data type will be ARRAY [4] of BOOL.
3. If users declare the operand $\mathbf{D_2}$ in ISPSoft, the data type will be ARRAY [8] of BOOLL.

API	Instruction code	Operand	Function
1704	SEGL	**S, D, n**	Seven-segment display with latches

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●	○	●				
S_2	●	●			●	●		●	●				●				
D		●															
n	●	●						●	●		●		●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
-	AH500	-

Symbol:

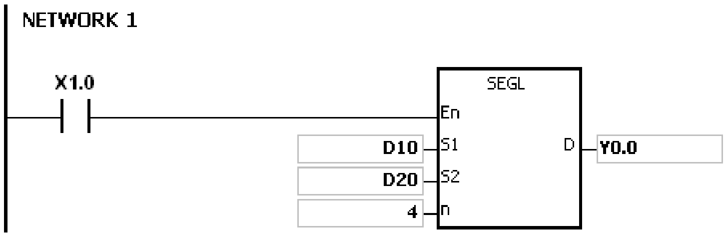
S_1	:	Source device	Word
S_2	:	For system use only	Word
D	:	Initial output device	Bit
n	:	Positive/Negative logic	Word

Explanation:

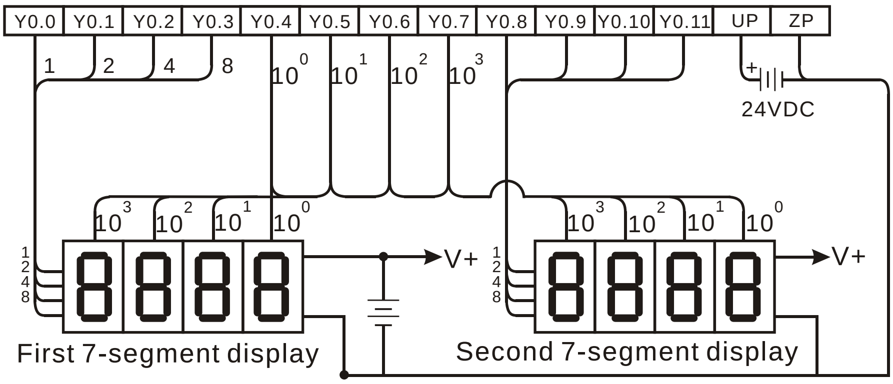
1. The eight external outputs starting from the output specified by **D** are connected to a four-digit seven-segment display, or the twelve external outputs starting from the output specified by **D** are connected to two four-digit seven-segment displays. Every place is equipped with a driver which converts a binary-coded decimal value into seven-segment data, and every driver is equipped with a latch which can be used to store state information.
2. The value in **S_1** is the value which will be shown on first seven-segment display, and the value in **S_1**+1 is the value which will be shown on second seven-segment display.
3. **S_2** is for system use only. Please do not alter the value in it.
4. The operand **n** should be within the range between 0 and 7. Please refer to the additional remark for more information.
5. Whether there is one four-digit seven-segment display or two four-digit seven-segment displays, and whether an output is a positive logic output or a negative logic output depend on **n**.
6. If there is one four-digit seven-segment display, eight outputs are occupied. If there are two four-digit seven-segment displays, twelve outputs are occupied.
7. When the instruction is executed, the outputs are ON cyclically. If the conditional contact is switched from OFF to ON during the execution of the instruction, the outputs are ON cyclically again.
8. After the execution of the instruction is complete, SM693 is ON for a scan cycle.

Example:

1. When X1.0 is ON, the instruction is executed. Y0.0~Y0.4 form a circuit. The value in D10 is converted into the binary-coded decimal value, and the conversion result is shown on first seven-segment display. The value in D11 is converted into the binary-coded decimal value, and the conversion result is shown on second seven-segment display. If the value in D10 or D11 exceeds 9,999, the operation error occurs.



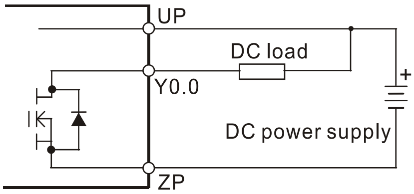
2. When X1.0 is ON, Y0.4~Y0.7 are ON cyclically. It takes twelve scan cycles for Y0.4~Y0.7 to be ON. After the execution of the instruction is complete, SM693 is ON for a scan cycle.
3. If there is on four-digit seven-segment display, **n** is within the range between 0 and 3.
   - After the pins 1, 2, 4, and 8 are connected in parallel, they are connected to Y0.0~Y0.3 on the PLC, and the latches are connected to Y0.4~Y0.7 on the PLC.
   - When X1.0 is ON, the instruction is executed. Y0.4~Y0.7 are ON cyclically, and the value in D10 is shown on seven-segment display.
4. If there are two four-digit seven-segment displays, **n** is within the range between 4 and 7.
   - After the pins 1, 2, 4, and 8 are connected in parallel, they are connected to Y0.8~Y0.11 on the PLC, and the latches are connected to Y0.4~Y0.7 on the PLC.
   - The value in D10 is shown on first seven-segment display, and the value in D11 is shown on second seven-segment display. If the values in D10 and D11 are 1234 and 4321 respectively, 1234 is shown on second seven-segment display.
5. The wiring:



Note: The transistor output module AH16AN01T-5A is used in this example.

Additional remark:

1. Whether an output is a positive output or a negative output, and whether there is one four-digit seven-segment display or two four-digit seven-segment displays depend on **n**.
2. The outputs on the PLC should be NPN transistors whose collectors are open collectors. Besides, an output has to connect a pull-up resistor to the DC power supply (less than 30 V DC). Therefore, when an output is ON, a signal of low potential is output.



- The negative logic:

Binary-coded decimal value				Output (Binary-coded decimal code)				Signal			
b_3	b_2	b_1	b_0	8	4	2	1	A	B	C	D
0	0	0	0	0	0	0	0	1	1	1	1
0	0	0	1	0	0	0	1	1	1	1	0
0	0	1	0	0	0	1	0	1	1	0	1
0	0	1	1	0	0	1	1	1	1	0	0
0	1	0	0	0	1	0	0	1	0	1	1
0	1	0	1	0	1	0	1	1	0	1	0
0	1	1	0	0	1	1	0	1	0	0	1
0	1	1	1	0	1	1	1	1	0	0	0
1	0	0	0	1	0	0	0	0	1	1	1
1	0	0	1	1	0	0	1	0	1	1	0

- The positive logic:

Binary-coded decimal value				Output (Binary-coded decimal code)				Signal			
b_3	b_2	b_1	b_0	8	4	2	1	A	B	C	D
0	0	0	0	1	1	1	1	0	0	0	0
0	0	0	1	1	1	1	0	0	0	0	1
0	0	1	0	1	1	0	1	0	0	1	0
0	0	1	1	1	1	0	0	0	0	1	1
0	1	0	0	1	0	1	1	0	1	0	0
0	1	0	1	1	0	1	0	0	1	0	1
0	1	1	0	1	0	0	1	0	1	1	0
0	1	1	1	1	0	0	0	0	1	1	1
1	0	0	0	0	1	1	1	1	0	0	0
1	0	0	1	0	1	1	0	1	0	0	1

- The latch:

Positive logic		Negative logic	
Latch	Signal	Latch	Signal
1	0	0	1

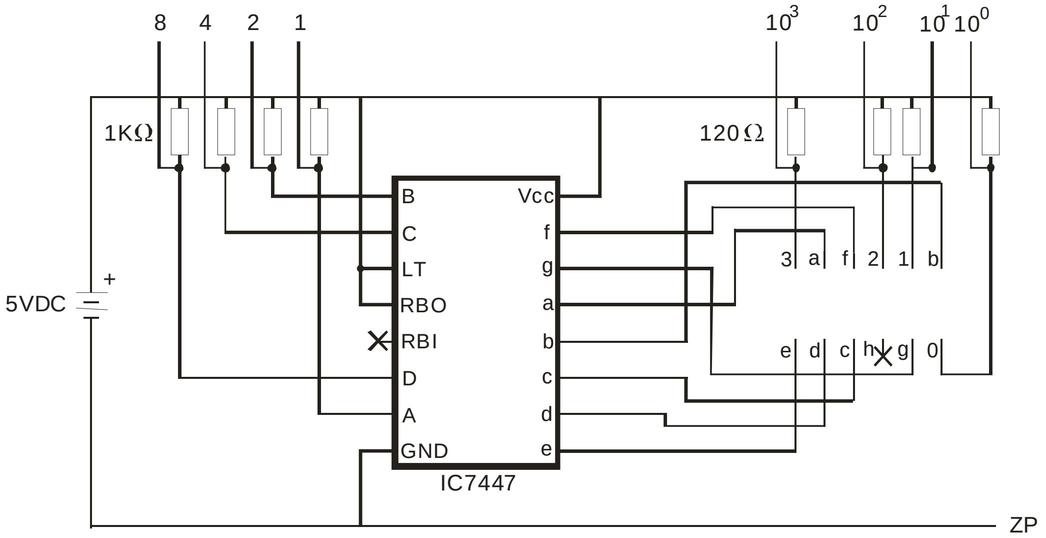
- The setting value of the parameter **n**:

Number of seven-segment displays	One				Two			
Output (Binary-coded decimal code)	+		-		+		-	
Latch	+	-	+	-	+	-	+	-
n	0	1	2	3	4	5	6	7

'+': Positive logic

'-': Negative logic

- The connection of the common-anode four-digit seven-segment display with IC 7447 is as follows.



6.19 Communication Instructions

6.19.1 List of Communication Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
1800	RS	–	–	Transmitting the user-defined communication command	9
1801	FWD	–	–	The AC motor drive runs clockwise.	7
1802	REV	–	–	The AC motor drive runs counterclockwise.	7
1803	STOP	–	–	The AC motor drive stops.	3
1804	RDST	–	–	Reading the statuses of the AC motor drives	5
1805	RSTEF	–	–	Resetting the abnormal AC motor drives	3
1806	LRC	–	✓	Longitudinal parity check	7
1807	CRC	–	✓	Cyclic Redundancy Check	7
1808	MODRW	–	–	Reading/Writing the MODBUS data	11
1812	COMRS	–	–	Sending and receiving communication data	11

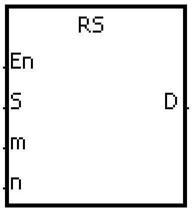
6.19.2 Explanation of Communication Instructions

API	Instruction code	Operand	Function
1800	RS	S, m, D, n	Transmitting the user-defined communication command

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●		●	●				●				
m	●	●			●	●		●	●				●	○	○		
D	●	●			●	●		●	●				●				
n	●	●			●	●		●	●				●	○	○		

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
-	AH500	-

Symbol:



S	:	Initial transmission device	Word
m	:	Number of data which is sent	Word
D	:	Initial reception device	Word
n	:	Number of data which is received	Word

Explanation:

1. The instruction is for the CPU module equipped with RS-232/422/485. Once the setups are done in the S, m, D, and n, the instruction can be executed. When using the E (modifying device) in the beginning position, do not change the values in E during operation to avoid errors in data reading or writing.
2. The m and n can be 0, when the instruction is used for sending or receiving data.
3. The instruction can be used several times in the program, but one instruction is executed at a time.
4. During the execution of the instruction RS, the data alteration is invalid.
5. The maximum transmission length (m, n) is 1000 characters (bytes).
6. Modes of 8-bit or 16-bit (SM106/SM107) for this instruciton can be selected by setting up the special register.
7. If the communication protocol used with the device is consistent with MODBUS, users can use the instruction MODRW. Please refer to the related instruction explanations for more details.

Communication setup

Before executing the serial communication instruction, users need to set up the communication methods (RS232/485, transmission speed). Users can set up the PLC communication port in HWCONFIG or set values in the relative spcial auxiliary relays to set up the communication.

1. Please refer to ISPSoft manual for more information on communication setups in HWCONFIG.
2. For setting values, communications, register formats in the relative special auxiliary relays, plese refer to the additional remarks in this section.

Data transmission format

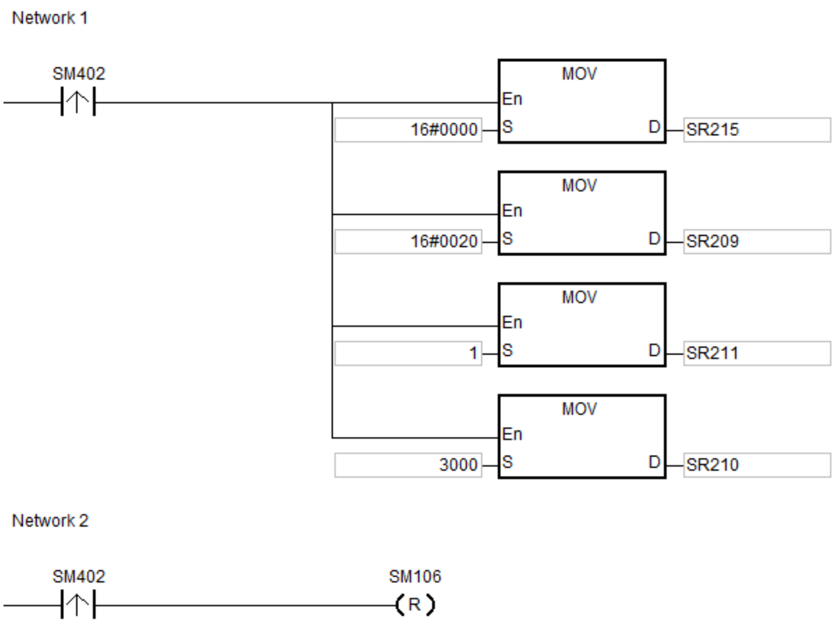
There are 2 modes for data transmission, 8-bit mode and 16-bit mode. For the 16-bit mode, data is divided into the high 8-bit data and the low 8-bit data. As for the 8-bit mode, the high 8-bit data is ignored, and the low 8-bit data can be sent or received.

8-bit mode, data transmission 0x01234567							
D10 (high)	D10 (low)	D11 (high)	D11 (low)	D12 (high)	D12 (low)	D13 (high)	D13 (low)
*	16#01	*	16#23	*	16#45	*	16#67
16-bit mode, data transmission 0x1234567							
D10		D11		D12		D13	
16#2301		16#6745					

Communication protocol setup example:

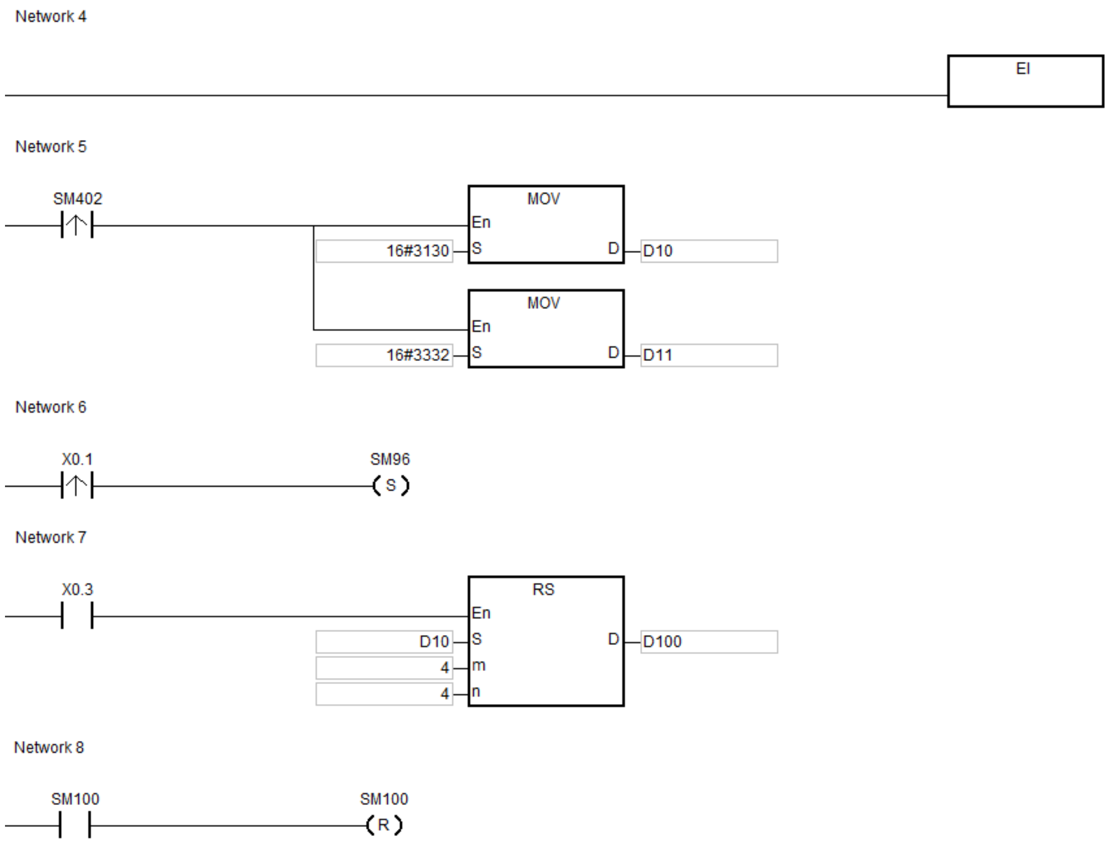
1. The communication setup for this example is RS232 9600, 7, N, 1.
2. Communication port for data transmission is RS232 (SR215=0).
3. The transmission speed and format for the communicationport are 9600, 7, N, 1 (SR209=16#0020).
4. Set the number of times the command is resent (SR211=1).
5. Set the communication timeout to 3000ms (SR210=3000).
6. Set the communication mode to 16-bit mode (SM106=OFF).
7. Enable the communication protocol (SM209=ON).

For users who set up the communication port in ISPSoft - > HWCONFIG - > COM Port, this step can be ignored.

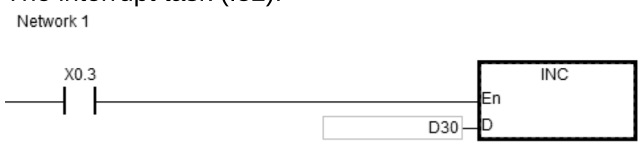


Example:

1. Users can set up the PLC communication port in HWCONFIG or set values in the relative spcial auxiliary relays to set up the communication (as the example stated).
2. Write the data which will be sent into the registers starting from D10, and then set SM96 to ON.
3. When X0.1 and X0.3 are ON, the instruction RS is executed. The data in the **n** registers starting from D10 is sent. After the sending of the data is complete, SM96 is reset to OFF automatically. (Please do not use the instruction RST to reset SM96.) If there is data which needs to be received, the data is stored in the registers starting from D100.
4. After the receiving of the data is complete, SM100 is ON. Besides, SM100 has to be reset to OFF after the data which has been received is processed. Please do not execute the instruction RST continuously.
5. If the command which the PLC receives includes a special character (SR621), I32 will be triggered. The value in D30 will increase by one.



The interrupt task (I32):




Network 1
X0.3
INC
En
D30
D

Additional remark:

1. If the value in m or n exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
2. The flags related to the instruction RS/MODRW:

Flag		Description	Action
COM1	COM2		
SM96	SM97	The data is sent through COM1/COM2. If users want to use the instruction RS/MODRW to send and receive the data, they have to use the pulse instruction to set SM96/SM97 to ON. When the instruction is executed, the PLC sends and receives the data. After the sending of the data is complete, the system automatically resets SM96/SM97 to OFF.	Users set the flag to ON, and the system automatically resets it to OFF.
SM98	SM99	When SM98/SM99 is ON, the PLC is waiting to receive the data.	The system automatically sets the flag to ON and resets it to OFF.
SM100	SM101	Reception through COM1/COM2 is complete. After the receiving of the data is complete, the system automatically sets SM100/SM101 to ON. When SM100 is ON, the data received can be processed. After the processing of the data received is complete, users have to reset SM100/SM101 to OFF.	The system automatically sets the flag to ON, and users reset it to OFF.
SM102	SM103	An error occurs during the reception of the data by using the instruction MODRW or the instruction RS. The error codes are recorded in the error logs.	The system automatically sets the flag to ON, and users reset it to OFF.
SM104	SM105	If users set the communication timeout (in SR210/ SR211, SR213/ SR214) and no data is received after the timeout period, the flag is ON. After the problem is solved, users have to reset SM104/SM105 to OFF.	The system automatically sets the flag to ON, and users reset it to OFF.
SM106	SM107	The choice between the 8-bit processing mode and the 16-bit processing mode ON: The 8-bit processing mode OFF: The 16-bit processing mode	Users set the flag to ON and reset it to OFF.
SM108	SM109	Data reception complete flag The receiving of data through COM1 is complete. ON: when the PLC receives data, it will determine whether there is any interrupt characters (SR621/SR622 low byte). If there is, it will run the interrupt task and then stop receiving data even if there is data that have not been received. OFF: when the PLC receives data, it will determine whether there is any interrupt characters (SR621/SR622 low byte). If there is, it will run the interrupt task and after that it will continue receiving data till the reception is complete. The receiving data length is n (default).	Users set the flag to ON and reset it to OFF.

Flag		Description	Action
COM1	**COM2**		
SM209	SM211	The communication protocol changes in accordance with the setting values in SR201, SR202, SR209, SR210, SR211, SR212, SR213, SR214, SR215, SR216, SM210, and SM212. If SM209/SM211 is set to ON, the communication protocol of COM1/COM2 changes in accordance with the setting values in SR201, SR202, SR209, SR210, SR211, SR212, SR213, SR214, SR215, SR216, SM210, and SM212. Besides, the system automatically resets SM209/SM211 to OFF.	Users set the flag to ON, and the system automatically resets it to OFF.

3. The special data registers related to the instruction RS/MODRW:

Special data register		Description
COM1	**COM2**	
SR201	SR202	The communication address of COM1/COM2 on the PLC as a slave
SR210	SR213	Communication timeout Suppose the setting value is larger than 0. When the instruction RS/MODRW is executed, SM104/SM105 is set to ON if no data is received after the timeout period or the intervening time of the two characters exceeds the setting value. After the problem is solved, users have to reset SM104/SM105 to OFF. The register can be set to 0 in the RS instruction and the communication timeout monitoring will be disabled. The MODRW instruction should be set between 100~65535 (ms).
SR621	X	The interrupt character used in the instruction RS If the character received is the low 8-bit data in SR621, I32 will be triggered. If **n** is 0, the interrupt task will not be triggered.
X	SR622	The interrupt character used in the instruction RS If the character received is the low 8-bit data in SR622, I33 will be triggered. If **n** is 0, the interrupt task will not be triggered.

4. SR215, SR216 are used for recording the PLC communication interface. The codes are shown in the following table.

Code	0	1	2
Communication Interface	RS232	RS485	RS422

5. SR209 and SR212: The setting values of the communication protocols RS485/232 are shown in the following table.

b0	Data length	7 (value=0)	8 (value=1)
b1 b2	Parity bits	00 : 00	
		01 : 01	
		10 : 10	
b3	stop bits	1 bit (value=0)	2 bits (value=1)
b4 b5 b6 b7	0001 (16#1) :	4800	
	0010 (16#2) :	9600	
	0011 (16#3) :	19200	
	0100 (16#4) :	38400	
	0101 (16#5) :	57600	

	0110	(16#6)	:	115200	
	0111	(16#7)	:	230400	RS-232 does not support the baud rate.
	1000	(16#8)	:	460800	RS-232 does not support the baud rate.
	1001	(16#9)	:	921600	RS-232 does not support the baud rate.
b8~b15	Undefined (reserved)				

6. The data transmission speed is as follows.

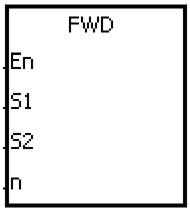
Baud rate (bps)	RTU timeout timer (ms)	Baud rate (bps)	RTU timeout timer (ms)
4800	9	115200	1
9600	5	230400	1
19200	3	460800	1
38400	2	921600	1
57600	1		

API	Instruction code			Operand	Function
1801		FWD		S_1, S_2, n	The AC motor drive runs clockwise.

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1								●	●				●	○	○		
S_2								●	●				●	○	○		
n								●	●				●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
-	AH500	-

Symbol:



S_1 : Unit address — Word

S_2 : Operation frequency of the AC motor drives — Word

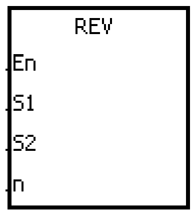
n : Mode — Word

API	Instruction code	Operand	Function
1802	REV	S_1, S_2, n	The AC motor drive runs counterclockwise.

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1								●	●				●	○	○		
S_2								●	●				●	○	○		
n								●	●				●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
-	AH500	-

Symbol:



S_1 : Unit address — Word

S_2 : Operation frequency of the AC motor drives — Word

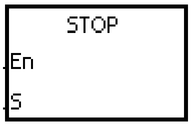
n : Mode — Word

API	Instruction code			Operand	Function
1803		STOP		S_1	The AC motor drive stops.

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1								●	●				●	○	○		

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
-	AH500	-

Symbol:



S_1 : Unit address Word

Explanation:

1. The instruction FWD/REV/STOP is for the Delta VFD series AC motor drives. FWD/REV/STOP has to be used with SR210 or SR213.
2. The operand **S_1** should be within the range between 0 and 255. If the station address is 0, it indicates that the PLC broadcasts to all AC motor drives.
3. Please refer to AC Motor Drives User Manual for more information about the setting of **S_2**. There is no **S_2** in the instruction STOP.
4. FWD: Clockwise running mode

    n=0: General clockwise running mode

    n=1: Jog clockwise running mode

    FWD does not support **n** if **n** is neither 0 nor 1.

    REV: Counterclockwise running mode

    n=0: General counterclockwise running mode

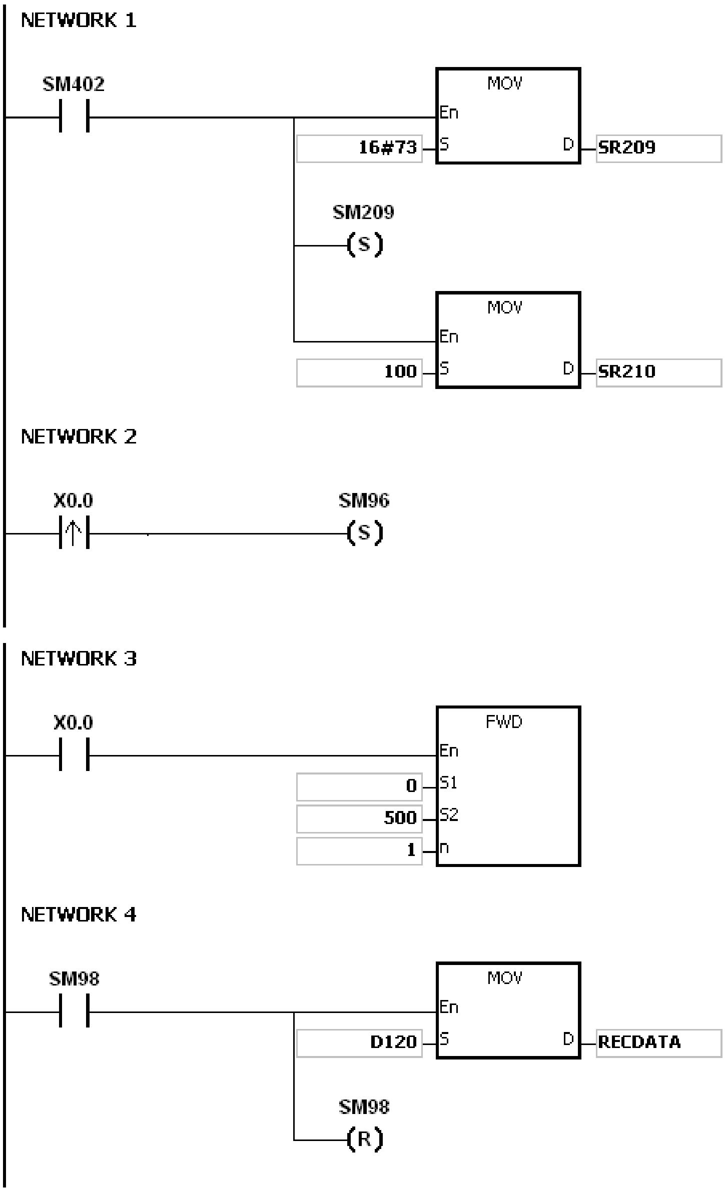
    n=1: Jog counterclockwise running mode

    REV does not support **n** if **n** is neither 0 nor 1.

    STOP: None
5. If the clockwise running mode is the jog clockwise running mode, **S_2** is ineffective. Users can refer to AC Motor Drives User Manual for more information about the modification of the jog frequency.

Example:

1. The PLC is connected to the VFD series AC motor drive. If the communication timeout occurs or an error occurs during the reception of the data, the PLC retries the sending of the command.



PLC⇨VFD

The PLC sends “：01 10 2000 0002 04 0012 01F4 C2 CR LF”.

VFD⇨PLC

The PLC receives “：01 10 2000 0002 CD CR LF”.

The PLC sends the data.

Data		Description	
'0'	16#30	ADR 1	ADR (10) is the station address of the AC motor drive.
'1'	16#31	ADR 0	
'1'	16#31	CMD 1	CMD (10) is the command code.
'0'	16#30	CMD 0	
'2'	16#32	Data address	
'0'	16#30		
'0'	16#30		
'0'	16#30		
'0'	16#30	Data	
'0'	16#30		
'0'	16#30		
'2'	16#32		
'0'	16#30	Number of bytes	
'4'	16#34		
'0'	16#30	Data 1	16#12: The AC motor drive runs clockwise.
'0'	16#30		
'1'	16#31		
'2'	16#32		
'0'	16#30	Data 2	Operation frequency=K500Hz 16#01F4
'1'	16#31		
'F'	16#46		
'4'	16#34		
'C'	16#43	LRC CHK 1	LRC CHK (01) is the error checking code.
'2'	16#32	LRC CHK 0	

The PLC receives the data.

Data		Description	
'0'	16#30	ADR 1	ADR (10) is the station address of the AC motor drive.
'1'	16#31	ADR 0	
'1'	16#31	CMD 1	CMD (10) is the command code.
'0'	16#30	CMD 0	
'2'	16#32	Data address	
'0'	16#30		
'0'	16#30		
'0'	16#30		
'0'	16#30	Number of Registers	
'0'	16#30		
'0'	16#30		
'2'	16#32		
'C'	16#43	LRC CHK 1	
'D'	16#44	LRC CHK 0	

Additional remark:

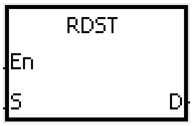
1. Please refer to the additional remark on the instruction RS for more information about the related flags and the special registers.
2. The instructions FWD, REV, STOP, RDST, and RSTEF can be used several times in the program, but one instruction is executed at a time.
3. If the value in $\mathbf{S}_1$ exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If **n** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
5. The instructions FWD, REV, STOP, RDST, and RSTEF are consistent with the MODBUS communication format.

API	Instruction code	Operand	Function
1804	RDST	**S, D**	Reading the statuses of the AC motor drives

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S								●	●				●	○	○		
D								●	●				●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
-	AH500	-

Symbol:



S : Unit address — Word

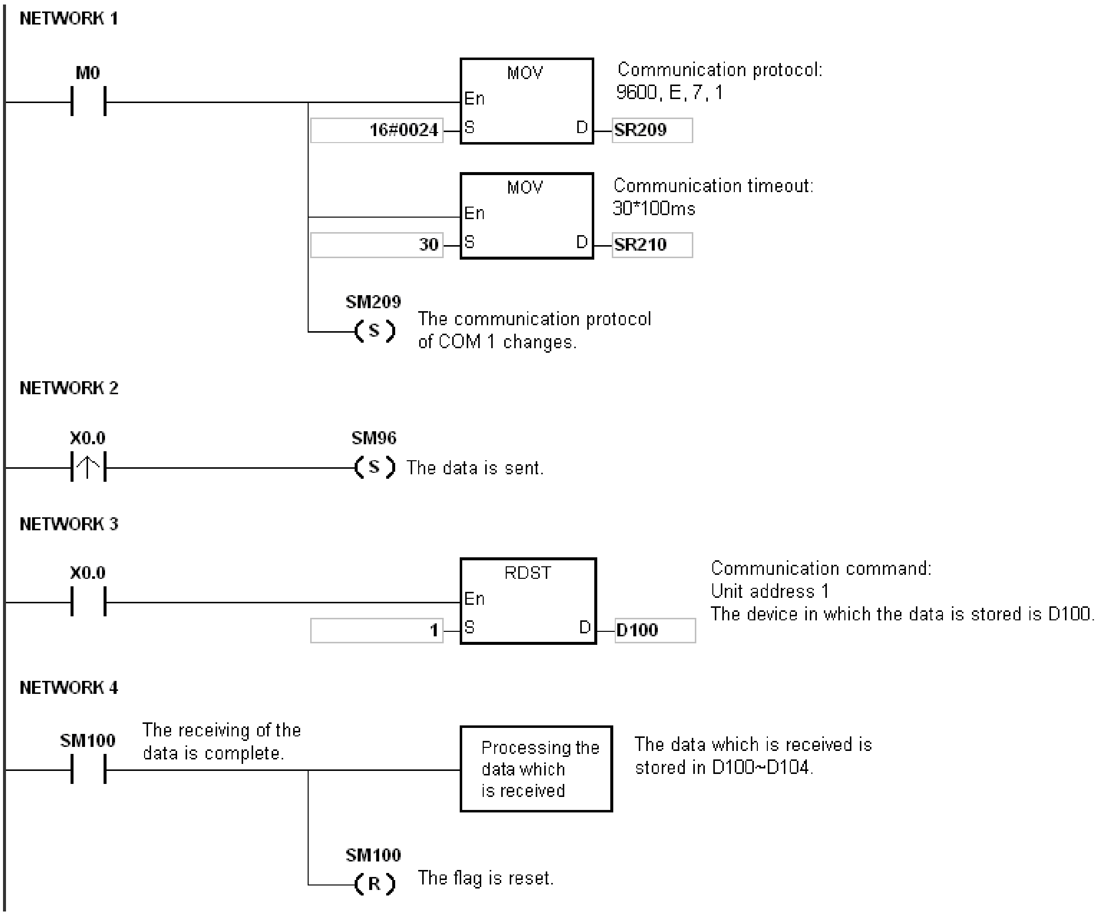
D : Initial device in which the data is stored — Word

Explanation:

1. The operand **S** should be within the range between 1 and 255. It can not be 0.
2. **D**: The data which the PLC receives from the AC motor drives is stored in the device specified by users.
3. The instruction is used to read the states of the devices at the addresses 16#2100~16#2104 in the AC motor drive. (Please refer to AC Motor Drive User Manual for more information about the states of the devices.) The data which is received is stored in the device specified by **D**. However, the data in **D** can not be altered if the communication timeout occurs or an error occurs during the reception of the data. Therefore, make sure of the setting of SM100/SM101 before the PLC reads the states of the devices in the AC motor drive.
4. The operand **D** occupies five registers, i.e. $\mathbf{D}_n$, $\mathbf{D}_n$+1, $\mathbf{D}_n$+2, $\mathbf{D}_n$+3, and $\mathbf{D}_n$+4.

Example:

1. The PLC is connected to the VFD series AC motor drive (ASCII mode: SM210 and SM212 are OFF). If the communication timeout occurs, the PLC retries the sending of the command.
2. The PLC reads the states of the devices at the addresses 16#2100~16#2104 in the AC motor drive. The data which is received is stored in D100~D104.



PLC⇨VFD

The PLC sends " : 01 03 2100 0005 D6 CR LF" (ASCII).

VFD⇨PLC

The PLC receives " : 01 03 0A 0000 0500 01F4 0000 0000 F8 CR LF" (ASCII).

The PLC sends the data.

Data		Description	
'0'	16#30	ADR 1	ADR (10) is the station address of the AC motor drive.
'1'	16#31	ADR 0	
'0'	16#30	CMD 1	CMD (10) is the command code.
'3'	16#33	CMD 0	
2'	16#32	Initial data address	
'1'	16#31		
'0'	16#30		
'0'	16#30		
'0'	16#30	Number of data (counted by the word)	
'0'	16#30		
'0'	16#30		
'5'	16#35		
'D'	16#44	LRC CHK 1	LRC CHK (01) is the error checking code.
'6'	16#36	LRC CHK 0	

The PLC receives the data.

Data		Description	
‘0’	16#30	ADR 1	
‘1’	16#31	ADR 0	
‘0’	16#30	CMD 1	
‘3’	16#33	CMD 0	
‘0’	16#30	Number of data (counted by the byte)	
‘A’	16#41		
‘0’	16#30	Data in the device at address 16#2100	The PLC automatically converts the ASCII character into the value 16#0000, and 16#0000 is stored in D100.
‘0’	16#30		
‘0’	16#30		
‘0’	16#30		
‘0’	16#30	Data in the device at address 16#2101	The PLC automatically converts the ASCII character into the value 16#0500, and 16#0500 is stored in D101.
‘5’	16#35		
‘0’	16#30		
‘0’	16#30		
‘0’	16#33	Data in the device at address 16#2102	The PLC automatically converts the ASCII character into the value 16#01F4, and 16#01F4 is stored in D1072.
‘1’	16#45		
‘F’	16#30		
‘4’	16#30		
‘0’	16#30	Data in the device at address 16#2103	The PLC automatically converts the ASCII character into the value 16#0000, and 16#0000 is stored in D1073.
‘0’	16#30		
‘0’	16#30		
‘0’	16#30		
‘0’	16#30	Data in the device at address 16#2104	The PLC automatically converts the ASCII character into the value 16#0000, and 16#0000 is stored in D1074.
‘0’	16#30		
‘0’	16#30		
‘0’	16#30		
‘2’	16#32	LRC CHK 1	
‘A’	16#41	LRC CHK 0	

Additional remark:

1. Please refer to the additional remark on the instruction RS for more information about the related flags and the special registers.
2. The instructions FWD, REV, STOP, RDST, and RSTEF can be used several times in the program, but one instruction is executed at a time.
3. If the value in **S** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If **D**+4 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
5. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [5] of WORD/INT.

API	Instruction code	Operand	Function
1805	RSTEF	**S**	Resetting the abnormal AC motor drives

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S								●	●				●	○	○		

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
-	AH500	-

Symbol:

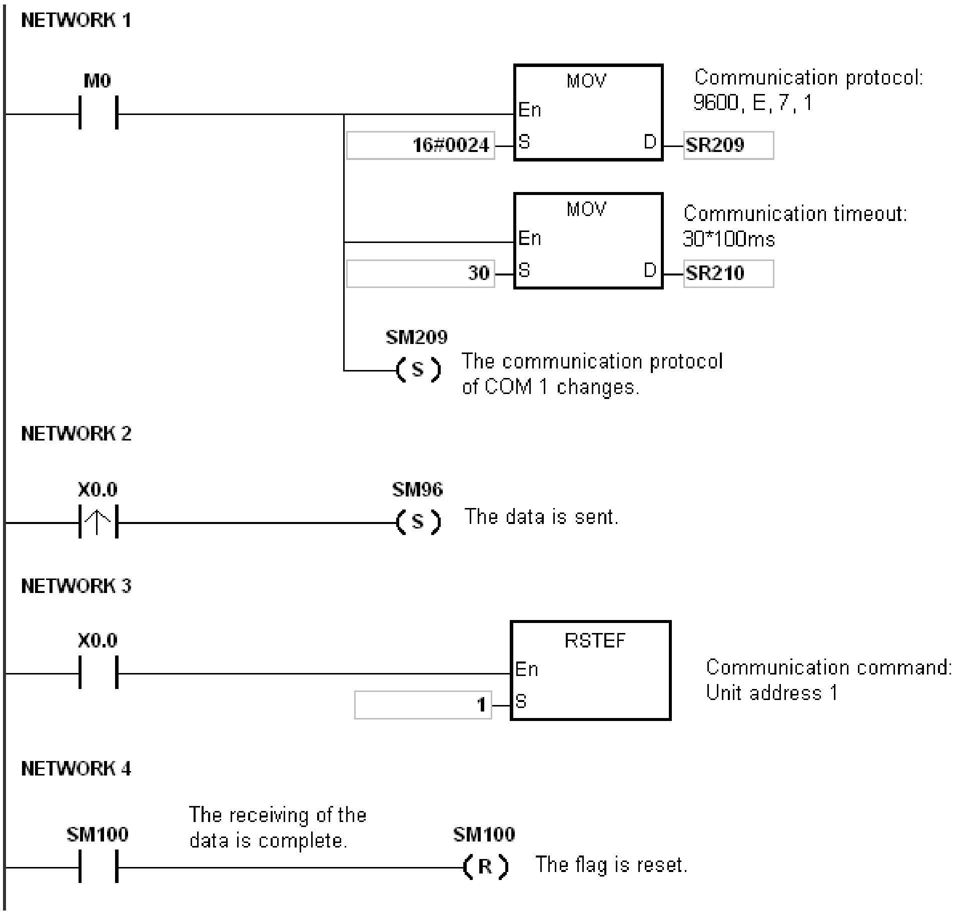
S : Unit address Word

Explanation:

The operand **S** should be within the range between 0 and 255. If the station address is 0, it indicates that the PLC broadcasts to all AC motor drives.

Example: COM2 (RS-485)

The PLC is connected to the VFD series AC motor drive (ASCII mode: SM210 and SM212 are OFF.). If the communication timeout occurs, the PLC retries the sending of the command.



PLC⇨VFD

The PLC sends " : 01 06 2002 0002 D5 CR LF" (ASCII).

VFD⇨PLC

The PLC receives " : 01 06 2002 0002 D5 CR LF" (ASCII).

The PLC sends the data.

Data		Description	
'0'	16#30	ADR 1	ADR (10) is the station address of the AC motor drive.
'1'	16#31	ADR 0	
'0'	16#30	CMD 1	CMD (10) is the command code.
'6'	16#36	CMD 0	
'2'	16#32	Data address	
'0'	16#30		
'0'	16#30		
'2'	16#32		
'0'	16#30	Data	
'0'	16#30		
'0'	16#30		
'2'	16#32		
'D'	16#44	LRC CHK 1	LRC CHK (01) is the error checking code.
'5'	16#35	LRC CHK 0	

The PLC receives the data.

Data		Description
‘0’	16#30	ADR 1
‘1’	16#31	ADR 0
‘0’	16#30	CMD 1
‘6’	16#36	CMD 0
‘2’	16#32	Data address
‘0’	16#30	
‘0’	16#30	
‘2’	16#32	
‘0’	16#30	Number of registers
‘0’	16#30	
‘0’	16#30	
‘2’	16#32	
‘D’	16#44	LRC CHK 1
‘5’	16#35	LRC CHK 0

Additional remark:

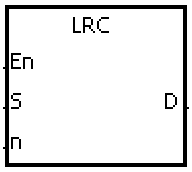
1. Please refer to the additional remark on the instruction RS for more information about the related flags and the special registers.
2. The instructions FWD, REV, STOP, RDST, and RSTEF can be used several times in the program, but one instruction is executed at a time.
3. If the value in **S** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
1806		LRC		**S, n, D**	Longitudinal parity check

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●		●	●				●				
n	●	●			●	●		●	●				●	○	○		
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
-	AH500	-

Symbol:



S : Initial device to which the LRC is applied — Word

n : Number of bytes — Word

D : Initial device in which the operation result is stored — Word

Explanation:

1. Please refer to the additional remark on the instruction LRC for more information about the LRC check code.
2. The operand **n** should be an even number, and should be within the range between 1 and 1000. If **n** is not within the range, the operation error occurs, the instruction is not executed, SM0 and SM1 are ON, and the error code in SR0 is 16#200B.
3. The 16-bit conversion mode: When SM606 is OFF, the hexadecimal data in the device specified by **S** is divided into the high 8-bit data and the low 8-bit data. The LRC is applied to every byte, and the operation result is stored in the high 8-bit and the low 8-bit in the device specified by **D**. The number of bytes depends on **n**.
4. The 8-bit conversion mode: When SM606 is ON, the hexadecimal data in the device specified by **S** is divided into the high 8-bit data (invalid data) and the low 8-bit data. The LRC is applied to every byte, and the operation result is stored in the low 8-bit in the two registers. The number of bytes depends on **n**. (The values of the high 8 bits in the two registers are 0.)

Example:

1. The PLC is connected to the VFD-S series AC motor drive (ASCII mode: SM210 is OFF; 8-bit mode: SM606 is ON.). The PLC sends the command, and reads the data in the six devices at the addresses starting from 16#2101 in the VFD-S series AC motor drive.

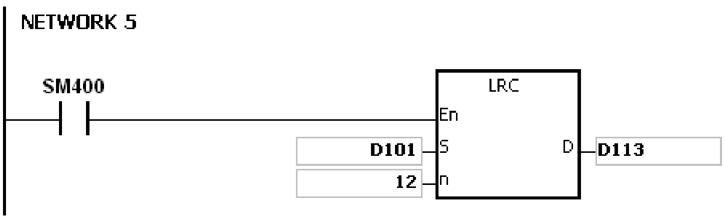
   PLC⇨VFD-S

   The PLC sends “ : 01 03 2101 0006 D4 CR LF”.

The PLC sends the data.

Register	Data		Description	
D100 Low 8 bits	‘ : ’	16#3A	STX	
D101 Low 8 bits	‘0’	16#30	ADR 1	AD (1, 0) is the station address of the AC motor drive.
D102 Low 8 bits	‘1’	16#31	ADR 0	
D103 Low 8 bits	‘0’	16#30	CMD 1	CMD (10) is the command code.
D104 Low 8 bits	‘3’	16#33	CMD 0	
D105 Low 8 bits	‘2’	16#32	Initial data address	
D106 Low 8 bits	‘1’	16#31		
D107 Low 8 bits	‘0’	16#30		
D108 Low 8 bits	‘1’	16#31		
D109 Low 8 bits	‘0’	16#30	Number of data (counted by the word)	
D110 Low 8 bits	‘0’	16#30		
D111 Low 8 bits	‘0’	16#30		
D112 Low 8 bits	‘6’	16#36		
D113 Low 8 bits	‘D’	16#44	LRC CHK 0	LRC CHK (01) is the error checking code.
D114 Low 8 bits	‘4’	16#34	LRC CHK 1	
D115 Low 8 bits	CR	16#0D	END	
D116 Low 8 bits	LF	16#0A		

LRC CHK (01) above is the error checking code. It can be calculated by means of the instruction LRC. (8-bit mode: SM606 is ON.)



LRC check code: 16#01+16#03+16#21+16#01+16#00+16#06=16#2C

The two’s complement of 16#2C is 16#D4. ‘D’ (16#44) is stored in the low 8-bit in D113, and ‘4’ (16#34) is stored in the low 8-bit in D114.

Additional remark:

1. The format of the communication data in the ASCII mode:

STX	‘ : ’	The start-of-text character is ‘ : ’ (16#3A).
Address Hi	‘ 0 ’	Communication address: The 8-bit address is composed of two ASCII codes.
Address Lo	‘ 1 ’	
Function Hi	‘ 0 ’	Function code: The 8-bit function code is composed of two ASCII codes.
Function Lo	‘ 3 ’	
DATA (n-1) **…….** **DATA 0**	‘ 2 ’	Data: The n×8-bit data is composed of 2n ASCII codes.
	‘ 1 ’	
	‘ 0 ’	
	‘ 2 ’	
	‘ 0 ’	
	‘ 0 ’	
	‘ 0 ’	
	‘ 2 ’	
LRC CHK Hi	‘ D ’	LRC check code: The 8-bit check code is composed of two ASCII codes.
LRC CHK Lo	‘ 7 ’	
END Hi	CR	End-of-text character: END Hi=CR（16#0D）, END Lo=LF（16#0A）
END Lo	LF	

2. LRC check code: The values starting from the communication address to the data are added up. The two’s complement of the sum gotten is the LRC check code.

   Example:

   16#01+16#03+16#21+16#02+16#00+16#02=16#29

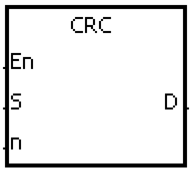
   The two’s complement of 16#29 is 16#D7.

API	Instruction code	Operand	Function
1807	CRC	**S, n, D**	Cyclic Redundancy Check

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●				●				
n	●	●			●	●		●	●				●	○	○		
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
-	AH500	-

Symbol:



S : Initial device to which the CRC is applied — Word

n : Number of bytes — Word

D : Initial device in which the operation result is stored — Word

Explanation:

1. Please refer to the additional remark on the instruction CRC for more information about the CRC check code.
2. The operand **n** should be within the range between 1 and 1000. If **n** is not within the range, the operation error occurs, the instruction is not executed, SM0 and SM1 are ON, and the error code in SR0 is 16#200B.
3. The 16-bit conversion mode: When SM606 is OFF, the hexadecimal data in the device specified by **S** is divided into the high 8-bit data and the low 8-bit data. The CRC is applied to every byte, and the operation result is stored in the high 8-bit and the low 8-bit in the device specified by **D**. The number of bytes depends on **n**.
4. The 8-bit conversion mode: When SM606 is ON, the hexadecimal data in the device specified by **S** is divided into the high 8-bit data (invalid data) and the low 8-bit data. The CRC is applied to every byte, and the operation result is stored in the low 8-bit in the two registers. The number of bytes depends on **n**.

Example:

1. The PLC is connected to the VFD-S series AC motor drive (RTU mode: SM210 is ON; 16-bit mode: SM606 is ON.). The value 16#12, which will be written into the device at 16#2000 in the VFD-S series AC motor drive, is written into the device in the PLC first.

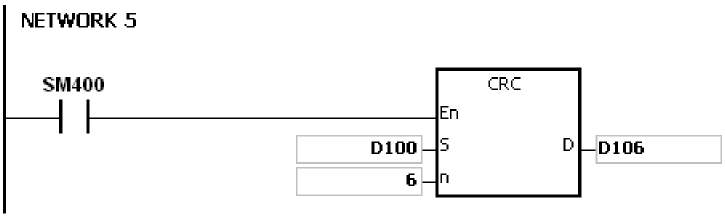
   PLC⇨VFD-S

   The PLC sends 01 06 2000 0012 02 07.

The PLC sends the data.

Register	Data	Description
D100 Low 8 bits	16#01	Address
D101 Low 8 bits	16#06	Function
D102 Low 8 bits	16#20	Data address
D103 Low 8 bits	16#00	
D104 Low 8 bits	16#00	Data
D105 Low 8 bits	16#12	
D106 Low 8 bits	16#02	CRC CHK 0
D107 Low 8 bits	16#07	CRC CHK 1

CRC CHK (01) above is the error checking code. It can be calculated by means of the instruction CRC. (8-bit mode: SM606 is ON.)



CRC check code: 16#02 is stored in the low 8-bit in D106, and 16#07 is stored in the low 8-bit in D107.

Additional remark:

1. The format of the communication data in the RTU mode:

START	Time interval
Address	Communication address: 8-bit binary address
Function	Function code: 8-bit binary code
DATA (n-1)	Data: n×8-bit data
…….	
DATA 0	
CRC CHK Low	CRC check code: The 16-bit check code is composed of two 8-bit binary codes.
CRC CHK High	
END	Time interval

2. CRC check code: The check code starts from the address to the data. The operation rule is as follows.

Step 1: Suppose the data in the 16-bit register (the register in which the CRC check code is stored) is 16#FFFF.

Step 2: The logical operator XOR takes the first 8-bit message and the low 8-bit data in the 16-bit register, and performs the logical exclusive OR operation on each pair of corresponding bits. The operation result is stored in the 16-bit register.

Step 3: The values of the bits in the 16-bit registers are shifted by one bit to the right. The value of the highest bit becomes 0.

Step 4: If the value of the right-most bit which is shifted to the right is 0, the data gotten from step 3 is stored in the 16-bit register. Otherwise, the logical operator XOR takes 16#A001 and the data in the 16-bit register, and performs the logical exclusive OR operation on each pair of corresponding bits. The operation result is stored in the 16-bit register.

Step 5: Repeat step 3 and step 4, and perform the operation on the 8-bit message.

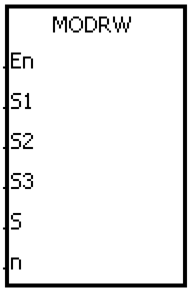
Step 6: Repeat step 2~step 5, and get the next 8-bit message. Perform the operations on all messages. The final result in the 16-bit register is the CRC check code. Notice that the low 8-bit data in the 16-bit register is interchanged with the high 8-bit data in the 16-bit register before the CRC check code is put into the check code of the message

API	Instruction code	Operand	Function
1808	MODRW	S_1, S_2, S_3, S, n	Reading/Writing the MODBUS data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●				●	○	○		
S_2	●	●			●	●		●	●				●	○	○		
S_3	●	●			●	●		●	●				●	○	○		
S	●	●			●	●		●	●				●				
n	●	●			●	●		●	●				●	○	○		

Pulse instruction	16-bit instruction (11 steps)	32-bit instruction
-	AH500	-

Symbol:



S_1	:	Unit address	Word
S_2	:	Function code	Word
S_3	:	Device address	Word
S	:	Register involved in the reading/writing of the data	Bit/Word
n	:	Data length	Word

Explanation:

1. The operand **S_1** should be within the range between 0 and 255.
2. **S_2**: The function code
   For example:
   1 (16#01): The AH500 series PLC reads the data from several bit devices which are not discrete input devices.
   2 (16#02): The AH500 series PLC reads the data from several bit devices which are discrete input devices.
   3 (16#03): The AH500 series PLC reads the data from several word devices which are not input registers.
   4 (16#04): The AH500 series PLC reads the data from several word devices which are input registers.
   5 (16#05): The AH500 series PLC writes the state into a bit device.
   6 (16#06): The AH500 series PLC writes the data into a word device.
   15 (16#0F): The AH500 series PLC writes the states into several bit devices.
   16 (16#10): The AH500 series PLC writes the data into several word devices.
   Only the function codes mentioned above are supported, and other function codes can not be executed. Please refer to the examples below.
3. **S_3**: The device address
   If the device address is illegal, the error occurs. The error code is stored in the error log.
4. **S**: The register involved in the reading/writing of the data
   The data which will be written into the external equipment is stored in the register in advance.
   The data which is read from the external equipment is stored in the register.
5. **n**: The length of the data
   The size of the data can not be larger than 240 bytes. For the communication commands related to the coils, the unit of the data is the bit, and **n** should be within the range between 1 and 1920. For the communication commands related to the registers, the unit of the data is

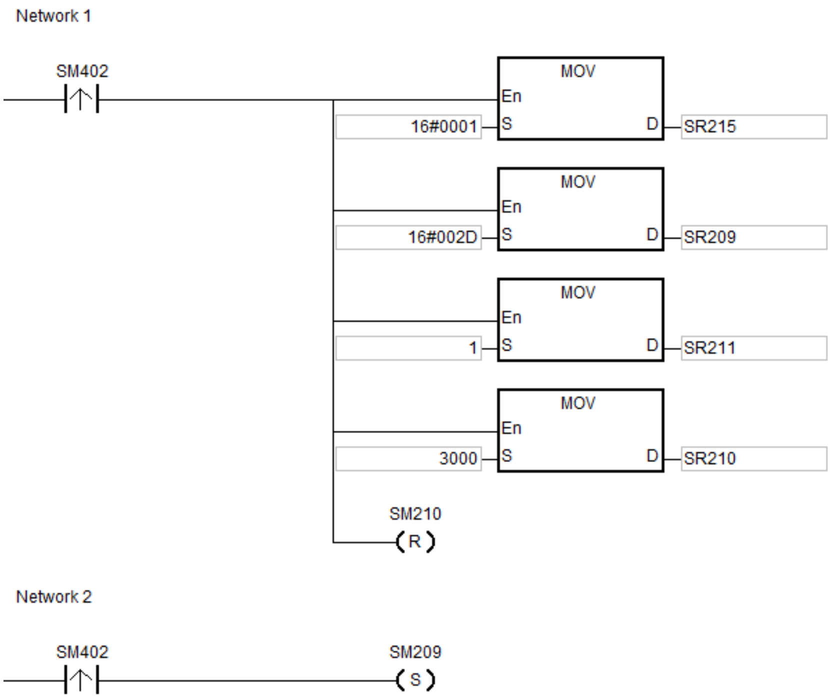
the word, and **n** should be within the range between 1 and 120.

6. The instruction can be used several times in the program, but one instruction is executed at a time.
7. If the communication timeout occurs, SM104 and SM105 are ON. After the problem is solved, users have to reset SM104 and SM105 to OFF. When using the instruction MODRW, the timeout value cannot be 0, and the value should be set between 100 ~ 65535ms.
8. In the MODBUS ASCII mode, users only need to set up the data for transmission, the instruction will add the head code (:), error checking code (LRC) and tail code (CRLF). The data which is received is stored as the ASCII character in the internal register. The AH500 series PLC automatically converts the data into the hexadecimal value, and the conversion result is stored in **S**.
9. In the MODBUS RTU mode, users only need to set up the data for transmission, the instruction will add the checking code (CRC) and the data which is received is stored as the ASCII character in the internal register. The AH500 series PLC automatically converts the data into the hexadecimal value, and the conversion result is stored in **S**.

Communication protocol setup example:

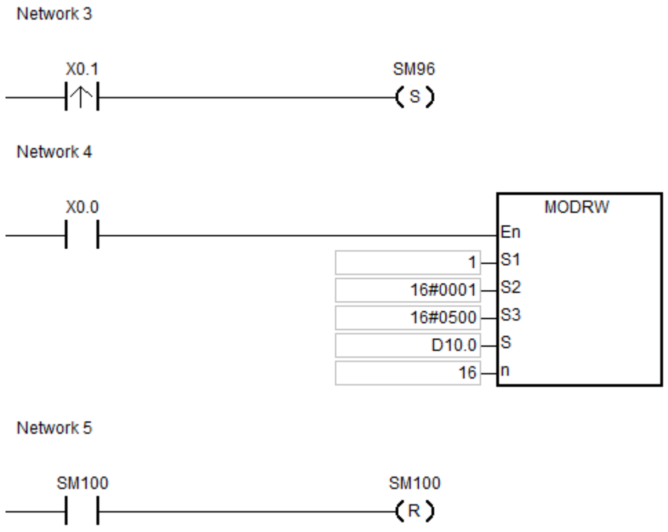
1. Users can set up the PLC communication port in HWCONFIG or set values in the relative spcial auxiliary relays to set up the communication. Please refer to ISPSoft manual for setups in HWCONFIG. As for communication register setups (SM, SR), please refer to API1800 RS instruction for more information.
2. The communication setup for this example is RS485 ASCII, 9600, 8, E, 1.
3. Communication port for data transmission is RS485 (SR215=1).
4. The transmission speed and format for the communicationport are 9600, 8, E, 1 (SR209=16#002D).
5. Set the number of times the command is resent (SR211=1).
6. Set the communication timeout to 3000ms (SR210=3000).
7. Set the communication mode to ASCII mode (SM210=OFF).
8. Enable the communication protocol (SM209=ON).

For users who set up the communication port in ISPSoft - > HWCONFIG - > COM Port, this step can be ignored.



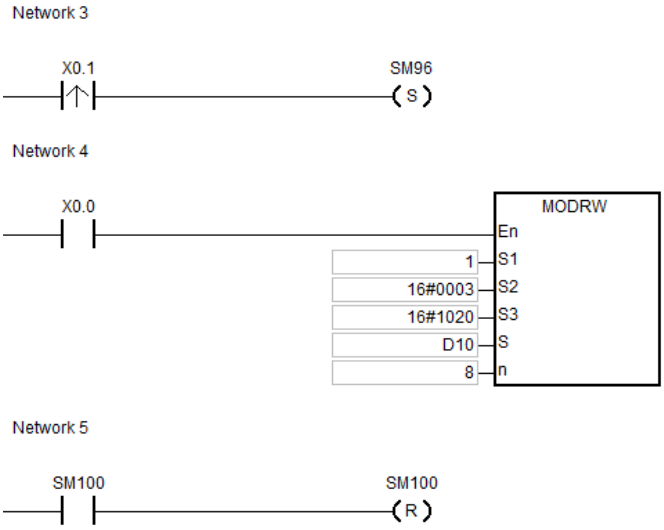
Example 1:

1. Function code 01 (16#01): The AH500 series PLC reads the data from several bit devices which are not discrete input devices. (16 peiece of data is read in this example.)
2. AH500 series is connected to the DVP-ES2 series PLC.
   ASCII Mode: The AH500 series PLC is connected to the DVP-ES2series PLC. When SM96 and X0.0 are on, the AH500 series PLC sends and receives the Y0~Y15 (Y0 address is 16#0500) commands from DVP-ES2.
3. The data which the AH500 series PLC receives from the DVP-ES2 series PLC is stored in D10.0~D10.15.
4. After the reception of data is complete, it will check the data format of what have been sent from the DVP-ES2 series PLC. If the format is correct, SM100 will be ON, and if not, SM102 will be ON.



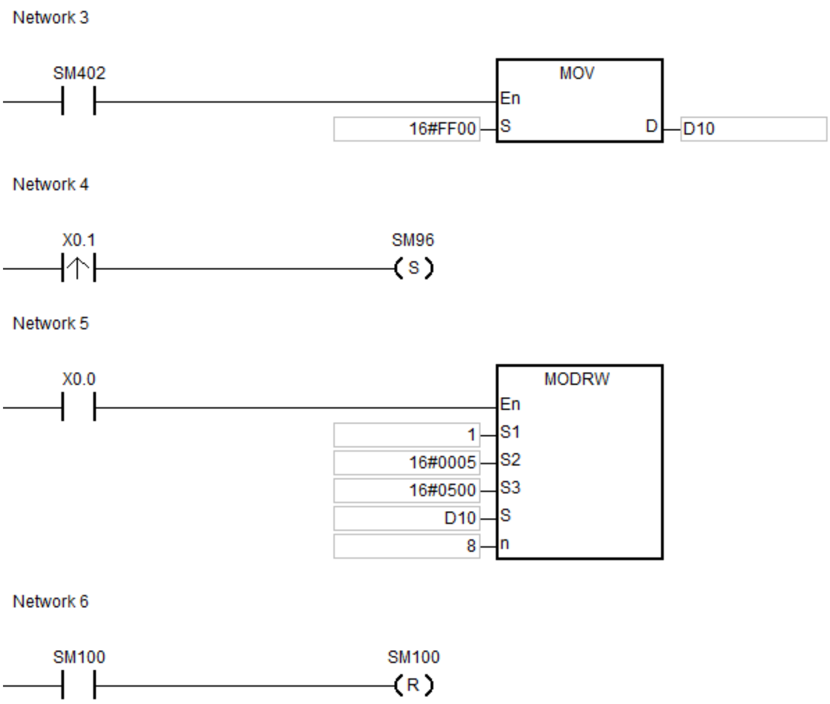
Example 2:

1. Function code 03 (16#03): The AH500 series PLC reads the data from several bit devices which are not discrete input devices. (8 peiece of data is read in this example.)
2. AH500 series is connected to the DVP-ES2 series PLC.
   ASCII Mode: The AH500 series PLC is connected to the DVP-ES2series PLC. When SM96 and X0.0 are on, the AH500 series PLC sends and receives the D20~D27 (D20 address is 16#1020) commands from DVP-ES2.
3. The data which the AH500 series PLC receives from the DVP-ES2 series PLC is stored in D10~D17.
4. After the reception of data is complete, it will check the data format of what have been sent from the DVP-ES2 series PLC. If the format is correct, SM100 will be ON, and if not, SM102 will be ON.



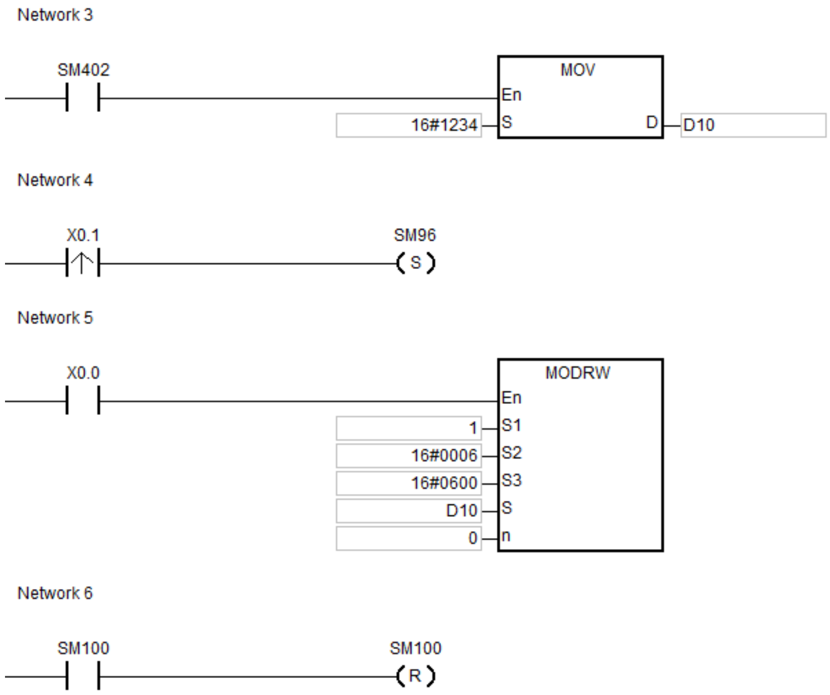
Example 3:

1. Function code 05 (16#05): The AH500 series PLC reads the data from several bit devices which are not discrete input devices.
2. AH500 series is connected to the DVP-ES2 series PLC.
   ASCII Mode: The AH500 series PLC is connected to the DVP-ES2series PLC. When SM96 and X0.0 are on, the AH500 series PLC sends and receives the Y0 (Y0 address is 16#0500) commands from DVP-ES2.
3. After the reception of data is complete, it will check the data format of what have been sent from the DVP-ES2 series PLC. If the format is correct, SM100 will be ON, and if not, SM102 will be ON.
4. When the DVP-ES2 series PLC receives the communication instruction, the Y0 will be switch to ON.
5. This function code is for writing. Thus the n vaule in this instruction will not be used.



Example 4:

1. Function code 06 (16#06): The AH500 series PLC reads the data from one single bit device which are not discrete input devices.
2. AH500 series is connected to the DVP-ES2 series PLC.
   ASCII Mode: The AH500 series PLC is connected to the DVP-ES2series PLC. When SM96 and X0.0 are on, the AH500 series PLC sends and receives the T0 (T0 address is 16#0600) commands from DVP-ES2.
3. After the reception of data is complete, it will check the data format of what have been sent from the DVP-ES2 series PLC. If the format is correct, SM100 will be ON, and if not, SM102 will be ON.
4. When the DVP-ES2 series PLC receives the communication instruction, the value in D10 will be written in T0.
5. This function code is for writing. Thus the n vaule in this instruction will not be used.



Additional remark:

1. If the value in $\mathbf{S_1}$ or $\mathbf{S_2}$ exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the device specified by **S** is not sufficient to contain the **n** pieces of data, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If **n** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
4. If the function code specified by $\mathbf{S_2}$ is related to the bit device, the device specified by **S** has to be the bit device. Otherwise, the operation error occurs, the instruction is not executed, and the error code in SR0 is 16#2003.
5. If the function code specified by $\mathbf{S_2}$ is related to the word device, the device specified by **S** has to be the word device. Otherwise, the operation error occurs, the instruction is not executed, and the error code in SR0 is 16#2003.
6. If the communication command is 0x05 or 0x06, **n** does not work. The state or the data is written into one bit device or one word device. **n** cannot exceed the length of data to be read and written.

7. If SM96 and SM97 are not ON, the instruction MODRW is not executed.
8. If the communication timeout occurs, SM104 and SM105 are ON, and SM98 and SM99 are OFF.
9. If the error occurs during the reception of the data, SM102 and SM103 are ON, and SM98 and SM99 are OFF.
10. If the function code specified by $\mathbf{S_2}$ is related to the word device, the device in the external equipment with which the AH500 series PLC communicates has to be the word device. If the function code specified by $\mathbf{S_2}$ is related to the bit device, the device in the external equipment with which the AH500 series PLC communicates has to be the bit device.
11. The flags related to the instruction MODRW:

Flag		**Description**
COM1	**COM2**	
SM96	SM97	The data is sent through COM1/COM2.
SM98	SM99	Waiting to receive the reply through COM1/COM2
SM100	SM101	Reception through COM1/COM2 is complete.
SM102	SM103	An error occurs during the reception of the data through COM1/COM2
SM104	SM105	No data is received through COM1/COM2 after a specified period of time.
SM209	SM211	The communication protocol of COM1 changes (in accordance with SM210, SR201, SR209, and SR215).

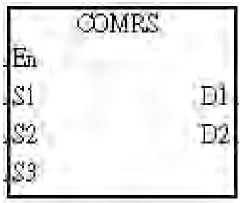
Please refer to the explanation of the instruction RS for more information about the functions of the flags.

API	Instruction code			Operand	Function
1812		COMRS		**S_1, S_2, S_3, D_1, D_2**	Sending and receiving communication data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	K	16#	"$"	DF
S_1	●	●			●	●		●	●				○	○		
S_2	●	●			●	●		●	●							
S_3	●	●			●	●		●	●				○	○		
D_1	●	●			●	●		●	●							
D_2	●	●			●	●		●	●							

Pulse instruction	16-bit instruction (11 steps)	32-bit instruction (5 steps)
-	AH500	-

Symbol:



S_1	:	Communication port number (1~2)	Word
S_2	:	Source of the data which is sent	Word
S_3	:	Length of the data which is sent	Word
D_1	:	Initial device in which communication data received is stored	Word
D_2	:	Condition of ending the receiving of data	Word

Explanation:

1. Only applicable for version V1.03 or later versions.
2. If a specific character or specific characters are used as the condition of ending the receiving of data, it is suggested that the instruction should be applied to ASCII data. If the instruction is not applied to ASCII data, it is suggested that a timeout period should be used as the condition of ending the receiving of data.
3. The instruction COMRS only supports the built-in communication ports of an AH500 series CPU module. (COM1 in AHCPU5xx-EN, and COM1 and COM2 in AHCPU5xx-RS2 are supported.)
4. **S_1**: Communication port number
   S_1=1: COM1
   S_1=1: COM2
   If the value in **S_1** is neither 1 nor 2, the instruction will not be executed.
5. **S_2**: Source of the data which is sent
   S_3: Length of the data which is sent
   If **S_2** is D100 and **S_3** is K10, the values in the low bytes in D100~D109 will be sent through the communication port specified by **S_1**.
6. If the setting value in **S_3** is 0, no string will be sent. The maximum number of characters which can be sent is 1000.
7. **D_1**: Length of the data which has been received.
   D_1+1~**D_1**+n: Devices in which the data received is stored
   If **D_1** is D200, the value in **D_2** is 3, and the value in **D_2**+1 is 16#0D0A, the data received will be stored in the low bytes in the devices starting from D201 (the high bytes will be unchanged), the receiving of data will not stop until the consecutive stop characters 16#0D and 16#0A are received, the length of the data received will be written to D200 after 16#0D and 16#0A are received, and a completion flag will be set to ON after the receiving of data stops.

8. **D_2**: Mode of receiving data
   D_2+1: Condition of ending the receiving of data
   D_2 and **D_2**+1 are described below.

D_2	Mode of receiving data	Setting value in D_2+1	Remark
0	Not receiving communication data	Unused	After the sending of data is complete, a completion flage will be set to ON.
1	When the time which passes before the next piece of data is received exceeds the time set in **D_2**+1, the receiving of data is complete.	The setting value in **D_2**+1 is time. The unit of measurement for time is 1 millisecond. The setting value in **D_2**+1 is in the range of 2 to 3000.	If the time that users set is greater than 3000 milliseconds, the value in **D_2**+1 will be 3000. If the time that users set is less than 2 milliseconds, the value in **D_2**+1 will be 2.
2	The data received ends with a specific character.	The setting value in **D_2**+1 is a specific character.	If a specific character is 16#0A, the value in **D_2**+1 will be 16#000A.
3	The data received ends with two consecutive specific characters.	The setting value in **D_2**+1 is two specific characters.	If two specific characters are 16#0D and 16#0A, the value in **D_2**+1 will be 16#0D0A.
4	The data received starts with a specific character. When the time which passes before the next piece of data is received exceeds the time set in **D_2**+1, the receiving of data is complete.	A specific character is stored in the high byte in **D_2**+1, and time is stored in the low byte in **D_2**+1. (The time set in the low byte in **D_2**+1 is in the range of 2 milliseconds to 255 millseconds.)	If a start character is 16#3A, and time is 15 milliseconds, the value in **D_2**+1 will be 16#3A0F.
5	The data received starts with a specific character, and ends with a specific character.	The setting value in **D_2**+1 is a specific start character, and a specific end character.	If a start character is 16#3A, and a stop character is 16#0A, the value in **D_2**+1 will be 16#3A0A.
6	A specific quantity of data is received.	The setting value in **D_2**+1 is the length of the data which is received.	If users want to receive 10 characters, the value in **D_2**+1 is 10.
Others	If the mode used is not a mode which is supported, the instruction will not be executed.		

9. If the value in D2 is in the range of 1 to 5, the maximum number of characters which can be received is 1000. After 1000 characterse are received, the execution of the instruction will stop.
10. The relation among communication port, related spcial auxiliary relays, and a related special data register are described below.

Communication port number	COM1	COM2	Remark
Reception flag	SM98	SM99	When the PLC receive data, it sets a reception flag to ON. After the receiving of data is complete, the PLC will reset the reception flag to OFF.
Completion flag	SM100	SM101	When the receiving of data is complete, the PLC sets a completion flag to ON. Users have to reset the completion flag to OFF by means of a program. After the completion flag is reset to

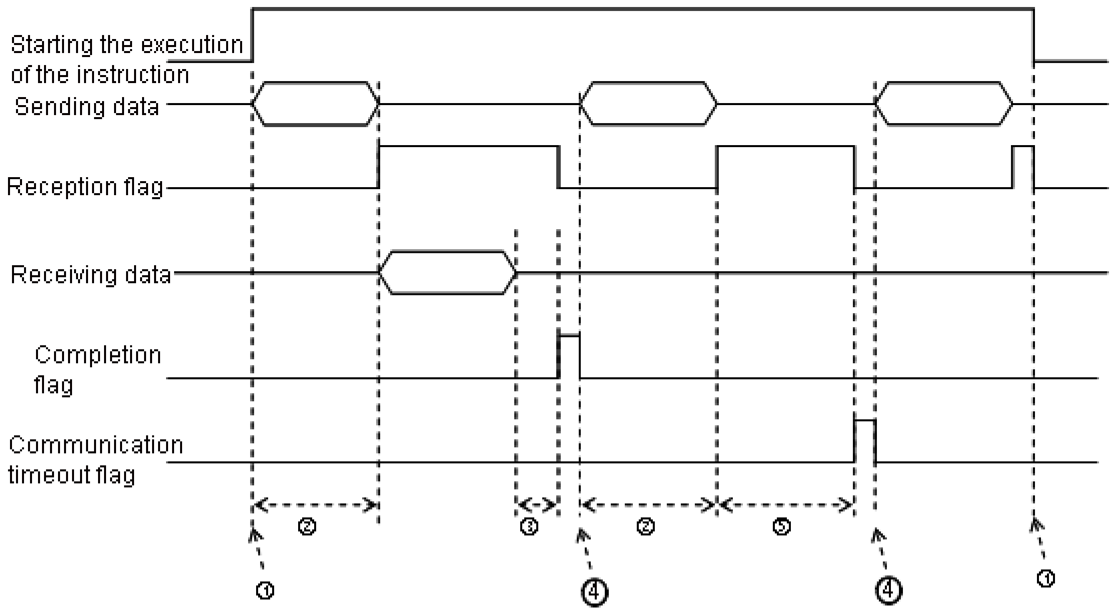
			OFF, the PLC will wait for the next communication data.
Communication timeout flag	SM104	SM105	When a timeout occurs, the PLC sets a communication timeout flag to ON. Users have to reset the communication timeout flag to OFF by means of a program. After the communication timeout is reset to OFF, the PLC will wait for the next communication data.
Timeout period	SR210	SR213	If the value in SR210/SR213 is 0, the communication timeout function will not be enabled. The unit of measurement for time is 1 millisecond.
Transmisson mode	SM106	SM107	Choice made by COM1 between the 8-bit processing mode and the 16-bit processing mode ON: 8-bit processing mode OFF: 16-bit processing mode

11. Timing diagrams

- Mode of receiving data: K0

  When data is sent, users can not cancel the sending of the data. If the conditional contact preceding the instruction is not enable, the data will still be sent, but a completion flag will not be set to ON after the sending of the data is complete.

- Mode of receiving data: 1 or 4



Description:

①→ Users start/stop the execution of the instruction.

②→ Time in which data is sent

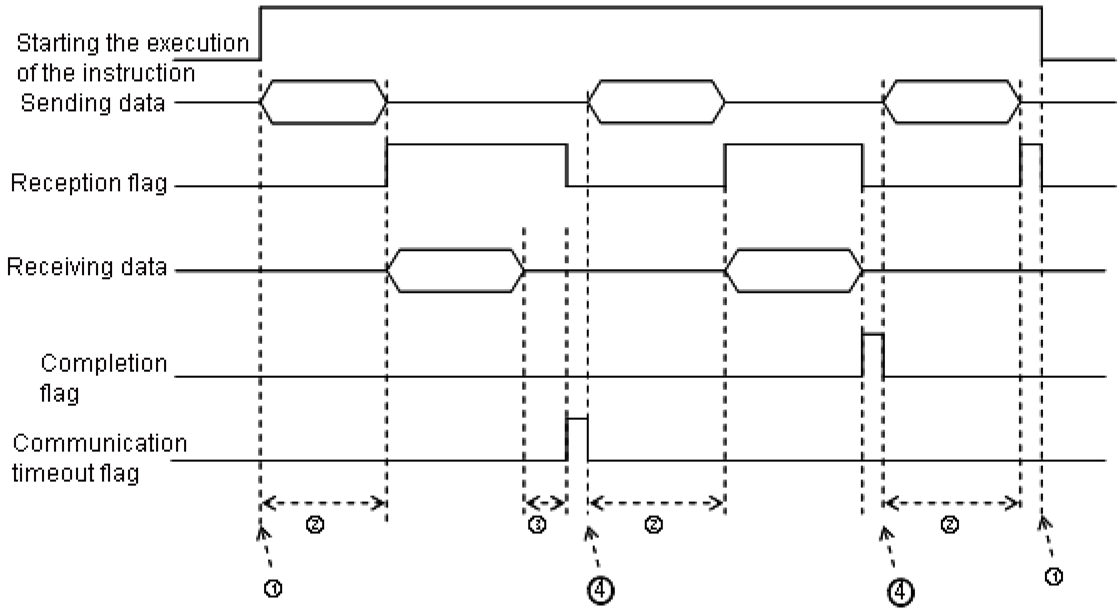
The period of time in which data is sent is not measured.

③→ After the first character is received, the time which passes before the next character is received will be measured. Whenever a character is received, the time measured is cleared. The completion flag will not be set to ON until the time measured is greater than the setting value in $\mathbf{D_2}$+1.

④→ If the instruction is still enabled after users reset the completion flag or the communication flag, the next communication data is sent automatically when the instruction is scanned in the next cycle.

⑤→ When the PLC begins to receive data, it begins to measure the time which passes. The communication timeout will not be set to ON until the time measured exceeds the timeout period set. It is suggested that the timeout period set should be longer than the time set in $\mathbf{D_2}$+1.

- Mode of receiving data: 2, 3, 5, or 6



Description:

①→ Users start/stop the execution of the instruction.

②→ Time in which data is sent

The period of time in which data is sent is not measured.

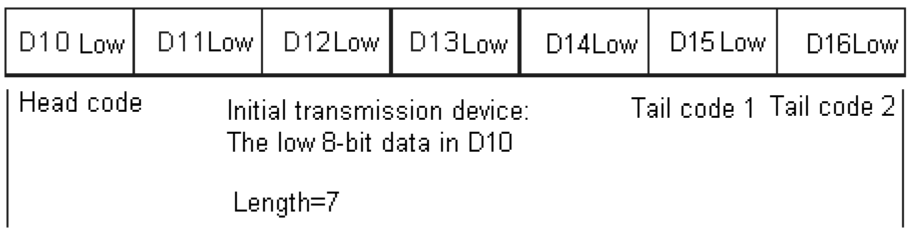
③→ After the first character is received, the time which passes before the next character is received will be measured. Whenever a character is received, the time measured is cleared. A communication timeout flag will not be set to ON until the time measured exceeds the timeout period set.

④→ If the instruction is still enabled after users reset a completion flag or a communication flag, the next communication data is sent automatically when the instruction is scanned in the next cycle.

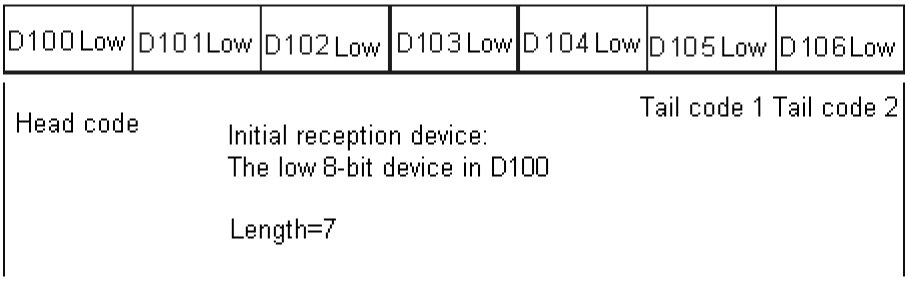
12. Mode of sending data/Mode of receiving data

8-bit mode: The command which is edited is stored in the initial transmission device, and the command which will be sent include the head code and the tail code. The 16-bit data is divided into the high 8-bit data and the low 8-bit data. The high 8-bit data is ignored, and the low 8-bit data can be sent or received. (Take standard Modbus for example.)

Sending the data: (PLC→External equipment)

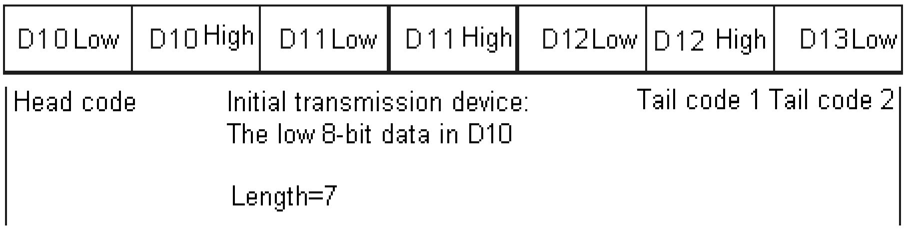


Receiving the data: (External equipment→PLC)

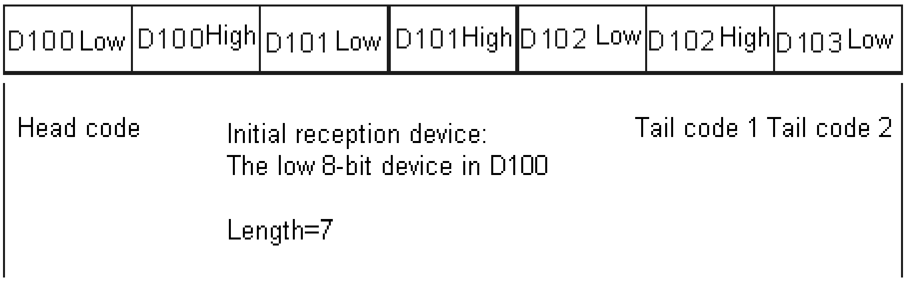


16-bit mode: The command which is edited is stored in the initial transmission device, and the command which will be sent include the head code and the tail code. The 16-bit data is divided into the high 8-bit data and the low 8-bit data.

Sending the data: (PLC→External equipment)



Receiving the data: (External equipment→PLC)



The data which the PLC receives from the external equipment includes the head and the tail code. Therefore, users have to be aware of the setting of a length.

Additional remark:

1. There is no limit on the number of times the communication instruction COMRS can be executed. However, every communication port can only be enabled by one communication instruction, and the communication instructions which follow will not be executed.
2. The instructions which use communication ports are communication instructions, e.g. RS, MODRW, FWD, and REV.
3. When COMRS is executed, no checksum is used. If users need a checksum, they can use COMRS and another instruction available.
4. If the value in $\mathbf{D_2}$ is 2, 3, 5, or 6, it is suggested that users should set a timeout period. After a timeout period is set, the sending of data will be retried if a stop character is not received.
5. The instruction does not automatically clear the value in $\mathbf{D_1}$~$\mathbf{D_1}$+n whenever the instruction is just executed or the PLC begins to receive new communication data. Only after a completion flag is switched from OFF to ON can users know whether data is received, and how much data the PLC receives. If the users want to clear the values in $\mathbf{D_1}$~$\mathbf{D_1}$+n, they can use the instruction ZRST.

6. If the value in $\mathbf{S_1}$ is neither 1 nor 2, the instruction will not be executed, SM0 will be ON, and the error code in SR0 will be 16#2003.
7. If the number of devices starting from $\mathbf{S_2}$ is not equal to the value in $\mathbf{S_3}$, the instruction will not be executed, SM0 will be ON, and the error code in SR0 will be 16#2003.
8. If the value in $\mathbf{D_2}$ is not in the range of 0 to 6, the instruction will not be executed, SM0 will be ON, and the error code in SR0 will be 16#2003.
9. If the value in $\mathbf{D_2}$ is 6, and the number of devices starting from $\mathbf{D_1}$ is not equal to the value in $\mathbf{D_2}$+1, the instruction will not be executed, SM0 will be ON, and the error code in SR0 will be 16#2003.
10. If the value in $\mathbf{S_2}$ is in the range of 1 to 5, and the quantity of data received is greater than the number of devices starting from $\mathbf{D_1}$, the data which can not be stored will be ignored.
11. If a completion flag is ON, the PLC will stop receiving data. If a communication port receives data when a completion flag is ON, the data will not be received.
12. If the setting value in $\mathbf{S_3}$ is less than 0 or greater than 1000, the instruction will not be executed, SM0 will be ON, and the error code in SR0 will be 16#2003.

6.20 Other Instructions

6.20.1 List of Other Instructions

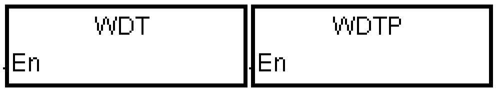
API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
1900	WDT	–	✓	Watchdog timer	1
1901	DELAY	–	✓	Delaying the execution of the program	3
1902	GPWM	–	–	General pulse width modulation	7
1903	TIMCHK	–	–	Checking time	7
1904	EPUSH	–	✓	Storing the contents of the index registers	3
1905	EPOP	–	✓	Reading the data into the index registers	3

6.20.2 Explanation of Other Instructions

API		Instruction code			Operand	Function
1900			WDT	P	–	Watchdog timer

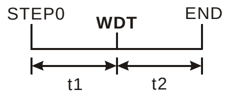
Pulse instruction	16-bit instruction (1 step)	32-bit instruction
–	AH500	–

Symbol:



Explanation:

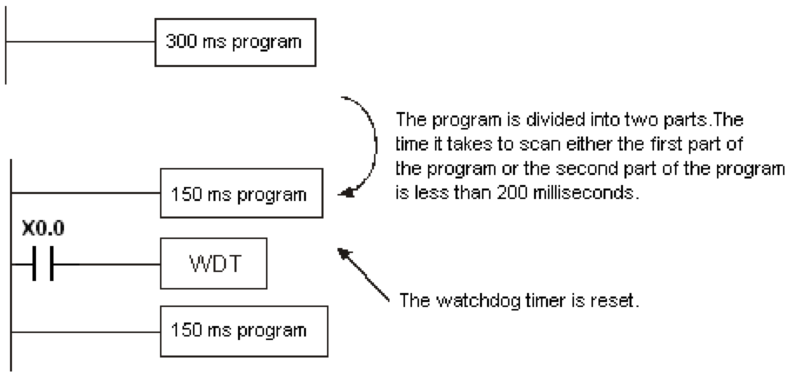
1. In the AH500 series PLC, there is a watchdog timer which is used to monitor the operation of the system.
2. The instruction WDT is used to reset the watchdog timer in the PLC. If the program scanning time exceeds 200 milliseconds, the error LED indicator is ON, and the PLC stops running.
3. The particular point when the watchdog timer acts:
   - The system is abnormal.
   - The execution of the program takes much time, and therefore the scam time is larger than the setting value of the watchdog timer. There are two way users can use to improve the situation.
     1. Using the instruction WDT



     2. Please refer to ISPSoft User Manual for more information about changing the setting value of the watchdog timer.

Example:

Suppose the program scanning time is 300 milliseconds. After the program is divided into two parts, and the instruction WDT is inserted between these two parts, the time it takes to scan either the first part of the program or the second part of the program is less than 200 milliseconds.



Additional remark:

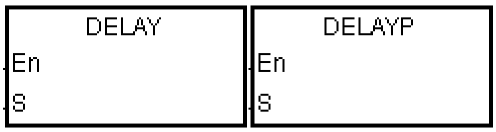
Please refer to ISPSoft User Manual for more information related to the setting of the watchdog timer.

API	Instruction code			Operand	Function
1901		DELAY	P	**S**	Delaying the execution of the program

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S	●	●			●	●		●	●		●		●	○	○		

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
AH500	AH500	–

Symbol:



S : Delay Word

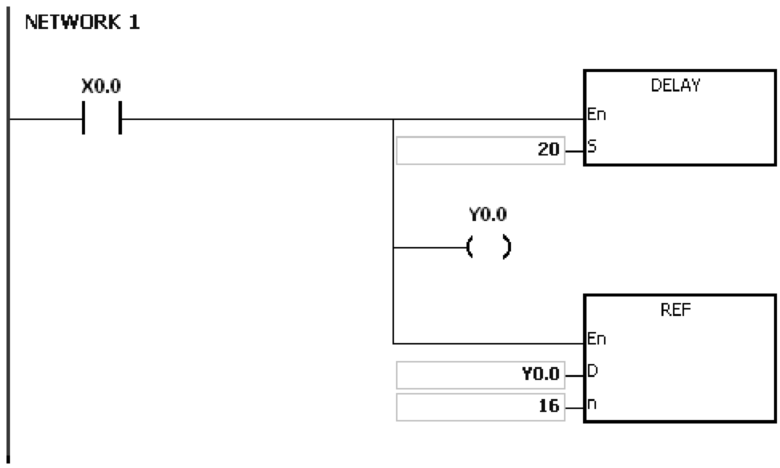
Explanation:

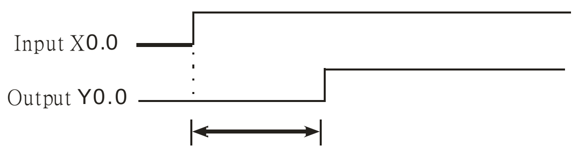
After the instruction DELAY is executed, the execution of the program following the DELAY is delayed for a period of time specified by users.

The unit of **S** is 0.1 milliseconds.

Example:

When X0.0 is ON, the instruction DELAY is executed. The execution of the program following DELAY is delayed for two milliseconds. That is, Y0.0 is ON and the states of Y0.0~Y0.15 are refreshed two milliseconds after the instruction DELAY is executed.





Additional remark:

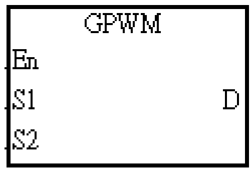
1. If **S** l less than 0, there is no delay.
2. If **S** is larger than 1000, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. Users can adjust the delay according to the practical condition.
4. The delay will increase due to the communication or other influences.

API	Instruction code	Operand	Function
1902	GPWM	**S_1, S_2, D**	General pulse width modulation

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●		●				
S_2	●	●			●	●		●	●				●				
D		●	●	●				●	●				●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
–	AH500	–

Symbol:



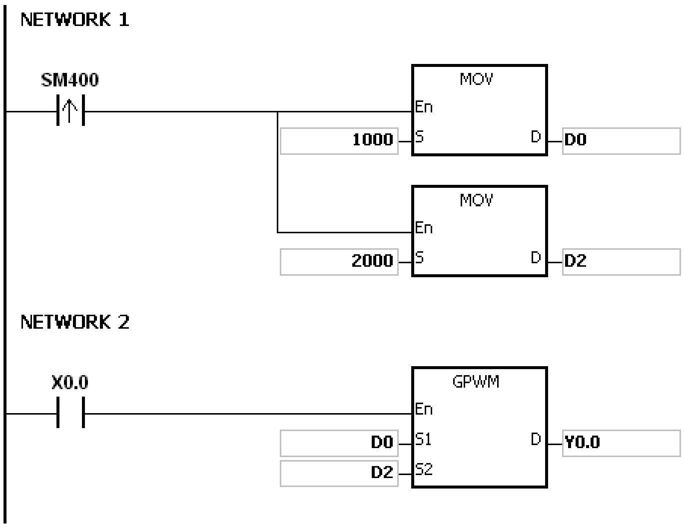
S_1	:	Pulse width	Word
S_2	:	Pulse cycle	Word
D	:	Output device	Bit

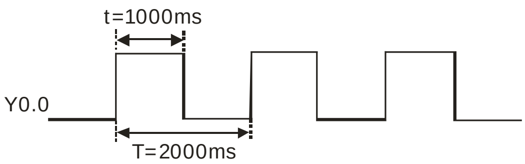
Explanation:

1. When the instruction GPWM is executed, every pulse with a width specified by **S_1** and with a cycle specified by **S_2** is output from the device specified by **D**.
2. The pulse width specified by **S_1** is t. t should be within the range between 0 and 3276 milliseconds.
3. The pulse cycle specified by **S_2** is T. T should be within the range between 1 and 32767 milliseconds, and **S_1** should be less than **S_2**.
4. **S_2**+1 and **S_2**+2 are parameters for system use. Please do not occupy them.
5. If **S_1** is less than 0, there is no pulse output. If **S_1** is larger than **S_2**, the output device keeps ON.
6. **S_1** and **S_2** can be altered during the execution of the instruction GPWM.
7. If the conditional contact is not enabled, there is no pulse output.
8. When the on-line editing is used, please reset the conditional contact to initialize the instruction.

Example:

When the program is executed, the values in D0 and D2 are 1000 and 2000 respectively. When X0.0 is ON, the pulses illustrated below are output from Y0.0. When X0.0 is OFF, Y0.0 is OFF.





Additional remark:

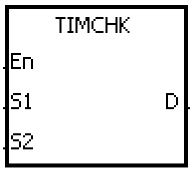
1. The instruction counts by the scan cycle. Therefore, the maximum error is one scan cycle. Besides, $\mathbf{S_1}$, $\mathbf{S_2}$, and ($\mathbf{S_2}$-$\mathbf{S_1}$) should be larger than the scan cycle. Otherwise, an error occurs when the instruction GPWM is executed.
2. If the instruction is used in the function block or the interrupt task, the inaccurate pulse output will occur.
3. If users declare the operand $\mathbf{S_2}$ in ISPSoft, the data type will be ARRAY [3] of WORD/INT.

API	Instruction code	Operand	Function
1903	TIMCHK	**S_1, S_2, D**	Checking time

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●				●				
S_2	●	●			●	●		●	●		●	○	●	○	○		
D	●	●	●	●				●	●				●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
–	AH500	–

Symbol:



S_1 : Time which passes — Word

S_2 : Setting value — Word

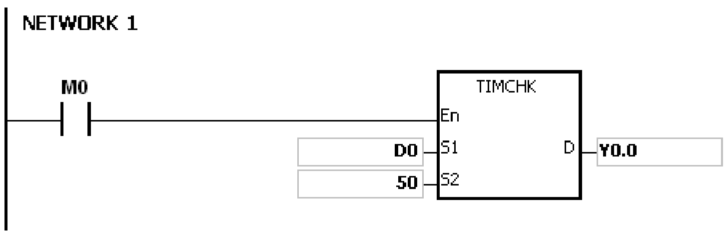
D : Output device — Bit

Explanation:

1. When the conditional contact is ON, **S_1** starts to count. **D** is not ON until the value in **S_1** is larger than or equal to the value in **S_2**. Even if the conditional contact is switched OFF later, the value in **S_1** is unchanged, and **D** is still ON.
2. If the conditional contact is switched from OFF to ON, S is cleared to 0, and D is OFF.
3. **S_1** takes 100 milliseconds as the timing unit.
4. **S_1**+1 and **S_1**+2 are parameters for system use. Please do not occupy them.
5. When the on-line editing is used, please reset the conditional contact to initialize the instruction.

Example:

When M0 is ON, D0 starts to count. Y0.0 is not ON until the value in D0 is larger than or equal to 50 (5 seconds). Even if the conditional contact is switched OFF later, the value in D0 is unchanged, and Y0.0 is still ON.



Additional remark:

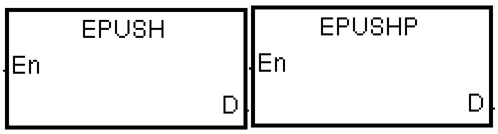
1. If S exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If users declare the operand **S_1** in ISPSoft, the data type will be ARRAY [3] of WORD/INT.

API	Instruction code			Operand	Function
1904		EPUSH	P	**D**	Storing the contents of the index registers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
AH500	AH500	–

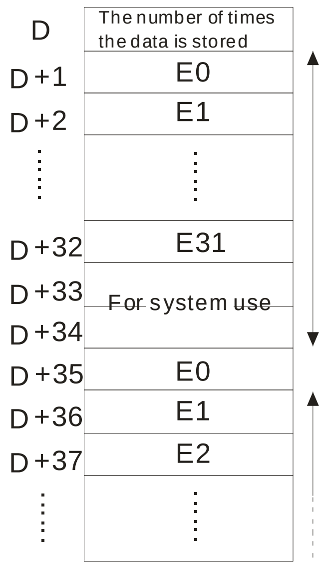
Symbol:



D : Device in which the value in the index register is stored — Word

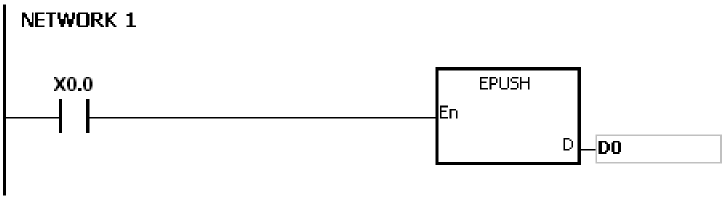
Explanation:

1. The values in E0~E31 are stored in the devices specified by the value in **D**.
2. The execution of the instruction involves thirty-four devices, and the last two devices are for system use. If the instruction is executed and the number of times the data is stored is n, which is the value in **D**, the data in E0~E31 is stored in **D**+34*n+1~**D**+34*n+32, and the value in **D** becomes n+1.
3. If the instruction EPUSH is executed several times, the data in E0~E31 is stored several times in the devices specified by the changeable value in **D**. Therefore, the range of devices should be wide enough.
4. If the instruction is used with the instruction EPOP, the value which is stored last in the device specified by the value in **D** is read first.



Example:

Suppose the value in D0 is 0. When X0.0 is ON for the first time, the data in E0~E31 is transmitted to D1~D32, and the value in D0 becomes 1. When X0.0 is switched from OFF to ON for the second time, the data in E0~E31 is transmitted to D35~D66, and the value in D0 becomes 2. When X0.0 is switched from OFF to ON for the n^{th} time, the data in E0~E31 is transmitted to D+(the value in D0)*34+1~D+(the value in D0)*34+32.



Additional remark:

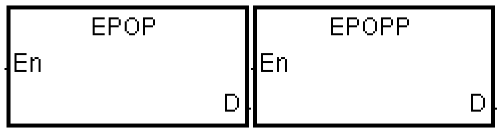
1. If the value in **D** is less than 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **D**+((the value in **D**)+1)*34-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
1905		EPOP	P	**D**	Reading the data into the index registers

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
AH500	AH500	–

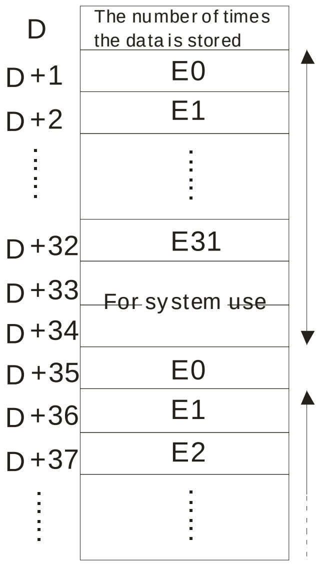
Symbol:



D : Device from which the value is read — Word

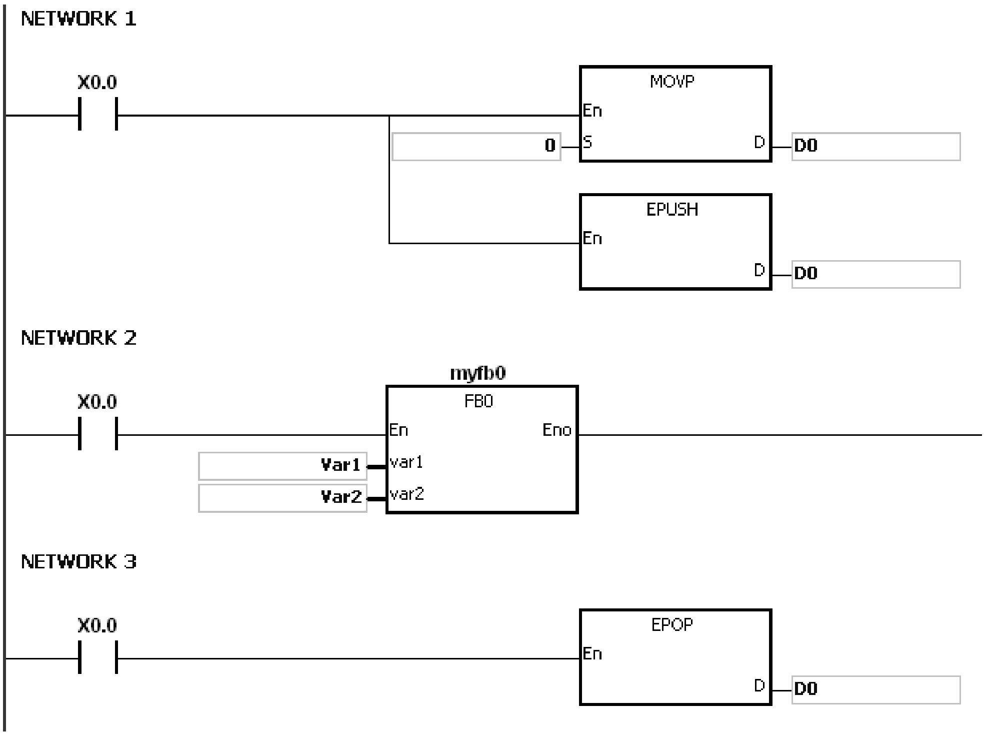
Explanation:

1. The values in the devices specified by the value in **D** are read into E0~E31, and the value in **D** decreases by one.
2. The execution of the instruction involves thirty-four devices, and the last two devices are for system use. If the instruction is executed and the number of times the data is stored is n, which is the value in **D**, the data in D+34*(n-1)+1~D+34*(n-1)+32 is read into E0~E31, and the value in **D** becomes n-1.
3. The value which is stored last in the device specified by the value in **D** is read first.



Example:

When X0.0 is ON, the value in D0 is set to 0, and the values in E0~E31 are transmitted to D1~D32. After the execution of FB0 is complete, the values in D1~D32 are read into D1~D32.



Additional remark:

1. If the value in **D** is less than or equal to 0, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **D**+(the value in **D**)*34-1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

6.21 String Processing Instructions

6.21.1 List of String Processing Instructions

API	Instruction code			Pulse instruction	Function	Step
	16-bit	32-bit	64-bit			
2100	BINDA	DBINDA	–	✓	Converting the singed decimal number into the ASCII code	5
2101	BINHA	DBINHA	–	✓	Converting the binary hexadecimal number into the hexadecimal ASCII code	5
2102	BCDDA	DBCDDA	–	✓	Converting the binary-coded decimal number into the ASCII code	5
2103	DABIN	DDABIN	–	✓	Converting the signed decimal ASCII code into the signed decimal binary number	5-11
2104	HABIN	DHABIN	–	✓	Converting the hexadecimal ASCII code into the hexadecimal binary number	5-11
2105	DABCD	DDABCD	–	✓	Converting the ASCII code into the binary-coded decimal number	5-11
2106	$LEN	–	–	✓	Calculating the length of the string	5-11
2107	$STR	$DSTR	–	✓	Converting the binary number into the string	7
2108	$VAL	$DVAL	–	✓	Converting the string into the binary number	7-13
2109	$FSTR	–	–	✓	Converting the floating-point number into the string	7-8
2110	$FVAL	–	–	✓	Converting the string into the floating-point number	5-11
2111	$RIGHT	–	–	✓	The retrieve of the characters in the string begins from the right.	7-13
2112	$LEFT	–	–	✓	The retrieve of the characters in the string begins from the left.	7-13
2113	$MIDR	–	–	✓	Retrieving a part of the string	7-13
2114	$MIDW	–	–	✓	Replacing a part of the string	7-13
2115	$SER	–	–	✓	Searching the string	9-21
2116	$RPLC	–	–	✓	Replacing the characters in the string	11-17
2117	$DEL	–	–	✓	Deleting the characters in the string	9
2118	$CLR	–	–	✓	Clearing the string	3
2119	$INS	–	–	✓	Inserting the string	9-15
2120	–	FMOD	–	✓	Converting the floating-point number into the binary-coded decimal floating-point number	7-8
2121	FREXP	–	–	✓	Converting the Binary-coded decimal floating-point number into the floating-point number	7

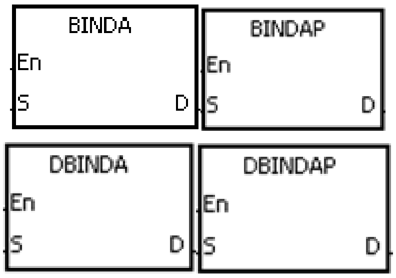
6.21.2 Explanation of String Processing Instructions

API	Instruction code			Operand	Function
2100	D	BINDA	P	**S, D**	Converting the singed decimal number into the ASCII code

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:

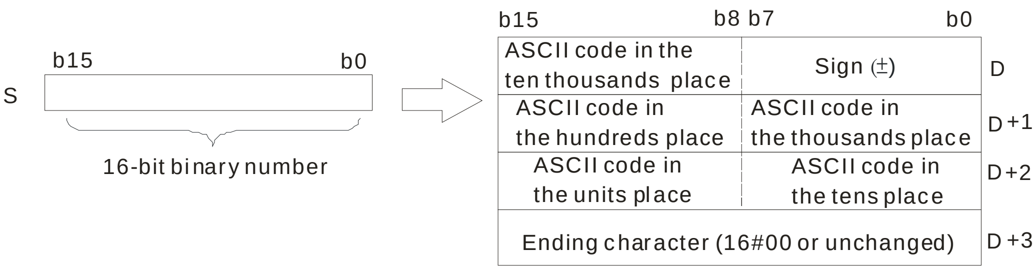


S :Source value Word/Double word

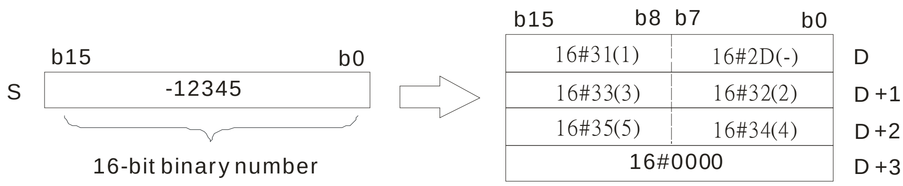
D :Device in which the conversion result is stored Word

Explanation:

1. The signed decimal binary number in **S** is converted into the ASCII code, and the conversion result is stored in **D**.
2. The instruction supports SM690, which controls the ending character.
3. The value in **S** used in the 16-bit instruction should be within the range between -32768 and 32767, and should be a six-digit binary number. The operand **D** occupies four word devices. The data is converted as follows.



If SM690 is OFF, 16#0000 is stored in **D**+3. If SM690 is ON, the value in **D**+3 is unchanged. Besides, if the value in **S** is a positive value, the sign character in **D** is 16#20. If the value in **S** is a negative value, the sign character in **D** is 16#2D. For example, if the value in **S** is -12345 and SM690 is OFF, the conversion result is as follows.



4. The value in **S** used in the 32-bit instruction should be within the range between -2147483648 and 2147483647, and should be an eleven-digit binary number. The operand **D** occupies six word devices. The data is converted as follows.

S: High 16 bits | Low 16 bits

32-bit binary number

b15 ~ b8	b7 ~ b0	
ASCII code in the billions place	Sign (±)	D
ASCII code in the ten millions place	ASCII code in the hundred millions place	D+1
ASCII code in the hundred thousands place	ASCII code in the millions place	D+2
ASCII code in the thousands place	ASCII code in the ten thousands place	D+3
ASCII code in the tens place	ASCII code in the hundreds place	D+4
Ending character (16#00 or 16#20)	ASCII code in the units place	D+5

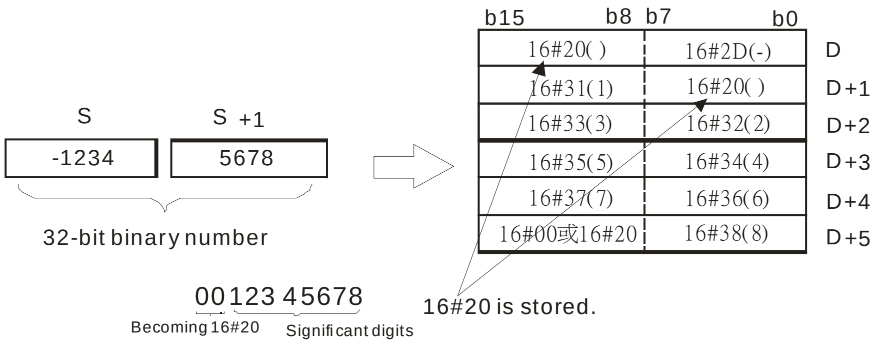
If SM690 is OFF, 16#0000 is stored in the high 8 bits in **D**+5. If SM690 is ON, 16#20 is stored in the high 8 bits in **D**+5. Besides, if the value in **S** is a positive value, the sign character in **D** is 16#20. If the value in **S** is a negative value, the sign character in **D** is 16#2D. For example, if the value in **S** is -12345678, the conversion result is as follows.

S	S +1
-1234	5678

32-bit binary number

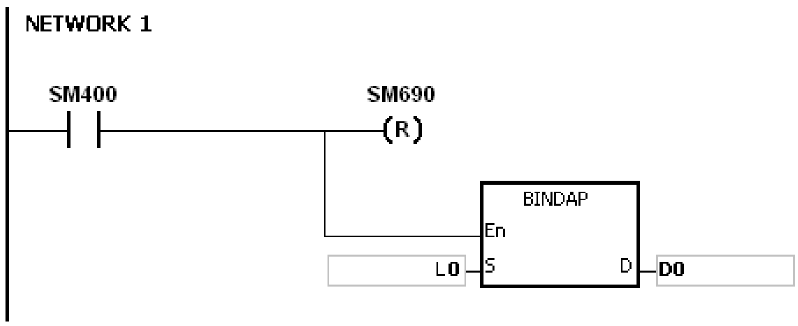
b15 ~ b8	b7 ~ b0	
16#20( )	16#2D(-)	D
16#31(1)	16#20( )	D+1
16#33(3)	16#32(2)	D+2
16#35(5)	16#34(4)	D+3
16#37(7)	16#36(6)	D+4
16#00或16#20	16#38(8)	D+5

5. Take the 32-bit binary number -12345678 in **S** for example. The digit in the hundred millions place of the number and the digit in the billions place of the number are 0. When the instruction is executed, 16#20 is stored in the low 8 bits in **D**+1 and the high 8 bits in **D**.



Example 1:

Suppose the value in L0 is 5126 and SM690 is OFF. When the PLC runs, the values in D0, D1, D2, and D3 are 16#2020, 16#3135, 16#3135, and 16#0000 respectively.



L0

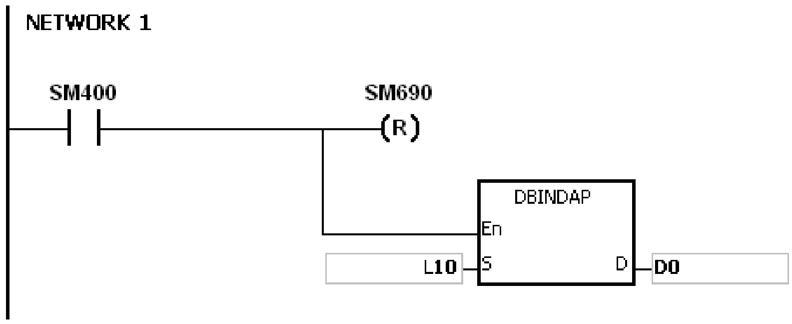
5126

BIN

b15 … b8	b7 … b0
16#20()	16#20()
16#31(1)	16#35(5)
16#36(6)	16#32(2)
16#00	

Example 2:

Suppose the value in L10 is -3842563 and SM690 is OFF. When the PLC runs, the values in D0, D1, D2, D3, D4, and D5 are 16#202D, 16#2020, 16#3833, 16#3234, 16#3635, and 16#0033 respectively.



L10	L11
-384	2563

BIN

b15 … b8	b7 … b0
16#20( )	16#2D(-)
16#20()	16#20( )
16#38(8)	16#33(3)
16#32(2)	16#34(4)
16#36(6)	16#35(5)
16#00	16#33(3)

Additional remark:

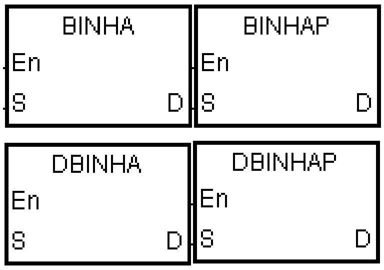
1. If **D**+3 used in the 16-bit instruction exceeds the device range, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **D**+5 used in the 32-bit instruction exceeds the device range, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the operand **D** used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [4] of WORD/INT.
4. If the operand **D** used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [6] of WORD/INT.

API	Instruction code			Operand	Function
2101	D	BINHA	P	S, D	Converting the binary hexadecimal number into the hexadecimal ASCII code

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

Symbol:

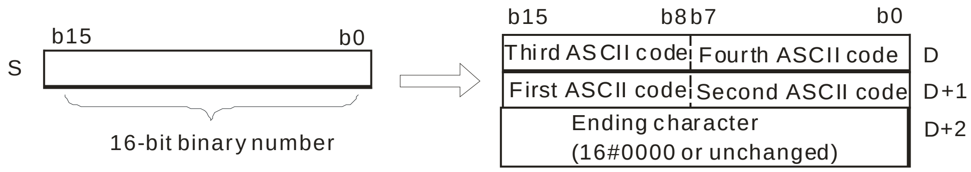


S : Source value — Word/Double word

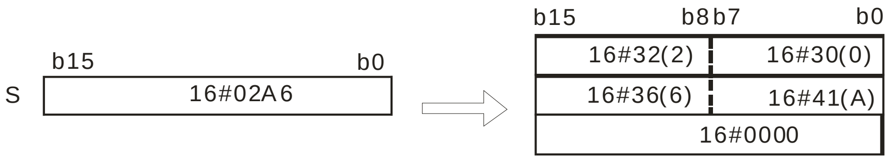
D : Device in which the conversion result is stored — Word

Explanation:

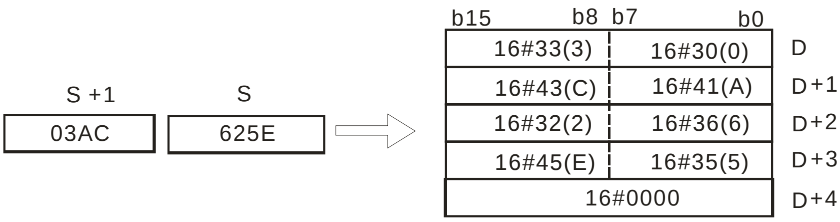
1. The hexadecimal binary number in **S** is converted into the ASCII code, and the conversion result is stored in **D**.
2. The instruction supports SM690, which controls the ending character.
3. The value in **S** used in the 16-bit instruction should be within the range between 16#0000 and 16#FFFF, and should be a four-digit binary number. The operand **D** occupies three word devices. The data is converted as follows.



If SM690 is OFF, 16#0000 is stored in **D**+2. If SM690 is ON, the value in **D**+2 is unchanged. For example, if the value in **S** is 16#02A6 and SM690 is OFF, the conversion result is as follows.



4. The value in **S** used in the 32-bit instruction should be within the range between 16#00000000 and 16#FFFFFFFF, and should be an eight-digit binary number. The operand **D** occupies five word devices. The data is converted as follows.



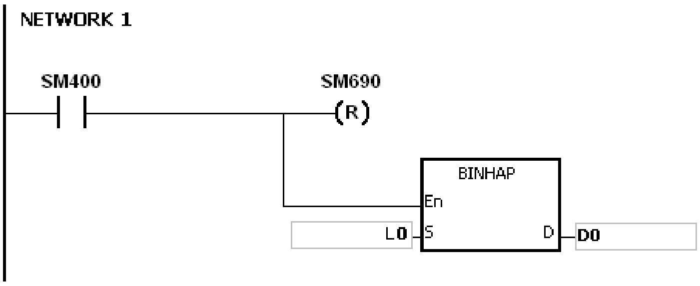
If SM690 is OFF, 16#0000 is stored in **D**+4. If SM690 is ON, the value in **D**+4 is unchanged. For example, if the value in **S** is 16#03AC625E and SM690 is OFF, the conversion result is as follows.

S +1	S
03AC	625E

b15 … b8	b7 … b0	
16#33(3)	16#30(0)	D
16#43(C)	16#41(A)	D +1
16#32(2)	16#36(6)	D +2
16#45(E)	16#36(6)	D +3
16#0000		D +4

Example 1:

Suppose the value in L0 is 16#9C06 and SM690 is OFF. When PLC runs, the values in D0, D1, and D2, are 16#2020, 16#3135, 16#3135, and 16#0000 respectively.

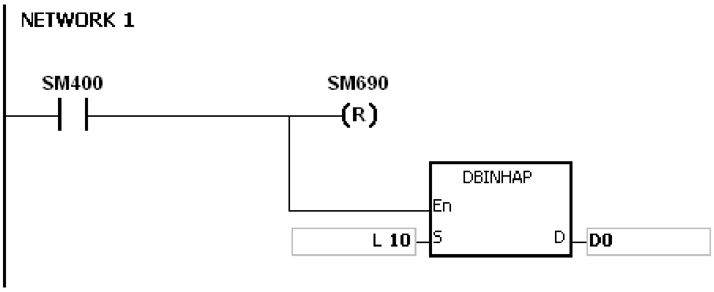


L0: 16#9C06

b15 … b8	b7 … b0	
16#43(C)	16#39(9)	D0
16#36(6)	16#30(0)	D1
16#0000		D2

Example 2:

Suppose the value in L10 is 16#7B3C581F and SM690 is OFF. When the PLC runs, the values in D0, D1, D2, D3, and D4 are 16#4237, 16#4333, 16#3835, 16#4631, and 16#0000 respectively.



L11	L10
7B3C	581F

b15 … b8	b7 … b0	
16#42(B)	16#37(7)	D0
16#43(C)	16#33(3)	D1
16#38(8)	16#35(5)	D2
16#46(F)	16#31(1)	D3
16#0000		D4

Additional remark:

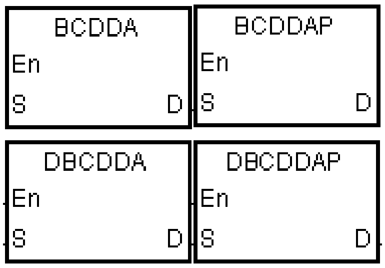
1. If **D**+2 used in the 16-bit instruction exceeds the device range, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **D**+4 used in the 32-bit instruction exceeds the device range, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the operand **D** used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [3] of WORD/INT.
4. If the operand **D** used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [5] of WORD/INT.

API	Instruction code			Operand	Function
2102	D	BCDDA	P	S, D	Converting the binary-coded decimal number into the ASCII code

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction (5 steps)
AH500	AH500	AH500

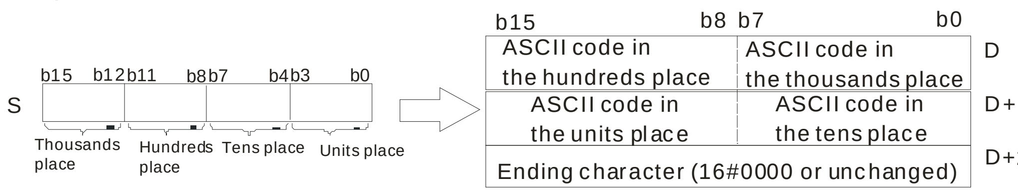
Symbol:



S :	Source value	Word/Double word
D :	Device in which the conversion result is stored	Word

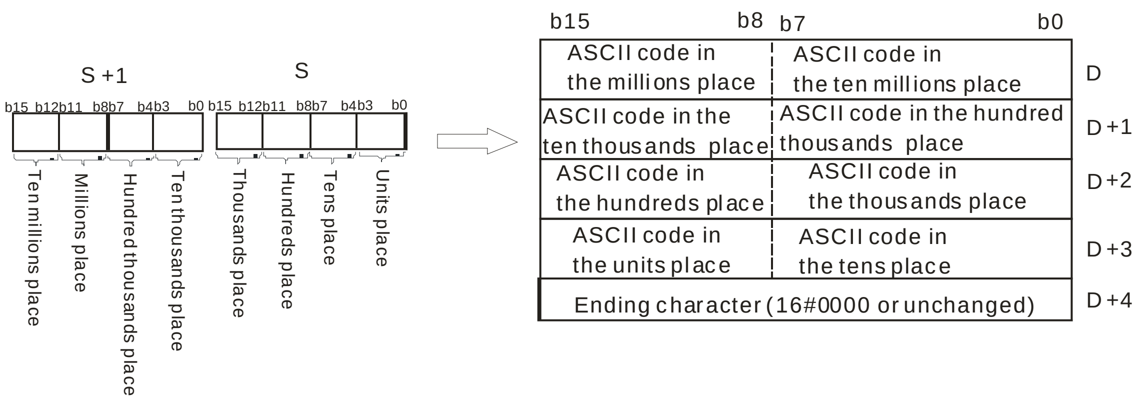
Explanation:

1. The binary-coded decimal number in **S** is converted into the ASCII code, and the conversion result is stored in **D**.
2. The instruction supports SM690, which controls the ending character.
3. The binary-coded decimal value in **S** used in the 16-bit instruction should be within the range between 0 and 9999, and should be a four-digit binary-coded decimal value. The operand **D** occupies three word devices. The data is converted as follows.



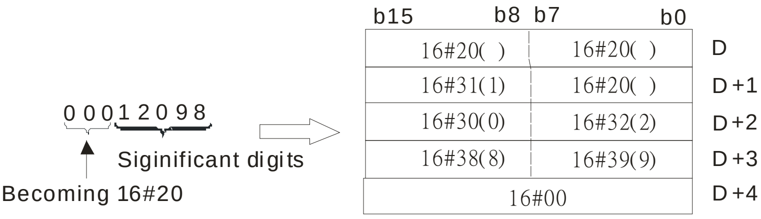
If SM690 is OFF, 16#0000 is stored in **D**+2. If SM690 is ON, the value in **D**+2 is unchanged.

4. The binary-coded decimal value in **S** used in the 32-bit instruction should be within the range between 0 and 99999999, and should be an eight-digit binary-coded decimal value. The operand **D** occupies five word devices. The data is converted as follows.



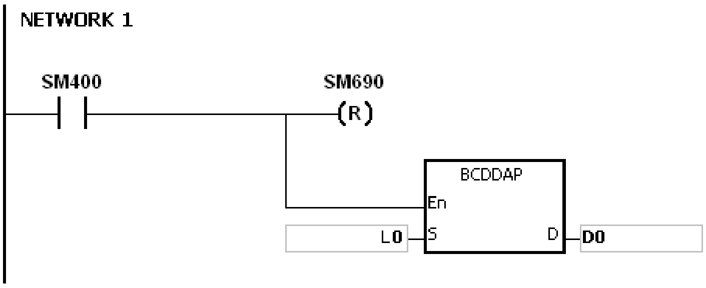
If SM690 is OFF, 16#0000 is stored in **D**+5. If SM690 is ON, the value in **D**+5 is unchanged.

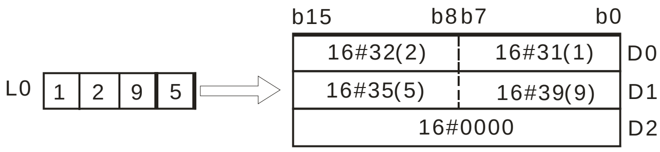
5. Take the binary-coded decimal number 12098 in **S** for example. The digit in the hundred thousands place of the number, the digit in the millions place of the number, and the digit in the ten millions place of the number are 0. When the instruction is executed, 16#20 is stored in the low 8 bits in **D**+1, the high 8 bits in **D**, and the low 8 bits in **D**.



Example 1:

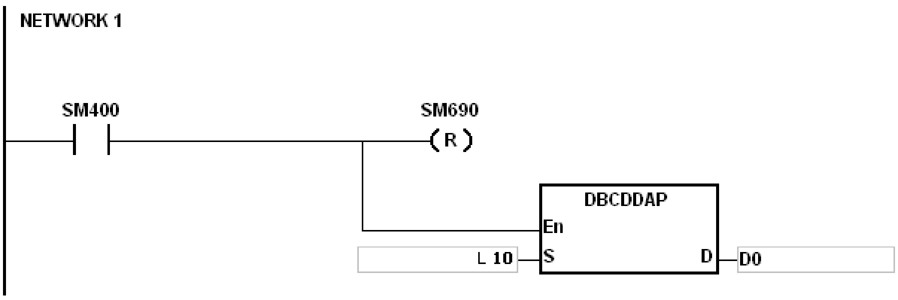
Suppose the binary-coded decimal value in L0 is 1295 and SM690 is OFF. When PLC runs, the values in D0, D1, and D2 are 16#3231, 16#3539, 16#3135, and 16#0000 respectively.

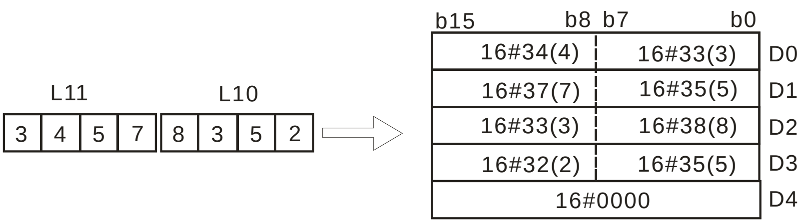




Example 2:

Suppose the binary-coded decimal value in L10 is 34578352 and SM690 is OFF. When the PLC runs, the values in D0, D1, D2, D3, and D4 are 16#3433, 16#3735, 16#3338, 16#3235, and 16#0000 respectively.





Additional remark:

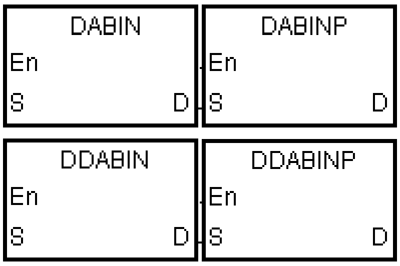
1. If the value in **S** used in the 16-bit instruction is not within the range between 0 and 9999, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200D. (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.)
2. If the value in **S** used in the 32-bit instruction is not within the range between 0 and 99999999, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200D. (The binary-coded decimal value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.)
3. If **D**+2 used in the 16-bit instruction exceeds the device range, SM0 is ON, and the error code in SR0 is 16#2003.
4. If **D**+4 used in the 32-bit instruction exceeds the device range, SM0 is ON, and the error code in SR0 is 16#2003.
5. If the operand **D** used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [3] of WORD/INT.
6. If the operand **D** used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [5] of WORD/INT.

API	Instruction code			Operand	Function
2103	D	DABIN	P	**S, D**	Converting the signed decimal ASCII code into the signed decimal binary number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●			○	
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5-11 steps)	32-bit instruction (5-11 steps)
AH500	AH500	AH500

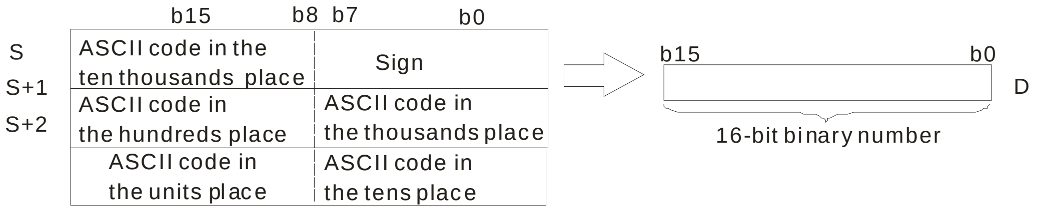
Symbol:



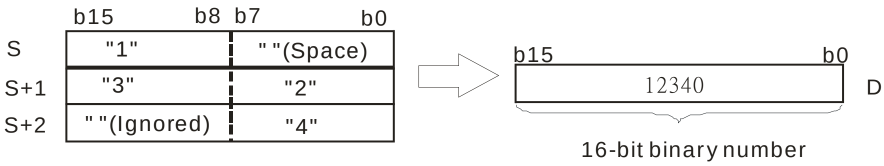
S	:Source value	Word
D	:Device in which the conversion result is stored	Word/Double word

Explanation:

1. The signed decimal ASCII code in **S** is converted into the signed decimal binary number, and the conversion result is stored in **D**.
2. The operand **S** used in the 16-bit instruction occupies three word devices, and the decimal ASCII code in **S** should be within the range between -32768 and 32767. If **S** is a string, the string should be within the range between "-32768" and "32767".

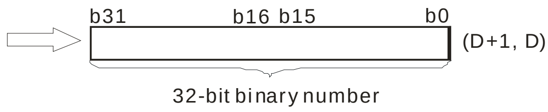


3. If **S** used in the 16-bit instruction is a string and the number of characters contained in the string is less than 6, the characters which the string lacks are regarded as 0. The first character is a sign character. If the first character is " " (a space), the sign is a positive sign. If the first character is "-", the sign is a negative sign. Take the string "1234" for example.



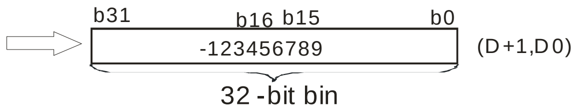
4. The operand **S** used in the 32-bit instruction occupies six word devices, and the decimal ASCII code in **S** should be within the range between -2147483648 and 2147483647. If **S** is a string, the string should be within the range between "-2147483648" and "2147483647".

b15 ... b8	b7 ... b0	
ASCII code in the billions place	Sign	S
ASCII code in the ten millions place	ASCII code in the hundred millions place	S+1
ASCII code in the hundred thousands place	ASCII code in the millions place	S+2
ASCII code in the thousands place	ASCII code in the ten thousands place	S+3
ASCII code in the tens place	ASCII code in the hundreds place	S+4
Ignored	ASCII code in the units place	S+5



5. If **S** used in the 32-bit instruction is a string and the number of characters contained in the string is less than 11, the characters which the string lacks are regarded as 0. The first character is a sign character. If the first character is “ ” (a space), the sign is a positive sign. If the first character is “-”, the sign is a negative sign. Take the string “-0123456789” for example.

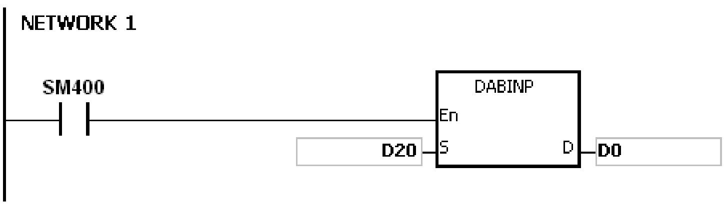
b15 ... b8	b7 ... b0	
"0"	"-"	S
"2"	"1"	S+1
"4"	"3"	S+2
"6"	"5"	S+3
"8"	"7"	S+4
“(Ignored)”	"9"	S+5



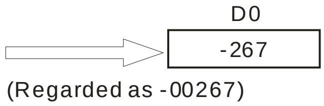
6. If the value in **S** is 16#20 or 16#00, the value is processed as 16#30.
7. If the sign character is 16#20, 16#30 or 16#2B, the conversion result is a positive value. If the sign character is 16#2D, the conversion result is a negative value.
8. If **S** used in the 16-bit instruction is a string, the number of characters contained in the string should be within the range between 1 and 6. If **S** used in the 32-bit instruction is a string, the number of characters contained in the string should be within the range between 1 and 11.

Example 1:

Suppose the values in D20, D21, and D22 are 16#202D, 16#3220, and 16#3736. When the PLC runs, the value in D0 is -267.

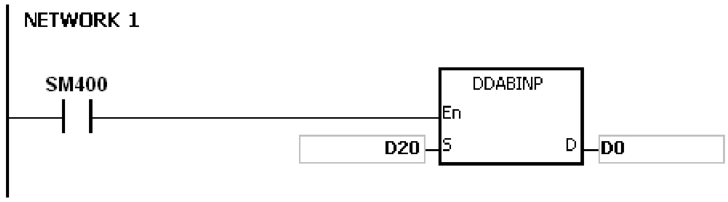


	b15 ... b8	b7 ... b0
D20	16#20( )	16#2D(-)
D21	16#32(2)	16#20(0)
D22	16#37(7)	16#36(6)



Example 2:

Suppose the values in D20, D21, D22, D23, D24 and D25 are 16#2020, 16#2020, and 16#3933, 16#3836, 16#3733, and 16#3330. When the PLC runs, the value in D0 is 3968370.



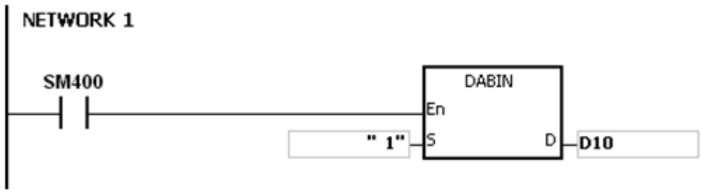
	b15	b8 b7	b0
D20	16#20( )	16#20( )	
D21	16#20( )	16#20( )	
D22	16#39(9)	16#33(3)	
D23	16#38(8)	16#36(6)	
D24	16#37(7)	16#33(3)	
D25		16#30(0)	

3968370 (D1, D0)

(Regarded as +0003968370)

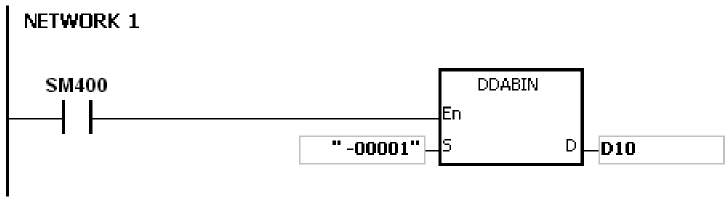
Example 3:

Suppose **S** is the string “1”. The first character is “ ”. Since the number of characters contained in the string is less than 6, the string is regarded as “10000”. When the PLC runs, the value in D10 is 10000.



Example 4:

Suppose **S** is the string “-00001”. The first character is “ ”. Since the number of characters contained in the string is less than 11, the string is regarded as “-0000100000”. When the PLC runs, the value in (D11, D10) is -100000.



Additional remark:

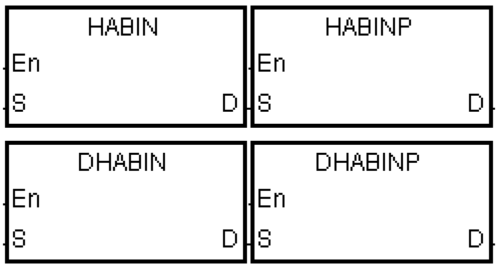
1. If the sign character in **S** is not 16#20, 16#30, 16#2B, or 16#2D, the operation error occurs, the instruction is executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the ASCII code in **S** is not 16#20, 16#0, or within the range between 16#30 and 16#39, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in **S** exceeds the device range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If **S**+2 used in the 16-bit instruction exceeds the device range, SM0 is ON, and the error code in SR0 is 16#2003.
5. If **S**+5 used in the 32-bit instruction exceeds the device range, SM0 is ON, and the error code in SR0 is 16#2003.
6. If the operand **S** used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [3] of WORD/INT.
7. If the operand **S** used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [6] of WORD/INT.

API	Instruction code			Operand	Function
2104	D	HABIN	P	**S, D**	Converting the hexadecimal ASCII code into the hexadecimal binary number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●			○	
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5-11 steps)	32-bit instruction (5-11 steps)
AH500	AH500	AH500

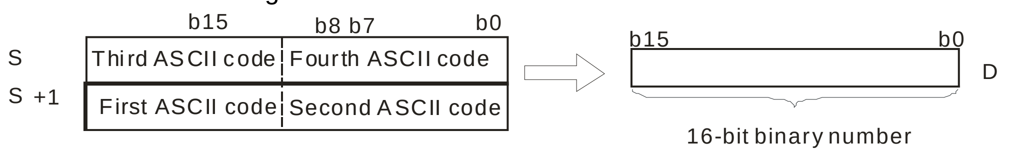
Symbol:



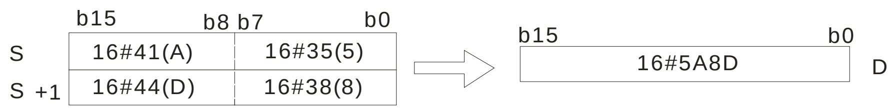
S	:	Source value	Word
D	:	Device in which the conversion result is stored	Word/Double word

Explanation:

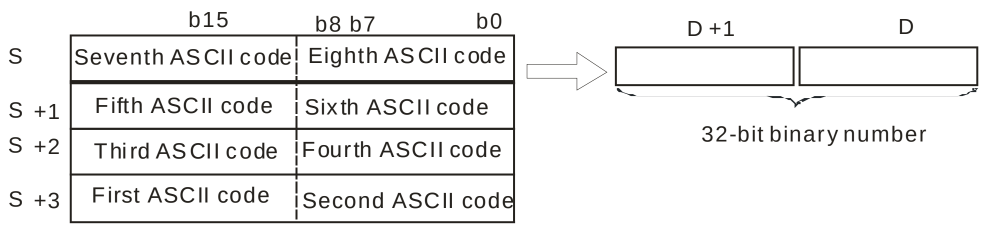
1. The hexadecimal ASCII code in **S** is converted into the hexadecimal binary number, and the conversion result is stored in **D**.
2. The operand **S** used in the 16-bit instruction occupies two word devices, and the hexadecimal ASCII code in **S** should be within the range between 0000 and FFFF. If **S** is a string, the string should be within the range between "0" and "FFFF".



If the ASCII code in **S**~**S**+1 is 5A8D, the conversion result is as follows.



3. The operand **S** used in the 32-bit instruction occupies four word devices, and the hexadecimal ASCII code in **S** should be within the range between 00000000 and FFFFFFFF. If **S** is a string, the string should be within the range between "0" and "FFFFFFFF".



If the ASCII code in **S**~**S**+3 is 5CB807E1, the conversion result is as follows.

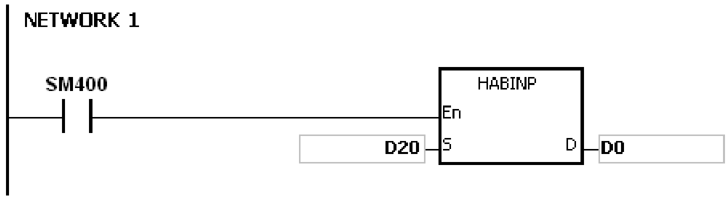
	b15 ... b8	b7 ... b0
S	16#43(C)	16#35(5)
S +1	16#38(8)	16#42(B)
S +2	16#37(7)	16#30(0)
S +3	16#31(1)	16#45(E)

D+1	D
16# 5CB8	16# 07E1

4. If **S** used in the 16-bit instruction is a string, the number of characters contained in the string should be within the range between 1 and 4. If **S** used in the 32-bit instruction is a string, the number of characters contained in the string should be within the range between 1 and 8.

Example 1:

Suppose the values in D20 and D21 are 16#3641 and 16#4633 respectively. When the PLC runs, the value in D0 is -22977.



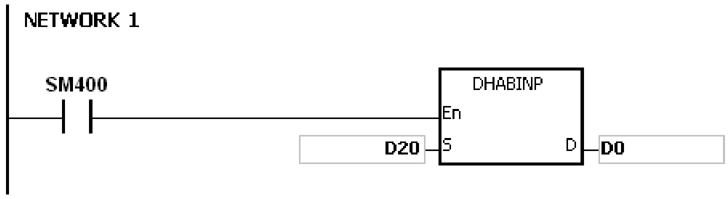
	b15 ... b8	b7 ... b0
D20	16#36(6)	16#41(A)
D21	16#46(F)	16#33(3)

D0
-22977

Conversion result=16#A63F=-22977

Example 2:

Suppose the values in D20, D21, D22, and D23 are 16#4634, 16#3244, 16#3738, and 16#3035 respectively. When the PLC runs, the value in (D1, D0) is 1339197264.



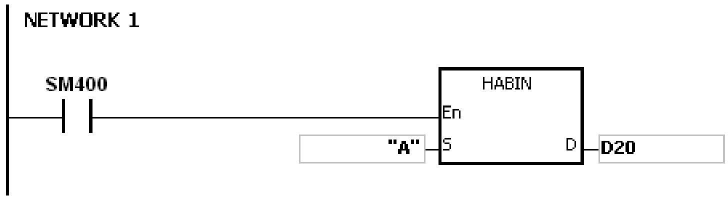
	b15 ... b8	b7 ... b0
D20	16#46(F)	16#34(4)
D21	16#32(2)	16#44(D)
D22	16#37(7)	16#38(8)
D24	16#30(0)	16#35(5)

(D1,D0)
1339197264

Conversion result= 16#4FD28750=1339197264

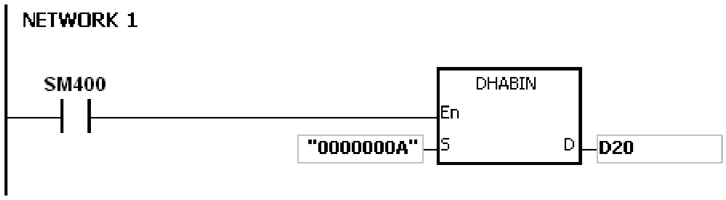
Example 3:

Suppose **S** is the string “A”. Since the number of characters contained in the string is less than 4, the string is regarded as “A000”. When the PLC runs, the value in D20 is -24576.



Example 4:

Suppose **S** is the string “0000000A”. When the PLC runs, the value in (D21, D20) is 10.



Additional remark:

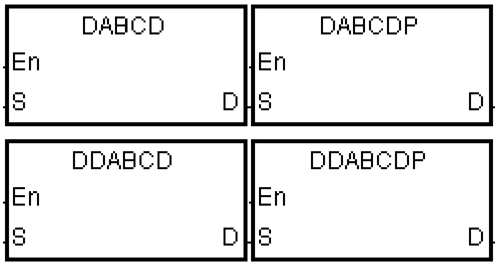
1. If the ASCII code in **S** is not within the range between 16#30 and 16#39, or within the range between 16#41 and 16#46, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the operand **S** used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of WORD/INT.
3. If the operand **S** used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [4] of WORD/INT.

API		Instruction code		Operand	Function
2105	D	DABCD	P	S, D	Converting the ASCII code into the binary-coded decimal number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●			○	
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5-11 steps)	32-bit instruction (5-11 steps)
AH500	AH500	AH500

Symbol:

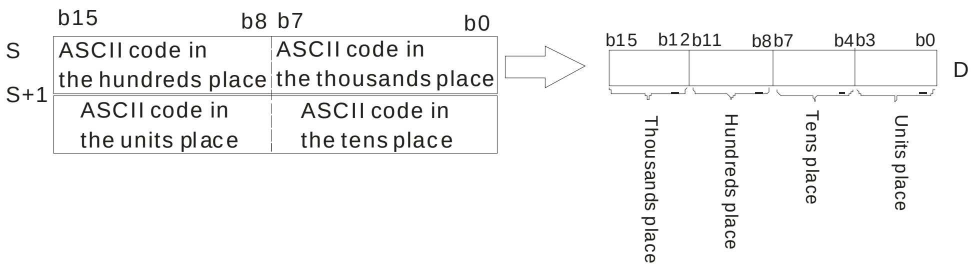


S : Source value — Word/Double word

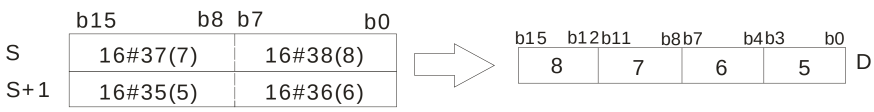
D : Device in which the conversion result is stored — Word/Double word

Explanation:

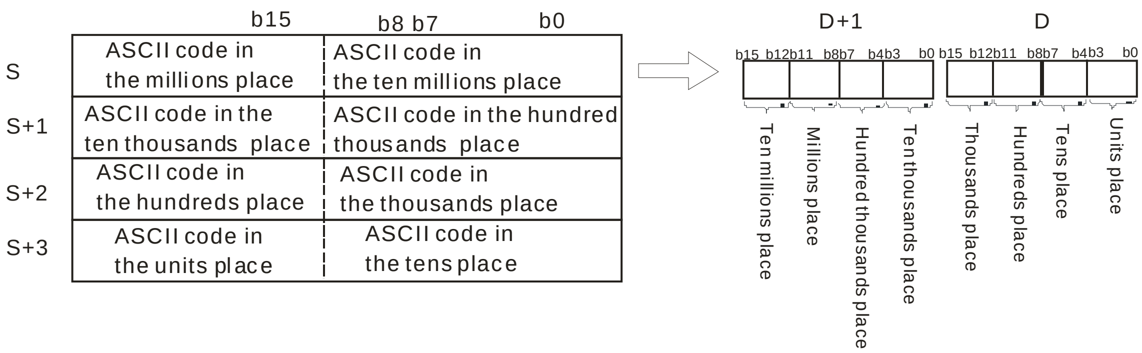
1. The ASCII code in **S** is converted into the binary-coded decimal number, and the conversion result is stored in **D**.
2. The operand **S** used in the 16-bit instruction occupies two word devices, and the ASCII code in **S** should be within the range between 0000 and 9999. If **S** is a string, the string should be within the range between "0" and "9999".



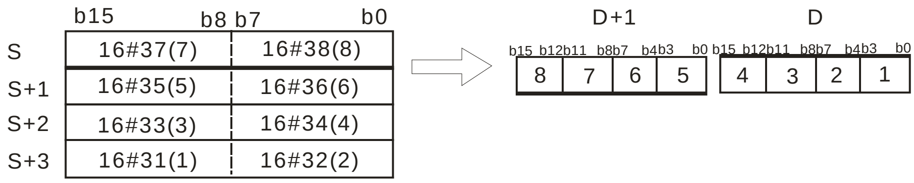
If the ASCII code in **S**~**S**+1 is 8765, the conversion result is as follows.



3. The operand **S** used in the 32-bit instruction occupies four word devices, and the ASCII code in **S** should be within the range between 0000000 and 99999999. If **S** is a string, the string should be within the range between "0" and "99999999".



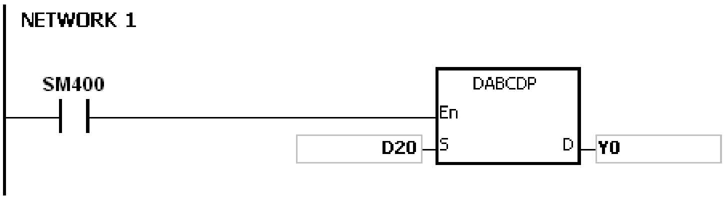
If the ASCII code in **S**~**S**+3 is 87654321, the conversion result is as follows.

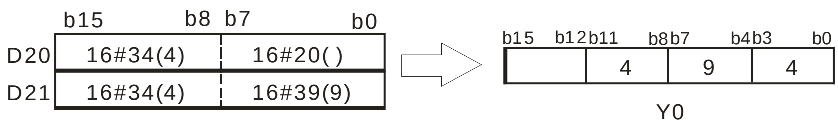


4. If the value in **S** is 16#20 or 16#00, the value is processed as 16#30.
5. If **S** used in the 16-bit instruction is a string, the number of characters contained in the string should be within the range between 1 and 4. If **S** used in the 32-bit instruction is a string, the number of characters contained in the string should be within the range between 1 and 8.

Example 1:

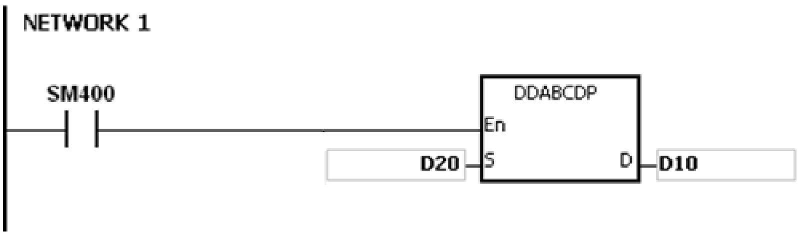
Suppose the values in D20 and D21 are 16#3420 and 16#3439 respectively. When the PLC runs, the value in Y0 is 16#494.

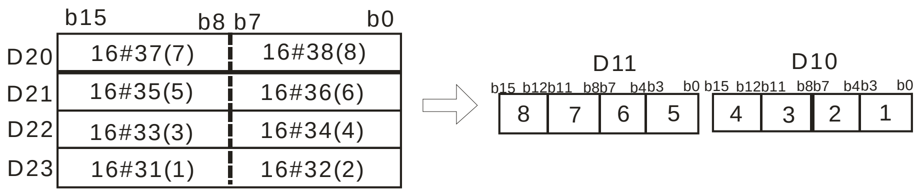




Example 2:

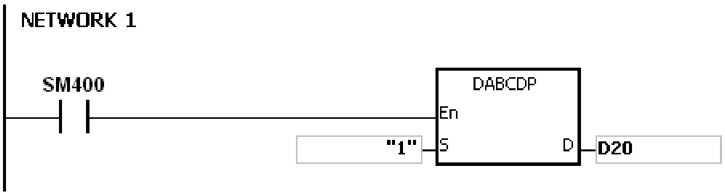
Suppose the values in D20, D21, D22, and D23 are 16#3738, 16#3536, 16#3334, and 16#3132 respectively. When the PLC runs, the value in (D11, D10) is 16#87654321.





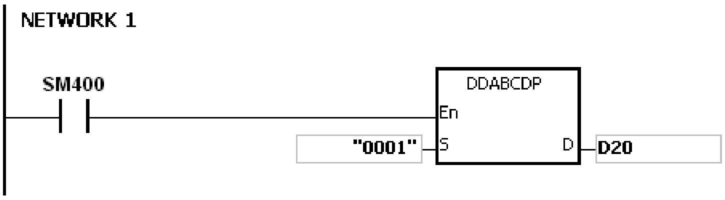
Example 3:

Suppose **S** is the string “1”. Since the number of characters contained in the string is less than 4, the string is regarded as “1000”. When the PLC runs, the value in D20 is 16#1000.



Example 4:

Suppose **S** is the string “0001”. Since the number of characters contained in the string is less than 8, the string is regarded as “00010000”. When the PLC runs, the value in (D21, D20) is 16#10000.



Additional remark:

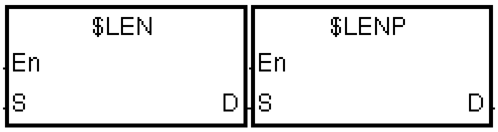
1. If the ASCII code in **S** is not within the range between 16#30 and 16#39, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **S** is a string and the number of characters contained in the string exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the operand **S** used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of WORD/INT.
4. If the operand **S** used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [4] of WORD/INT.

API	Instruction code		Operand	Function
2106	$LEN	P	**S, D**	Calculating the length of the string

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●			○	
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (5-11 steps)	32-bit instruction
AH500	AH500	-

Symbol:

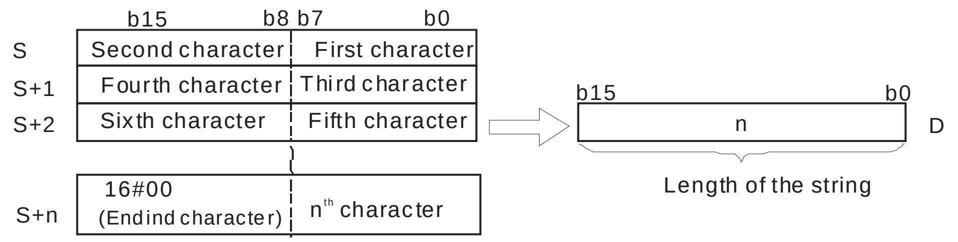


S :String Word/Double word

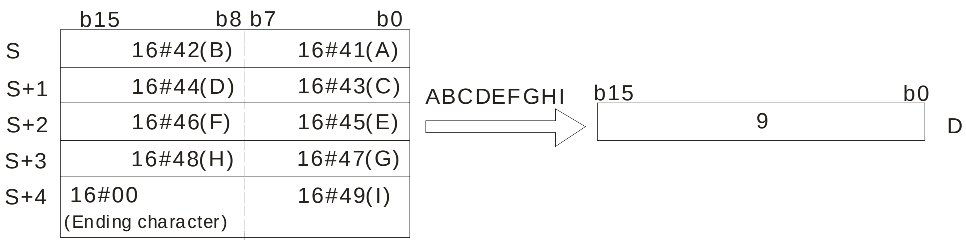
D :Length of the string Word/Double word

Explanation:

1. The length of the string in **S** is calculated, exclusive of 16#00 with which the string ends. The length of the string is stored in **D**.
2. The value stored in D should be within the range between 0 and 65535.
   If the number of characters contained in the string is 65536, which is equal to 16#10000, the value in D is 0.
   If the number of characters contained in the string is 65537, which is equal to 16#10001, the value in D is 0.

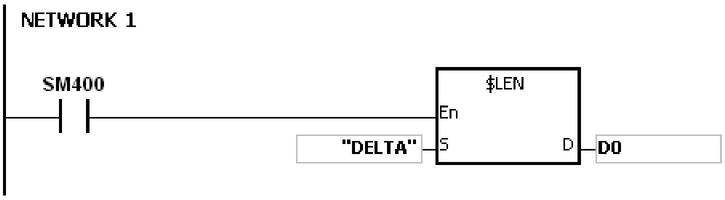


If the data in **S**~**S**+4 is ABCDEFGHI, the calculation result is as follows.



Example 1:

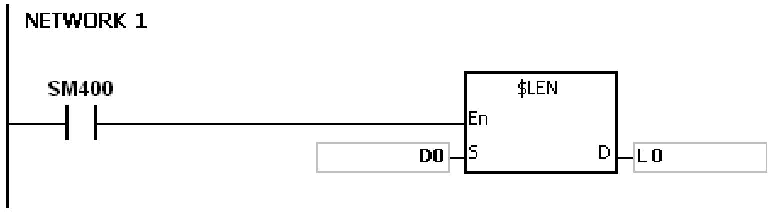
Suppose **S** is the string "DELTA". When the PLC runs, the value in D0 is 5.



Example 2:

Suppose the data in D0~D2 is as follows. When the PLC runs, the value in L0 is 5.

D0	16#45 (E)	16#44 (D)
D1	16#54 (T)	16#4C (L)
D2	16#00 (Ending character)	16#41 (A)



Additional remark:

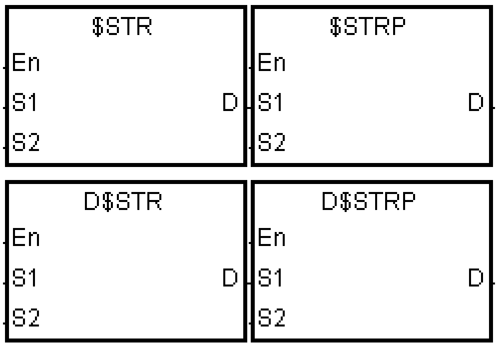
If the string does not end with 16#00, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200E.

API	Instruction code			Operand	Function
2107	D	$STR	P	S_1, S_2, D	Converting the binary number into the string

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●	○	●				
S_2	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction (7 steps)
AH500	AH500	AH500

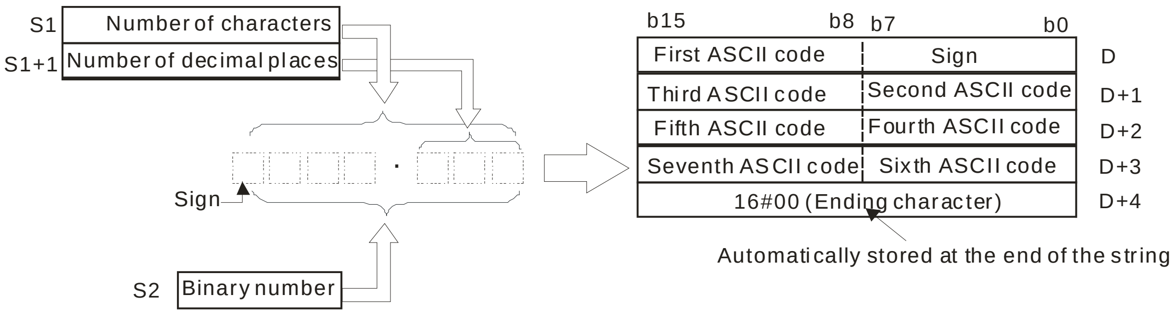
Symbol:



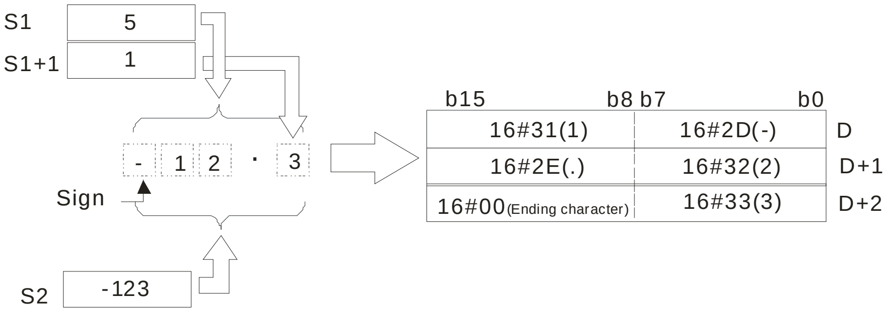
S_1	:	Initial device in which the number of characters is stored	Word/Double word
S_2	:	Value which is converted	Word/Double word
D	:	Initial device in which the conversion result is stored	Word

Explanation:

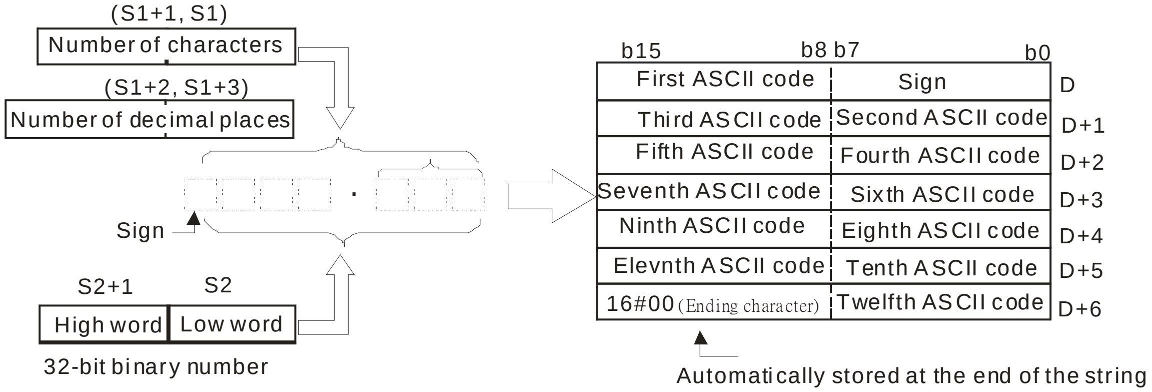
1. A decimal point is added to the value in S_2, the value in S_1+1 indicates the number of decimal places, and the value in S_1 indicates the number of characters. The conversion result is stored in **D**.
2. **$STR:**
   The value in S_1 should be within the range between 2 and 8.
   The value in S_1+1 should be within the range between 0 and 5, and should be less than or equal to the value in S_1 minus 3.
   The value in S_2 should be within the range between -32768 and 32767.



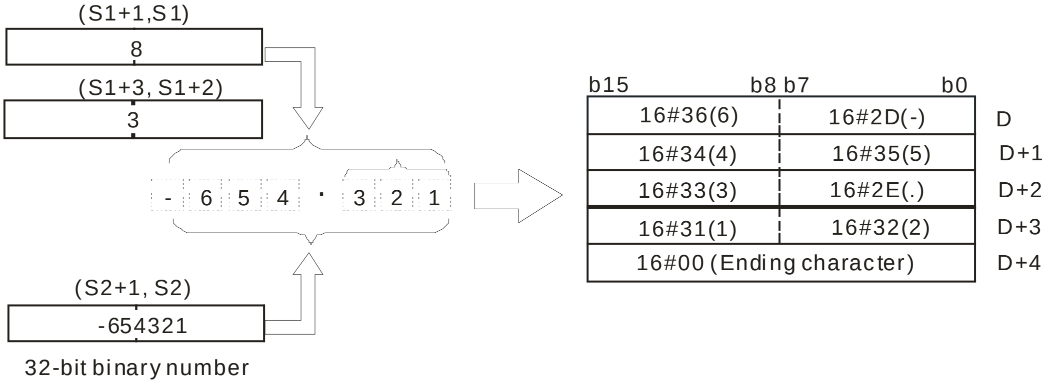
Suppose the number of characters is 5, the number of decimal places is 1, and the value is -123. The conversion result is as follows.



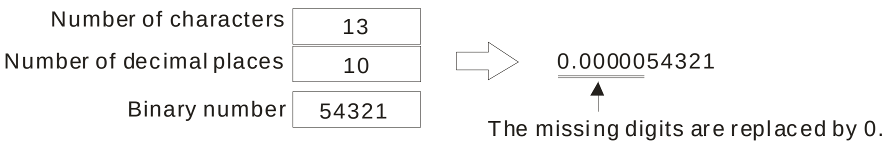
3. **D$STR:**
   The value in $\mathbf{S_1}$ should be within the range between 2 and 13.
   The value in $\mathbf{S_1}$+1 should be within the range between 0 and 10, and should be less than or equal to the value in $\mathbf{S_1}$ minus 3.
   The value in $\mathbf{S_2}$ should be within the range between -2147483648 and 2147483647.



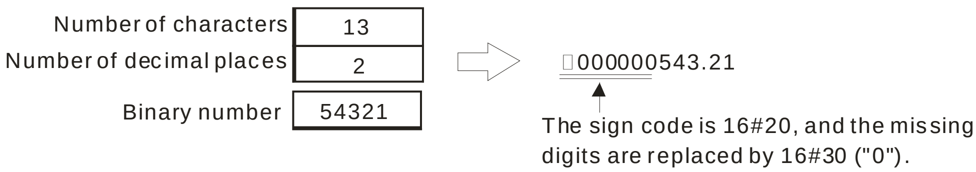
Suppose the number of characters is 8, the number of decimal places is 3, and the value is -654321. The conversion result is as follows.



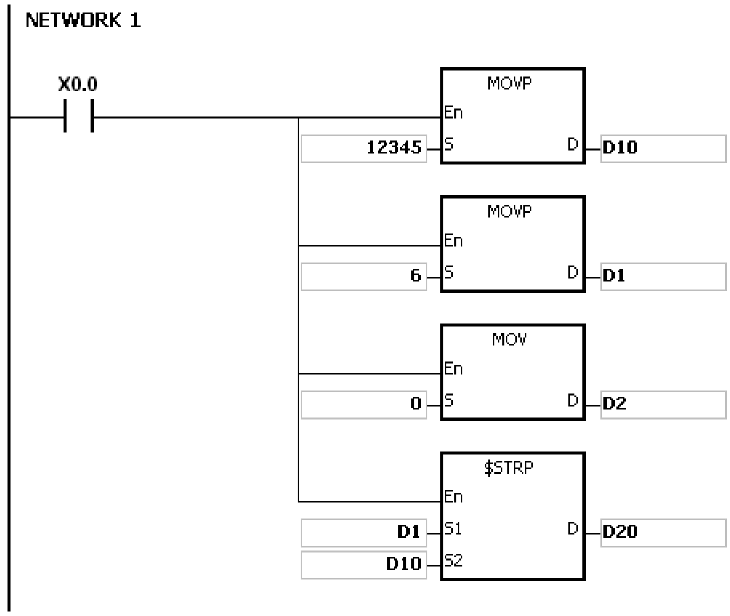
4. If the value in $\mathbf{S_2}$ is a positive value, the sign code in **D** is 16#20. If the value in $\mathbf{S_2}$ is a negative value, the sign code in **D** is 16#2D.
5. The code in **D** which represents the decimal point is 16#2E.
6. If the value in $\mathbf{S_1}$+1 is larger than the number of digits in $\mathbf{S_2}$, the missing digits are replaced by 0.

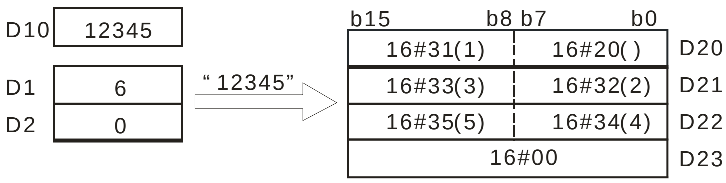


7. If the value in $\mathbf{S_1}$ is larger than the number of digits in $\mathbf{S_2}$ plus the number of characters which include the decimal point and the sign, the missing digits are replaced by 0.

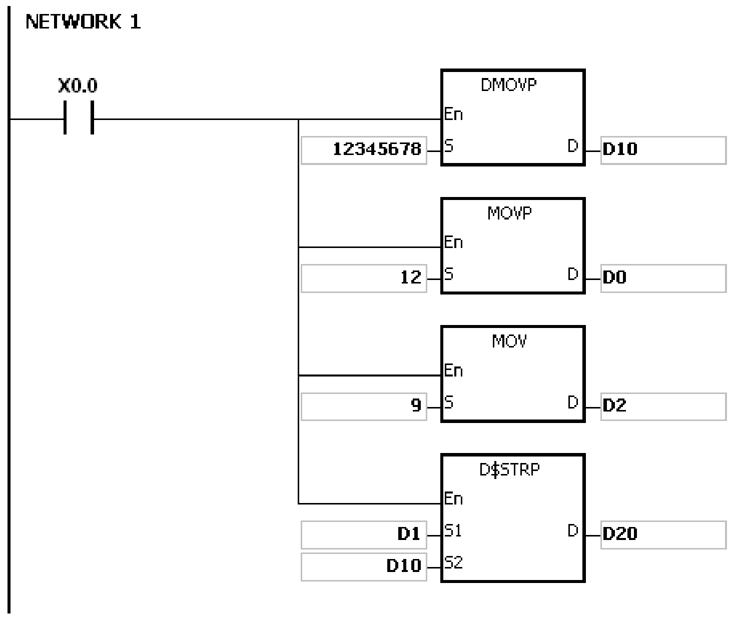


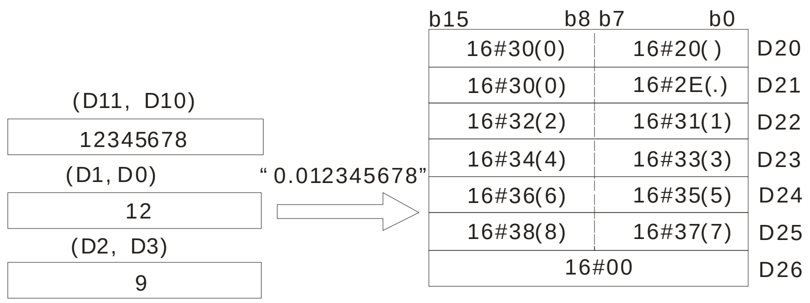
Example 1:





Example 2:





Additional remark:

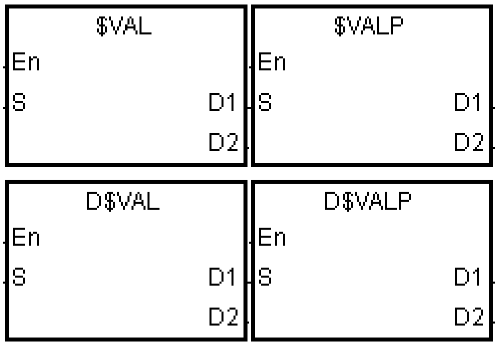
1. If the value in $\mathbf{S_1}$ exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the value in $\mathbf{S_1}$+1 exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. The value in $\mathbf{S_1}$+1 should be less than or equal to the value in $\mathbf{S_1}$ minus 3. Otherwise, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If the value in $\mathbf{S_1}$ is less than the number of digits in $\mathbf{S_2}$ plus the number of characters which include the decimal point and the sign, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
5. If the operand $\mathbf{S_1}$ used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of WORD/INT.
6. If the operand $\mathbf{S_1}$ used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of DWORD/DINT.

API	Instruction code			Operand	Function
2108	D	$VAL	P	**S, D₁, D₂**	Converting the string into the binary number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●			○	
D_1	●	●			●	●		●	●				●				
D_2	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (7-13 steps)	32-bit instruction (7-13 steps)
AH500	AH500	AH500

Symbol:



S : Source value — Word

D_1 : Device in which the number of characters is stored — Word/Double word

D_2 : Device in which the binary number is stored — Word/Double word

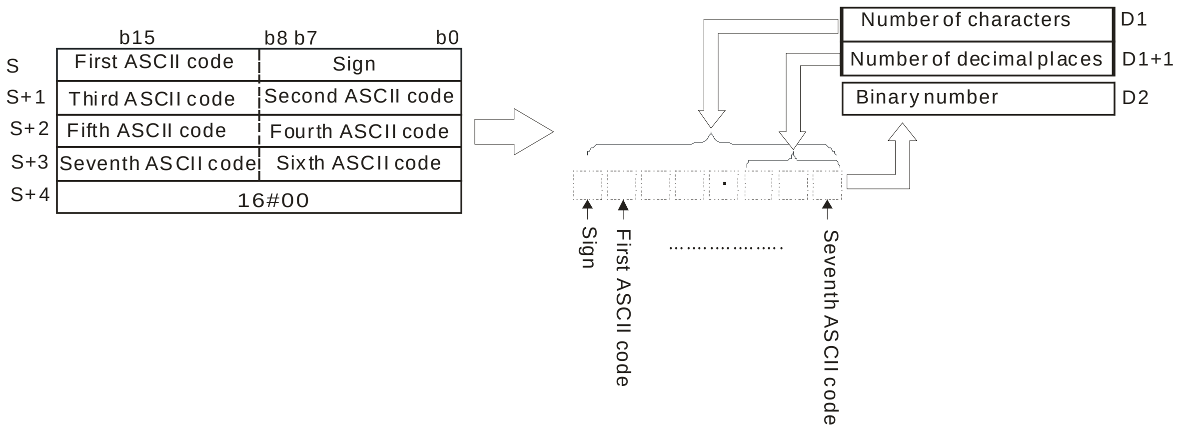
Explanation:

1. The string in **S** is converted into binary number. The number of characters is stored in **D_1**, the number of decimal places is stored in **D_1**+1, and the binary number is stored in **D_2**.
2. **$VAL:**

   The operand **S** occupies five word devices at most.

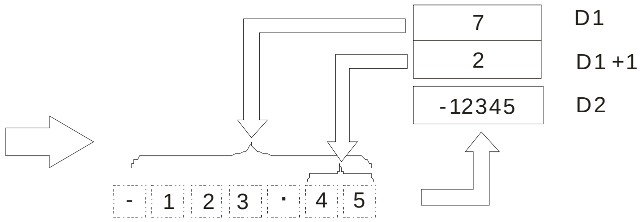
   The number of characters contained in the string in **S** should be within the range between 2 and 8.

   If there is a decimal point in the string in **S**, 16#2E should be stored between the first character after the sign character and the last character.

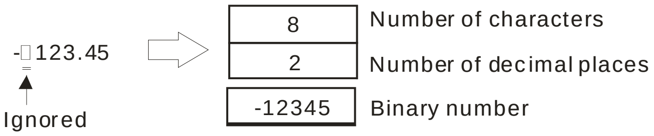


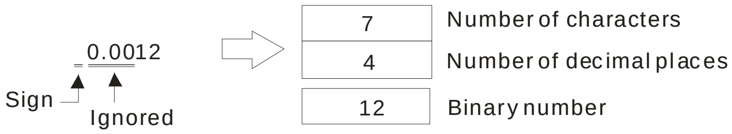
If the data in **S**~**S**+3 is -123.45, the calculation is as follows.

	b15 ... b8	b7 ... b0
S	16#31(1)	16#2D(-)
S+1	16#33(3)	16#32(2)
S+2	16#34(4)	16#2E(.)
S+3	16#00	16#35(5)



If there is 16#20 or 16#30 between the sign character and the first value which is not 0 in the string, 16#20 or 16#30 is ignored when the string is converted into the binary number.





If 16#2E, which represents the decimal point, is ignored, the string in **S** should be within the range between -32768 and 32767. For example, if the string is “1235.3”, users have to check whether “12353” is within the range.

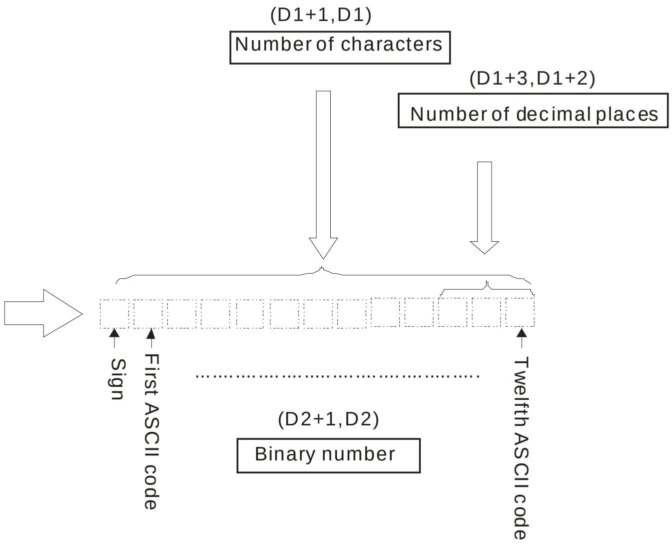
3. **D$VAL:**

   The operand **S** occupies seven word devices at most.

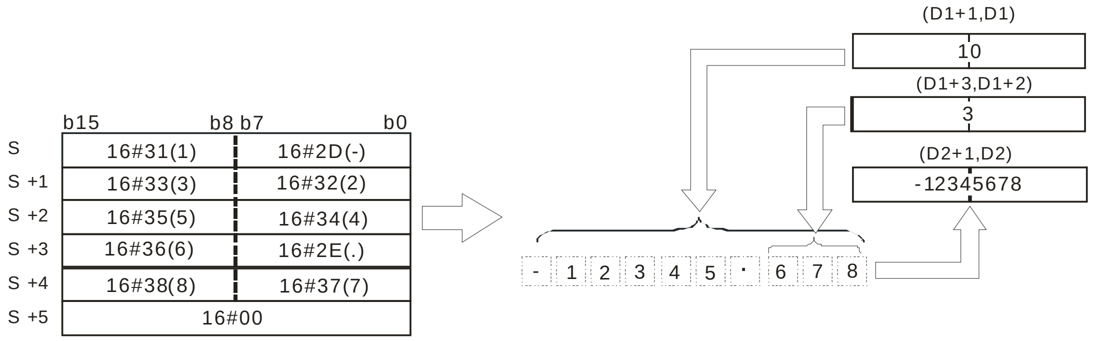
   The number of characters contained in the string in **S** should be within the range between 2 and 13.

   If there is a decimal point in the string in **S**, 16#2E should be stored between the first character after the sign character and the last character.

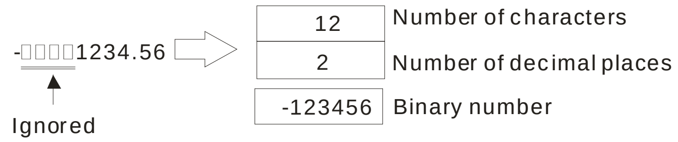
	b15 ... b8	b7 ... b0
S	First ASCII code	Sign
S+1	Third ASCII code	Second ASCII code
S+2	Fifth ASCII code	Fourth ASCII code
S+3	Seventh ASCII code	Sixth ASCII code
S+4	Ninth ASCII code	Eighth ASCII code
S+5	Elevnth ASCII code	Tenth ASCII code
S+6	16#00	Twelfth ASCII code

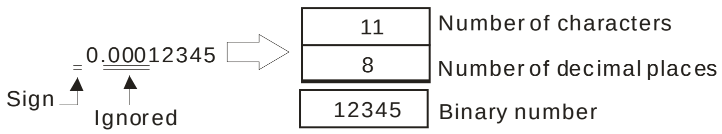


If the data in **S**~**S**+5 is -12345.678, the calculation is as follows.



If there is 16#20 or 16#30 between the sign character and the first value which is not 0 in the string in **S**, 16#20 or 16#30 is ignored when the string is converted into the binary number.

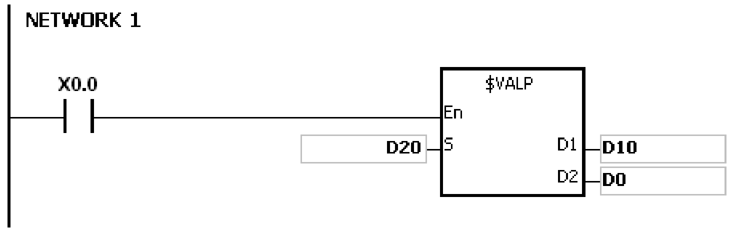


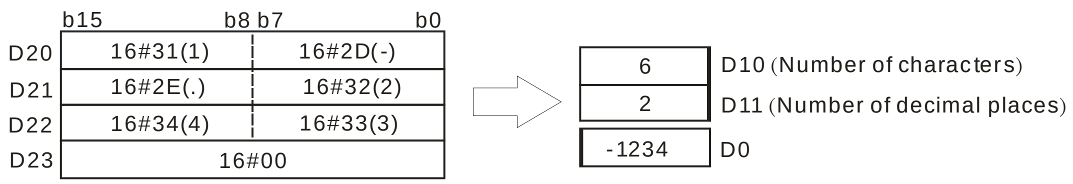


If 16#2E, which represents the decimal point, is ignored, the string in **S** should be within the range between -2147483648 and 2147483647. For example, if the string is “1234567.8”, users have to check whether “12345678” is within the range.

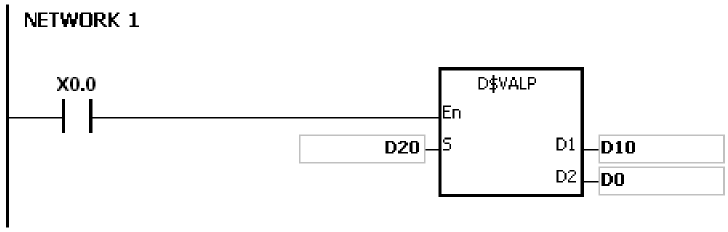
4. If the sign code in **S** is 16#20, 16#2B, and 16#30 the conversion result is a positive value. If the sign code in **S** is 16#2D, the conversion result is a negative value.
5. In the string in **S**, except for the sign code, the code representing the decimal point, and the code which can be ignored, i.e. 16#20 or 16#30, the other codes have to be within the range between 16#30 and 16#39.

Example 1:





Example 2:



	b15 … b8	b7 … b0
D20	16#31(1)	16#20( )
D21	16#33(3)	16#32(2)
D22	16#35(5)	16#34(4)
D23	16#36(6)	16#2E(.)
D24	16#38(8)	16#37(7)
D25	16#00	

Register	Value	
(D11,D10)	10	Number of characters
(D13,D12)	3	Number of decimal places
(D1,D0)	12345678	

Additional remark:

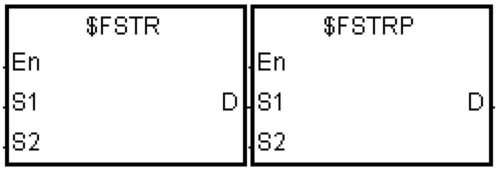
1. If the number of characters contained in the string in **S** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the sign code in **S** is not 16#20, 16#2B, 16#30 and 16#2D, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the decimal point in the string in **S** is not stored between the first character after the sign character and the last character, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If the binary number converted from the string in **S** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
5. In the string in **S**, except for the sign code, the code representing the decimal point, and the code which can be ignored, i.e. 16#20 or 16#30, the other codes have to be within the range between 16#30 and 16#39. If the other codes are not within the range between 16#30 and 16#39, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
6. If the operand **D_1** used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of WORD/INT.
7. If the operand **D_1** used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of DWORD/DINT.

API	Instruction code		Operand	Function
2109	$FSTR	P	**S_1, S_2, D**	Converting the floating-point number into the string

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●		●				○
S_2	●	●			●	●		●	●		●		●				
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (7-8 steps)	32-bit instruction
AH500	AH500	-

Symbol:



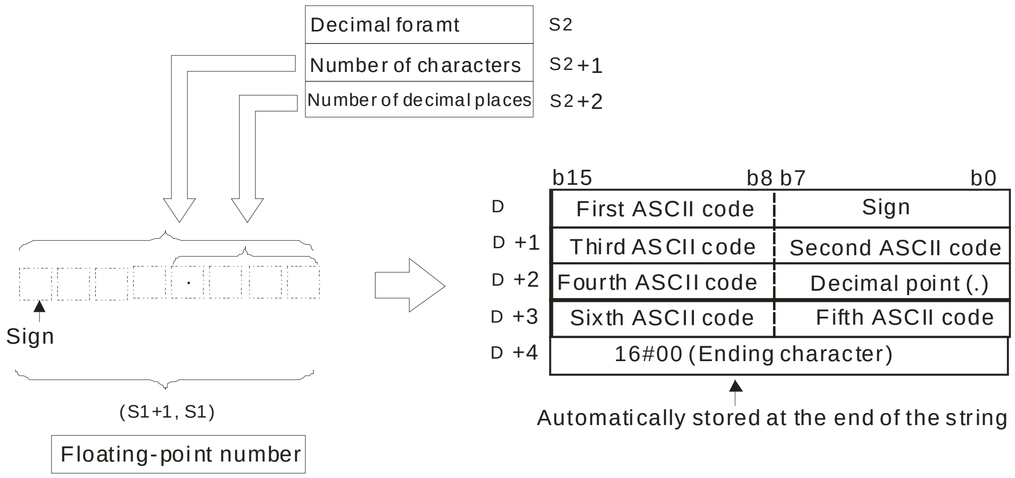
S_1	:	Source value	Double word
S_2	:	Initial device in which the format is stored	Word
D	:	Initial device in which the conversion result is stored	Word

Explanation:

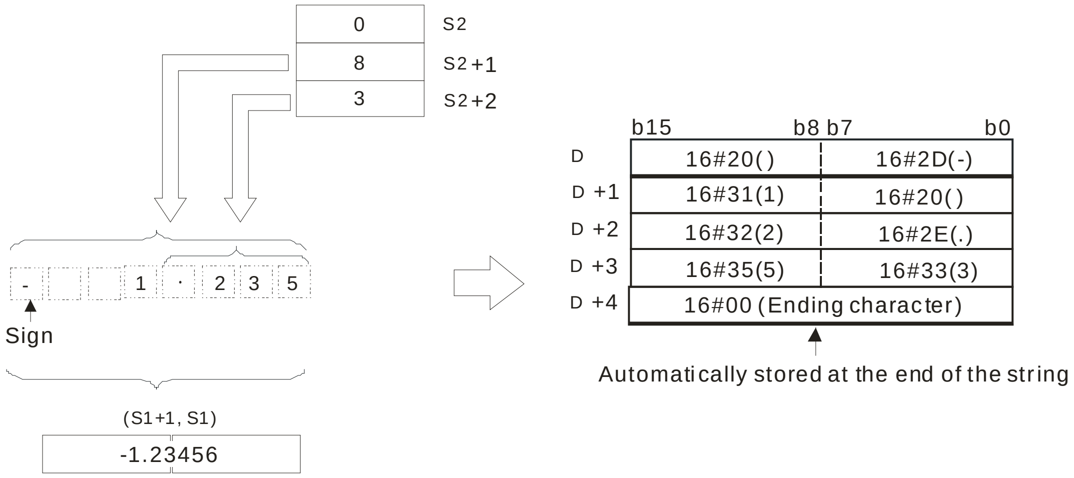
1. The floating-point number in **S_1** is converted into the string in accordance with the setting of **S_2**, and the conversion result is stored in **D**.
2. The conversion result varies with the setting of **S_2**.
3. The value in **S_2**+1 should be within the range between 2 and 24.

S2	0: Decimal format 1: Exponential
S2+1	Number of characters
S2+2	Number of decimal places

4. Decimal format



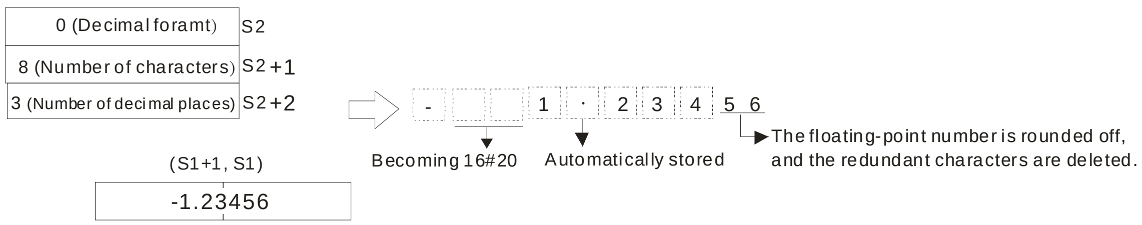
Suppose the number of characters is 8, the number of decimal places is 2, and the value is -1.23456. The calculation is as follows.



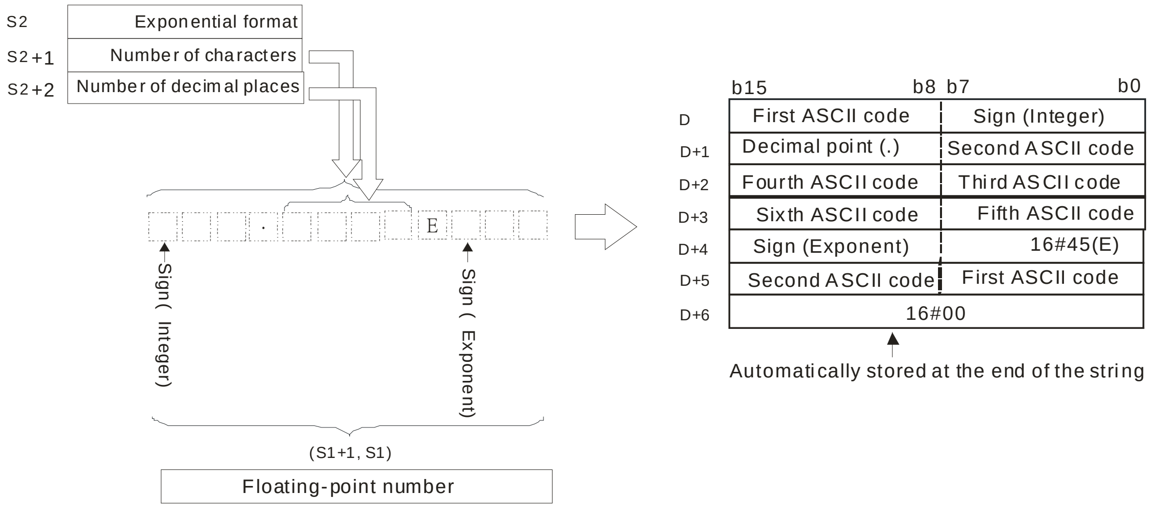
- The value in S_2+1:

  If the value in S_2+2 is 0, the value in S_2+1 should be within the range between 2 and 24, and the number of characters which the integer part contains should be less than or equal to 23.

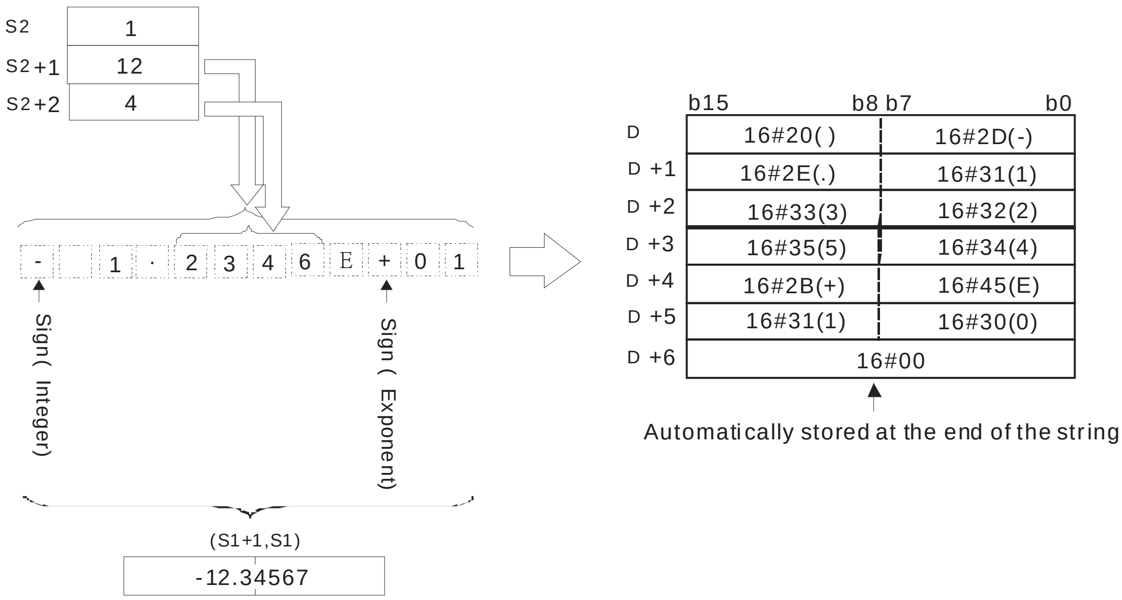
  If the value in S_2+2 is not 0, the value in S_2+1 should be within the range between the value in S_2+2 plus 3 and 24, and the number of characters which the integer part contains should be less than or equal to 22 minus the value in S_2+2.
- The value in S_2+2 should be within the range between 0 and 7. If the value in S_2+2 is not 0, it should be less than or equal to the value in S_2+1 minus 3.
- If the floating-point number in S_1 is a positive number, the sign code in **D** is 16#20. If the floating-point number in S_1 is a negative number, the sign code in **D** is 16#2D.
- If the length of the floating-point number is larger than the value in S_2+1, the floating-point number is rounded off, and the redundant characters are deleted.
- If the value in S_2+2 is larger than 0, 16#2E (".") is stored in front of the specified character automatically.
- If the length of the conversion result is less than the value in S_2+1, the codes between the sign character and the real number are 16#20.
- The conversion result ends with 16#00.



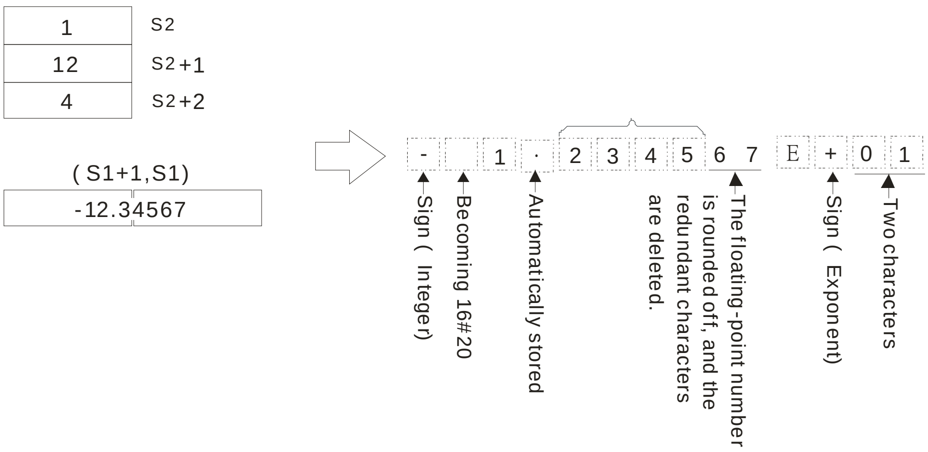
5. Exponential format



Suppose the number of characters is 12, the number of decimal places is 4, and the value is -12.34567. The calculation is as follows.

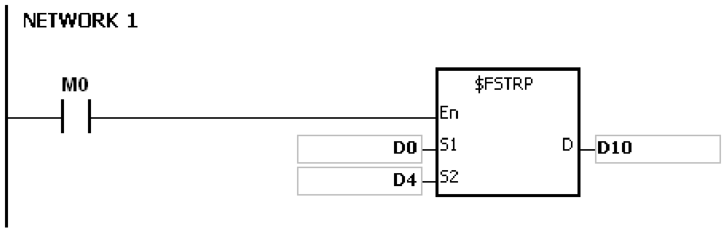


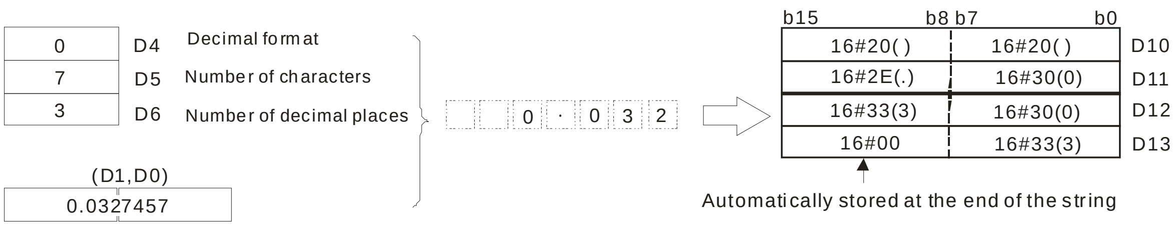
- The value in $\mathbf{S_2}$+1:
  If the value in $\mathbf{S_2}$+2 is 0, the value in $\mathbf{S_2}$+1 should be within the range between 6 and 24.
  If the value in $\mathbf{S_2}$+2 is not 0, the value in $\mathbf{S_2}$+1 should be within the range between the value in $\mathbf{S_2}$+2 plus 7 and 24.
- The value in $\mathbf{S_2}$+2 should be within the range between 0 and 7. If the value in $\mathbf{S_2}$+2 is not 0, it should be less than or equal to the value in $\mathbf{S_2}$+1 minus 7.
- If the floating-point number in $\mathbf{S_1}$ is a positive number, the sign code in **D** is 16#20. If the floating-point number in $\mathbf{S_1}$ is a negative number, the sign code in **D** is 16#2D.
- The integer part contains one character. To fulfill the number of characters, the codes between the sign code and the integer part are 16#20.
- If the value in $\mathbf{S_2}$+2 is larger than 0, 16#2E (".") is stored in front of the specified character automatically.
- If the exponent is a positive number, the sign code in **D** is 16#2B. If the exponent is a negative number, the sign code in **D** is 16#2D.
- The exponent part contains two characters. If there is only one character, the other character is "0" (16#30).
- The conversion result ends with 16#00.



Example 1:

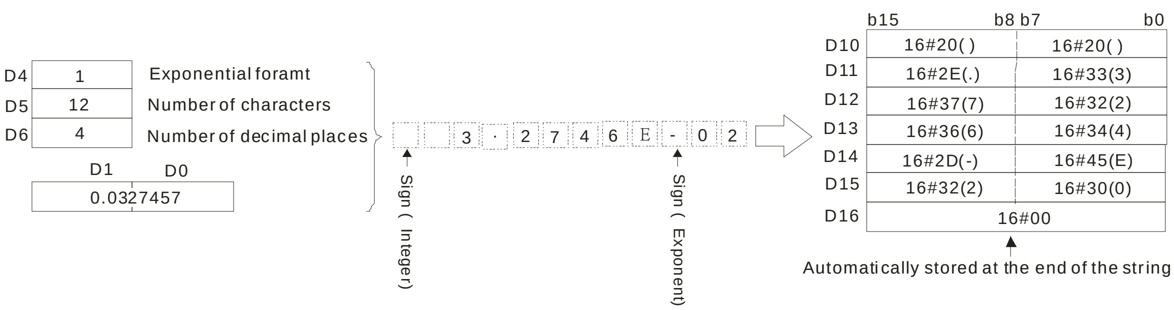
Suppose the value in D4 is 0. The floating-point number in (D1, D0) is converted into the decimal format of the string.





Example 2:

Suppose the value in D4 is 1. The floating-point number in (D1, D0) is converted into the exponential format of the string.



Additional remark:

1. If the value in **S_1** exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.
2. If the value in **S_2** is neither 0 nor 1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in **S_2**+1 exceeds the range below, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
   - The decimal format:

     If the value in **S_2**+2 is 0, the value in **S_2**+1 should be within the range between 2 and 24, and the number of characters which the integer part contains should be less than or equal to 23.

     If the value in **S_2**+2 is not 0, the value in **S_2**+1 should be within the range between the value in **S_2**+2 plus 3 and 24, and the number of characters which the integer part contains should be less than or equal to 22 minus the value in **S_2**+2
   - The exponential format:

     If the value in **S_2**+2 is 0, the value in **S_2**+1 should be within the range between 6 and 24.

     If the value in **S_2**+2 is not 0, the value in **S_2**+1 should be within the range between the value in **S_2**+2 plus 7 and 24.
4. If the value in **S_2**+2 exceeds the range below, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
   - The decimal format:

     The value in **S_2**+2 should be within the range between 0 and 7. Besides, it should be less than or equal to the value in **S_2**+1 minus 3.
   - The exponential format:

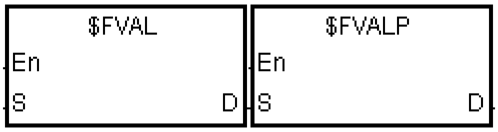
     The value in **S_2**+2 should be within the range between 0 and 7. Besides, it should be less than or equal to the value in **S_2**+1 minus 7.
5. If users declare the operand **S_2** in ISPSoft, the data type will be ARRAY [3] of WORD/INT.

API	Instruction code			Operand	Function
2110		$FVAL	P	S, D	Converting the string into the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●			○	
D	●	●			●	●		●	●		●		●				

Pulse instruction	16-bit instruction (5-11 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S	:	Source value	Word
D	:	Device in which the conversion result is stored	Double word

Explanation:

1. The string in **S** is converted into the floating-point number, and the conversion result is stored in **D**.

	b15 … b8	b7 … b0
S	First ASCII code	Sign
S +1	Third ASCII code	Second ASCII code
S +2	Fifth ASCII code	Fourth ASCII code
S +3	Seventh ASCII code	Sixth ASCII code
S +4	……	
……	……	
S +…	16#00	

The end of the string

→ (D+1, D): Floating-point number

2. The string in **S** can be the decimal format of the string or the exponential format of the string.
   - The decimal format:

	b15 … b8	b7 … b0
S	16#31H(1)	16#2D(-)
S +1	16#30(0)	16#2E(.)
S +2	16#38(8)	16#37(7)
S +3	16#32(2)	16#31(1)
S +4	16#00	

→ (D+1, D): HBF89FFD4

Floating-point number -1.07812

- 1 . 0 7 8 1 2

   - The exponential format:

	b15 … b8	b7 … b0
S	16#20( )	16#2D(-)
S +1	16#2E(.)	16#31(1)
S +2	16#32(2)	16#33(3)
S +3	16#31(1)	16#30(0)
S +4	16#2B(+)	16#45(E)
S +5	16#30(0)	16#31(1)
S +6	16#00	

→ (D+1, D): 16#D044B5D1

Floating-point number -1.3201E+10

- 1 . 3 2 0 1 E + 1 0

3. If the sign code in **S** is 16#20, 16#30, or 16#2B the conversion result is a positive value. If the sign code in $\mathbf{S_1}$ is 16#2D, the conversion result is a negative value.
4. 16#20 or 16#30 is ignored during the conversion, as the example below shows.

	b15 … b8	b7 … b0
S	16#20( )	16#2D(-)
S +1	16#31(1)	16#30(0)
S +2	16#32(2)	16#2E(.)
S +3	16#31(1)	16#33(3)
S +4	16#00	

(D+1, D)

16#BF9D9168

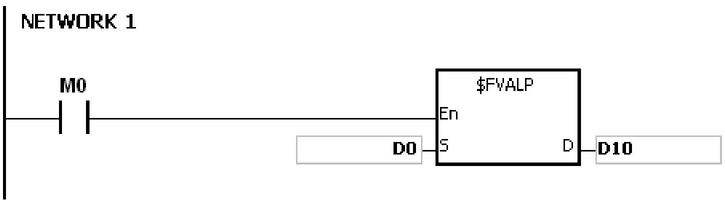
Floating-point number -1.231

-   0 1 . 2 3 1

Ignored

5. 24 characters at most can be contained in the string S.

Example 1:



	b15 … b8	b7 … b0
D0	16#20( )	16#2D(-)
D1	16#31(1)	16#30(0)
D2	16#32(2)	16#2E(.)
D3	16#34(4)	16#33(3)
D4	16#32(2)	16#35(5)
D5	16#00	16#31(1)

(D11, D10)

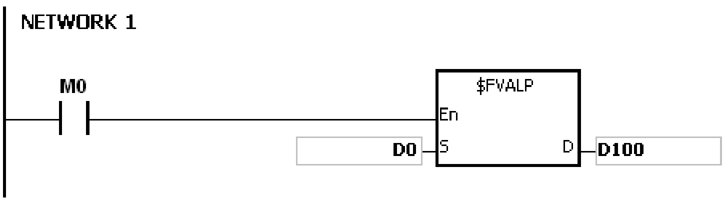
16#BF9E04C7

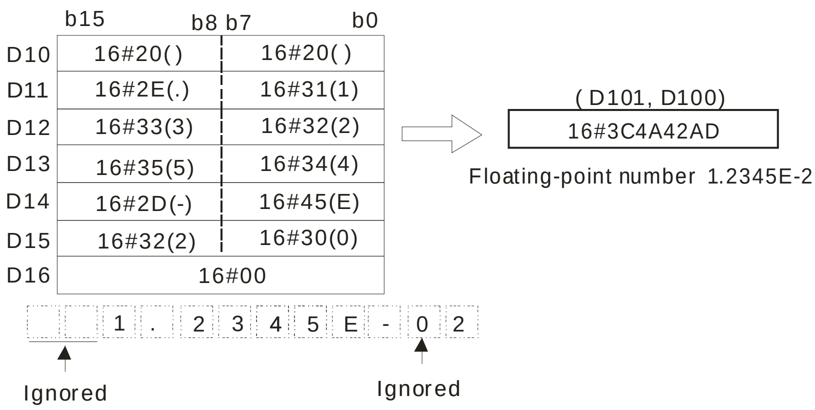
Floating-point number -1.234521

-   0 1 . 2 3 4 5 2 1

Ignored

Example 2:





Additional remark:

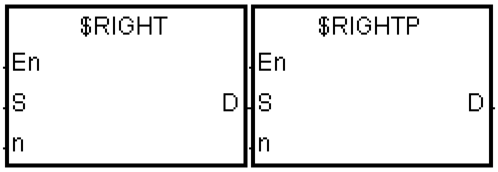
1. If the string in **S** does not end with 16#00, SM0 is ON, and the error code in SR0 is 16#200E.
2. If the length of the string in **S** exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the sign code in **S** is not 16#20, 16#30, 16#2B or 16#2D, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If there is more than one 16#2E (“.”), 16#2B (“+”), or 16#2D (“-”) in the string in **S**, exclusive of 16#2D (“-”) with which the string starts, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
5. If the characters which constitute the integer part and the characters which constitute the fractional part in the string in **S** are not within the range between 16#30 (“0”) and 16#39 (“9”), the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
6. The character in the exponent part in the string in **S** only can be “E” (16#45), “+” (16#2B), “-” (16#2D), or the number between “0” (16#30) and “9” (16#39). Otherwise, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
7. If the conversion result exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.

API	Instruction code		Operand	Function
2111	$RIGHT	P	**S, n, D**	The retrieve of the characters in the string begins from the right.

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●			○	
n	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (7-13 steps)	32-bit instruction
AH500	AH500	-

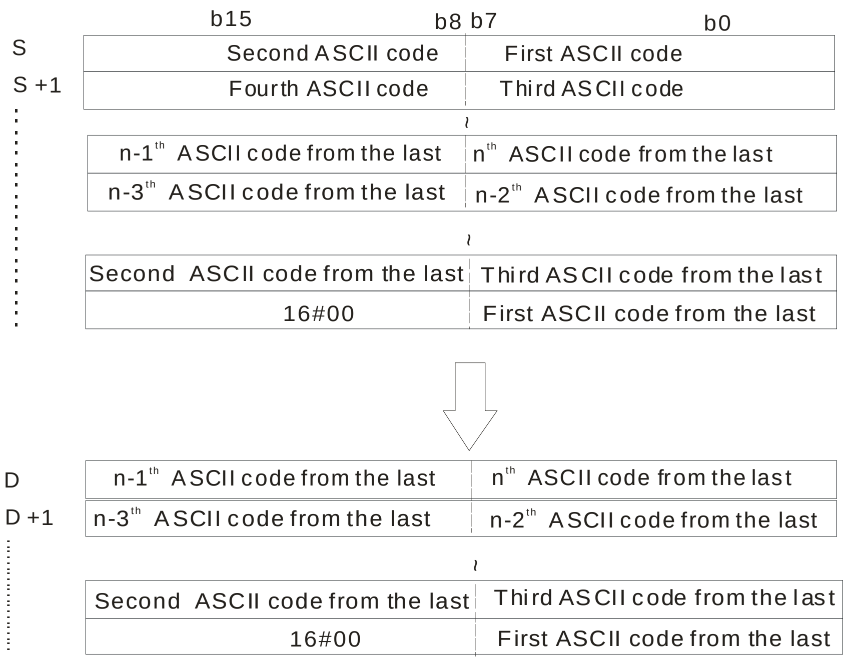
Symbol:



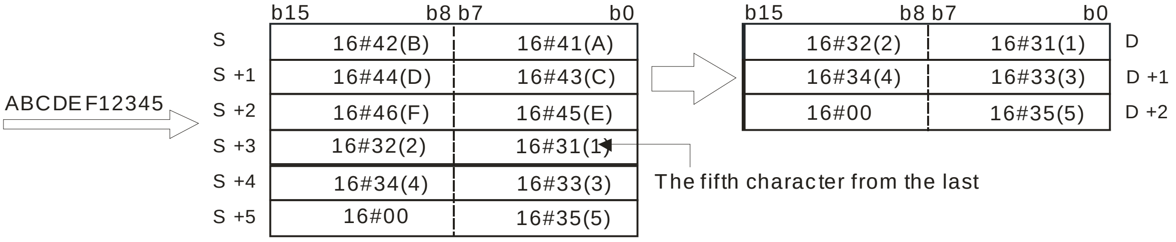
S	:	String	Word
n	:	Number of characters which are retrieved	Word
D	:	Device in which the characters retrieved are stored	Word

Explanation:

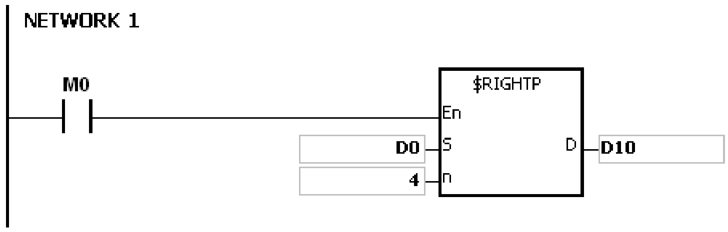
1. The instruction is used to retrieve **n** characters in the string in **S** from the right, and the characters which are retrieved are stored in **D**.
2. If **n** is 0, the value in **D** is 0.

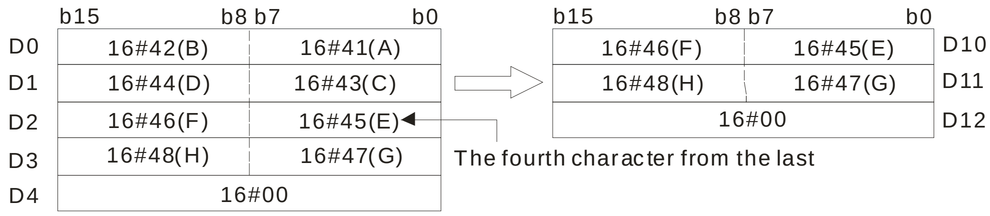


If the data in **S** is ABCDEF12345 and **n** is 5, five characters in the string in **S** are retrieved from the right. The conversion result is as follows.



Example:





Additional remark:

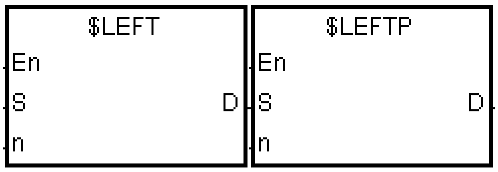
1. If the string in **S** does not end with 16#00, SM0 is ON, and the error code in SR0 is 16#200E.
2. If **n** is less than 0, or if **n** is larger than the length of the string in **S**, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If **D** is not sufficient to contain **n** characters, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API		Instruction code		Operand	Function
2112		$LEFT	P	**S, n, D**	The retrieve of the characters in the string begins from the left.

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●			○	
n	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (7-13 steps)	32-bit instruction
AH500	AH500	-

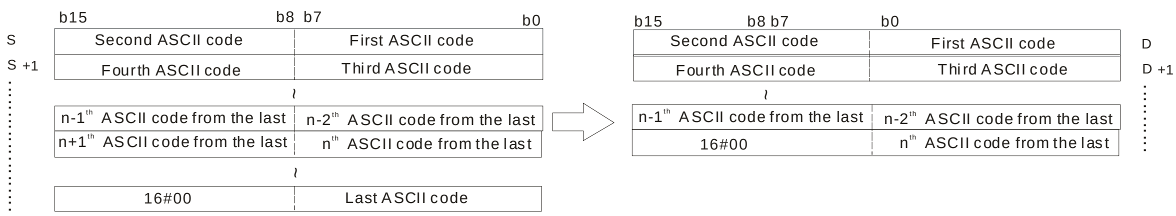
Symbol:



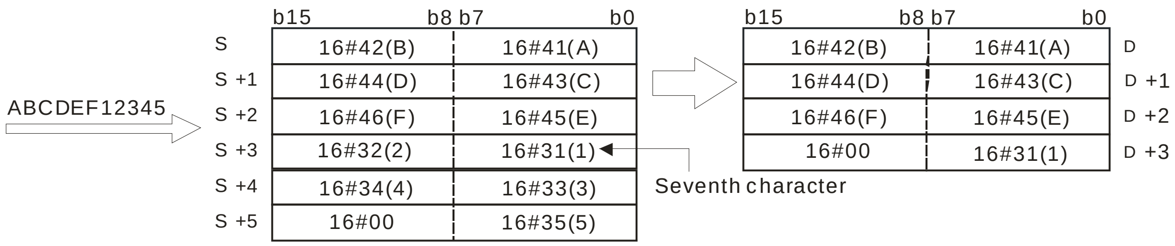
S	:	String	Word
n	:	Number of characters which are retrieved	Word
D	:	Device in which the characters retrieved are stored	Word

Explanation:

1. The instruction is used to retrieve **n** characters in the string in **S** from the left, and the characters which are retrieved are stored in **D**.
2. If **n** is 0, the value in **D** is 0.

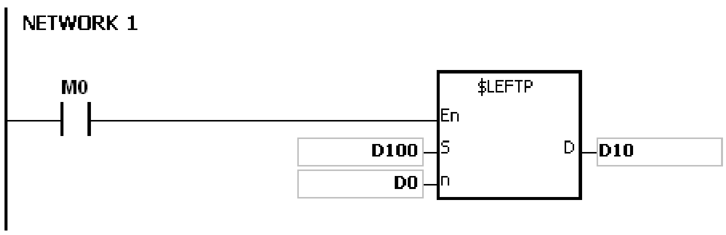


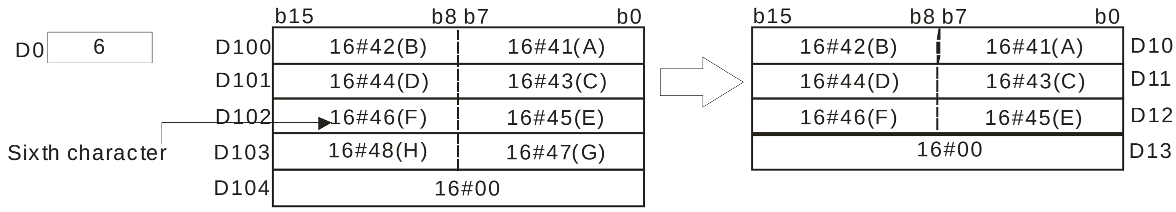
If the data in **S** is ABCDEF12345 and **n** is 7, seven characters in the string in **S** are retrieved from the left. The conversion result is as follows.



Example:

When M0 is ON, the instruction $LEFT is executed. The six characters starting from the character in D100 are retrieved, and stored in D10~D12.





Additional remark:

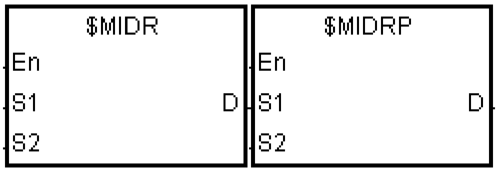
1. If the string in **S** does not end with 16#00, SM0 is ON, and the error code in SR0 is 16#200E.
2. If **n** is less than 0, or if **n** is larger than the length of the string in **S**, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If **D** is not sufficient to contain **n** characters, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code		Operand	Function
2113	$MIDR	P	**S_1, S_2, D**	Retrieving a part of the string

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●		●			○	
S_2	●	●			●	●		●	●		●	○	●				
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (7-13 steps)	32-bit instruction
AH500	AH500	-

Symbol:



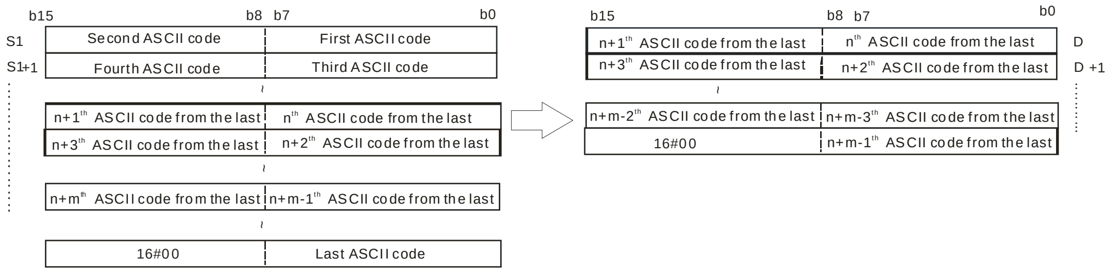
S_1 : String — Word

S_2 : Part of the string which is retrieved — Word

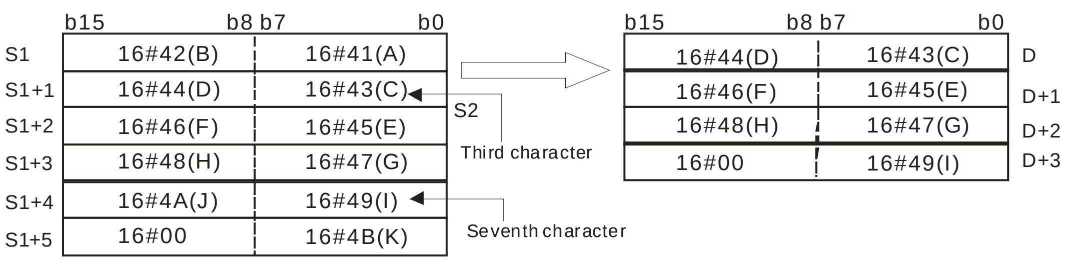
D : Device in which the characters retrieved are stored — Word

Explanation:

1. Suppose the values in **S_2** and **S_2**+1 are n and m respectively. The m characters starting from the nth character in the string in **S_1** are retrieved, and stored in **D**.



2. If the data in **S_1** is ABCDEFGHIJK, the value in **S_2** is 3, and the value in **S_2**+1 is 7, the seven characters starting from the third characters in the string are retrieved from the left. The conversion result is as follows.



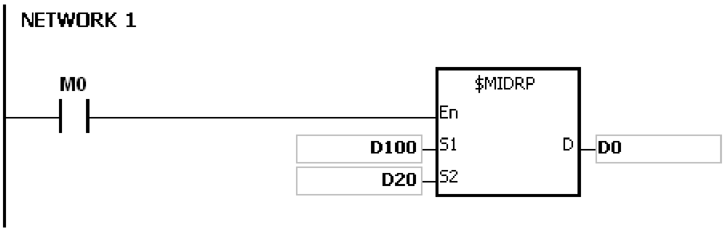
3. If the value in **S_2**+1 is 0, the instruction is not executed.
4. If the value in **S_2**+1 is -1, the characters in **S_1** starting from the character indicated by the value in **S_2** to the last character in **S_1** are retrieved.
5. If the data in **S_1** is ABCDEFGHIJK, the value in **S_2** is 5, and the value in **S_2**+1 is -1, the conversion result is as follows.

	b15 ... b8	b7 ... b0
S1	16#42(B)	16#41(A)
S1+1	16#44(D)	16#43(C)
S1+2	16#46(F)	16#45(E) ◄ Fifth character
S1+3	16#48(H)	16#47(G)
S1+4	16#4A(J)	16#49(I)
S1+5	16#00	16#4B(K)

⇒

b15 ... b8	b7 ... b0	
16#46(F)	16#45(E)	D
16#48(H)	16#47(G)	D +1
16#4A(J)	16#49(I)	D +2
16#00	16#4B(K)	

Example:



	b15 ... b8	b7 ... b0
D10	16#32(2)	16#31(1)
D11	16#34(4)	16#33(3)
D12	16#36(6)	16#35(5)
D13	16#00	16#37(7)

⇒

b15 ... b8	b7 ... b0	
16#34(4)	16#33(3)	D0
16#36(6)	16#35(5)	D1
16#00		D2

D20	3
D21	4

Additional remark:

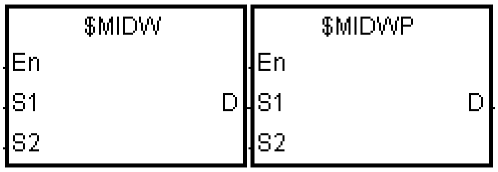
1. If the string in **S_1** does not end with 16#00, SM0 is ON, and the error code in SR0 is 16#200E.
2. If the value in **S_2** is less than or equal to 0, or if the value in **S_2**+1 is less than -1, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in **S_2** is larger than the length of the string in **S_1**, SM0 is ON, and the error code in SR0 is 16#2003.
4. If the value in **S_2**+1 is larger than the number of characters which can be retrieved from the string in **S_1**, SM0 is ON, and the error code in SR0 is 16#2003.
5. If the operand **S_2** used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of WORD/INT.

API	Instruction code		Operand	Function
2114	$MIDW	P	**S_1, S_2, D**	Replacing a part of the string

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●		●			○	
S_2	●	●			●	●		●	●		●	○	●				
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (7-13 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1	:	String	Word
S_2	:	Part of the string which is replaced	Word
D	:	String which is replaced	Word

Explanation:

1. **S_2**: The initial character in **D** which is replaced
   S_2+1: The number of characters which are retrieved from **S_1**
2. The retrieve of the characters in the string in **S_1** begins from the first character, and the value in **S_2**+1 indicates the number of characters which are retrieved from the string in **S_1**. The characters which are retrieved from the string in **S_1** replace the characters in **D** starting from the character indicated by the value in **S_2**.

	b15 … b8	b7 … b0
S1	16#32(2)	16#31(1)
S1+1	16#34(4)	16#33(3)
S1+2	16#36(6)	16#35(5)
S1+3	16#38(8)	16#37(7)
S1+4	16#00	16#39(9)

S2	3	Initial character in D which is replaced
S2+1	6	Number of characters which are retrieved from S1

b15 … b8	b7 … b0	
16#46(F)	16#45(E)	D
16#48(H)	16#47(G)	D +1
16#4A(J)	16#49(I)	D +2
16#4C(L)	16#4B(K)	D +3
16#00	16#4D(M)	D +4

After the instruction is executed

b15 … b8	b7 … b0	
16#46(F)	16#45(E)	D
16#32(2)	16#31(1)	D +1
16#34(4)	16#33(3)	D +2
16#36(6)	16#35(5)	D +3
16#00	16#4D(M)	D +4

3. If the value in **S_2**+1 is 0, the instruction is not executed.
4. If the value in **S_2**+1 is larger than the length of the string in **D**, the characters in **D** which are replaced start from the character indicated by the value in **S_2** to the last character in **D**.

	b15 ... b8	b7 ... b0
S1	16#32(2)	16#H31(1)
S1+1	16#34(4)	16#33(3)
S1+2	16#36(6)	16#35(5)
S1+3	16#38(8)	16#37(7)
S1+4	16#00	16#39(9)

S2	5	Initial character in D which is replaced
S2+1	8	Number of characters which are retrieved from S1

b15 ... b8	b7 ... b0	
16#46(F)	16#45(E)	D
16#48(H)	16#47(G)	D +1
16#4A(J)	16#49(I)	D +2
16#4C(L)	16#4B(K)	D +3
16#00	16#4D(M)	D +4

After the instruction is executed

b15 ... b8	b7 ... b0	
16#46(F)	16#45(E)	D
16#48(H)	16#47(G)	D +1
16#32(2)	16#31(1)	D +2
16#34(4)	16#33(3)	D +3
16#00	16#35(5)	D +4

5. If the value in **S₂**+1 is -1, all characters in **S₁** are retrieved.

	b15 ... b8	b7 ... b0
S1	16#32(2)	16#31(1)
S1+1	16#34(4)	16#33(3)
S1+2	16#36(6)	16#35(5)
S1+3	16#38(8)	16#37(3)
S1+4	16#00	16#39(9)

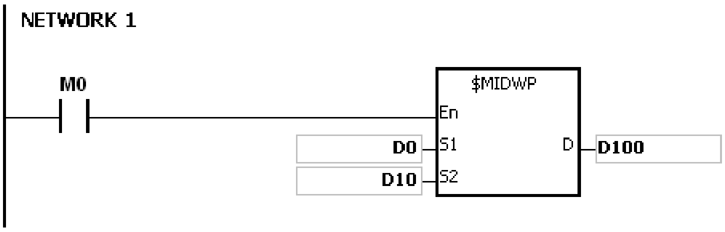
S2	2	Initial character in D which is replaced
S2+1	-1	Number of characters which are retrieved from S1

b15 ... b8	b7 ... b0	
16#46(F)	16#45(E)	D
16#48(H)	16#47(G)	D +1
16#4A(J)	16#49(I)	D +2
16#4C(L)	16#4B(K)	D +3
16#00	16#4D(M)	D +4

After the instruction is executed

b15 ... b8	b7 ... b0	
16#46(F)	16#45(E)	D
16#32(2)	16#31(1)	D +1
16#34(4)	16#33(3)	D +2
16#36(6)	16#35(5)	D +3
16#00	16#37(7)	D +4

Example:



	b15 ... b8	b7 ... b0
D0	16#42(B)	16#41(A)
D1	16#44(D)	16#43(C)
D2	16#46(F)	16#45(E)
D3	16#00	

b15 ... b8	b7 ... b0	
16#32(2)	16#31(1)	D100
16#34(4)	16#33(3)	D101
16#36(6)	16#35(5)	D102
16#38(8)	16#37(7)	D103
16#00		D104

D10	3	Initial character in D which is replaced
D11	4	Number of characters which are retrieved from S1

After the instruction is executed

b15 ... b8	b7 ... b0	
16#32(2)	16#31(1)	D100
16#42(B)	16#41(A)	D101
16#44(D)	16#43(C)	D102
16#38(8)	16#37(7)	D103
16#00		D104

Additional remark:

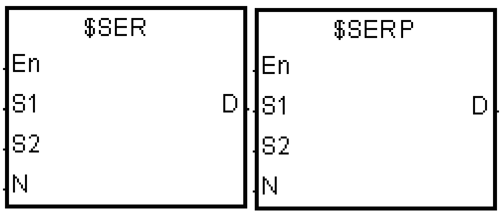
1. If the string in $\mathbf{S_1}$ does not end with 16#00, SM0 is ON, and the error code in SR0 is 16#200E.
2. If the string in **D** does not end with 16#00, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in $\mathbf{S_2}$ is less than or equal to 0, or if the value in $\mathbf{S_2}$ is larger than the length of the string in **D**, SM0 is ON, and the error code in SR0 is 16#2003.
4. If the value in $\mathbf{S_2}$+1 is less than -1, or if the value in $\mathbf{S_2}$+1 is larger than the number of characters which can be retrieved from the string in $\mathbf{S_1}$, SM0 is ON, and the error code in SR0 is 16#2003.
5. If the operand $\mathbf{S_2}$ used during the execution of the 16-bit instruction is declared in ISPSoft, the data type will be ARRAY [2] of WORD/INT.

API	Instruction code		Operand	Function
2115	$SER	P	**S_1, S_2, n, D**	Searching the string

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●		●			○	
S_2	●	●			●	●		●	●		●		●			○	
n	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●	○	●				

Pulse instruction	16-bit instruction (9-21 steps)	32-bit instruction
AH500	AH500	-

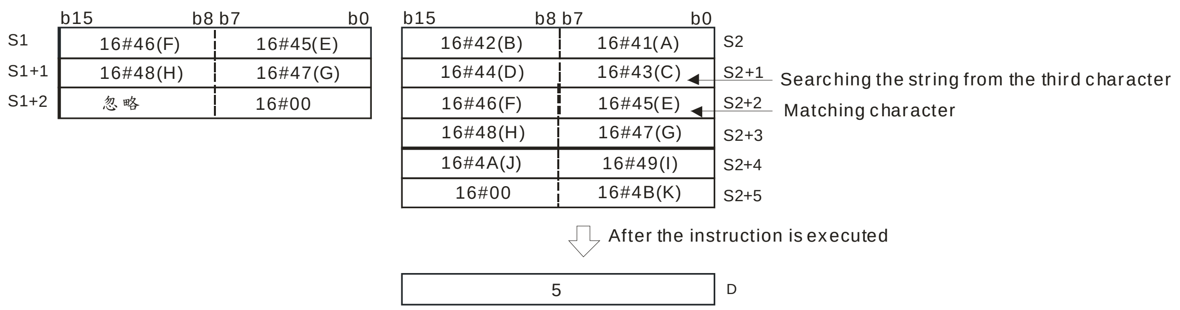
Symbol:



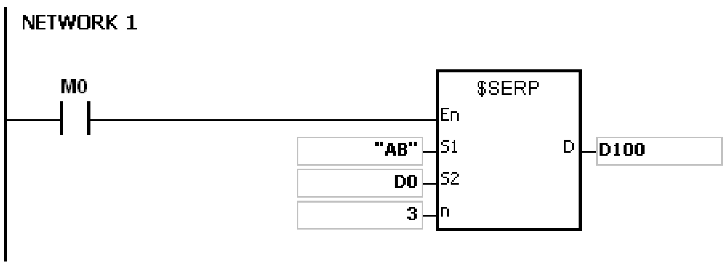
S_1	:	String which is searched	Word
S_2	:	String which is searched for	Word
n	:	**n**th character in **S_2** from which the search begins	Word
D	:	Search result	Word

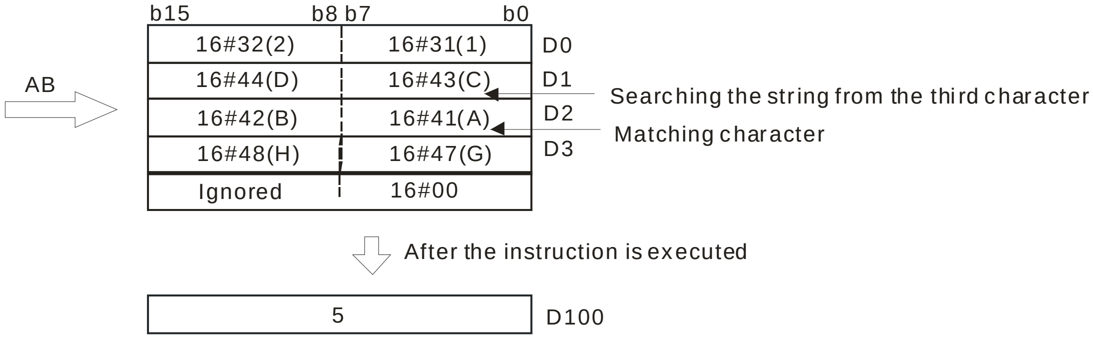
Explanation:

1. The instruction is used to search the string from the **n**th character in **S_2** for the string which is the same as the string in **S_1**, and the search result is stored in **D**.
2. Suppose the string in **S_2** is "ABCDEFGHIJK", the string in **S_1** is "EFGH", and **n** is 3. The search begins from the third character in **S_2**, and the value in **D** is 5.



Example:





Additional remark:

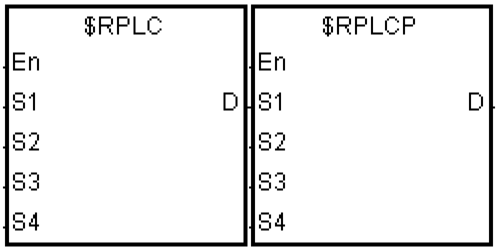
1. If the string in **S₁** does not end with 16#00, SM0 is ON, and the error code in SR0 is 16#200E.
2. If the string in **S₂** does not end with 16#00, SM0 is ON, and the error code in SR0 is 16#2003.
3. If **n** is less than or equal to 0, or if **n** is larger than the length of the string in **S₂**, SM0 is ON, and the error code in SR0 is 16#2003

API	Instruction code			Operand	Function
2116		$RPLC	P	S_1, S_2, S_3, S_4, D	Replacing the characters in the string

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●	●	●		●				
S_2	●	●			●	●		●	●	●	●		●			○	
S_3	●	●			●	●		●	●	●	●	○	●	○	○		
S_4	●	●			●	●		●	●	●	●	○	●	○	○		
D	●	●			●	●		●	●	●			●				

Pulse instruction	16-bit instruction (11-17 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1	:	String which is replaced	Word
S_2	:	New string	Word
S_3	:	Number of characters in **S_1** which are replaced	Word
S_4	:	The characters in **S_1** starting from the character indicated by the value in **S_4** are replaced.	Word
D	:	Device in which the execution result is stored	Word

Explanation:

1. The characters in **S_1** starting from the character indicated by the value in **S_4** are replaced by the characters in **S_2**, the number of characters which are replaced is indicated by the value in **S_3**, and the result is stored in **D**.
2. The four characters starting from the sixth character in the string "12345**6789**0" are replaced by "MN", and the result is "12345**MN**0".

	b15 b8	b7 b0
S1	16#32(2)	16#31(1)
S1+1	16#34(4)	16#33(3)
S1+2	16#36(6)	16#35(5)
S1+3	16#38(8)	16#37(7)
S1+4	16#30(0)	16#39(9)
S1+5	Ignored	16#00

After the instruction is executed

b15 b8	b7 b0	
16#32(2)	16#31(1)	D
16#34(4)	16#33(3)	D+1
16#4D(M)	16#35(5)	D+2
16#30(0)	16#4E(N)	D+3
16#0000		D+4

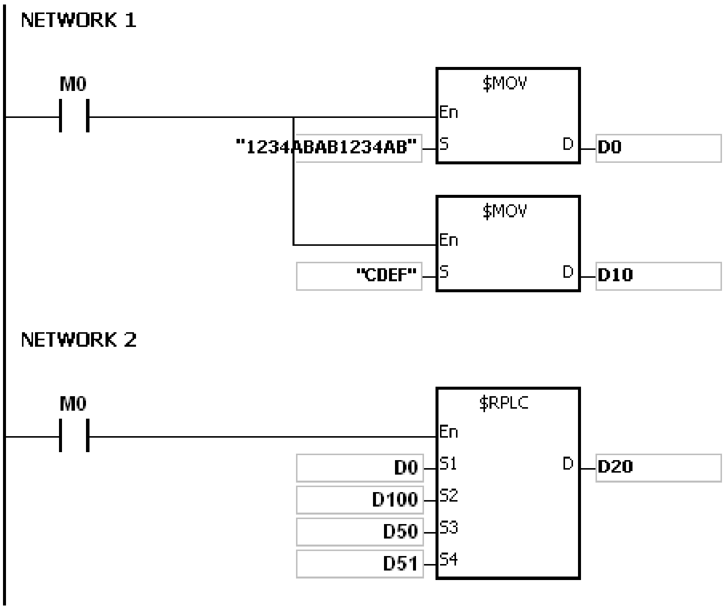
S2	16#4E(N)	16#4D(M)
S2+1	Ignored	16#00

S3	4	Number of characters which are replaced
S4	6	Character which is replaced

3. If the string in **S_2** is 16#00, the instruction has the function of deleting the characters.
4. If the value in **S_3** is larger than the number of characters which can be replaced in the string in **S_1**, the characters in **S_1** starting from the character indicated by the value in **S_4** to the last character in **S_1** are replaced.
5. If the value in **S_3** is equal to 0, the instruction is not executed.

Example:

When M0 is ON, the data in D0~D7 is “1234ABAB1234AB”, and the data in D10~D11 is “CDEF”. When the instruction $RPLC is executed, the characters in D0~D7 starting from the character indicated by the value in D51 are replaced by the characters in D10~D11. The number of characters which are replaced is indicated by the value in D50, and the result is stored in D20~D27.



If the values in D50 and D51 are 3 and 4 respectively, the execution result is as follows.

	b15 ~ b8	b7 ~ b0
D0	16#32(2)	16#31(1)
D1	16#34(4)	16#33(3)
D2	16#42(B)	16#41(A)
D3	16#42(B)	16#41(A)
D4	16#32(2)	16#31(1)
D5	16#34(4)	16#33(3)
D6	16#42(B)	16#41(A)
D7	Ignored	16#00

⇨

b15 ~ b8	b7 ~ b0	
16#32(2)	16#31(1)	D20
16#43(C)	16#33(3)	D21
16#45(E)	16#44(D)	D22
16#41(A)	16#46(F)	D23
16#31(1)	16#42(B)	D24
16#33(3)	16#32(2)	D25
16#41(A)	16#34(4)	D26
16#00	16#42(B)	D27

D10	16#44(D)	16#43(C)
D11	16#45(F)	16#45(E)
D12	Ignored	16#00

D50	3	Number of characters which are replaced
D51	4	Character which is replaced

If the values in D50 and D51 are 4 and 4 respectively, the execution result is as follows.

	b15 ~ b8	b7 ~ b0
D0	16#32(2)	16#31(1)
D1	16#34(4)	16#33(3)
D2	16#42(B)	16#41(A)
D3	16#42(B)	16#41(A)
D4	16#32(2)	16#31(1)
D5	16#34(4)	16#33(3)
D6	16#42(B)	16#41(A)
D7	Ignored	16#00

After the instruction is executed

b15 ~ b8	b7 ~ b0	
16#32(2)	16#31(1)	D20
16#43(C)	16#33(3)	D21
16#45(E)	16#44(D)	D22
16#42(B)	16#46(F)	D23
16#32(2)	16#31(1)	D24
16#34(4)	16#33(3)	D25
16#42(B)	16#41(A)	D26
16#0000		D27

	b15 ~ b8	b7 ~ b0
D10	16#44(D)	16#43(C)
D11	16#45(F)	16#45(E)
D12	Ignored	16#00

D50	4	Number of characters which are replaced
D51	4	Character which is replaced

If the values in D50 and D51 are 20 and 4 respectively, the execution result is as follows.

	b15 ~ b8	b7 ~ b0
D0	16#32(2)	16#31(1)
D1	16#34(4)	16#33(3)
D2	16#42(B)	16#41(A)
D3	16#42(B)	16#41(A)
D4	16#32(2)	16#31(1)
D5	16#34(4)	16#33(3)
D6	16#42(B)	16#41(A)
D7	Ignored	16#00

After the instruction is executed

b15 ~ b8	b7 ~ b0	
16#32(2)	16#31(1)	D20
16#43(C)	16#33(3)	D21
16#45(E)	16#44(D)	D22
16#00	16#46(F)	D23

	b15 ~ b8	b7 ~ b0
D10	16#44(D)	16#43(C)
D11	16#45(F)	16#45(E)
D12	Ignored	16#00

D50	20	Number of characters which are replaced
D51	4	Character which is replaced

If the values in D50, D51, and D10 are 3, 4, and 16#00 respectively, the execution result is as follows. The three characters in D0~D7 starting from the fourth character are deleted.

	b15 ~ b8	b7 ~ b0
D0	16#32(2)	16#31(1)
D1	16#34(4)	16#33(3)
D2	16#42(B)	16#41(A)
D3	16#42(B)	16#41(A)
D4	16#32(2)	16#31(1)
D5	16#34(4)	16#33(3)
D6	16#42(B)	16#41(A)
D7	16#00	

After the instruction is executed

b15 ~ b8	b7 ~ b0	
16#32(2)	16#31(1)	D20
16#41(A)	16#33(3)	D21
16#31(1)	16#42(B)	D22
16#33(3)	16#32(2)	D23
16#41(A)	16#34(4)	D24
16#00	16#42(B)	D25

D10	16#00

D50	3	Number of characters which are replaced
D51	4	Character which is replaced

Additional remark:

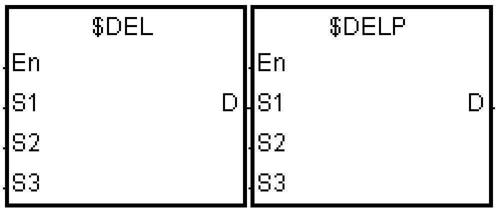
1. If the string in $\mathbf{S_1}$ does not end with $\mathbf{\text{-}S_1}$, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code		Operand	Function
2117	$DEL	P	S_1, S_2, S_3, D	Deleting the characters in the string

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●		●				
S_2	●	●			●	●		●	●		●	○	●	○	○		
S_3	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1	:	String	Word
S_2	:	Number of characters which are deleted	Word
S_3	:	The characters in S_1 starting from the character indicated by the value in S_3 are deleted.	Word
D	:	Device in which the execution result is stored	Word

Explanation:

1. The characters in S_1 starting from the character indicated by the value in S_3 are deleted, the number of characters which are deleted is indicated by the value in S_2, and the result is stored in **D**.
2. The four characters starting from the third character in the string "12**3456**7890" in S_1 are deleted, and the result "127890" is stored in **D**.

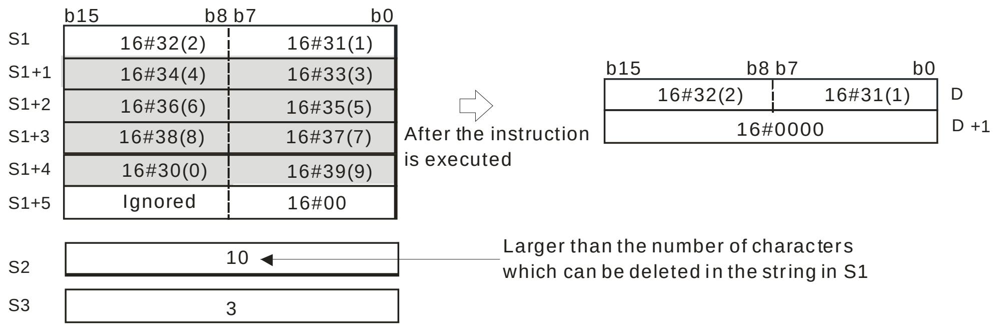
	b15 ... b8	b7 ... b0
S1	16#32(2)	16#31(1)
S1+1	16#34(4)	16#33(3)
S1+2	16#36(6)	16#35(5)
S1+3	16#38(8)	16#37(7)
S1+4	16#30(0)	16#39(9)
S1+5	Ignored	16#00

S2	4
S3	3

After the instruction is executed

b15 ... b8	b7 ... b0	
16#32(2)	16#31(1)	D
16#38(8)	16#37(7)	D +1
16#30(0)	16#39(9)	D +2
16#0000		D +2

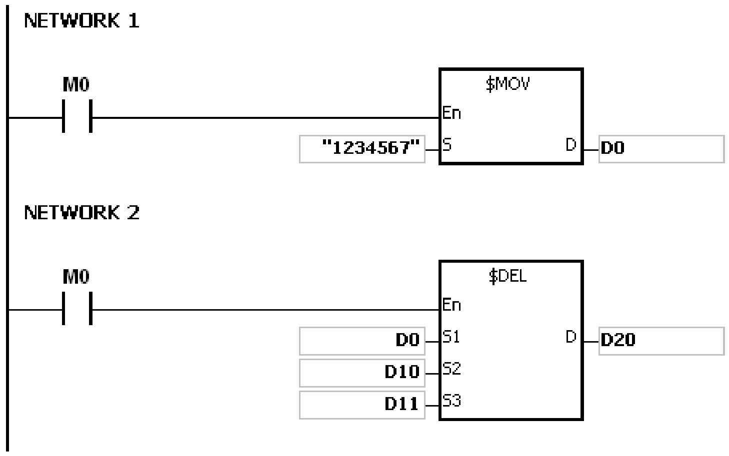
3. If the value in S_2 is larger than the number of characters which can be deleted in the string in S_1, the characters in S_1 starting from the character indicated by the value in S_3 to the last character in S_1 are deleted, and 16#00 is stored in **D**.



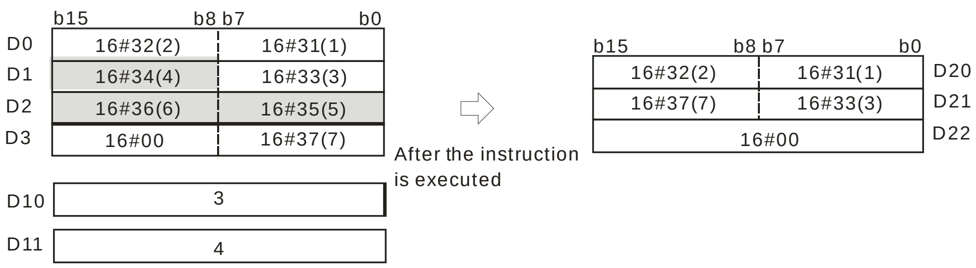
4. If the value in **S₂** is equal to 0, the instruction is not executed.

Example:

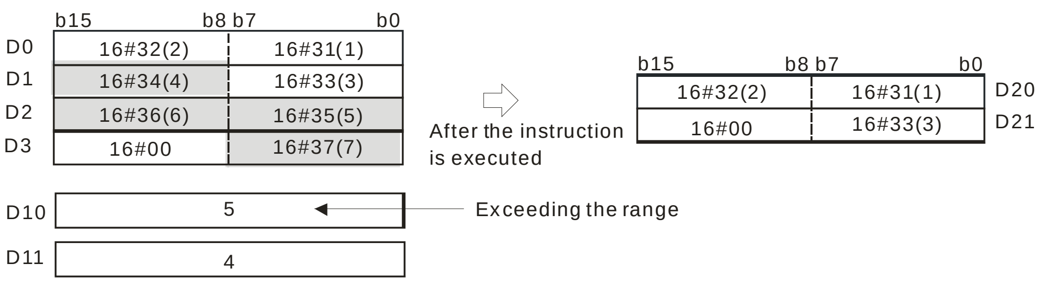
When M0 is ON, the data in D0~D3 is “1234567”. When the instruction $DEL is executed, the characters in D0~D3 starting from the character indicated by the value in D11 are deleted. The number of characters which are deleted is indicated by the value in D10, and the result is stored in D20~D22.



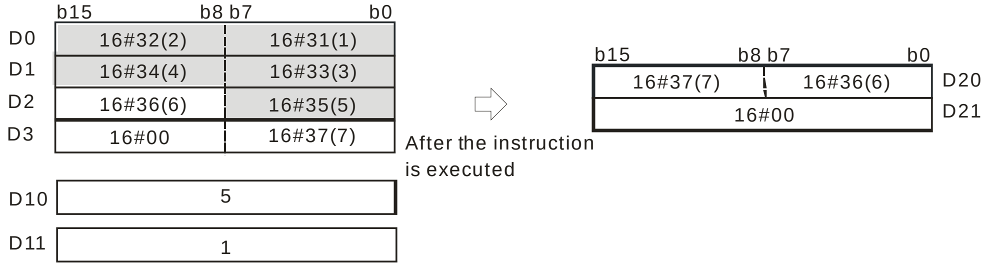
If the values in D10 and D11 are 3 and 4 respectively, the execution result is as follows.



If the values in D10 and D11 are 5 and 4 respectively, the execution result is as follows. Owing to the fact that the number of characters which are deleted exceeds the range, the characters in D0~D3 starting from the fourth character to the last character are deleted.



If the values in D10 and D11 are 5 and 1 respectively, the execution result is as follows.



Additional remark:

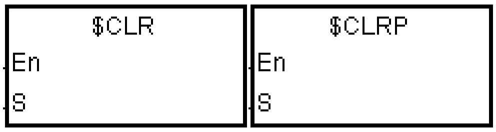
1. If the string in $\mathbf{S_1}$ does not end with 16#00, SM0 is ON, and the error code in SR0 is 16#200E.
2. If the value in $\mathbf{S_2}$ is less than 0, the value in $\mathbf{S_3}$ is less than or equal to 0, or the value in $\mathbf{S_3}$ is larger than the length of the string in $\mathbf{S_1}$, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
2118		$CLR	P	**S**	Clearing the string

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : String which is cleared Word

Explanation:

1. The string in **S** is cleared.

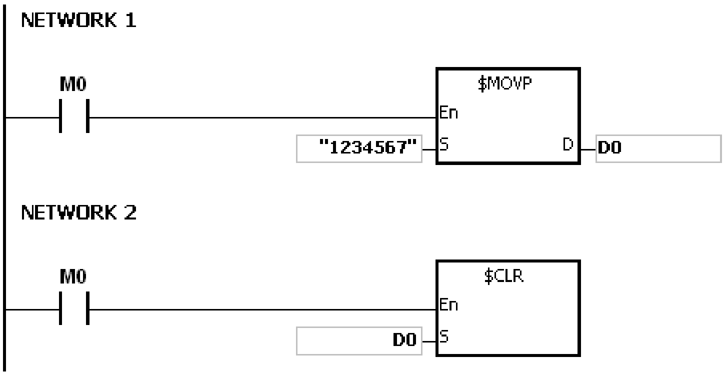
	b15 ... b8	b7 ... b0
S	16#31(1)	16#2D(-)
S +1	16#33(3)	16#32(2)
S +2	16#34(4)	16#35(5)
S +3	16#36(6)	16#2E(.)
S +4	16#38(8)	16#37(7)
S +5	16#00	

After the instruction is executed

S	16#0000
S +1	16#0000
S +2	16#0000
S +3	16#0000
S +4	16#0000
S +5	16#0000

Example:

The string in D0 is cleared, as illustrated below.



	b15 ... b8	b7 ... b0
D0	16#32(2)	16#31(1)
D1	16#34(4)	16#33(3)
D2	16#36(6)	16#35(5)
D3	16#00	16#37(7)

After the instruction is executed

16#0000	D0
16#0000	D1
16#0000	D2
16#0000	D3

Additional remark:

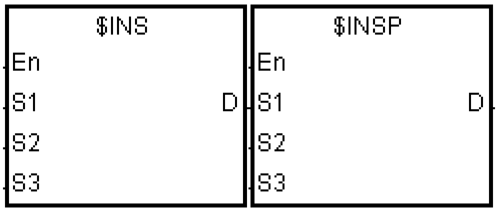
1. If the string in **S** does not end with 16#00, SM0 is ON, and the error code in SR0 is 16#200E.

API	Instruction code			Operand	Function
2119		$INS	P	S_1, S_2, S_3, D	Inserting the string

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●		●				
S_2	●	●			●	●		●	●		●		●			○	
S_3	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction (9-15 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1	:	String	Word
S_2	:	String which is inserted	Word
S_3	:	The string is inserted into S_1 after the character indicated by the value in S_3.	Word
D	:	Device in which the execution result is stored	Word

Explanation:

1. The string in S_2 is inserted into the string in S_1 after the character indicated by the value in S_3, and the result is stored in **D**.
2. If the string in either S_1 or S_2 is a null string, the other string which is not a null string is stored in **D**.
3. If the strings in S_1 and S_2 are null strings, 16#0000 is stored in **D**.

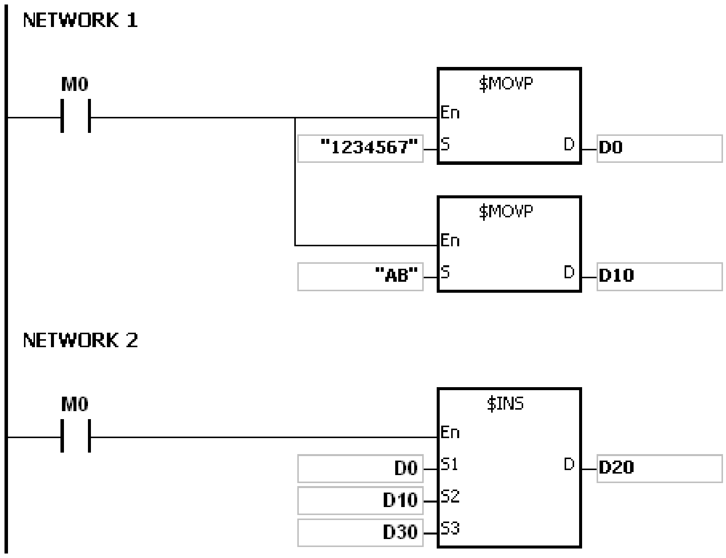
	b15 … b8	b7 … b0
S1	16#32(2)	16#31(1)
S1+1	16#34(4)	16#33(3)
S1+2	16#36(6)	16#35(5)
S1+3	16#38(8)	16#37(7)
S1+4	16#30(0)	16#39(9)
S1+5	16#00	
S2	16#4E(N)	16#4D(M)
S2+1	16#00	
S3	6	

After the instruction is executed

b15 … b8	b7 … b0	
16#32(2)	16#31(1)	D
16#34(4)	16#33(3)	D +1
16#36(6)	16#35(5)	D +2
16#4E(N)	16#4D(M)	D +3
16#38(8)	16#37(7)	D +4
16#30(0)	16#39(9)	D +5
16#00		D +6

Example:

When M0 is ON, the data in D0~D3 is “1234567”, and the data in D10 is “AB”. When the instruction $INS is executed, “AB” is inserted into the string in D0~D3 after the character indicated by the value in D30. The result is stored in D20~D24.



If the value in D30 is 1, the execution result is as follows.

	b15 ~ b8	b7 ~ b0
D0	16#32(2)	16#31(1)
D1	16#34(4)	16#33(3)
D2	16#36(6)	16#35(5)
D3	16#00	16#37(7)
D10	16#42(B)	16#41(A)
D11	Ignored	16#00
D30	1	

After the instruction is executed

b15 ~ b8	b7 ~ b0	
16#41(A)	16#31(1)	D20
16#32(2)	16#42(B)	D21
16#34(4)	16#33(3)	D22
16#36(6)	16#35(5)	D23
16#00	16#37(7)	D24

If the value in D30 is 0, the execution result is as follows.

	b15 ~ b8	b7 ~ b0
D0	16#32(2)	16#31(1)
D1	16#34(4)	16#33(3)
D2	16#36(6)	16#35(5)
D3	16#00	16#37(7)
D10	16#42(B)	16#41(A)
D11	Ignored	16#00
D30	0	

After execution

b15 ~ b8	b7 ~ b0	
16#42(B)	16#41(A)	D20
16#32(2)	16#31(1)	D21
16#34(4)	16#33(3)	D22
16#36(6)	16#35(5)	D23
16#00	16#37(7)	D24

Additional remark:

1. If the string in S_1 does not end with 16#00, SM0 is ON, and the error code in SR0 is 16#200E.
2. If the string in S_2 does not end with 16#00, SM0 is ON, and the error code in SR0 is 16#200E.
3. If the value in S_3 is less than 0, or if the value in S_3 is larger than the length of the string in S_1, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
2120		FMOD	P	**S_1, S_2, D**	Converting the floating-point number into the binary-coded decimal floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●		●				○
S_2	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●				●				

Pulse instruction	32-bit instruction (7-8 steps)	64-bit instruction
AH500	AH500	-

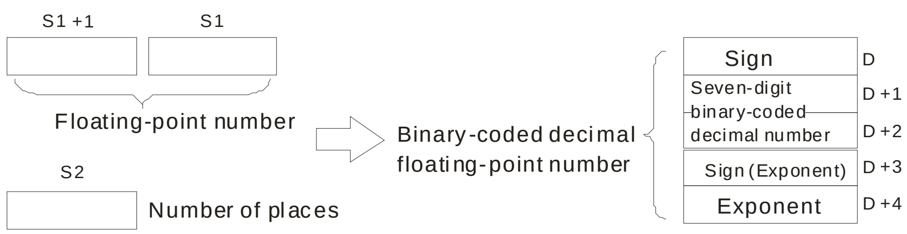
Symbol:

FMOD	FMODP
En S1 D S2	En S1 D S2

S_1	:	Floating-point number	Double word
S_2	:	Number of places	Word
D	:	Conversion result	Word

Explanation:

1. The decimal point in the floating-point number in **S_1** is moved to the right in accordance with the setting of **S_2** first, and then the result is converted into the binary-coded decimal floating-point number. The final conversion result is stored in **D**.



The binary-coded decimal floating-point number format:

S_2: The number of places

The value in **S_2** should be within the range between 0 and 7.

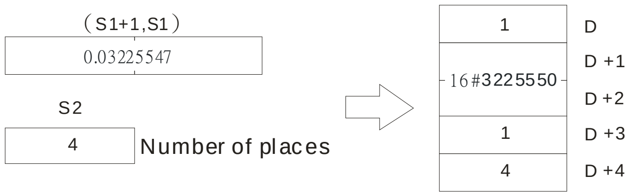
D: If the floating-point number in **S_1** is a positive number, the value in **D** is 0. If the floating-point number in **S_1** is a negative number, the value in **D** is 1.

(**D**+2, **D**+1): The seven-digit binary-coded decimal number converted from the floating-point number

D+3: If the exponent is a positive number, the value in **D**+3 is 0. If the exponent is a negative number, the value in **D**+3 is 1.

D+4: The exponent

If the floating-point number in **S_1** is -0.03225547 and the value in **S_2** is 4, the conversion result is as follows.



Since the value in **S_2** is 4, the decimal point in the floating-point number in **S_1** is moved to the right by four decimal places. The floating-point number in **S_1** becomes -322.5547.

-322.5547 is equal to -3225547E-4. The binary-coded decimal floating-point number format is as follows.

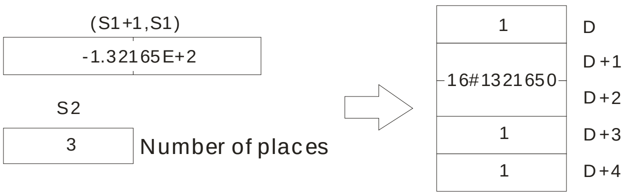
The value in **D** is 1 because the floating-point number in **S_1** is a negative number.

The value stored in (**D**+2, **D**+1) is 16#3225550. (The floating-point number is converted into the seven-digit binary-coded decimal number, and the seven-digit binary-coded decimal number is rounded off).

The value in **D**+3 is 1 because the exponent is a negative number.

The value in **D**+4 is 4.

If the floating-point number in **S_1** is -1.32165E+2 and the value in **S_2** is 3, the conversion result is as follows.



-1.32165E+2 is equal to 132.165. Since the value in **S_2** is 3, the decimal point in the floating-point number in **S_1** is moved to the right by three decimal places. The floating-point number in **S_1** becomes -132165.

-132165 is equal to -1321650E-1. The binary-coded decimal floating-point number format is as follows.

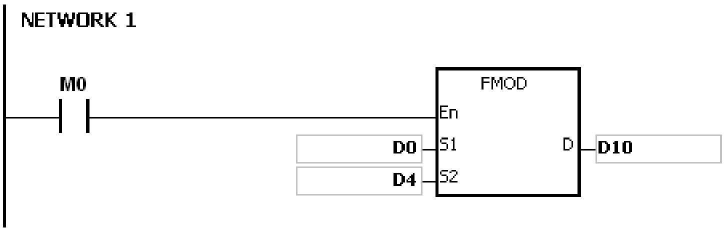
The value in **D** is 1 because the floating-point number in **S_1** is a negative number.

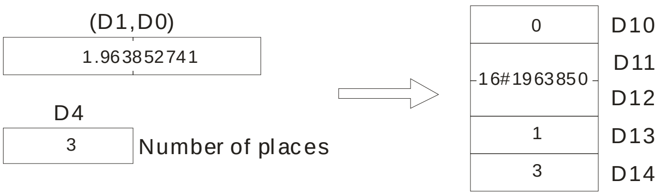
The value stored in (**D**+2, **D**+1) is 16#1321650. (The floating-point number is converted into the seven-digit binary-coded decimal number, and the seven-digit binary-coded decimal number is rounded off).

The value in **D**+3 is 1 because the exponent is a negative number.

The value in **D**+4 is 4.

Example:





Since the value in D4 is 3, the decimal point in 1.963852741 in (D1, D0) is moved to the right by three decimal places. The floating-point number in (D1, D0) becomes 1963.852741.

The value in D10 is 0 because the floating-point number in **S_1** is a positive number.

1963.852741 is equal to 1963852E-3. The binary-coded decimal floating-point number format is as follows.

The value stored in (D12, D11) is 16#1963850. (The floating-point number is converted into the seven-digit binary-coded decimal number, and the seven-digit binary-coded decimal number is rounded off).

The value in D13 is 1 because the exponent is a negative number.

The value in D14 is 3.

Additional remark:

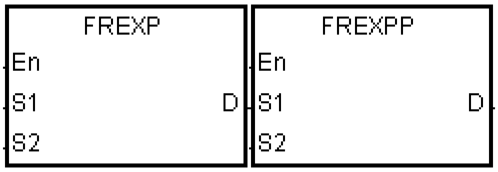
1. If the value in $\mathbf{S_1}$ exceeds the range of values which can be represented by the floating-point numbers, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2013.
2. If the value in $\mathbf{S_2}$ exceeds the range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the operand **D** used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [5] of WORD/INT.

API	Instruction code			Operand	Function
2121		FREXP	P	S_1, S_2, D	Converting the Binary-coded decimal floating-point number into the floating-point number

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●		●		●				
S_2	●	●			●	●		●	●		●	○	●	○	○		
D	●	●			●	●		●	●		●		●				

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

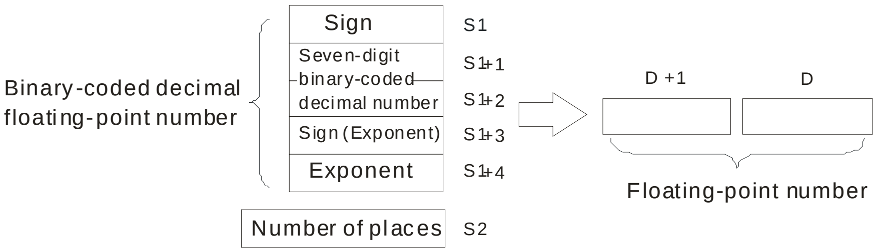
Symbol:



S_1	:	Binary-coded decimal floating-point number	Word
S_2	:	Number of places	Word
D	:	Conversion result	Double word

Explanation:

The binary-coded decimal floating-point number in S_1 is converted into the floating-point number first, and then the decimal point in the floating-point number is moved to the left in accordance with the setting of S_2. The final result is stored in **D**.

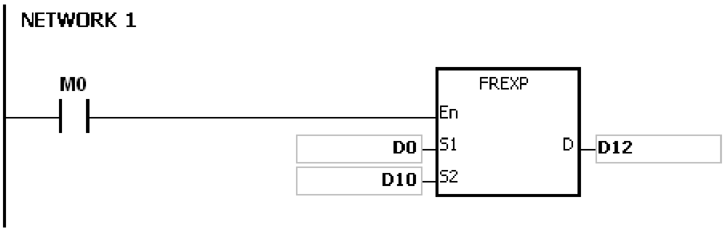


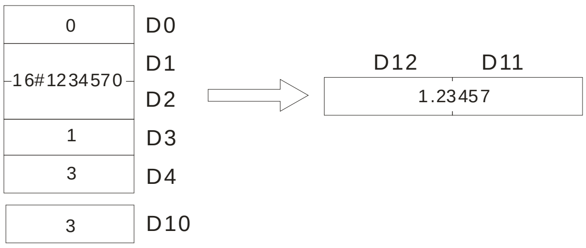
The binary-coded decimal floating-point number format:

1. If the binary-coded decimal floating-point number is a positive number, the value in S_1 is 0. If the binary-coded decimal floating-point number is a negative number, the value in S_1 is 1.
2. The seven-digit binary-coded decimal number is stored in (S_1+2, S_1+1).
3. If the exponent is a positive number, the value in S_1+3 is 0. If the exponent is a negative number, the value in S_1+3 is 1.
4. S_1+4: The exponent
   The value in S_1+4 should be within the range between 0 and 38.
5. S_2: The number of places
   The value in S_2 should be within the range between 0 and 7.

Example:

When the conditional contact MO is ON, the binary-coded decimal floating-point number is converted into the floating-point number.





The value in D0 is 0 because the binary-coded decimal floating-point number is a positive number.

16#1234570 is stored in (D2, D1).

The value in D3 is 1 because the exponent is a negative number.

The value in D4 is 3.

1234570E-3, the binary-coded decimal floating-point number in D0~D4, is converted into the 1234.57.

Since the value in D10 is 3, the decimal point in 1234.57 in is moved to the left by three places. The result is 1.23457, and is stored in (D12, D11).

Additional remark:

1. If the value in $\mathbf{S_1}$ is neither 0 nor 1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the number of digits in ($\mathbf{S_1}$+2, $\mathbf{S_1}$+1) is larger than 7, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in ($\mathbf{S_1}$+2, $\mathbf{S_1}$+1) is not a binary-coded decimal value (The value is represented by the hexadecimal number, but one of digits is not within the range between 0 and 9.), the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200D.
4. If the value in $\mathbf{S_1}$+3 is neither 0 nor 1, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
5. If the value in $\mathbf{S_1}$+4 is less than 0 or larger than 38, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003
6. If the value in $\mathbf{S_2}$ is less than 0 or larger than 7, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
7. If the operand $\mathbf{S_1}$ used during the execution of the 32-bit instruction is declared in ISPSoft, the data type will be ARRAY [5] of WORD/INTT.

6.22 Ethernet Instructions

6.22.1 List of Ethernet Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
2200	SOPEN	–	✓	Opening the socket	7
2201	SSEND	–	✓	Sending the data through the socket	5
2202	SRCVD	–	✓	Receiving the data through the socket	5
2203	SCLOSE	–	✓	Closing the socket	5
2204	MSEND	–	✓	Sending the email	9
2205	EMDRW	–	✓	Reading/Writing the Modbus TCP data	11
2206	–	DINTOA	✓	Converting the IP address of the integer type into the IP address of the string type	5
2207	–	DIATON	✓	Converting the IP address of the string type into the IP address of the integer type	5-11
2208	EIPRW	–	–	Reading and writing EtherNet/IP data	23

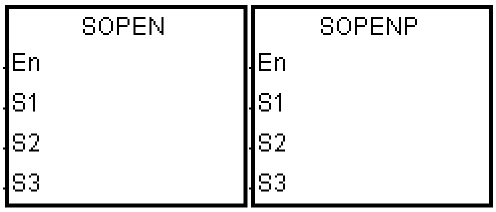
6.22.2 Explanation of Ethernet Instructions

API	Instruction code		Operand	Function
2200	SOPEN	P	S_1, S_2, S_3	Opening the socket

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●			○	●	○	○		
S_2	●	●			●	●		●	●			○	●	○	○		
S_3	●	●			●	●		●	●			○	●	○	○		

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1	:	Socket mode	Word
S_2	:	Socket number	Word
S_3	:	Start mode	Word

Explanation:

1. **S_1** is 1 if users want to open the TCP socket, and **S_1** is 0 if users want to open the UDP socket. **S_2** is the socket number, ranging from 1 to 8.
2. The AH500 series PLC as the client, sends the TCP connection request to the server if **S_3** is 1 or 3, and the AH500 series PLC as the sever, waits for the TCP connection request from the client if **S_3** is 0 or 2. If users want to start the UDP connection, **S_3** can be 0 or 2.
   Setting values in **S_3** and its modes:

Setting values in **S_3**	Socket mode	Role of the AH500 PLC	Max. data to be sent (Words)	Max. data to be received (Words)
0	TCP	Client	500	500
1	TCP	Client	500	500
2 (FW V2.0X)	TCP	Server	4096	4096
3 (FW V2.0X)	TCP	Server	4096	4096
0~1	UDP	N/A	500	500
2 (FW V2.0X)	UDP	N/A	4096	4096

3. Before using the instruction, users have to accomplish the following setting in HWCONFIG of ISPSoft or using the instruction MOV to transfer the data related to the sockets to the corresponding special data registers.
   - PLC Parameter Setting→Ethernet-Basic→Setting the IP addres and the netmask address
   - PLC Parameter Setting→Ethernet-Advance→Socket→Enable Socket Function
   - PLC Parameter Setting→Ethernet-Advance→Socket→TCP/UDP Socket Connection→ Setting the sockets which are used.
4. Users can set the sockets which uses the TCP protocol to execute the data exchange. The values in all registers can be altered except that the transmitted data counter and the received data counter are read-only counters.

Item \ Socket Number	1	2	3	4	5	6	7	8
Local communication port	SR1118	SR1131	SR1144	SR1157	SR1170	SR1183	SR1196	SR1209
Remote IP address (high word)	SR1119	SR1132	SR1145	SR1158	SR1171	SR1184	SR1197	SR1210
Remote IP address (low word)	SR1120	SR1133	SR1146	SR1159	SR1172	SR1185	SR1198	SR1211
Remote communication port	SR1121	SR1134	SR1147	SR1160	SR1173	SR1186	SR1199	SR1212
Transmitted data length	SR1122	SR1135	SR1148	SR1161	SR1174	SR1187	SR1200	SR1213
Transmitted data address (high word)	SR1123	SR1136	SR1149	SR1162	SR1175	SR1188	SR1201	SR1214
Transmitted data address (low word)	SR1124	SR1137	SR1150	SR1163	SR1176	SR1189	SR1202	SR1215
Received data length	SR1125	SR1138	SR1151	SR1164	SR1177	SR1190	SR1203	SR1216
Received data address (high word)	SR1126	SR1139	SR1152	SR1165	SR1178	SR1191	SR1204	SR1217
Received data address (low word)	SR1127	SR1140	SR1153	SR1166	SR1179	SR1192	SR1205	SR1218
Persistent connection time	SR1128	SR1141	SR1154	SR1167	SR1180	SR1193	SR1206	SR1219
Data receiving counter	SR1129	SR1142	SR1155	SR1168	SR1181	SR1194	SR1207	SR1220
Data sending counter	SR1130	SR1143	SR1156	SR1169	SR1182	SR1195	SR1208	SR1221

5. If the value of the persistent connection time is set to 0, the connection will not be on hold and there will be no timeout.
6. Users can set the sockets which uses the UDP protocol to execute the data exchange. The values in all registers can be altered except that the transmitted data counter and the received data counter are read-only counters.

Item \ Socket Number	1	2	3	4	5	6	7	8
Local communication port	SR1222	SR1234	SR1246	SR1258	SR1270	SR1282	SR1294	SR1306
Remote IP address (high word)	SR1223	SR1235	SR1247	SR1259	SR1271	SR1283	SR1295	SR1317
Remote IP address (low word)	SR1224	SR1236	SR1248	SR1260	SR1272	SR1284	SR1296	SR1318
Remote communication port	SR1225	SR1237	SR1249	SR1261	SR1273	SR1285	SR1297	SR1309

Item \ Socket Number	1	2	3	4	5	6	7	8
Transmitted data length	SR1226	SR1238	SR1250	SR1262	SR1274	SR1286	SR1298	SR1310
Transmitted data address (high word)	SR1227	SR1239	SR1251	SR1263	SR1275	SR1287	SR1299	SR1311
Transmitted data address (low word)	SR1228	SR1240	SR1252	SR1264	SR1276	SR1288	SR1300	SR1312
Received data length	SR1229	SR1241	SR1253	SR1265	SR1277	SR1289	SR1301	SR1313
Received data address (high word)	SR1230	SR1242	SR1254	SR1266	SR1278	SR1290	SR1302	SR1314
Received data address (low word)	SR1231	SR1243	SR1255	SR1267	SR1279	SR1291	SR1303	SR1315
Data receiving counter	SR1232	SR1244	SR1256	SR1268	SR1280	SR1292	SR1304	SR1316
Data sending counter	SR1233	SR1245	SR1257	SR1269	SR1281	SR1293	SR1305	SR1317

7. When the TCP socket is opened, the remote IP address and the communication ports can be set as follows.

Remote IP address	**Local communication port**	**Remote communication port**	**Description**
0.0.0.0	0	0	Illegal
0.0.0.0	Not equal to 0	0	Only applied to the server 1. The connection request from the same local communication port is accepted. 2. The packet sent from any device is received through the local communication port.
0.0.0.0	0	Not equal to 0	Illegal
Specific IP address	0	0	Illegal
Specific IP address	Not equal to 0	0	Only applied to the server 1. The packet is received from the specific IP address through the local communication port.
Specific IP address	0	Not equal to 0	Only applied to the client 1. The system will specify an unused communication port as the local communication port. 2. The data is sent to the specific IP address through the remote communication port.

Remote IP address	Local communication port	Remote communication port	Description
Specific IP address	Not equal to 0	Not equal to 0	1. The connection requests from the local communication port, the remote communication port, and the specific IP address are received. 2. The data is sent to the specific IP address through the remote communication port. 3. The packet is received from the specific IP address through the local communication port.

8. If the TCP socket is opened, and no error occurs after the instruction is executed, the PLC is connected to the remote device, and the flag related to the connection's being started is ON. If the connection is successful, the flag related to the connection's being successful is ON, and the flag related to the connection's being started is OFF. If an error occurs, the error flag is ON.

TCP socket number	Being starting the connection	Successful connection	Error flag
1	SM1273	SM1270	SM1277
2	SM1281	SM1278	SM1285
3	SM1289	SM1286	SM1293
4	SM1297	SM1294	SM1301
5	SM1305	SM1302	SM1309
6	SM1313	SM1310	SM1317
7	SM1321	SM1318	SM1325
8	SM1329	SM1326	SM1333

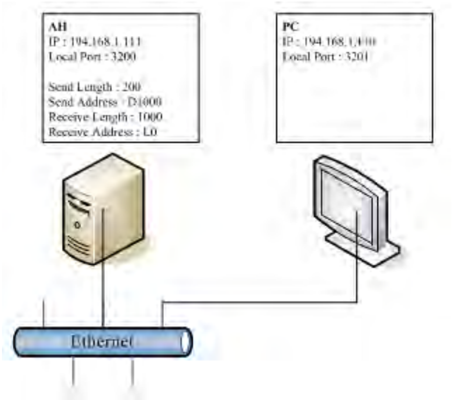
9. If the UDP socket is opened, and no error occurs after the instruction is executed, the flag related to the connection's having been started is ON. If an error occurs, the error flag is ON.

UDP socket number	Having started the connection	Error flag
1	SM1334	SM1338
2	SM1339	SM1343
3	SM1344	SM1348
4	SM1349	SM1353
5	SM1354	SM1358
6	SM1359	SM1363
7	SM1364	SM1368
8	SM1369	SM1373

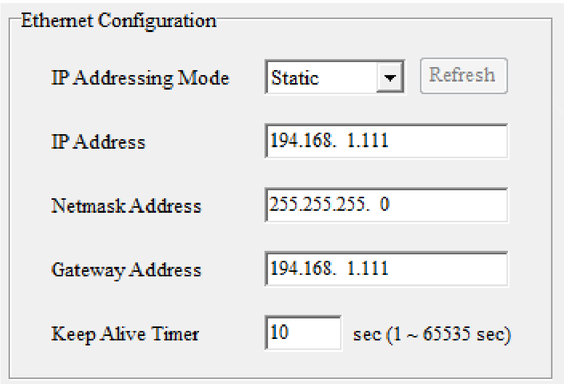
10. Generally, the pulse instruction SOPENP is used.

Example 1:

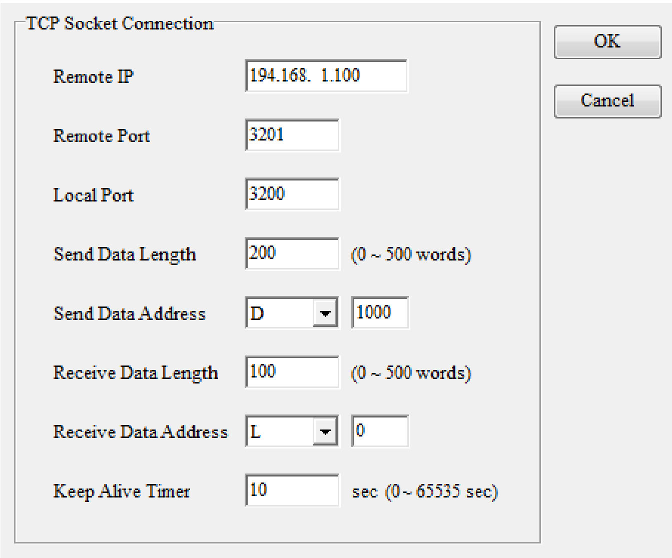
1. The system framework below illustrates how to establish the TCP connection between a computer as the server and an AH500 series PLC as the client.



2. Ethernet Configuration Setups: ISPSoft > HWCONFIG > CPU > PLC Parameter Setting > Ethernet - Basic



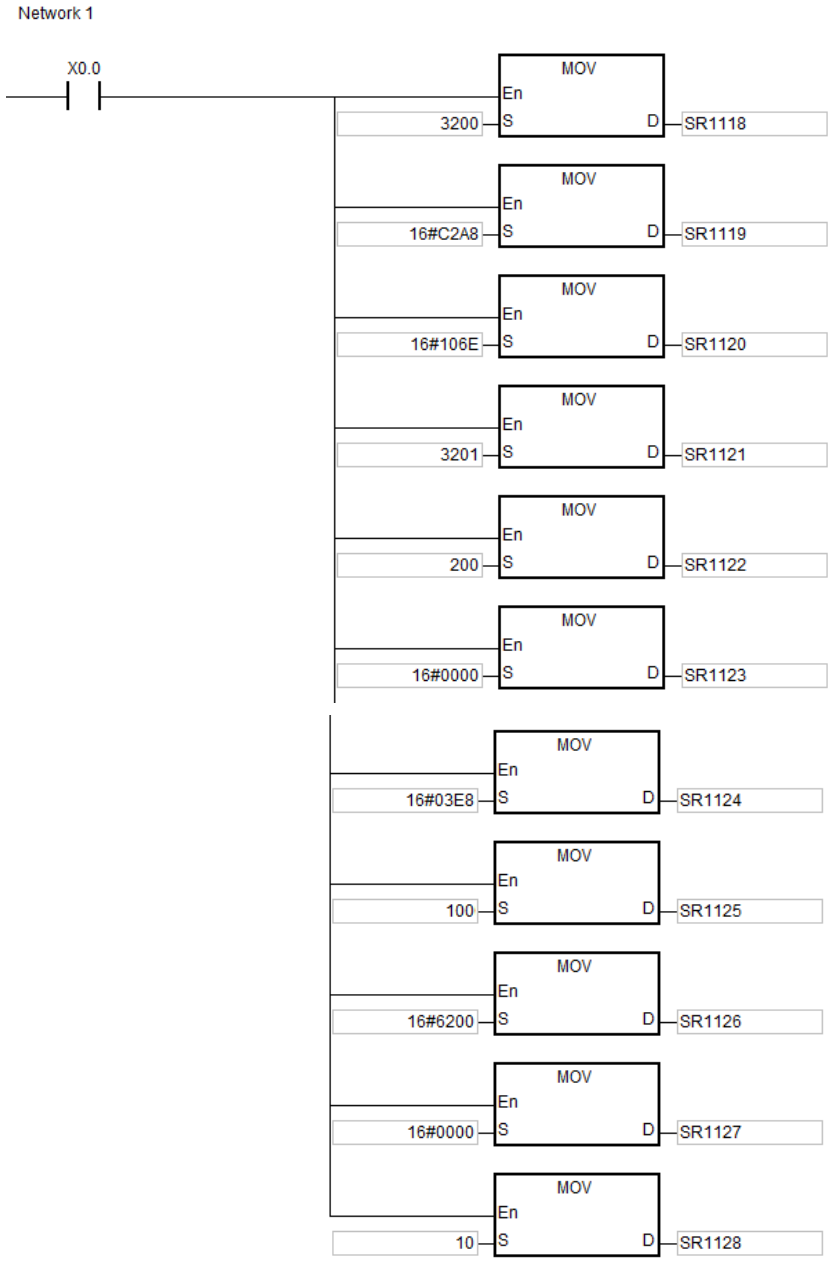
3. Ethernet Configuration Setups: ISPSoft > HWCONFIG > CPU > PLC Parameter Setting > Ethernet – Advance > Socket > TCP Socket Connection > Click the specific item to configure.

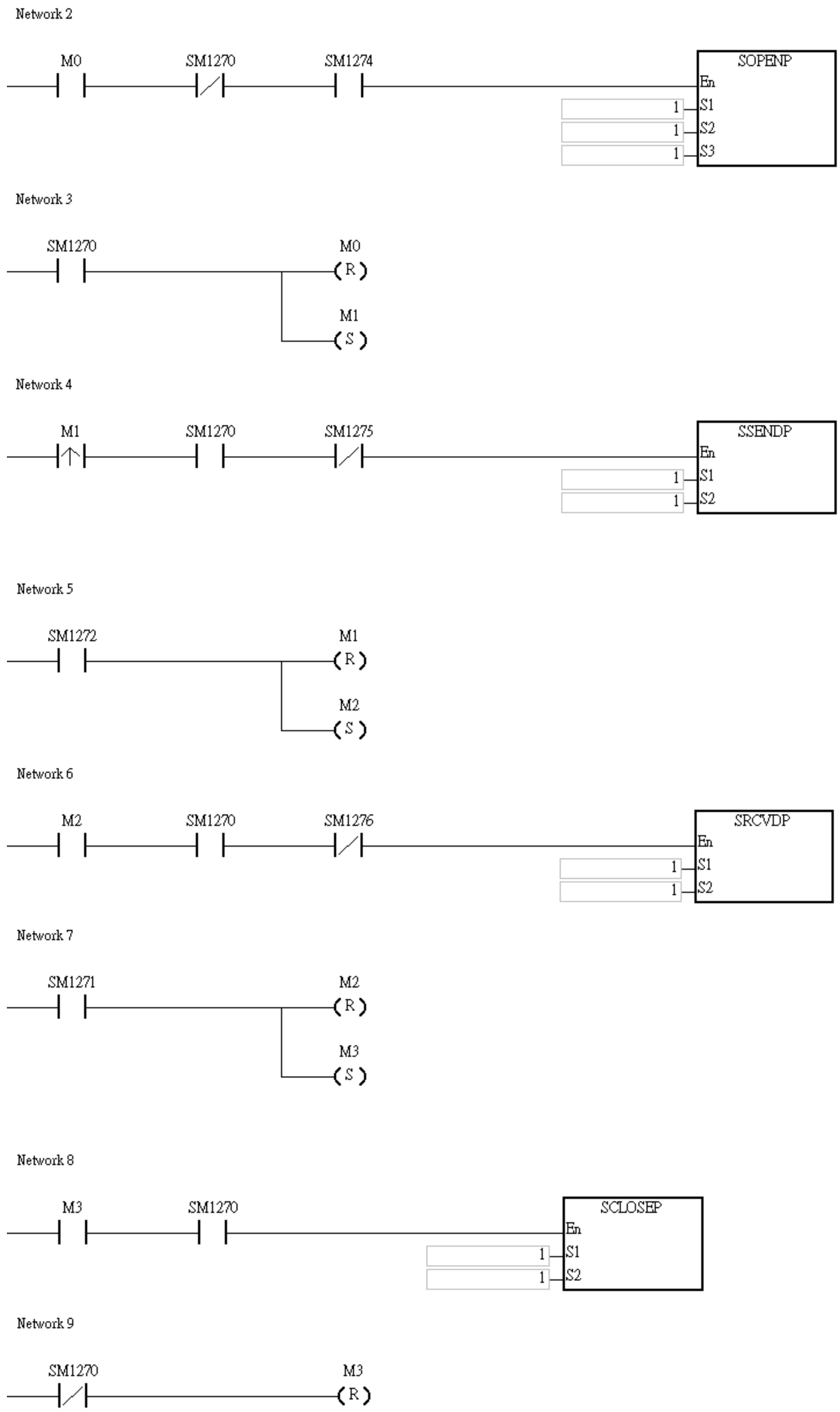


4. When X0.0 is ON, the data related to the TCP socket 1 is transferred to the corresponding special data registers. Users also can set the TCP socket 1 in ISPSoft.
5. When M0 is ON, whether the socket is closed, has been connected, or is being connected is checked. If the socket is not closed, has not been connected, or is not being connected, the

connection procedure is performed. After the socket has been connected, M0 will is switched OFF and M1 will be ON.

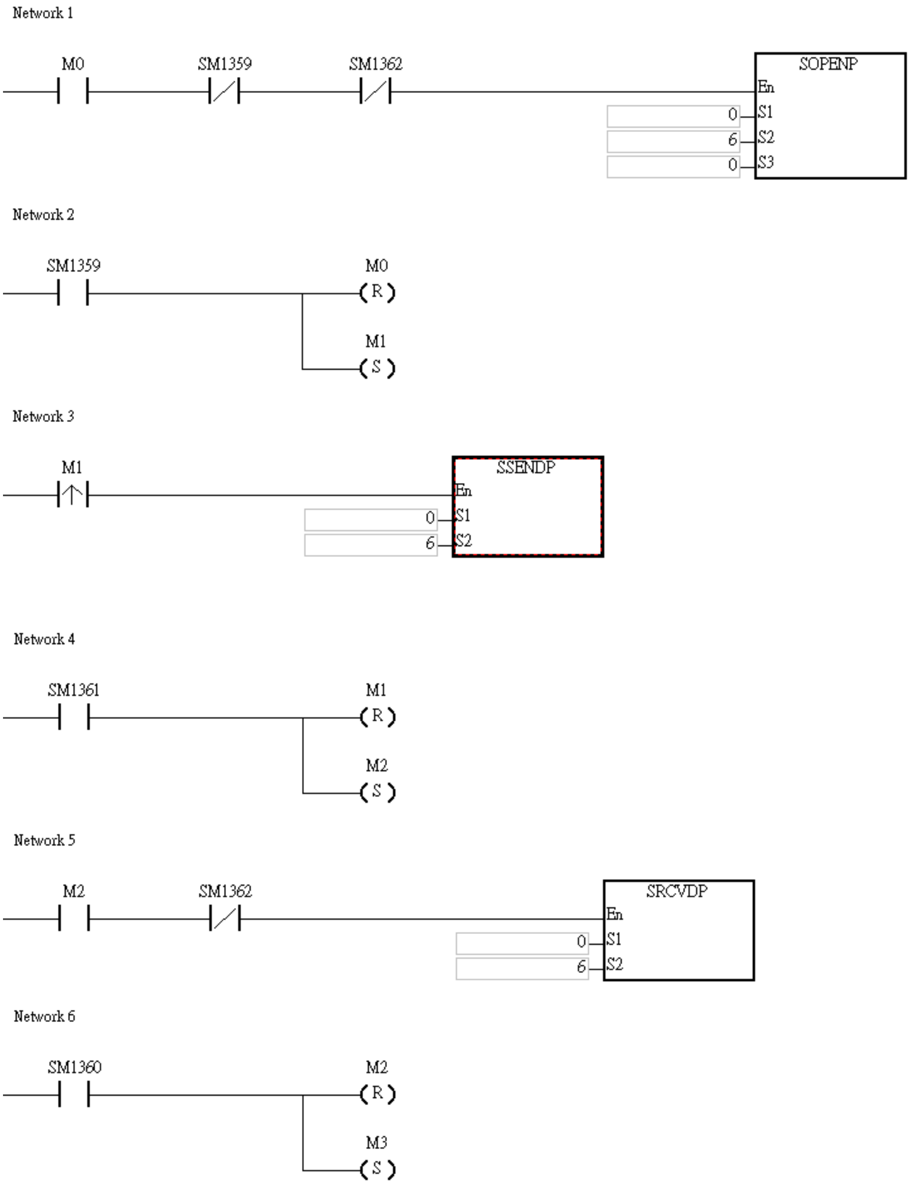
6. When M1 is ON, whether the socket has been connected and no data is being sent is checked. If the socket has been connected, and no data is being sent, the data will be sent. If the socket has not been connected, the instruction is not executed. After the sending of the data is complete, M1 will be switched OFF and M2 will be ON.
7. When M2 is ON, whether the socket has been connected and no data is being received is checked. If the socket has been connected, and no data is being received, the data will be received. If the socket has not been connected, the instruction is not executed. After the sending of the data is complete, M2 will be switched OFF and M3 will be ON.
8. When M3 is ON, whether the socket has been connected is checked. If the socket has been connected, the connection will be closed. If the socket has not been connected, the instruction is not executed. After the connection is closed, M3 will be switched OFF.





9. The example illustrates how to establish the UDP connection between a computer and an AH500 series PLC.
10. When M0 is ON, whether the socket has been connected is checked. If the socket has not been connected, the connection procedure is performed. After the socket has been connected, M0 will be switched OFF and M1 will be ON.
11. When M1 is ON, the data is sent. After the sending of the data is complete, M1 will be switched OFF and M2 will be ON.

12. When M2 is ON, whether the socket has been connected and no data is being received is checked. If the socket has been connected, and no data is being received, the data will be received. If the socket has not been connected, the instruction is not executed, M2 is switched OFF and M3 will be ON.
13. When M3 is ON, whether the socket has been connected is checked. If the socket has been connected, the connection will be closed. If the socket has not been connected, the instruction is not executed. After the connection is closed, M3 will be switched OFF.



Additional remark:

If both Client and Server are AH Series PLCs and the timeout time for both Client and Server is set identically. When a timeout occurs on the Server, the connection will be stopped and thus no error flag will be shown on the Client. But if a timeout occurs on the Client first, an error flag shows up and then the connection is stopped.

Error codes for the TCP connection:

Error Code	Description	Error Flag
16#2003	The value in $\mathbf{S_1}$, $\mathbf{S_2}$, or $\mathbf{S_3}$ exceeds the range, the instruction is not executed.	SM0/SM5
16#600A	Failed to establish a TCP connection.	SM1090
16#600C	The socket has been used.	SM1109
16#600D	The RJ45 port is NOT connected.	SM1100
16#6200	The remote socket IP address of the TCP connection is illegal.	Note 1
16#6201	The local socket of TCP connection is illegal.	Note 1
16#6202	The remote socket of TCP connection is illegal.	Note 1
16#6214	The connection to the remote socket was denied.	Note 1
16#6217	The current socket is opened.	Note 1
16#621A	The current socket is closed.	Note 1

Note 1:

SM1277: The error flag of TCP Socket 1

SM1285：The error flag of TCP Socket 2

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SM1325：The error flag of TCP Socket 7

SM1333：The error flag of TCP Socket 8

Error codes for the UDP connection:

Error Code	Description	Error Flag
16#2003	The value in **S**$_1$, **S**$_2$, or **S**$_3$ exceeds the range, the instruction is not executed.	SM0/SM5
16#600B	Failed to establish an UDP connection.	SM1090
16#600C	The socket has been used.	SM1109
16#600D	The RJ45 port is NOT connected.	SM1100
16#6209	The remote socket IP address of the UDP connection is illegal.	Note 2
16#620A	The local socket of UDP connection is illegal.	Note 2
16#620B	The remote socket of UDP connection is illegal.	Note 2
16#6217	The current socket is opened.	Note 2
16#621A	The current socket is closed.	Note 2

Note 2:

SM1338: The error flag of UDP Socket 1

SM1343: The error flag of UDP Socket 2

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SM1368: The error flag of UDP Socket 7

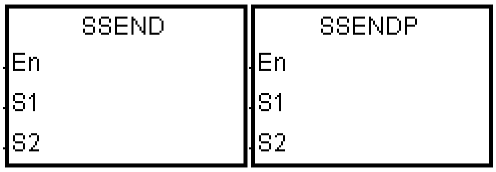
SM1373: The error flag of UDP Socket 8

API	Instruction code		Operand	Function
2201	SSEND	P	**S_1, S_2**	Sending the data through the socket

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●	●			●	●		●	●			○	●	○	○		
S_2	●	●			●	●		●	●			○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1 : Socket mode — Word

S_2 : Socket number — Word

Explanation:

1. **S_1** is 1 if users want to open the TCP socket, and **S_1** is 0 if users want to open the UDP socket. **S_2** is the socket number.
2. The operand **S_1** should be either 0 or 1, and the operand **S_2** should be within the range between 1 and 8.
3. Before using this instruction, users need to use the instruction SOPEN to open the socket. If the flag related to the connection’s being successful is ON, or the flag related to the connection’s having been started is ON, this instruction can be used.
4. If the data is sent through the TCP socket, and no error occurs after the instruction is executed, the data is sent, and the flag related to the data’s being sent is ON. If the data is sent successfully, the flag related to the data’s having been sent is ON, and the flag related to the data’s being sent is OFF. If an error occurs, the error flag is ON.

TCP socket number	Being sending the data	Having sent the data	Error flag
1	SM1275	SM1272	SM1277
2	SM1283	SM1280	SM1285
3	SM1291	SM1288	SM1293
4	SM1299	SM1296	SM1301
5	SM1307	SM1304	SM1309
6	SM1315	SM1312	SM1317
7	SM1323	SM1320	SM1325
8	SM1331	SM1328	SM1333

5. If the data is sent through the UDP socket, and no error occurs after the instruction is executed, the flag related to the data’s having been sent is ON. If an error occurs, the error flag is ON.

UDP socket number	Having sent the data	Error flag
1	SM1336	SM1338
2	SM1341	SM1343
3	SM1346	SM1348
4	SM1351	SM1353
5	SM1356	SM1358
6	SM1361	SM1363
7	SM1366	SM1368
8	SM1371	SM1373

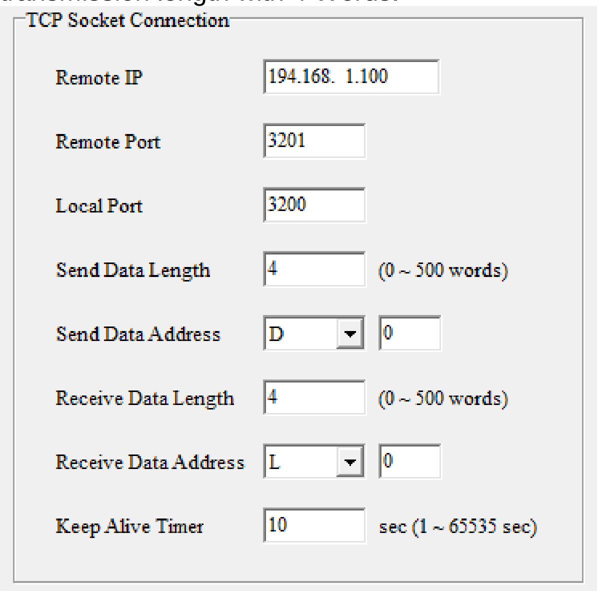
6. Generally, the pulse instruction SSENDP is used.

7. While using this instruction, if the transmission length is an odd number, use the following flag to set up.

Socket number	Flags for sending an odd number of characters (TCP socket)	Flags for sending an odd number of characters (UDP socket)
1	SM1375	SM1383
2	SM1376	SM1384
3	SM1377	SM1385
4	SM1378	SM1386
5	SM1379	SM1387
6	SM1380	SM1388
7	SM1381	SM1389
8	SM1382	SM1390

Explanation:

1. Refer to the execution of SOPEN instruction for relative setups and examples for the transmission length with 4 Words.



2. Using the flags for sending an odd number of characters will take 1 byte and thus the actual transmission will be 7 Bytes. For transmission without using the flags for sending an odd number of characters, the actual transmission will be 8 Bytes.

Data transmission address							
D0		D1		D2		D3	
High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Bytes	High Byte	Low Byte
16#01	16#02	16#03	16#04	16#05	16#06	16#07	16#08
Actual data transmission (The flag for sending an odd number of characters is OFF.)							
0102 0304 0506 0708							
Actual data transmission (The flag for sending an odd number of characters is ON.)							
0102 0304 0506 07							

Additional remark:

If both Client and Server are AH Series PLCs and the time of timeout for both Client and Server is set identically. When a timeout occurs on the Server, the connection will be stopped and thus no error flag will be shown on the Client. But if a timeout occurs on the Client first, an error flag shows up and then the connection is stopped.

Error codes for the TCP connection:

Error Code	Description	Error Flag
16#2003	The value in $\mathbf{S_1}$, $\mathbf{S_2}$, or $\mathbf{S_3}$ exceeds the range, the instruction is not executed.	SM0/SM5
16#600D	The RJ45 port is NOT connected.	SM1100
16#6203	The address of the TCP socket for the data to be sent is illegal.	Note 1
16#6204	The data length of the TCP socket for the data to be sent is illegal.	Note 1
16#6205	The data of the TCP socket exceeds the device range for the data to be sent.	Note 1
16#6212	The remote socket response timeout	Note 1
16#6214	The connection to the remote socket was denied.	Note 1
16#6215	The current socket is NOT opened.	Note 1
16#6218	The current socket is in transmission.	Note 1

Note 1:

SM1277: The error flag of TCP Socket 1

SM1285：The error flag of TCP Socket 2

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SM1325：The error flag of TCP Socket 7

SM1333：The error flag of TCP Socket 8

Error codes for the UDP connection:

Error Code	Description	Error Flag
16#2003	The value in **S**$_1$, **S**$_2$, or **S**$_3$ exceeds the range, the instruction is not executed.	SM0/SM5
16#600D	The RJ45 port is NOT connected.	SM1100
16#620C	The address of the UDP socket for the data to be sent is illegal.	Note 2
16#620D	The data length of the UDP socket for the data to be sent is illegal.	Note 2
16#620E	The data of the UDP socket exceeds the device range for the data to be sent.	Note 2
16#6218	The current socket is in transmission.	Note 2

Note 2:

SM1338: The error flag of UDP Socket 1

SM1343: The error flag of UDP Socket 2

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SM1368: The error flag of UDP Socket 7

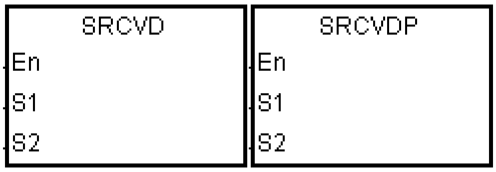
SM1373: The error flag of UDP Socket 8

API	Instruction code			Operand	Function
2202		SRCVD	P	**S_1, S_2**	Receiving the data through the socket

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●			○	●	○	○		
S_2	●	●			●	●		●	●			○	●	○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1 : Socket mode Word

S_2 : Socket number Word

Explanation:

1. **S_1** is 1 if users want to open the TCP socket, and **S_1** is 0 if users want to open the UDP socket. **S_2** is the socket number, ranging from 1 to 8.
2. Before using this instruction, users need to use the instruction SOPEN to open the socket. If the flag related to the connection's being successful is ON, or the flag related to the connection's having been started is ON, this instruction can be used.
3. If users need to send several data separately, you can use this new functionality: **S_3** = 2 or 3. The first device in the receiving destination is stored with the length of the data to be received, and the data to be received is stored from the second device and on. If users need to receive another data, clear the value in the first device and start another data transmission.
4. If the data is received through the TCP socket, and no error occurs after the instruction is executed, the data is received, and the flag related to the data's being received is ON. If the data is received successfully, the flag related to the data's having been received is ON, and the flag related to the data's being received is OFF. If an error occurs, the error flag is ON.

TCP socket number	Being receiving the data	Having received the data	Error flag
1	SM1276	SM1271	SM1277
2	SM1284	SM1279	SM1285
3	SM1292	SM1287	SM1293
4	SM1300	SM1295	SM1301
5	SM1308	SM1303	SM1309
6	SM1316	SM1311	SM1317
7	SM1324	SM1319	SM1325
8	SM1332	SM1327	SM1333

5. If the data is received through the UDP socket, and no error occurs after the instruction is executed, the flag related to the data's being received is ON. After the data is received, the flag related to the data's having been received is ON. If an error occurs, the error flag is ON.

UDP socket number	Being receiving the data	Having received the data	Error flag
1	SM1337	SM1335	SM1338
2	SM1342	SM1340	SM1343
3	SM1347	SM1345	SM1348
4	SM1352	SM1350	SM1353

UDP socket number	Being receiving the data	Having received the data	Error flag
5	SM1357	SM1355	SM1358
6	SM1362	SM1360	SM1363
7	SM1367	SM1365	SM1368
8	SM1372	SM1370	SM1373

6. Generally, the pulse instruction SRCVDP is used.

Example:

Please refer to the example of the execution of SOPEN.

Error codes for the TCP connection:

Error Code	Description	Error Flag
16#2003	The value in **S_1**, **S_2**, or **S_3** exceeds the range, the instruction is not executed.	SM0/SM5
16#600D	The RJ45 port is NOT connected.	SM1100
16#6206	The address of the TCP socket for the data to be sent is illegal.	Note 1
16#6207	The data length of the TCP socket for the data to be sent is illegal.	Note 1
16#6208	The data of the TCP socket exceeds the device range for the data to be sent.	Note 1
16#6212	The remote socket response timeout	Note 1
16#6213	The receiving data exceeds the socket range.	Note 1
16#6214	The connection to the remote socket was denied.	Note 1
16#6215	The current socket is NOT opened.	Note 1
16#6219	The current socket is in transmission.	Note 1

Note 1:

SM1277: The error flag of TCP Socket 1

SM1285：The error flag of TCP Socket 2

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SM1325：The error flag of TCP Socket 7

SM1333：The error flag of TCP Socket 8

Error codes for the UDP connection:

Error Code	Description	Error Flag
16#2003	The value in $\mathbf{S_1}$, $\mathbf{S_2}$, or $\mathbf{S_3}$ exceeds the range, the instruction is not executed.	SM0/SM5
16#600D	The RJ45 port is NOT connected.	SM1100
16#620F	The address of the UDP socket for the data to be sent is illegal.	Note 2
16#6210	The data length of the UDP socket for the data to be sent is illegal.	Note 2
16#6211	The data of the UDP socket exceeds the device range for the data to be sent.	Note 2
16#6213	The receiving data exceeds the socket range.	Note 2
16#6219	The current socket is in transmission.	Note 2

Note 2:

SM1338: The error flag of UDP Socket 1

SM1343: The error flag of UDP Socket 2

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SM1368: The error flag of UDP Socket 7

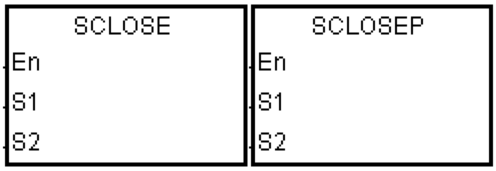
SM1373: The error flag of UDP Socket 8

API	Instruction code			Operand	Function
2203		SCLOSE	P	S_1, S_2	Closing the socket

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1	●	●			●	●		●	●			○	●	○	○		
S_2	●	●			●	●		●	●			○	●	○	○		

Pulse instruction	16-bit instruction (5 Steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1 : Socket mode Word

S_2 : Socket number Word

Explanation:

1. **S_1** is 1 if users want to close the TCP socket, and **S_1** is 0 if users want to close the UDP socket. **S_2** is the socket number.
2. The operand **S_1** should be either 0 or 1, and the operand **S_2** should be within the range between 1 and 8.
3. Before closing the socket, users need to make sure that the socket has been connected. Otherwise, the instruction is not executed.
4. If the TCP socket is closed by the client, the server continues to be connected to the local communication port. If the TCP socket is closed is by the server, the server is not connected to the local communication port. After the instruction is executed to close the TCP socket, the corresponding flag is OFF.
5. After the instruction is executed to close the UDP socket, the corresponding flag is OFF.
6. If the TCP socket is closed, and no error occurs after the instruction is executed, the PLC is not connected to the remote device, and the flag related to the connection's being closed is ON. If the connection is closed successfully, the flag related to the connection's being closed is OFF. If an error occurs, the error flag is ON.

Socket number	Being closing the connection	Error flag
1	SM1274	SM1277
2	SM1282	SM1285
3	SM1290	SM1293
4	SM1298	SM1301
5	SM1306	SM1309
6	SM1314	SM1317
7	SM1322	SM1325
8	SM1330	SM1333

7. If the UDP socket is close, and no error occurs after the instruction is executed, the flag related to the connection's having been started is OFF. If an error occurs, the error flag is ON.

Socket number	Error flag
1	SM1338
2	SM1343
3	SM1348
4	SM1353
5	SM1358
6	SM1363
7	SM1368
8	SM1373

8. Generally, the pulse instruction SCLOSEP is used.

Example:

Please refer to the example of the execution of SOPEN.

Additional remark:

Error codes for the TCP connection:

Error Code	Description	Error Flag
16#2003	The value in $\mathbf{S_1}$, $\mathbf{S_2}$, or $\mathbf{S_3}$ exceeds the range, the instruction is not executed.	SM0/SM5
16#600D	The RJ45 port is NOT connected.	SM1100
16#6212	The remote socket response timeout	Note 1
16#6214	The connection to the remote socket was denied.	Note 1
16#621A	The current socket is closed.	Note 1

Note 1:

SM1277: The error flag of TCP Socket 1

SM1285：The error flag of TCP Socket 2

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SM1325：The error flag of TCP Socket 7

SM1333：The error flag of TCP Socket 8

Error codes for the UDP connection:

Error Code	Description	Error Flag
16#2003	The value in **S_1**, **S_2**, or **S_3** exceeds the range, the instruction is not executed.	SM0/SM5
16#600D	The RJ45 port is NOT connected.	SM1100
16#6212	The remote socket response timeout	Note 1
16#6214	The connection to the remote socket was denied.	Note 1
16#621A	The current socket is closed.	Note 1

Note 2:

SM1338: The error flag of UDP Socket 1

SM1343: The error flag of UDP Socket 2

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SM1368: The error flag of UDP Socket 7

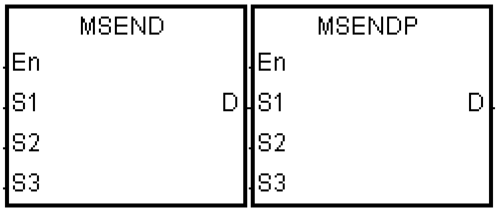
SM1373: The error flag of UDP Socket 8

API	Instruction code		Operand	Function
2204	MSEND	P	**S_1, S_2, S_3, D**	Sending the email

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●	●			●	●		●	●			○	●	○	○		
S_2	●	●			●	●		●	●			○	●				
S_3	●	●			●	●		●	●			○	●				
D	●	●	●	●				●	●				●				

Pulse instruction	16-bit instruction (9 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1 : Remote email address Word

S_2 : Email subject Word

S_3 : Email body Word

D : Completion of the instruction Bit

Explanation:

1. Users can send an email by setting **S_1**, **S_2**, and **S_3**.
2. Before using the instruction, users have to accomplish the following setting in ISPSoft.
   - PLC Parameter Setting→Ethernet-Basic→Setting the IP addres and the netmask address
   - PLC Parameter Setting→Ethernet-Advance→Email→Setting the SMTP server, the port, the local email address, and the SMTP subject
   - PLC Parameter Setting→Ethernet-Advance→Email and Trigger Configuration→Setting the email address
   - If the account identification is required,

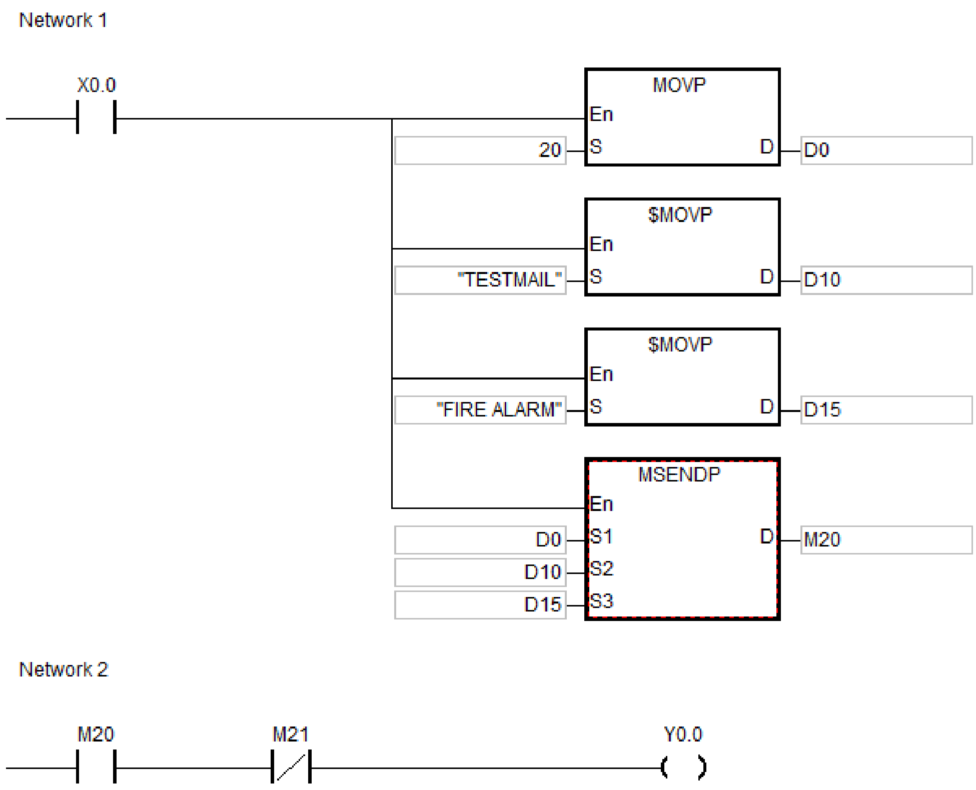
     PLC Parameter Setting→Ethernet-Advance→Email→Setting the user name and the password
3. The email is set as follows.

Operand	Description	Setting range
S_1	Remote email address	The value in **S_1** should be within the range between 1 and 256. The values of bit0~bit7 set in ISPSoft indicate the remote email addresses. (Users can set eight email addresses in ISPSoft.) The remote email address is 1 if the value of bit0 is 1, the remote email address is 2 if the value of bit1 is 1, and by analogy, the remote email address is 8 if the value of bit7 is 1. If users want to send an email, they have to set the values of bit0~bit7 in ISPSoft.
S_2	Email subject	The size of the email subject can be up to 16 words.
S_3	Email body	The size of the email body can be up to 64 words.
D	Completion of the instruction	After the execution of the instruction is complete, the bit is ON. If the execution of the instruction is abnormal, the next bit is ON.

4. Generally, the pulse instruction MSENDP is used.

Example:

Suppose the value in D0 is 00010100. When X0.0 is ON, the email is sent to remote email address 3, and remote email address 5. After the communication with the SMTP sever is complete, M20 is ON. If no error occurs during the communication, M21 is OFF, and Y0.0 is ON.



Additional remark:

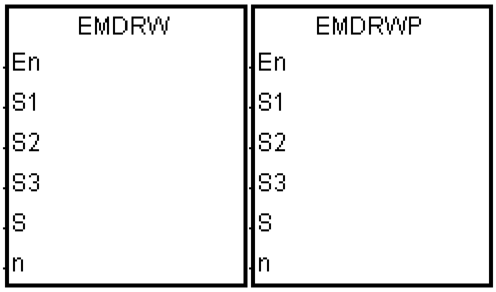
1. If **D**+1 exceeds the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the remote mail address is less than 1, or if the remote mail address is larger than 256, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the length of the string in $\mathbf{S_2}$ or $\mathbf{S_3}$ is larger than the maximum value (16#00), the length of the string in $\mathbf{S_2}$ or $\mathbf{S_3}$ will be counted equal to the maximum value.
4. When the instruction is executed, if the number of systems which can be connected to the SMTP server reaches the upper limit, the error occurs, and the error code is 16#6100.
5. If the account identification is required, and the account identification information is judged invalid by the SMTP server, the error occurs, and the error is is 16#6108. If the password is incorrect, the error code is 16#6109.
6. If the remote email address is judged invalid by the SMTP server, the error occurs, and the error code is 16#6111.
7. During the sending of the email, if there is an SMTP server response timeout, the error occurs, the error code is 16#6107, and the sending of the email is cancelled.
8. If users declare the operand **D** in ISPSoft, the data type will be ARRAY [2] of WORD/INT.

API	Instruction code		Operand	Function
2205	EMDRW	P	**S_1, S_2, S_3, S, n**	Reading/Writing the Modbus TCP data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	“$”	DF
S_1	●	●			●	●		●	●			○	●				
S_2	●	●			●	●		●	●			○	●	○	○		
S_3	●	●			●	●		●	●			○	●	○	○		
S	●	●	●		●	●		●	●			○	●				
n	●	●			●	●		●	●			○	●	○	○		

Pulse instruction	16-bit instruction (11 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S_1	:	Unit address	Word
S_2	:	Function code	Word
S_3	:	Device address	Word
S	:	Register involved in the reading/writing of the data	Bit/Word
n	:	Data length	Word

Explanation:

1. Before using the instruction, users have to accomplish the following setting in ISPSoft.
   PLC Parameter Setting→Ethernet-Basic→Setting the IP addres and the netmask address
2. Setting **S_1** :

Operand	Description	Setting range
S_1	Station address	The station address should be within the range between 0 and 255.
S_1+1	Remote IP address (high word)	Example: The remote IP address is 172.16.144.230. **S_1**+1=16#AC10 **S_1**+2=16#90E6
S_1+2	Remote IP address (low word)	
S_1+3	Whether to close the connection	0: The connection is closed after the execution of the instruction is complete. 1: The connection is persistent. (The closing of the connection depends on the setting of the TCP keepalive timer.)

S_2: Function code

For example:

1 (16#01): The AH500 series PLC reads the data from several bit devices which are not discrete input devices.

2 (16#02): The AH500 series PLC reads the data from several bit devices which are discrete input devices.

3 (16#03): The AH500 series PLC reads the data from several word devices which are not input registers.

4 (16#04): The AH500 series PLC reads the data from several word devices which are input registers.

5 (16#05): The AH500 series PLC writes the state into a bit device.
6 (16#06): The AH500 series PLC writes the data into a word device.
15 (16#0F): The AH500 series PLC writes the states into several bit devices.
16 (16#10): The AH500 series PLC writes the data into several word devices.
Only the function codes mentioned above are supported, and other function codes can not be executed. Please refer to the examples below.

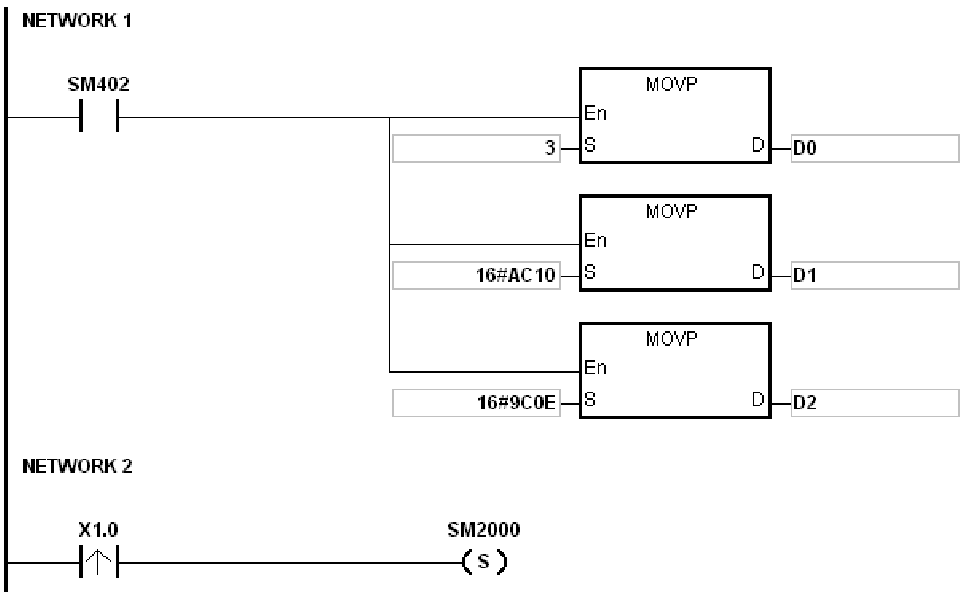
3. **S_3**: The device address
4. **S**: The register involved in the reading/writing of the data
   The data which will be written into the external equipment is stored in the register in advance.
   The data which is read from the external equipment is stored in the register.
5. **n**: The length of the data
   The size of the data can not be larger than 240 bytes. For the communication commands related to the coils, the unit of the data is the bit, and **n** should be within the range between 1 and 1920. For the communication commands related to the registers, the unit of the data is the word, and **n** should be within the range between 1 and 120.

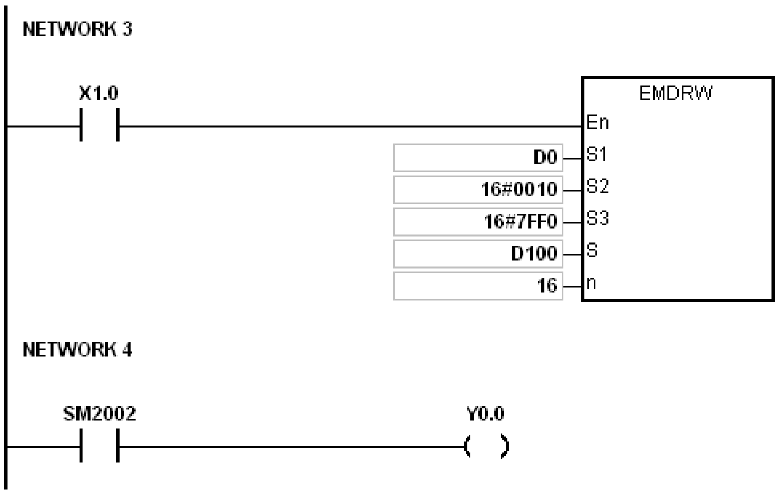
EMDRW \ Flag	Sending the data	Waiting for the data	Having received the data	Error flag	Timeout flag	Having closed the connection
1	SM2000	SM2001	SM2002	SM2003	SM2004	SM2005
2	SM2006	SM2007	SM2008	SM2009	SM2010	SM2011
3	SM2012	SM2013	SM2014	SM2015	SM2016	SM2017
4	SM2018	SM2019	SM2020	SM2021	SM2022	SM2023
5	SM2024	SM2025	SM2026	SM2027	SM2028	SM2029
6	SM2030	SM2031	SM2032	SM2033	SM2034	SM2035
7	SM2036	SM2037	SM2038	SM2039	SM2040	SM2041
8	SM2042	SM2043	SM2044	SM2045	SM2046	SM2047

6. The instruction can be used several times in the program, but only eight instructions are executed at a time.
7. If several flags which are related to the sending of the data are ON simultaneously, the data indicated by the flag whose number is the smallest is sent first.
8. Generally, the pulse instruction EMDRWP is used.

Example:

1. The remote station address is set to 3.





Additional remark:

1. If the function code specified by **S_2** is related to the bit device, the device specified by **S** has to be the bit device. Otherwise, the operation error occurs, the instruction is not executed, and the error code in SR0 is 16#2003.
2. If the function code specified by **S_2** is related to the word device, the device specified by **S** has to be the word device. Otherwise, the operation error occurs, the instruction is not executed, and the error code in SR0 is 16#2003.
3. If the communication command is 0x05 or 0x06, **n** does not work. The state or the data is written into one bit device or one word device.
4. If a flag related to the sending of the data is ON, and the corresponding flag related to the connection's having been closed is not ON, the system will search for the flags which both are ON to execute the instruction. If there are no flags which both are ON, the instruction is not executed.
5. If users declare the operand **S_1** in ISPSoft, the data type will be ARRAY [4] of WORD/INT.

Error codes of EMDRW instruction:

Error Code	Description	Error Flag
16#2003	The value in **S_1**, **S_2**, or **S_3** exceeds the range, the instruction is not executed.	SM0/SM5
16#200B	If **n** or **K/H** exceeds the range, the instruction is not executed.	SM0/SM5
16#600D	The RJ45 port is NOT connected.	SM1100
16#6400	The connection number exceeds the range or the sending flag is NOT set.	Note 1
16#6401	During the connection, the remote device is disconnected.	Note 1
16#6402	The remote device response timeout	Note 1
16#6403	The remote device response timeout	Note 1
16#6405	The byte count responded by Modbus is not consistent with the actual data length.	Note 1
16#6406	Modbus slave sent an error response. (EMDRW)	Note 1

Note 1:

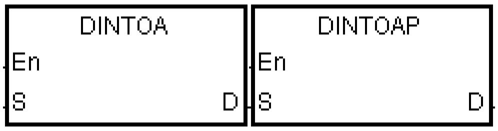
SM2003 ~ SM2045: The error flag of EMDRW 1 to EMDRW 8

API	Instruction code			Operand	Function
2206	D	INTOA	P	**S, D**	Converting the IP address of the integer type into the IP address of the string type

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●	○	○		
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction	32-bit instruction (5 steps)
AH500	-	AH500

Symbol:



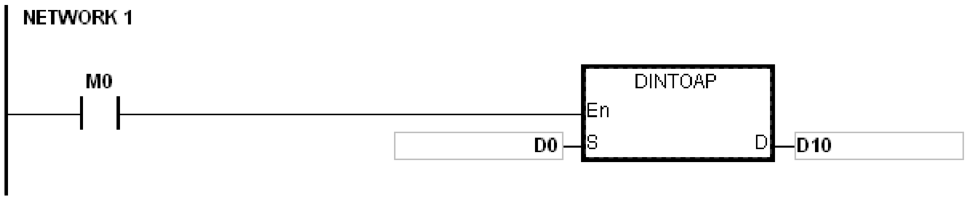
S : Source value Double word

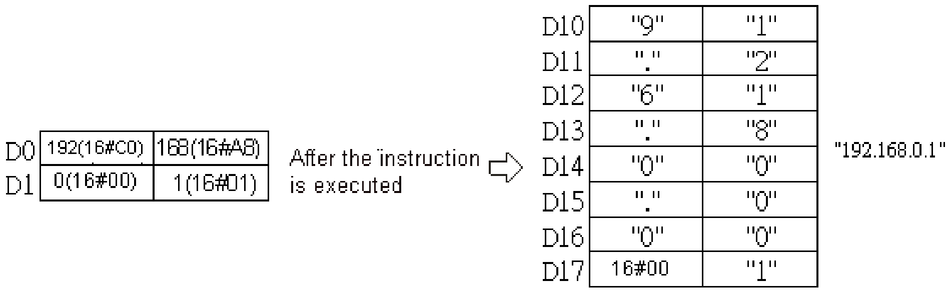
D : Conversion result Word

Explanation:

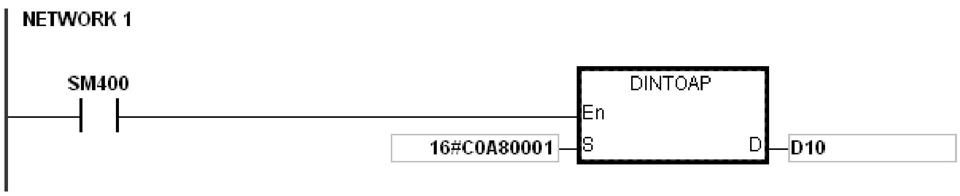
1. The IP address of the integer type in **S** is converted into the IP address of the string type, and the conversion result is stored in **D**.
2. The operand **D** occupies eight devices.

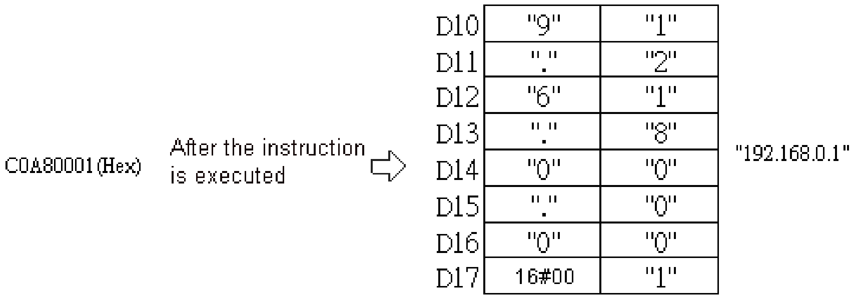
Example 1:





Example 2:





Additional remark:

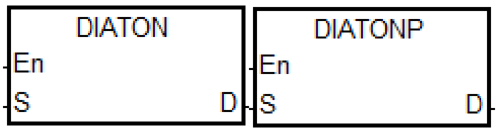
If users declare the operand **D** in ISPSoft, the data type will be ARRAY [8] of WORD/INT.

API	Instruction code			Operand	Function
2207	D	IATON	P	**S, D**	Converting the IP address of the string type into the IP address of the integer type

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S	●	●			●	●		●	●		●		●			○	
D	●	●			●	●		●	●				●				

Pulse instruction	16-bit instruction	32-bit instruction (5-11 steps)
AH500	-	AH500

Symbol:

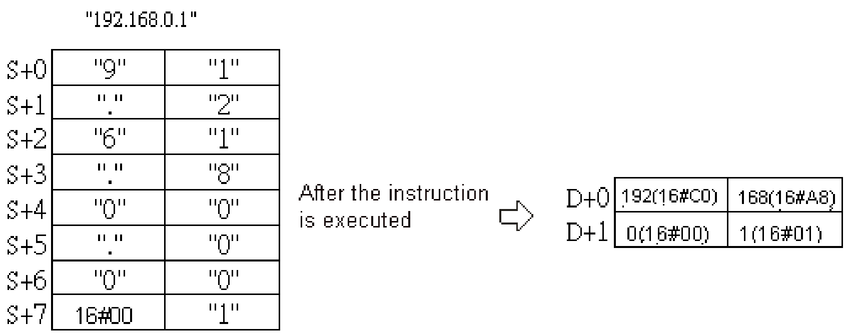


S : Source value String

D : Conversion result Double word

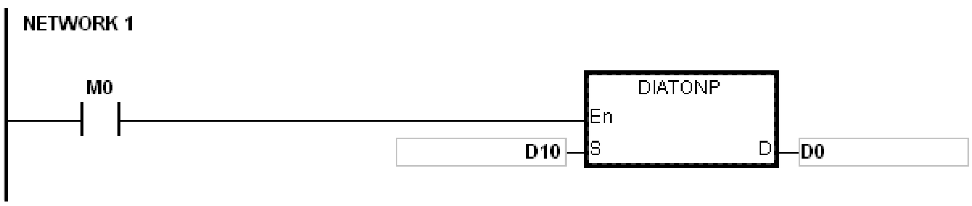
Explanation:

1. The IP address of the string type in **S** is converted into the IP address of the integer type, and the conversion result is stored in **D**.
2. The operand **S** occupies eight devices.



3. The IP address of the string type in **S** is divided into four sections. These sections are separated by "." (16#2E), and there are three characters in every section.
4. The value converted from the characters in every section of the IP address of the string type in **S** can not be larger than 255.
5. If **S** is a string, there are not necessarily three characters in every section of the IP address of the string type. For example, users can enter "192.168.0.1" instead of "192.168.000.001".

Example 1:



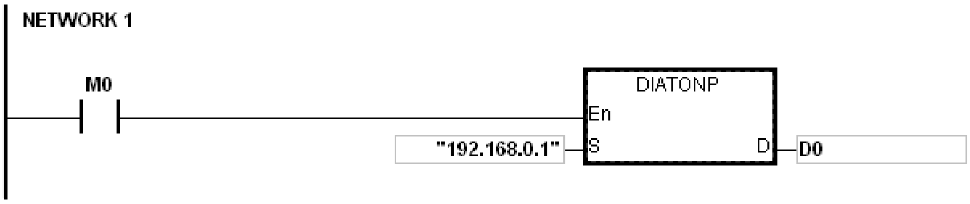
"192.168.0.1"

D10	"9"	"1"
D11	"."	"2"
D12	"6"	"1"
D13	"."	"8"
D14	"0"	"0"
D15	"."	"0"
D16	"0"	"0"
D17	16#00	"1"

After the instruction is executed ⇨

D0	192(16#C0)	168(16#A8)
D1	0(16#00)	1(16#01)

Example 2:



"192.168.0.1" After the instruction is executed ⇨

D0	192(16#C0)	168(16#A8)
D1	0(16#00)	1(16#01)

Additional remark:

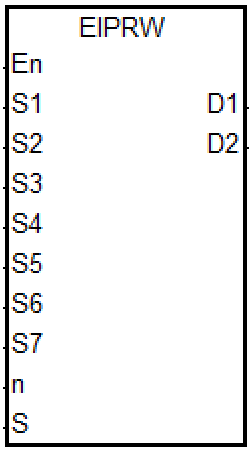
1. If the string in **S** does not end with 16#00, SM0 is ON, and the error code in SR0 is 16#200E.
2. In the string in **S**, except for the code representing the decimal point, the other binary codes have to be within the range between 16#30 and 16#39. If the other binary codes are not within the range between 16#30 and 16#39, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the fourth character, the eighth character, and the twelfth character in the string in **S** are not 16#2E, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If the number of decimals in the string in **S** is not equal to 3, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
5. If the value converted from the characters in any section of the IP address of the string type in **S** is larger than 255, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
6. If the number of characters in any section of the IP address of the string type in **S** is larger than 3, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
7. If users declare the operand **S** in ISPSoft, the data type will be ARRAY [8] of WORD/INT.

API	Instruction code	Operand	Function
2208	EIPRW	S_1~S_7, n, S, D_1, D_2	Reading and writing EtherNet/IP data

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
S_1								●	●								
S_2								●	●					○	○		
S_3								●	●					○	○		
S_4								●	●					○	○		
S_5								●	●					○	○		
S_6	●	●	●	●				●	●								
S_7								●	●					○	○		
n								●	●					○	○		
S								●	●								
D_1								●	●								
D_2								●	●								

Pulse instruction	16-bit instruction (23 steps)	32-bit instruction
-	AH500	-

Symbol



S_1	:	IP address	Word[2]
S_2	:	Connection mode	Word
S_3	:	Function code (Service code)	Word
S_4	:	Class ID	Word
S_5	:	Instance ID	Word
S_6	:	Attribute ID switch	Bit
S_7	:	Attribute ID	Word
n	:	Length of read and write data	Word
S	:	Register for the read/write data	Word[n]
D_1	:	Communication status	Word
D_2	:	Error code	Word[2]

Explanation:

1. This instruction reads and writes EtherNet/IP data. The following table lists the names and explanations of $\mathbf{S_1}$–$\mathbf{S_7}$, **n**, **S** and $\mathbf{D_1}$–$\mathbf{D_2}$.

Operand	Name	Description
$\mathbf{S_1}$	IP address	The first two sections of the IP address occupy the first word and the remaining two sections of the IP address occupy the second word. For example, if the IP address is 192.168.1.5, $\mathbf{S_1}$=16#C0A8 and $\mathbf{S_1}$+1=16#0105.
$\mathbf{S_2}$	Connection mode	0: UCMM, no CIP connection 1: Connected then close CIP connection 2: Connected then keep CIP connection
$\mathbf{S_3}$	Function code (Service code)	Range: 16#0000–00FF. If the function code exceeds the range, the instruction is not executed. Refer to the service codes of the to be connected device for more details.
$\mathbf{S_4}$	Class ID	Refer to the Class ID of the to be connected device for more details.
$\mathbf{S_5}$	Instance ID	Refer to the Instance ID of the to be connected device for more details.
$\mathbf{S_6}$	Attribute ID switch	ON: Enable; OFF: Disable, and $\mathbf{S_7}$ is not used.
$\mathbf{S_7}$	Attribute ID	Refer to the Attribute ID of the to be connected device for more details.
n	Length of read and write data	Size of the data to be written or read; unit: byte; maximum: 200 bytes
S	Register for the read/write data	Source register for the sent data or where the received data is stored; unit: word
$\mathbf{D_1}$	Communication status	0：Communication not triggered 1：Communication in process 2：Communication completed without errors 3：Communication error 4：Error in parameter settings
$\mathbf{D_2}$	Error code	$\mathbf{D_2}$: Major error code $\mathbf{D_2}$+1: extended error code

2. When you enable this instruction for the first time, it sends the communication command. If the number of connected slaves reaches the upper limit, the communication status value in **D_1** is 0, and the communication command is not sent.

3. When the parameter exceeds the range, the instruction is not executed and the communication status value in **D_1** is 4.

Additional remarks

1. If users declare the operand **S_1** in ISPSoft, the data type is ARRAY [2] of WORD.
2. If attribute ID is not provided, **S_6** is OFF. If attribute ID is provided, **S_6** is ON.
3. If users declare the operand **S** in ISPSoft, the data type is ARRAY [**n**] of WORD, where **n** is the size of the read/written data.
4. Write the data length of the Object in **n**. the value in **n** can be 0 (the data length of the Object will be automatically written in **n**) or a value less than the data length of the Object.
5. If the data length of the Object is 2 bytes, the value in **n** should be 2. The first data is stored in the low byte of the first word in **S** is and the second data is stored in high byte of the first word in **S**.
6. If users declare the operand **D_2** in ISPSoft, the data type is ARRAY [2] of WORD.
7. The following table explains the error codes in **D_2 [0]**.

Error Code	Error Flag	Description
16#2003	SM0 / **D_1**	1. Value in **S_2**, **S_3**, exceeds the range 2. **S**+n out of range of the device address
16#200B	SM0	Operand **n** out of range
16#600D	SM1100	Ethernet network not connected
16#6701	**D_1**	Connection with remote device broken
16#6702	**D_1**	Remote device response timeout
16#6703	**D_1**	Illegal IP address
16#6704	**D_1**	Error in response command service code
16#6705	**D_1**	Error in response command length
16#6706	**D_1**	All connections are occupied.

8. The following table explains the error codes in **D_2 [0]**.

Status Code	Description	What to Do
16#00	Connection successful	
16#01	Connection error	Ensure the EDS file of the slave is correct.
16#02	Connected devices unavailable	1. Ensure the number of devices connected to the master does not exceed the limit. 2. Ensure the number of devices connected to the slave does not exceed the limit. 3. The instruction is triggered repeatedly. Wait till the execution of the instruction is complete before starting another instruction.
16#03	Error in parameter	Ensure the read/written data in **S** is correct.
16#04	Path error	Ensure the settings are correct for Class ID (**S_4**), Instance ID (**S_5**), and Attribute ID (**S_7**).
16#05	Destination path does not exist	Ensure the settings are correct for Class ID (**S_4**), Instance ID (**S_5**), and Attribute ID (**S_7**).
16#07	Connection broken	1. Ensure the Ethernet port of the slave device is connected properly. 2. Ensure the keep alive timer setting is correct for the slave device.
16#08	Service code not supported	Ensure the function code (**S_3**) is correct.
16#09	Invalid attribute value	Ensure both the data source (**S**) and their contents are correct.
16#0A	Error in attribute list	Ensure the slave device object attribute allows PLC to perform the Get_Attribute_List and Set_Attribute_List functions.
16#0B	Transmission conflicts	Ensure the service setting is repeated.
16#0C	Object status conflicts	Ensure the Owner IO connection is established.

Status Code	Description	What to Do
16#0D	Object existed	Ensure the slave supports the defined object. The service does not need to execute if the defined object is supported.
16#0E	Attribute not writable	Ensure the object attribute supports the write function.
16#0F	No privilege to perform service code	Ensure the slave device is allowed to perform the service code.
16#10	Device cannot currently perform service	Ensure the Owner IO connection is established.
16#11	Size of response data too large	Ensure the length of data in the object attribute does not exceed the limit (100 words).
16#12	Data access sequence error when tag is accessed	Ensure the data length and the data type are correct.
16#13	Transmitted data too short	Ensure the length (**n**) of read/written data is correct.
16#14	Attribute value unsupported	Ensure the Attribute ID switch (**S_6**) and Attribute ID (**S_7**) are correct.
16#15	Transmitted data are too long	Ensure the read/written data length (**n**) is correct.
16#16	Object does not exist	Ensure the Class ID (**S_4**) is correct.
16#17	Data access sequence error when tag is accessed	1. Ensure the Ethernet network connection is correct. 2. Ensure no packets are lost in the Ethernet communication.
16#18	Attribute value not saved	Ensure no error state on the slave device occurred.
16#19	Attribute value storage error	Ensure no hardware error on the slave device occurred.
16#1A	Router error: length of request packet exceeds limit	Ensure the read/written data length (**n**) does not exceed the limit of the router.

Status Code	Description	What to Do
16#1B	Router error: length of response packet exceeds limit	Ensure the read/written data length (**n**) does not exceed the limit of the router.
16#1F	User-defined object access error	Refer to the definition of the slave device error.
16#20	Illegal parameter value	Ensure the read/written value in **S** is correct.

9. **D_2**+1: extended error code; refer to the error codes of the connected slave device for more details. If the connected slave device is from Delta Electronics, refer to section 6.2 Troubleshooting of EtherNet/IP Operation Manual for more details.

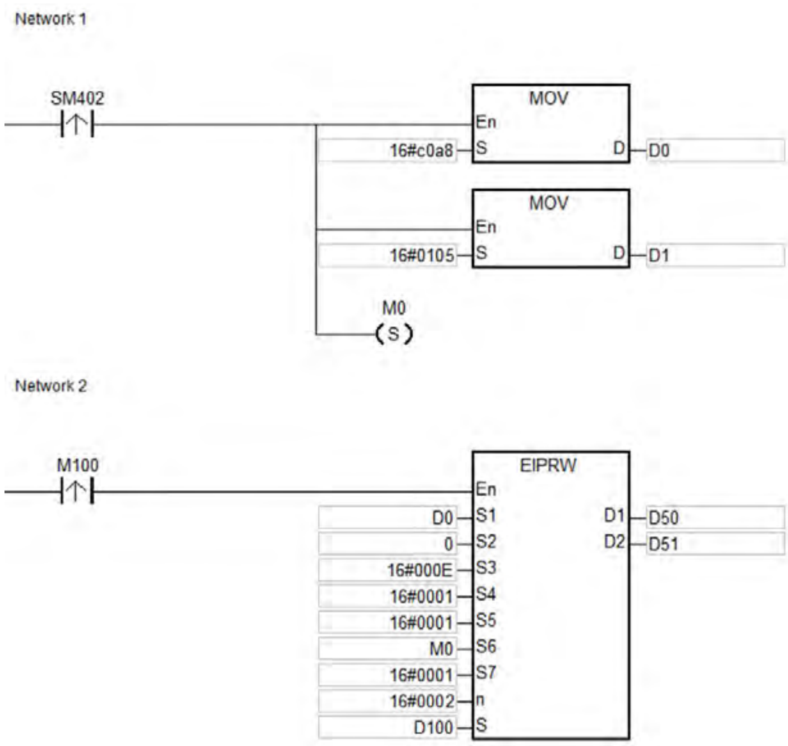
Example 1

The instruction reads the vendor code of the device at 192.168.1.5 and stores the value in D100. It sets the EtherNet/IP Object parameters as shown below.

(1) Service code = 16#000E

(2) Identity object: Class ID = 16#0001

(3) Vendor code: Instance ID = 1 and Attribute ID = 1



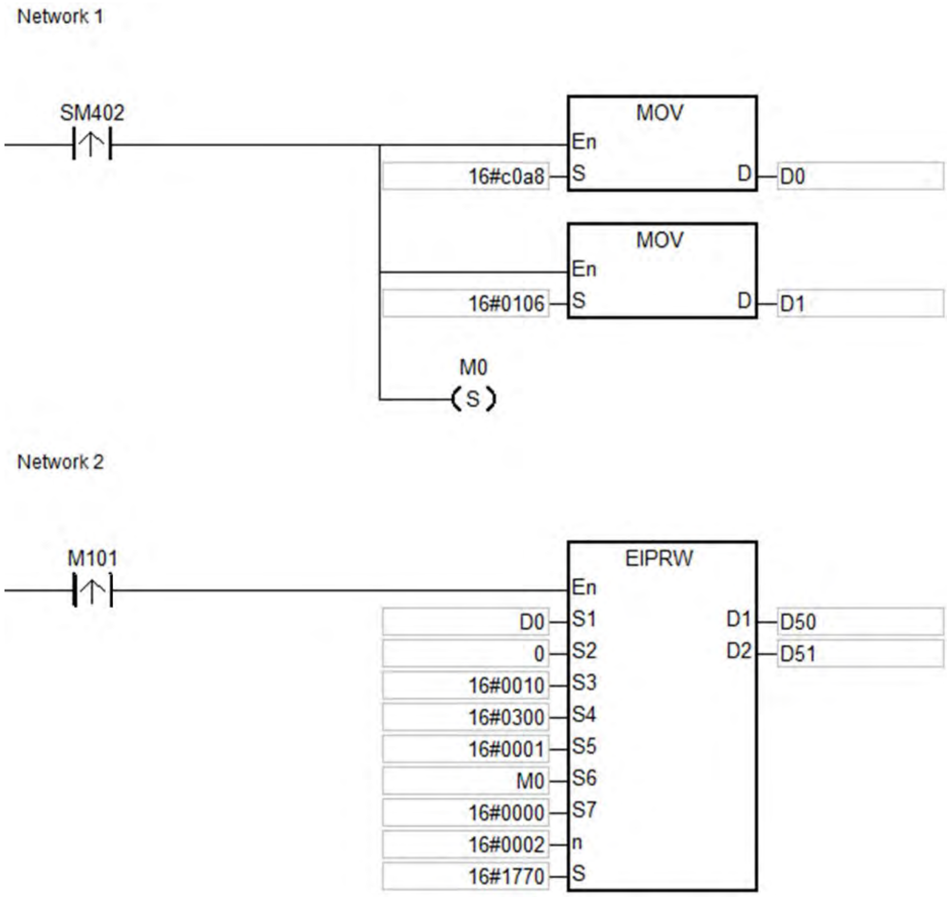
Example 2

The maximum frequency (01-00) of the AC motor drive (at 192.168.1.6) is set to 60.00Hz. The EtherNet/IP Object parameters are set as shown below.

(1) Service code = 16#0010

(2) Self-defined object: Class ID = 16#0300

(3) Highest operative frequency: Instance ID =16#0001and Attribute ID = 16#0000



This instruction is only available for AHCPU5x1-EN FW V2.02 or later as well as AHCPU560-EN2 FW V1.10 or later.

6.23 Memory Card Instructions

6.23.1 List of Memory Card Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
2300	MWRIT	–	✓	Writing the data from the PLC into the memory card	13
2301	MREAD	–	✓	Reading the data from the memory card into the PLC	13
2302	MTWRIT	–	✓	Writing the string into the memory card	11

6

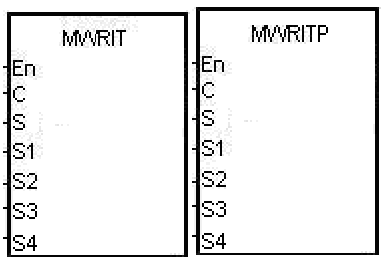
6.23.2 Explanation of Memory Card Instructions

API		Instruction code		Operand	Function
2300		MWRIT	P	**C, S, S_1, S_2, S3, S4**	Writing the data from the PLC into the memory card

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
C								●	●				●	○	○		
S								●	●				●				
S_1								●	●				●	○	○		
S_2								●	●				●	○	○		
S3								●	●				●				
S4								●	●				●	○	○		

Pulse instruction	16-bit instruction (13 steps)	32-bit instruction
AH500	AH500	-

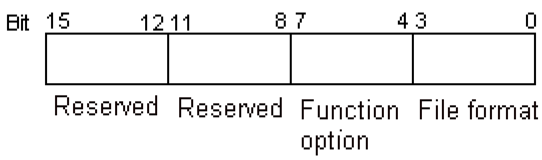
Symbol:



C	:	Control parameter	Word
S	:	Data source	Word
S_1	:	Data length	Double word
S_2	:	Line advance	Word
S_3	:	File name	Word
S_4	:	Data address in the file	Double word

Explanation:

1. The description of the operands:
   - **C**: The control parameter



Item	Code	Description
File format	0	Binary value Default value
		The file name extension is .dmd.
		The unit of the value is the word.
	1	The values are separated by a comma.
		The unit of the value is the word.
		The file name extension is .cvs.
		The ASCII codes are adopted.
		The value which is stored is a hexadecimal value.
	2	The values are separated by a comma.

Item	Code	Description
		The unit of the value is the double word.
File format	2	The file name extension is .cvs.
		The ASCII codes are adopted.
		The value which is stored is a hexadecimal value.
	3	The values are separated by a tab.
		The unit of the value is the word.
		The file name extension is .txt.
		The ASCII codes are adopted.
		The value which is stored is a hexadecimal value.
	4	The values are separated by a tab.
		The unit of the value is the double word.
		The file name extension is .txt.
		The ASCII codes are adopted.
		The value which is stored is a hexadecimal value.
	5	The values are not separated by any mark.
		The unit of the value is the word.
		The file name extension is .txt.
		The ASCII codes are adopted.
		The value which is stored is a hexadecimal value.
	6	The values are not separated by any mark.
		The unit of the value is the double word.
		The file name extension is .txt.
		The ASCII codes are adopted.
		The value which is stored is a hexadecimal value.
Function option	0	Appending The data which is written into the memory card is added after the last value in the file. Default value
		If the file does not exist, it is created automatically.
	1	Overwriting The data which is written into the memory card replaces the values in the file starting from the value indicated by the value in **S_4**.
		If the file does not exist, it is created automatically.
Reserved	-	The values of bit8~bit15 are 0.

- **S**: The data source
- **S_1**: The length of the data which is written into the file

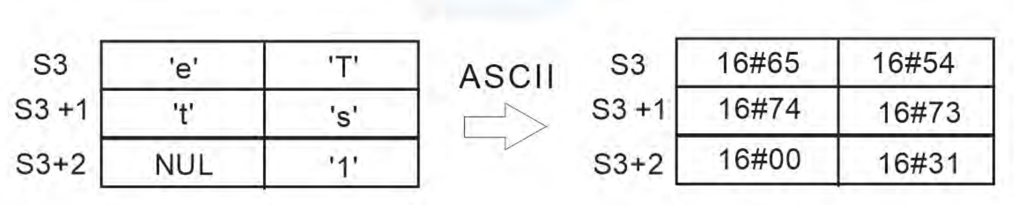
  If the value in **S_1** is 0, the data is not written into the file.

Item	Description
Value unit	If the file format is 0, 1, 3, or 5, the unit of the value is the word. If the file format is 2, 4, or 6, the unit of the value is the double word.
Parameter unit	Double word
Length of the data	The devices in which the data is stored can not exceed the device range, and the size of the data which is written into the file can not be more than four gigabytes. (Please refer to chapter 2 for more information about the devices.)

- **S_2**: The line advance

  The value in **S_2** should be within the range between 0 and 256.

- $\mathbf{S_3}$~$\mathbf{S_3}$+4: $\mathbf{S_3}$ occupies five devices. Nine characters at most constitute a file name, including 16#00. If the string does not end with 16#00, the error occurs. If the ending character is read, the reading of the characters stops, and whether the file name is legal is checked. The characters which can be used to constitute a file name are A~Z, a~z, and 0~9. Besides, the file name extension depends on the file format. The file which is created is in the default folder. If the file name is "Test1", the characters are written into the devices as follows.



- The default folder path:

Model name	Folder path
AHCPU530-RS2	PLC CARD\AH500\UserProg
AHCPU530-EN	
AHCPU530-EN/RM	
AHCPU533-EN	

- $\mathbf{S_4}$: The value in the file which is overwritten is indicated by the value in $\mathbf{S_4}$.

Item	Description
Value unit	If the file format is 0, 1, 3, or 5, the unit of the value is the word. If the file format is 2, 4, or 6, the unit of the value is the double word.
Parameter unit	The parameter unit is the double word.
Usage	If the function option is 0, $\mathbf{S_4}$ is not used.
	If the function option is 1, the data which is written into the memory card replaces the values in the file starting from the value indicated by the value in $\mathbf{S_4}$.
	The value in $\mathbf{S_4}$ should indicate the value in the file. If the value in $\mathbf{S_4}$ is 0, the first value in the file is overwritten.

2. The related flags:

Flag	Description
SM450	If the memory card is in the CPU module, the flag is ON.
SM451	The write protection switch on the memory card ON: The memory card is write protected. OFF: The memory card is not write protected.
SM452	The data is being written from the PLC to the memory card, or the data is being read from the memory card into the PLC.
SM453	If an error occurs during the operation of the memory card, the flag is ON. If the flag is ON, users have to reset it to OFF. The error code is stored in SR453.

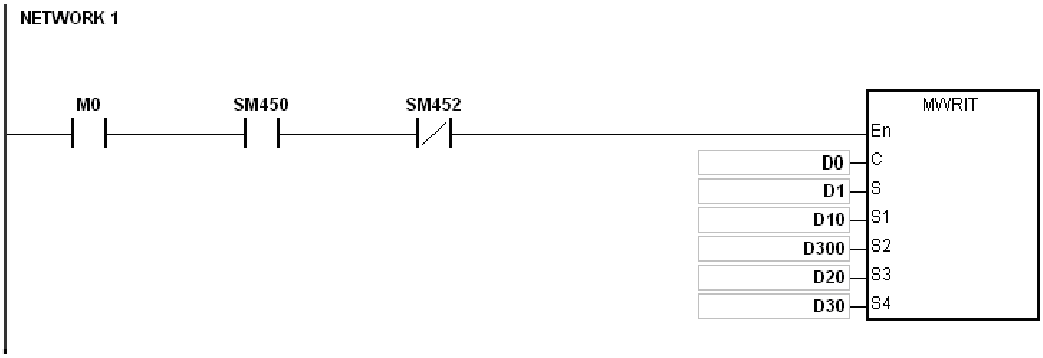
3. The related error codes (SR453):

Error code	Description
16#005E	An error occurs when the memory card is initialized.
16#005F	The path is incorrect, or the file does not exist.
16#0060	The default folder can not be created.
16#0061	The memory space is insufficient.
16#0062	The memory card is write protected.
16#0063	An error occurs when the data is written into the file.
16#0064	The data can not be read from the memory card.
16#0065	The file is a read-only file.

4. If the format of the file into which the data is written is 0, the format of the file from which the data is read is 0. Otherwise, the data can not be read, and SM453 is ON. The same applies to the other file formats.

Example:

SM450 is ON when the memory card is inserted into the CPU module; SM452 is ON when MWRIT is executed; SM452 is OFF when the execution of MWRIT is complete. MWRITP the pulse instruction, cannot be used continuously. If executing this pulse instruction to write data into the memory card continuously, it may exceed its written limitation and may lead to memory card broken.



Operand	Setting value	Description
D0	16#0011	The file into which the data is written
		The file format: The values are separated by a comma. The unit of the value is the word. The file name extension is .cvs. The ASCII codes are adopted.
D1	-	The data which is written into the file
D10, D11	16#00000030	The size of the data which is written into the file is 48 words.
D300	16#000A	Ten values are written into every line.
D20	D20=16#6554 D21=16#7473 D22=16#0031	The file name is “Test1”.
D30、D31	16#00000000	The data which is written into the memory card replaces the values in the file starting from the first value.

Additional remark:

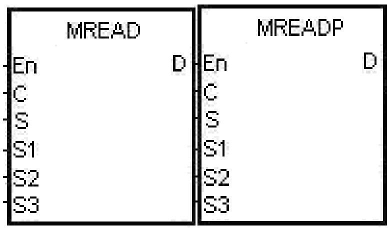
1. If the value in **C** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the value in $\mathbf{S_1}$ exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in $\mathbf{S_2}$ exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If the value in $\mathbf{S_3}$ exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code		Operand	Function
2301	MREAD	P	C, S, S_1, S_2, S_3, D	Reading the data from the memory card into the PLC

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
C								●	●				●	○	○		
S								●	●				●				
S_1								●	●				●	○	○		
S_2								●	●				●	○	○		
S_3								●	●				●	○	○		
D								●	●				●				

Pulse instruction	16-bit instruction (13 steps)	32-bit instruction
AH500	AH500	-

Symbol:



C : Control parameter Word

S : File name Word

S_1 : Data address in the file Double word

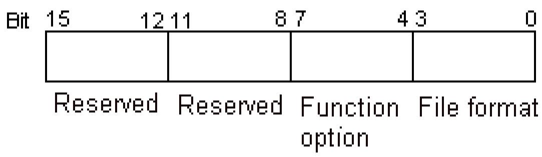
S_2 : Reserved Word

S_3 : Data length Double word

D : Data destination Word

Explanation:

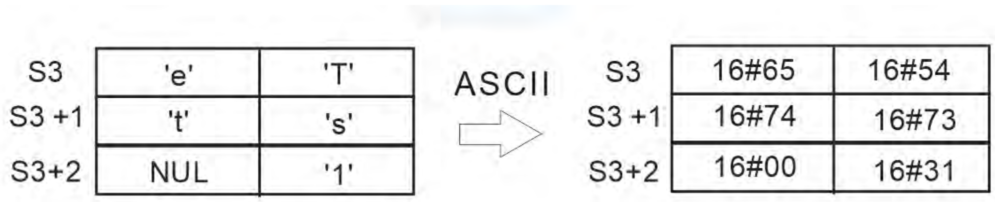
1. The description of the operands:
   - **C**: The control parameter



Item	Code	Description
File format	0	Binary value The default value is 0.
		The file name extension is .dmd.
		The unit of the value is the word.
	1	The values are separated by a comma.
		The unit of the value is the word.
		The file name extension is .cvs.
		The ASCII codes are adopted.
		The value which is stored is a hexadecimal value.
	2	The values are separated by a comma.
		The unit of the value is the double word.
		The file name extension is .cvs.
		The ASCII codes are adopted.
		The value which is stored is a hexadecimal value.
	3	The values are separated by a tab.

Item	Code	Description
File format	3	The unit of the value is the word.
		The file name extension is .txt.
		The ASCII codes are adopted.
		The value which is stored is a hexadecimal value.
	4	The values are separated by a tab.
		The unit of the value is the double word.
		The file name extension is .txt.
		The ASCII codes are adopted.
		The value which is stored is a hexadecimal value.
	5	The values are not separated by any mark.
		The unit of the value is the word.
		The file name extension is .txt.
		The ASCII codes are adopted.
		The value which is stored is a hexadecimal value.
	6	The values are not separated by any mark.
		The unit of the value is the double word.
		The file name extension is .txt.
		The ASCII codes are adopted.
		The value which is stored is a hexadecimal value.
Function option	0	The values in the file starting from the value indicated by the value in **S**$_1$. are read. The default value is 0.
	1	The number of values is stored in **D** and **D**+1.
		If the file format is 0, 1, 3, or 5, the unit of the value is the word. If the file format is 2, 4, or 6, the unit of the value is the double word.
Reserved	-	The values of bit8~bit15 are 0.

- **S~S**+4: **S** occupies five devices. Nine characters at most constitute a file name, including 16#00. If the string does not end with 16#00, the error occurs. If the ending character is read, the reading of the characters stops, and whether the file name is legal is checked. The characters which can be used to constitute a file name are A~Z, a~z, and 0~9. Besides, the file name extension depends on the file format. The file which is created is in the default folder. If the file name is “Test1”, the characters are written into the devices as follows.



- The default folder path:

Model name	Folder path
AHCPU530-RS2	PLC CARD\AH500\UserProg
AHCPU530-EN	
AHCPU530-EN/RM	
AHCPU533-EN	

- **S_1**: The value in the file which is read is indicated by the value in **S_1**.

Item	Description
Value unit	If the file format is 0, 1, 3, or 5, the unit of the value is the word. If the file format is 2, 4, or 6, the unit of the value is the double word.
Parameter unit	The parameter unit is the double word.
Usage	The value in **S_1** should indicate the value in the file. If the value in **S_1** is 0, the first value in the file is read.

- **S_3**: The length of the data which is read from the file

  The devices in which the data is stored can not exceed the device range. If the value in **S_3** is larger than the number of values in the file, the length of the data read from the file is the number of values in the file. The unit **S_3** is the double word.
- **D**: The initial device in which the data is stored.

2. The related flags:

Flag	Description
SM450	If the memory card is in the CPU module, the flag is ON.
SM451	The write protection switch on the memory card ON: The memory card is write protected. OFF: The memory card is not write protected.
SM452	The data is being written from the PLC to the memory card, or the data is being read from the memory card into the PLC.
SM453	If an error occurs during the operation of the memory card, the flag is ON. If the flag is ON, users have to reset it to OFF. The error code is stored in SR453.

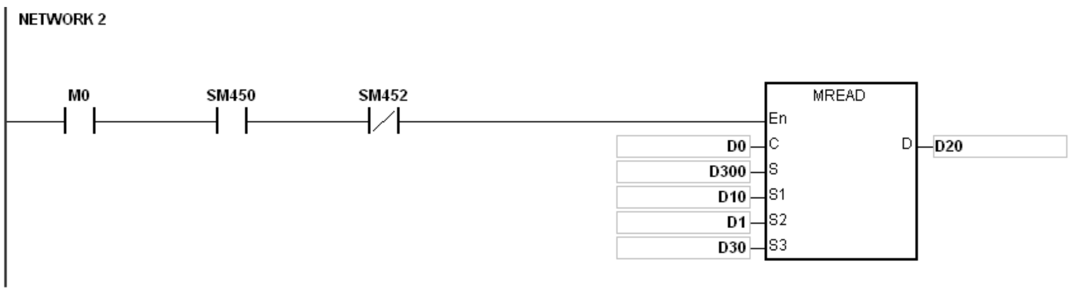
3. The related error codes (SR453):

Error code	Description
16#005E	An error occurs when the memory card is initialized.
16#005F	The path is incorrect, or the file does not exist.
16#0060	The default folder can not be created.
16#0061	The memory space is insufficient.
16#0062	The memory card is write protected.
16#0063	An error occurs when the data is written into the file.
16#0064	The data can not be read from the memory card.

4. If the format of the file into which the data is written is 0, the format of the file from which the data is read is 0. Otherwise, the data can not be read, and SM453 is ON. The same applies to the other file formats.

Example:

SM450 is ON when the memory card is inserted into the CPU module; SM452 is ON when MREAD is executed; SM452 is OFF when the execution of MREAD is complete.



Operand	Setting value	Description
D0	16#0011	The file from which the data is read
		The file format: The values are separated by a comma. The unit of the value is the word. The file name extension is .csv. The ASCII codes are adopted.
D300	D300=16#6554 D301=16#7473 D302=16#0031	The file name is “Test1”.
D10, D11	16#00000000	The values in the file starting from the first value are read.
D1	16#000A	Ten values are read from every line.
D30、D31	16#00000020	The size of the data which is read from the file is 32 words.
D20	-	The data which is read is stored in D20.

Additional remark:

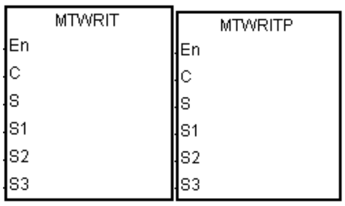
1. If the value in **C** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the value in $\mathbf{S_2}$ exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in $\mathbf{S_3}$ exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
4. If the value in **D** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

API	Instruction code			Operand	Function
2302		MTWRIT	P	C, S, S_1, S_2, S_3	Writing the string into the memory card

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
C								●	●				●	○	○		
S								●	●				●				
S_1								●	●				●	○	○		
S_2								●	●				●	○	○		
S_3								●	●				●				

Pulse instruction	16-bit instruction (11 steps)	32-bit instruction
AH500	AH500	-

Symbol:



C	:	Control parameter	Word
S	:	Data source	Word
S_1	:	Data length	Word
S_2	:	Separation mark	Word
S_3	:	File name	Word

Explanation:

1. The description of the operands:
   - **C**: The control parameter

Parameter value	Description
0 (Appending)	If the file exists, the data which is written into the memory card is added after the last byte in the file.
	If the file does not exist, it is created automatically.
1 (Overwriting)	If the file exists, the new data which is written into the memory card replaces the old data in the file. The size of the file is the size of the new data.
	If the file does not exist, it is created automatically.

   - **S**: The data source

     If the string which is written into the file is "12345", the characters are stored in the devices as follows. Owing to the fact that a byte is taken as the basic unit, the first character is stored in the low byte in D300, the second character is stored in the high byte in D300. The same applies to the other characters. "16#00" is stored in the high byte in D300+2, and indicates the end of the string.

S300		S300+1		S300+2	
byte 2	byte 1	byte 4	byte 3	byte 6	byte 5
16#32	16#31	16#34	16#33	16#00	16#35

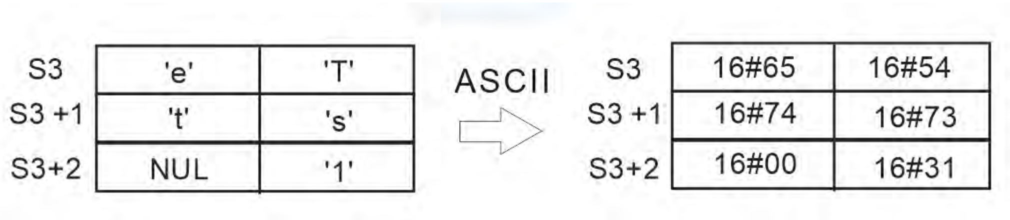
   - **S_1**: The length of the data which is written into the memory card

     A byte is taken as the basic unit. The devices in which the data is stored can not exceed the device range, and the length of the data which is written into the memory card can not be more than 255 bytes.

- **S_2**: The separation mark
  If the value in **S_1** is 6, the value in **S_2** is written into the memory card as follows.

S_2		**Description**
High byte	**Low byte**	
16#00	16#00 or not 16#00	The 6-byte data is written into the file.
Not 16#00	16#00	The 7-byte data is written into the file. The value in the high byte in **S_2** is the value in the seventh byte.
Not 16#00	Not 16#00	The 8-byte data is written into the file. The value in the high byte in **S_2** is the value in the seventh byte, and the value in low byte in **S_2** is the value in the eighth byte.

- **S_3~S_3**+4: **S_3** occupies five devices. Nine characters at most constitute a file name, including 16#00. If the string does not end with 16#00, the error occurs. If the ending character is read, the reading of the characters stops, and whether the file name is legal is checked. The characters which can be used to constitute a file name are A~Z, a~z, and 0~9. Besides, the file name extension depends on the file format. The file which is created is in the default folder. If the file name is "Test1", the characters are written into the devices as follows.



- The default folder path

Model name	**Folder path**
AHCPU530-RS2	PLC CARD\AH500\UserProg
AHCPU530-EN	
AHCPU530-EN/RM	
AHCPU533-EN	

2. The related flags:

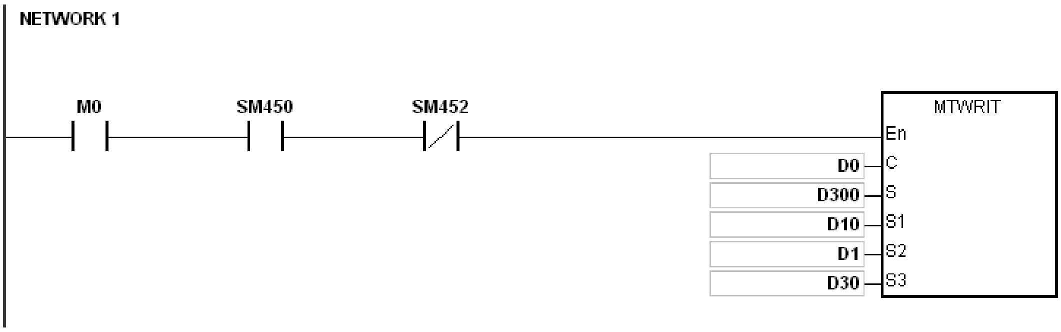
Flag	**Description**
SM450	If the memory card is in the CPU module, the flag is ON.
SM451	The write protection switch on the memory card ON: The memory card is write protected. OFF: The memory card is not write protected.
SM452	The data is being written from the PLC to the memory card, or the data is being read from the memory card into the PLC.
SM453	If an error occurs during the operation of the memory card, the flag is ON. If the flag is ON, users have to reset it to OFF. The error code is stored in SR453.

3. The related error codes (SR453):

Error code	**Description**
16#005E	An error occurs when the memory card is initialized.
16#005F	The path is incorrect, or the file does not exist.
16#0060	The default folder can not be created.
16#0061	The memory space is insufficient.
16#0062	The memory card is write protected.
16#0063	An error occurs when the data is written into the file.
16#0064	The data can not be read from the memory card.
16#0065	The file is a read-only file.

Example:

SM450 is ON when the memory card is inserted into the CPU module; SM452 is ON when MTWRIT is executed; SM452 is OFF when the execution of MTWRIT is complete.



Operand	Setting value	Description
D0	16#0001	The file into which the data is written
		The file format: The unit of the character is the byte. The file name extension is .txt. The ASCII codes are adopted. The data in D300 is written into the file.
D300	-	The data which is written into the file
D10	16#000A	The size of the string which is written into the file is 32 bytes.
D1	16#0A00	After the data is written into the file, the separation mark is added after the last byte in the file.
D30	D30=16#6554 D31=16#7473 D32=16#0031	The file name is “Test1”.

Additional remark:

1. If the value in **C** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If the value in **S_1** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in **S_3** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

6.24 Task Control Instructions

6.24.1 List of Task Control Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
2400	TKON	–	✓	Enabling the cyclic task	3
2401	TKOFF	–	✓	Disabling the cyclic task	3

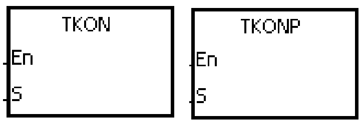
6.24.2 Explanation of Task Control Instructions

API	Instruction code		Operand	Function
2400	TKON	P	S	Enabling the cyclic task

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	K	16#	"$"	DF
S	●	●						●	●		●		○			

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Task number Word

Explanation:

1. The cyclic task specified by **S** is enabled.
2. When the PLC runs, the execution of the cyclic tasks depends on the setting of the cyclic tasks in ISPSoft.
3. The description of the operands:
   - The operand **S** should be within the range between 0 and 31.
   - Please refer to ISPSoft User Manual for more information about creating and enabling the tasks.

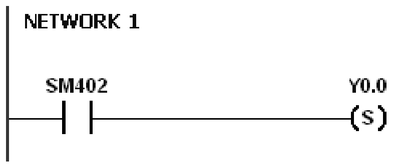
Example:

When the PLC runs, cyclic task (0) is enabled. Since the instruction TKON in cyclic task (0) is executed, cyclic task (1) is enabled, and Y0.0 is ON.

The two cyclic tasks are created in ISPSoft. Cyclic task (0) is enabled when the PLC runs, and cyclic task (1) is not enabled when the PLC runs.

Cyclic task (1) is enabled by the execution of the instruction TKON in cyclic task (0).

Cyclic task (1) is executed.



Additional remark:

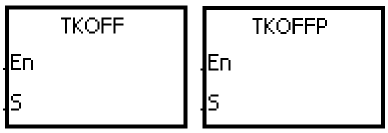
Please refer to ISPSoft User Manual for more information related to tasks.

API	Instruction code			Operand	Function
2401		TKOFF	P	**S**	Disabling the cyclic task

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	K	16#	“$”	DF
S	●	●						●	●		●		○			

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
AH500	AH500	-

Symbol:



S : Task number Word

Explanation:

1. The cyclic task specified by **S** is disabled.
2. When the PLC runs, the execution of the cyclic tasks depends on the setting of the cyclic tasks in ISPSoft.
3. The description of the operands:
   - The operand **S** should be within the range between 0 and 31.
   - Please refer to ISPSoft User Manual for more information about creating and enabling the tasks.

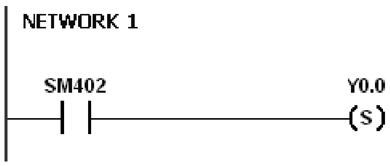
Example:

When the PLC runs, cyclic task (0) and cyclic task (1) are enabled. Since the instruction TKOOFF in cyclic task (0) is executed, cyclic task (1) is disabled, and Y0.0 is OFF.

The two cyclic tasks are created in ISPSoft. Cyclic task (0) and cyclic task (1) are enabled when the PLC runs, and cyclic task (1) is disabled when the instruction TKOFF in cyclic task (0) is executed.

Cyclic task (1) is disabled by the execution of the instruction TKOFF in cyclic task (0).

Cyclic task (1) is not executed.



Additional remark:

Please refer to ISPSoft User Manual for more information related to tasks.

6.25 SFC Instructions

6.25.1 List of SFC Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
2500	SFCRUN	–	–	SFC Run	7
2501	SFCPSE	–	–	SFC Pause	5
2502	SFCSTP	–	–	SFC Stop	3

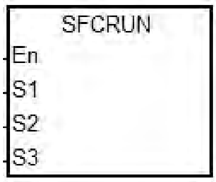
6.25.2 Explanation of Task Control Instructions

API	Instruction code	Operand	Function
2500	SFCRUN	**S_1, S_2, S_3**	SFC Run

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	K	16#	"$"	DF
S																
S_2	●	●						●	●		●		○	○		
S_3																

Pulse instruction	16-bit instruction (7 steps)	32-bit
	AH500	-

Symbol:



S_1	:	Name of the SFC POU	
S_2	:	Function code	Word
S_3	:	Device address	

Explanation:

1. The designated SFC program of **S_1** will be activated according to the setups of **S_2**.
2. When the instruction is executed, the SFC POU designated by **S_1** will be activated only when the SFC POU is being scanned.
3. Operand:
   - **S_1** defines the name of the SFC POU.
   - When the designated SFC POU of **S_1** is executed, the parameters such as SFC/STEP/ACTION/TRANSITION of the SFC program will be cleared when **S_2**=0 or 1, and the execution will start according to the value specified in **S_2**.
   - **S_2**=0, the system will execute the SFC POU from the initial Step.
   - **S_2**=1, the system will execute the SFC POU from the designated Step of **S_3**.
   - **S_2**=2, the status and the parameters such as SFC/STEP/ACTION/TRANSITION of the SFC will NOT be cleared and the system will start executing from where it pauses.
   - **S_3** designates the step to be started in the SFC program of **S_1**.
4. The range of **S_2** is 0 to 2. When it is out of range, it will be seen as 0.
5. When the state of the SFC POU is RUN, executing this instruction is invalid.

Example:

Set up one LD(ladder) POU and specify its POU name as Main, and 2 SFC POUs with the names of TestSFC1 and TestSFC2.

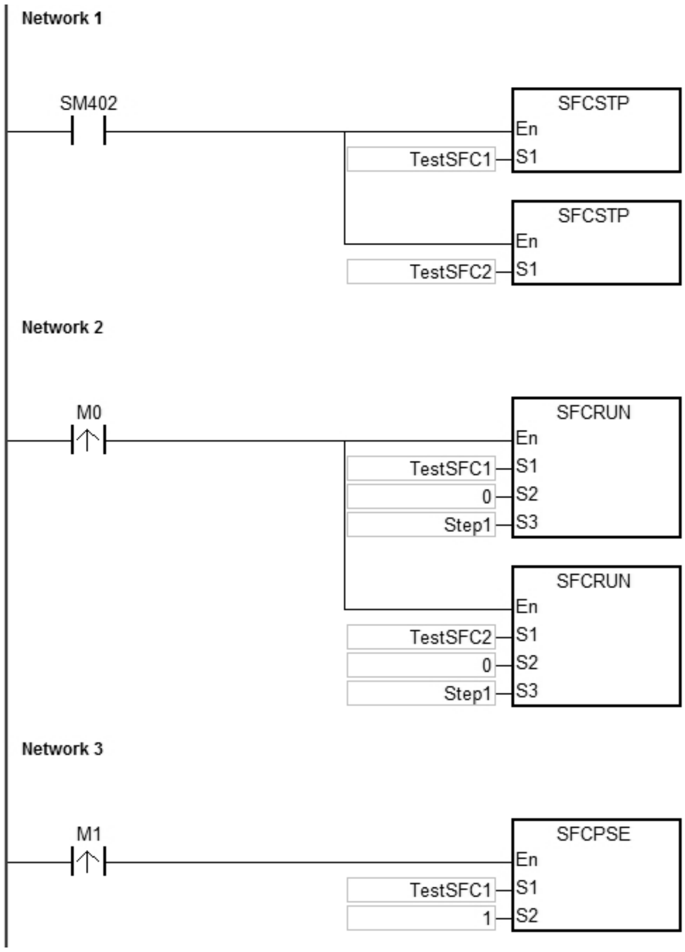
1. When the program is executed (RUN), TestSFC1 and TestSFC2 will execute the SFCSTP, and 2 SFC POUs will stop executing.
2. When M0 is set from OFF to ON, TestSFC1/ TestSFC2 POU will execute the SFCRUN* instructions. Refer to the contents of TestSFC1 and TestSFC2 for execution details of the 2 POUs. When **S_2** is set to 0, the status and the parameters of the SFC will be cleared and will

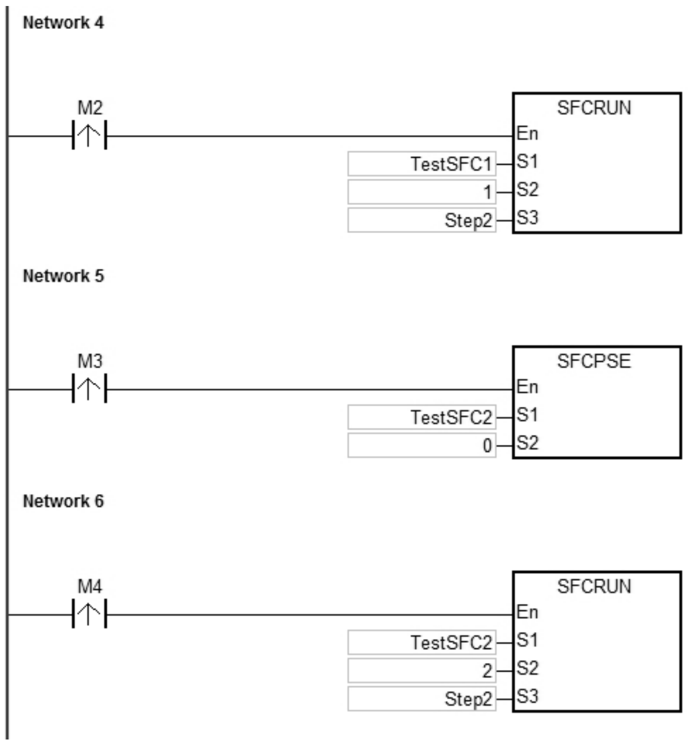
begin to execute from STEP 1. When **S_2** is set to 1, the status and the parameters will be cleared and will begin to execute from the designated STEP of **S_3**.

3. When M1 is set from OFF to ON, TestSFC1 POU will pause. When **S_2** is set to 1, all the executing actions and the outputs of the SFC will be cleared, and the system will run the final scan.
4. When M2 is set from OFF to ON, TestSFC1 POU will execute its actions. When **S_2** is set to 1, the status and the parameters will be cleared, and the system will begin to execute from STEP 2.
5. When M3 is set from OFF to ON, TestSFC2 POU will pause. When **S_2** is set to 0, all the executing actions of the SFC and the outputs will be kept, and the system will not run the final scan.
6. When M4 is set from OFF to ON, TestSFC1 POU will execute its actions. When **S_2** is set to 2, the status and the parameters will be kept and will begin to execute from where it pauses.

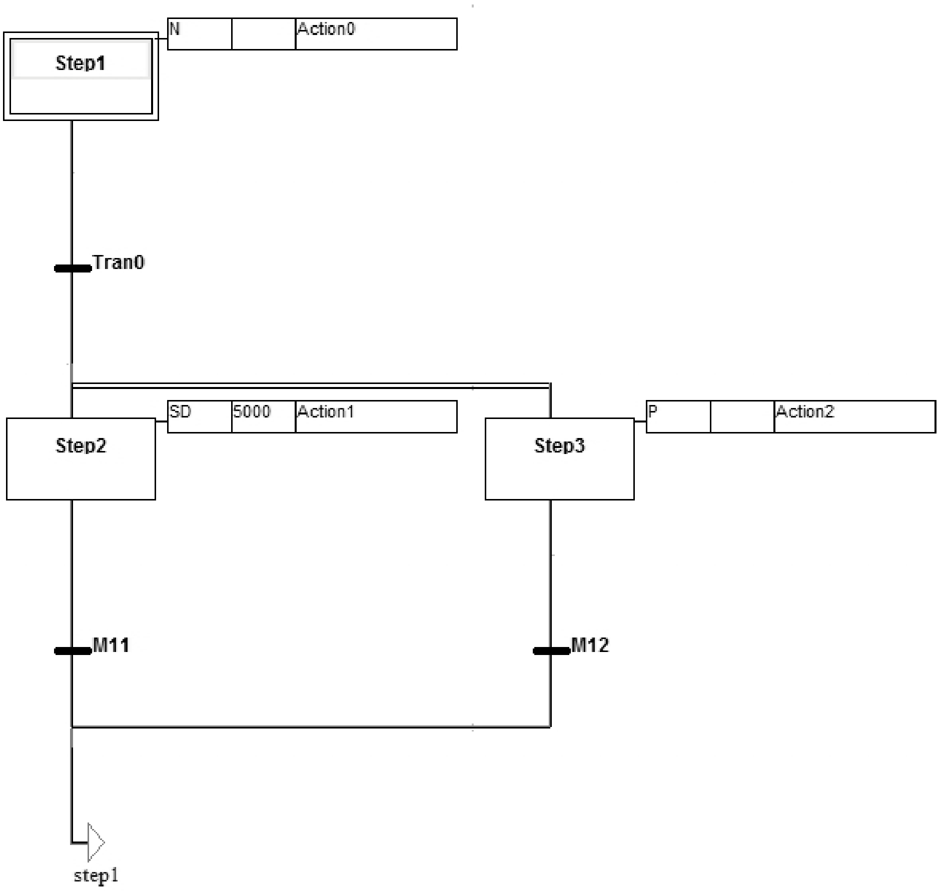
*SFCRUN will activate SPC POU at the next scan.

Main POU

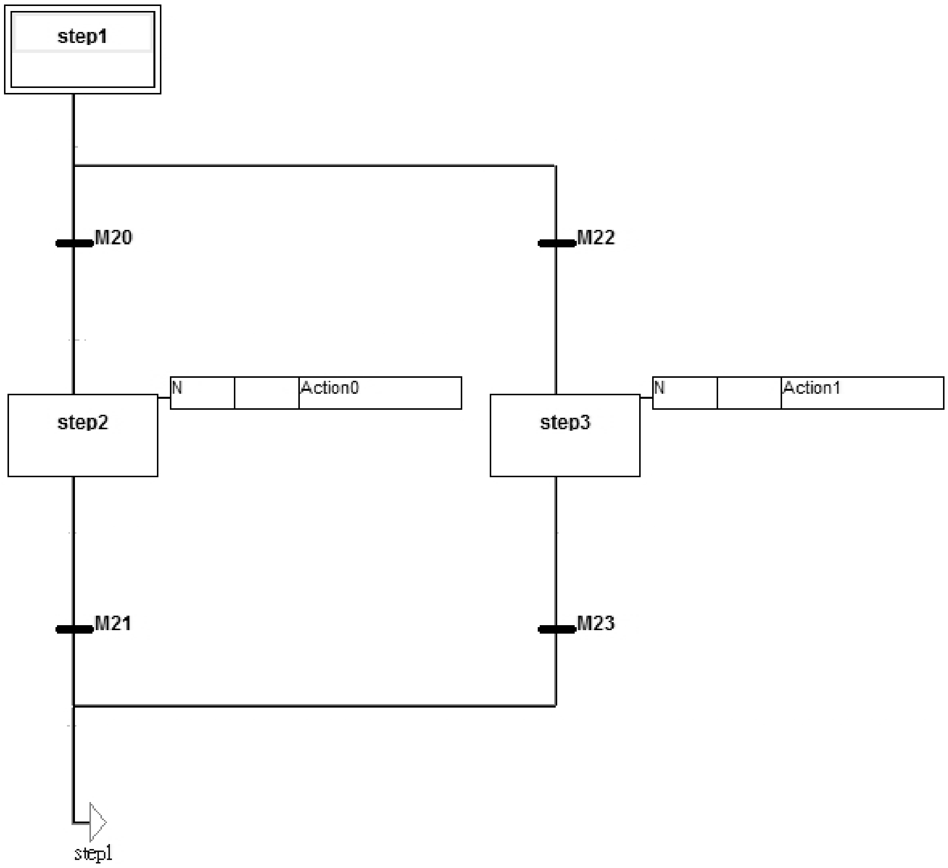




TestSFC1 POU



TestSFC2 POU



Additional Remark:

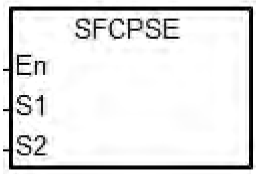
Please refer to ISPSoft User Manual for more information related to SFC.

API	Instruction code	Operand	Function
2501	SFCPSE	S_1、S_2	SFC Pause

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	K	16#	“$”	DF
S_1																
S_2	●	●						●	●		●		○	○		

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
	AH500	-

Symbol:



S_1 : Name of the SFC POU

S_2 : Function code Word

Explanation:

1. The designated SFC POU of S_1 will pause according to the setups of S_2.
2. When the instruction is executed, the SFC POU designated by S_1 will be paused only when the SFC POU is being scanned.
3. When pausing, the status and the parameters such as SFC/STEP/ACTION/TRANSITION of the SFC will be kept.
4. Operand:
   - S_1 defines the name of the SFC POU.
   - When S_2=0, all the executing actions of the SFC and the outputs will be kept, and the system will not run the final scan.
   - When S_2=1, all the executing actions and the outputs of the SFC POU will be cleared, and the system will run the final scan..
5. The range of S_2 is 0 to 1. When it is out of range, it will be seen as 0.
6. When the state of the SFC POU is PAUSE/STOP, executing this instruction is invalid.

Example:

Please refer to the SFCRUN programing example for more information.

Additional Remark:

Please refer to ISPSoft User Manual for more information related to SFC.

API	Instruction code	Operand	Function
2502	SFCSTP	**S**	SFC Stop

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	K	16#	"$"	DF
S																

Pulse instruction	16-bit instruction (3 steps)	32-bit instruction
	AH500	-

Symbol:

S : Name of the SFC POU

Explanation:

1. The designated SFC POU of **S** will stop.
2. When the instruction is executed, the SFC POU designated by $\mathbf{S_1}$ will stop only when the SFC POU is being scanned.
3. When stopping, the status and the parameters of the SFC will be cleared, and the system will run the final scan.
4. When the state of the SFC POU is STOP, executing this instruction is invalid.

Example:

Please refer to the SFCRUN programing example for more information.

Additional Remark:

Please refer to ISPSoft User Manual for more information related to SFC.

6.26 Redundant Instructions

6.26.1 List of SFC Instructions

API	Instruction code		Pulse instruction	Function	Step
	16-bit	32-bit			
2900	SSO	–	✓	Switching from Master CPU to Standby CPU	3
2901	RCS	–	–	Reading / setting redundant system data	5

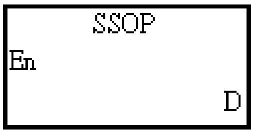
6.26.2 Explanation of Redundant Instructions

API		Instruction code		Operand	Function
2900		SSO	P	D	Switching from Master CPU to Standby CPU

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	K	16#	"$"	DF
D	●	●			●	●		●	●		●		●			

Pulse instruction	16-bit instruction (7 steps)	32-bit instruction
AH500	AH500	-

Symbol:



D : Error code Word

Explanation:

1. This instruction is for Redundant CPU Module AHCPU560-EN2.
2. When the instruction is executed, the system switches from Master CPU to Standby CPU.
3. Generally, the pulse instruction SSOP is used.
4. Before this instruction is used, you need go to *ISPSoft -> HWCONFIG -> CPU -> System -> Redundancy* to enable redundancy system.
5. You can only use this instruction in a working redundancy system. That means there should be a Standby CPU and it should pass the identification check. If there is no other CPU to switch to or the Standby CPU fails to pass the identification check, this instruction cannot be executed and an error code will be generated.

Codes Descriptions

Codes	Descriptions
0	A successful switchover
1	Failed to switch over; the Standby CPU not passing the identification check
2	Failed to switch over; the Standby CPU does not exist

Example:

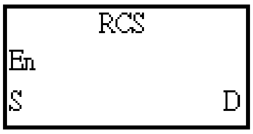
When M0 is from OFF to ON and the value in D0 is 0, the system switch from Master CPU to Standby CPU.

<table>
<tr><th>API</th><th colspan="3">Instruction code</th><th>Operand</th><th>Function</th></tr>
<tr><td>2901</td><td></td><td>RCS</td><td></td><td>S · D</td><td>Reading / setting redundant system data</td></tr>
</table>

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	K	16#	“$”	DF
S	●	●			●	●		●	●		●		●			
D	●	●			●	●		●	●		●		●			

Pulse instruction	16-bit instruction (5 steps)	32-bit instruction
-	AH500	-

Symbol:



S : Redundant system data type — Word

D : Redundant system data and operation result — Word

Explanation:

1. This instruction is for Redundant CPU Module AHCPU560-EN2.
2. RCS instruction is used to read the Standby CPU information in redundant mode. You can also use this instruction to set the system ID.
3. The operand **S** occupies two consecutive devices, **S** and **S+1**.
4. The operand **D** occupies four consecutive devices, **D, D+1, D+2,** and **D+3**.
5. The setting value in the operand **S** should be in the range of 0-5.
6. Before this instruction is used, you need go to *ISPSoft -> HWCONFIG -> CPU -> System -> Redundancy* to enable redundancy system.

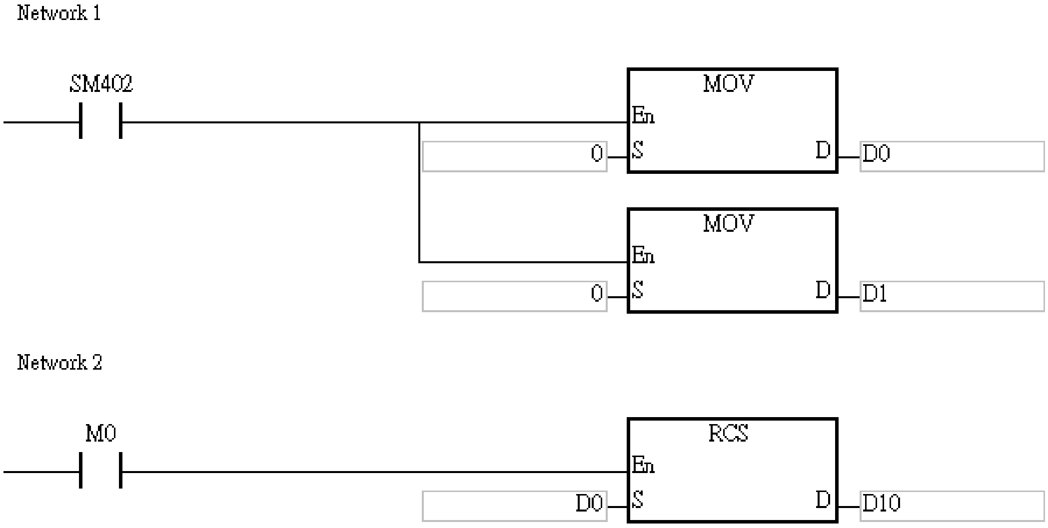
Codes Descriptions

<table>
<tr><th>S</th><th>Description</th><th>S+1</th><th>Description</th><th>D</th><th>Description</th></tr>
<tr><td rowspan="4">0</td><td rowspan="4">System ID</td><td rowspan="2">0</td><td rowspan="2">Read the CPU ID</td><td>1</td><td>The system ID is A.</td></tr>
<tr><td>2</td><td>The system ID is B.</td></tr>
<tr><td>1</td><td>Set the CPU ID to A</td><td colspan="2">Idle</td></tr>
<tr><td>2</td><td>Set the CPU ID to A</td><td colspan="2">Idle</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Redundant System Status</td><td colspan="2" rowspan="5">Idle</td><td>1</td><td>Under identification check</td></tr>
<tr><td>2</td><td>A successful switchover</td></tr>
<tr><td>3</td><td>Redundant function is not enabled.</td></tr>
<tr><td>4</td><td>Standby CPU not passing the identification check</td></tr>
<tr><td>5</td><td>Standby CPU does not exist</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Power module</td><td colspan="2" rowspan="3">Idle</td><td>1</td><td>Normal power module</td></tr>
<tr><td>2</td><td>Left side power module abnormal</td></tr>
<tr><td>3</td><td>Right side power module abnormal</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">CPU LED</td><td colspan="2" rowspan="2">Idle</td><td colspan="2">D: Master CPU ; D+2: Standby CPU</td></tr>
<tr><td>Bit0</td><td>D: Standby CPU does not exist
D+2: Master CPU does not exist</td></tr>
</table>

S	Description	S+1	Description	D	Description
				Bit1	RUN LED ON
				Bit2	RUN LED OFF
				Bit3	RUN LED Blinking
				Bit4	ERROR LED ON
				Bit5	ERROR LED OFF
				Bit6	ERROR LED Blinking
				Bit7	BUS FAULT LED ON
				Bit8	BUS FAULT LED OFF
				Bit9	BUS FAULT LED Blinking
				Bit10	SYSTEM LED ON
				Bit11	SYSTEM LED OFF
				Bit12	SYSTEM LED Blinking
				Bit13~ Bit15	Idle
				D+1: Master CPU ; D+3: Standby CPU	
				Bit0	MASTER LED ON
				Bit1	MASTER LED OFF
				Bit2	MASTER LED Blinking
				Bit3	SYNC LED (Orange) ON
				Bit4	SYNC LED (Orange) Blinking
				Bit5	SYNC LED (Green) ON
				Bit6	SYNC LED (Green) Blinking
				Bit7	SYNC LED (Red) ON
				Bit8	SYNC LED (Red) Blinking
				Bit9	SYNC LED OFF
				Bit10~ Bit15	Reserved
4	Power module of the redundant system	Idle		0	Redundant controller does NOT exist.
				1	Power module is normal
				2	Left side power module abnormal
				3	Right side power module abnormal
5	Power module of the extension backplane	1	The 1st extension backplane	0	Extension backplane does NOT exist.
		2	The 2nd extension backplane	1	Power module is normal
		3	The 3rd extension backplane	2	Left side power module abnormal
		4	The 4th extension backplane		
		5	The 5th extension backplane	3	Right side power module abnormal
		6	The 6th extension backplane		
		7	The 7th extension backplane		

Example:

This is an example of reading the CPU ID. When M0 is from OFF to ON, D10 is 1. That means this CPU ID is A. When D10 is 2, the CPU ID is B.



MEMO

Chapter 7 Error Codes

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7.1 Error Codes and LED Indicators

- **Columns**

a. Error code: If the error occurs in the system, the error code is generated.
b. Description: The description of the error
c. CPU status: If the error occurs, the CPU stops running, keeps running, or in the status defined by users.

- ➢ Stop: The CPU stops running when the error occurs.
- ➢ Keep: The CPU keeps running when the error occurs.
- ➢ Self-defined: The status of the CPU can be defined by users. Please refer to section 8.2.1 in Operation Manual for more information.

d. LED indicator status: If the error occurs, the LED indicator is ON, OFF, or blinks.

- ➢ ERROR: The system error
- ➢ BUS FAULT: The I/O bus error
- ➢ Module ERROR: The module error

- **LED indicators**

	LED indicator	Description
CPU	ERROR	The status of the CPU ON: A serious error occurs in the system. OFF: The system is normal. Blinking: A slight error occurs in the system.
	BUS FAULT	The status of the I/O bus ON: A serious error occurs in the I/O bus. OFF: The I/O bus is normal. Blinking: A slight error occurs in the I/O bus.
Module	ERROR	The status of the module ON: A serious error occurs in the module. OFF: The module is normal. Blinking: A slight error occurs in the module.

7.1.1 CPU Modules

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#000A	Scan timeout (SM8: The watchdog timer error)	Stop	Blinking	Keep
16#000B	The program in the PLC is damaged.	Stop	ON	Keep
16#000C	The program downloaded to the PLC is incorrect.	Stop	Blinking	Keep
16#000D	The CPU parameter is damaged.	Stop	ON	Keep
16#000E	The program or the parameter is being downloaded, and therefore the PLC can not run.	Stop	Blinking	Keep
16#000F	The original program in the PLC is damaged.	Continue	Keep	Keep
16#0010	The access to the memory in the CPU is denied.	Stop	ON	Keep
16#0011	The PLC ID is incorrect. (SM9)	Continue	ON	Keep
16#0012	The PLC password is incorrect.	Continue	ON	Keep
16#0013	The I/O module can not run/stop. (SM10)	Stop	Keep	ON
16#0014	The procedure of restoring the system can not be executed. (SM9)	Stop	ON	ON
16#0015	The module table is incorrect. (SM10)	Stop	ON	Keep
16#0016	The module setting is incorrect. (SM10)	Stop	ON	Keep
16#0017	The device which is associated with the data register is incorrect. (SM10)	Stop	ON	Keep
16#0018	The serial port is abnormal. (SM9)	Continue	Blinking	Keep
16#0019	The USB is abnormal. (SM9)	Continue	Blinking	Keep
16#001A	The contents of the system backup file (DUP) are incorrect.	Stop	ON	Keep
16#001B	Timed interrupt 0 is set incorrectly.	Stop	ON	Keep
16#001C	Timed interrupt 1 is set incorrectly.	Stop	ON	Keep
16#001D	Timed interrupt 2 is set incorrectly.	Stop	ON	Keep
16#001E	Timed interrupt 3 is set incorrectly.	Stop	ON	Keep
16#001F	The watchdog timer is set incorrectly.	Stop	ON	Keep
16#0020	The setting of the fixed scan time is incorrect.	Stop	ON	Keep
16#0021	The setting of the fixed scan time is incorrect.	Stop	ON	Keep
16#0022	The CPU parameter downloaded to the PLC is incorrect.	Stop	ON	Keep
16#0023	The Y state (STOP->RUN) section in the PLC Parameter Setting window is set incorrectly.	Stop	ON	Keep
16#0024	There is no I/O module on a backplane.	Continue	Keep	Keep
16#0026	The latching auxiliary relay range which is set is incorrect.	Stop	ON	Keep
16#0027	The latching data register range which is set is incorrect.	Stop	ON	Keep
16#0028	The latching timer range which is set is incorrect.	Stop	ON	Keep
16#0029	The latching counter range which is set is incorrect.	Stop	ON	Keep
16#002A	The latching 32-bit counter range which is set is incorrect.	Stop	ON	Keep
16#002B	The latching auxiliary relay range which is set is incorrect.	Stop	ON	Keep
16#0033	The communication setting of COM1 is incorrect. (SM9)	Continue	Blinking	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#0034	The setting of the station address of COM1 is incorrect. (SM9)	Continue	Blinking	Keep
16#0035	The setting of the communication type of COM1 is incorrect. (SM9)	Continue	Blinking	Keep
16#0038	The communication setting of COM2 is incorrect. (SM9)	Continue	Blinking	Keep
16#0039	The setting of the station address of COM2 is incorrect. (SM9)	Continue	Blinking	Keep
16#003A	The setting of the communication type of COM2 is incorrect. (SM9)	Continue	Blinking	Keep
16#0050	The memories in the latched special auxiliary relays are abnormal.	Continue	ON	Keep
16#0051	The latched special data registers are abnormal.	Continue	ON	Keep
16#0052	The memories in the latched auxiliary relays are abnormal.	Continue	ON	Keep
16#0053	The latched timers are abnormal.	Continue	ON	Keep
16#0054	The latched counters are abnormal.	Continue	ON	Keep
16#0055	The latched 32-bit counters are abnormal.	Continue	ON	Keep
16#0056	The memories in the latched timers are abnormal.	Continue	ON	Keep
16#0057	The memories in the latched counters are abnormal.	Continue	ON	Keep
16#0058	The memories in the latched 32-bit counters are abnormal.	Continue	ON	Keep
16#0059	The latched data registers are abnormal.	Continue	ON	Keep
16#005A	The latched working registers are abnormal.	Continue	ON	Keep
16#005B	The SFC parameters are abnormal.	Continue	ON	Keep
16#005D	The CPU module does not detect a memory card. (SM453)	Continue	Keep	Keep
16#005E	The memory card is initialized incorrectly. (SM453)	Continue	Keep	Keep
16#005F	The data is read from the inexistent file in the memory card, or the data is written into the inexistent file in the memory card. (SM453)	Continue	Keep	Keep
16#0060	The default folder can not be created in the CPU module. (SM453)	Continue	Keep	Keep
16#0061	The capacity of the memory card is not large enough. (SM453)	Continue	Keep	Keep
16#0062	The memory card is write protected. (SM453)	Continue	Keep	Keep
16#0063	An error occurs when the data is written into the memory card. (SM453)	Continue	Keep	Keep
16#0064	The file in the memory card can not be read. (SM453)	Continue	Keep	Keep
16#0065	The file in the memory card is a read-only file. (SM453)	Continue	Keep	Keep
16#0066	An error occurs when the system is backupped.	Continue	Blinking	Keep
16#0067	The size of the PLC parameters restored exceeds the size of the PLC parameters of the CPU module.	Continue	Blinking	Keep
16#0068	The symbol initialization table is corrupted.	Stop	Blinking	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#0069	The EIP parameters are damaged.	Stop	Blinking	Keep
16#1001	PLC CPU can NOT read or write data on the modules.	Continue	Keep	Blinking
16#1003	The exchanged data between PLC CPU and modules are not right.	Continue	Keep	Blinking
16#1400	An error occurs when the data is accessed through the auxiliary processor. (SM9)	Stop	Keep	ON
16#1401	An error occurs when the data in the I/O module is accessed. (SM9)	Stop	Keep	ON
16#1402	The actual arrangement of the I/O modules is not consistent with the module table. (SM9)	Stop	Keep	ON
16#1403	An error occurs when the data is read from the module. (SM9)	Stop	Keep	ON
16#1405	The setting parameter of the module is not found. (SM9)	Stop	Keep	ON
16#1407	A communication error occurs when the data is accessed through the auxiliary processor. (SM9)	Continue	ON	Keep
16#1409	The extension backplane is disconnected. (SM9)	Stop	Keep	ON
16#140A	The communication with the extension backplane is incorrect. (SM9)	Stop	Keep	ON
16#140B	The number of network modules exceeds the limit. (SM9)	Stop	Keep	ON
16#140C	The checksum of the high-speed data exchange is incorrect. (SM9)	Stop	Keep	ON
16#140D	The ID of the actual power supply module is not the same as the ID of the power supply module set in HWCONFIG. (SM9)	Stop	Keep	ON
16#140E	The amount of data exchanged at a high speed exceeds the maximum amount supported. (SM10)	Stop	Keep	ON
16#140F	High-speed data exchange error (SM11)	Stop	Keep	ON
16#1410	Error occurs from RTU I/O module	Stop	Keep	ON
16#1411	Alarm occurs from RTU I/O module	Continue	Keep	ON
16#1420	Cable disconnected from the module Ethernet port	Continue	Keep	Keep
16#1421	Error occurs when CPU reads data from the Intelligent of Module Configuration.	Stop	Keep	ON
16#1422	Error occurs when CPU writes data to the Intelligent of Module Configuration.	Stop	Keep	ON
16#1801	There is no interrupt service routine in the CPU module.	Continue	Keep	Keep
16#2000	There is no END in the program in the PLC. (SM5)	Stop	Blinking	Keep
16#2001	The program is incorrect. There is a syntax error. (SM5)	Stop	Blinking	Keep
16#2002	GOEND is used incorrectly. (SM5)	Stop	Blinking	Keep
16#2003	The devices used in the program exceed the range. (SM0/SM5)	Self-defined	Blinking	Keep
16#2004	The part of the program specified by the label used in CJ/JMP is incorrect, or the label is used repeatedly. (SM0/SM5)	Stop	Blinking	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#2005	The N value used in MC is not the same as the corresponding N value used in MCR, or the number of N values used in MC is not the same as the number of N values used in MCR. (SM5)	Stop	Blinking	Keep
16#2006	The N values used in MC do not start from 0, or the N values used in MC are not continuous. (SM5)	Stop	Blinking	Keep
16#2007	The operands used in ZRST are not used properly. (SM5)	Stop	Blinking	Keep
16#200A	Invalid instruction (SM5)	Stop	Blinking	Keep
16#200B	The operand **n** or the other constant operands exceed the range. (SM0/SM5)	Self-defined	Blinking	Keep
16#200C	The operands overlap. (SM0/SM5)	Self-defined	Blinking	Keep
16#200D	An error occurs when the binary number is converted into the binary-coded decimal number. (SM0/SM5)	Self-defined	Blinking	Keep
16#200E	The string does not end with 0x00. (SM0/SM5)	Self-defined	Blinking	Keep
16#200F	The instruction does not support the modification by an index register. (SM5)	Stop	Blinking	Keep
16#2010	1. The instruction does not support the device. 2. Encoding error 3. The instruction is a 16-bit instruction, but the constant operand is a 32-bit code. (SM5)	Stop	Blinking	Keep
16#2011	The number of operands is incorrect. (SM5)	Stop	Blinking	Keep
16#2012	Incorrect division operation (SM0/SM5).	Self-defined	Blinking	Keep
16#2013	The value exceeds the range of values which can be represented by the floating-point numbers. (SM0/SM5)	Self-defined	Blinking	Keep
16#2014	The task designated by TKON/YKOFF is incorrect, or exceeds the range. (SM5)	Stop	Blinking	Keep
16#2015	There are more than 32 levels of nested program structures supported by CALL. (SM0)	Self-defined	Blinking	Keep
16#2016	There are more than 32 levels of nested program structures supported by FOR/NEXT. (SM0/SM5)	Self-defined	Blinking	Keep
16#2017	The number of times FOR is used is different from the number of times NEXT is used. (SM5)	Stop	Blinking	Keep
16#2018	There is a label after FEND, but there is no SRET. There is SRET, but there is no label. (SM5)	Stop	Blinking	Keep
16#2019	The interrupt task is not after FEND. (SM5)	Stop	Blinking	Keep
16#201A	IRET/SRET is not after FEND. (SM5)	Stop	Blinking	Keep
16#201B	There is an interrupt task, but there is no IRET. There is IRET, but there is not interrupt task. (SM5)	Stop	Blinking	Keep
16#201C	End is not at the end of the program. (SM5)	Stop	Blinking	Keep
16#201D	There is CALL, but there is no MAR. (SM5)	Stop	Blinking	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#201E	The function code used in MODRW is incorrect. (SM102/SM103)	Self-defined	Blinking	Keep
16#201F	The length of the data set in MODRW is incorrect. (SM102/SM103)	Self-defined	Blinking	Keep
16#2020	The communication command received by using MODRW is incorrect. (SM102/SM103)	Self-defined	Blinking	Keep
16#2021	The checksum of the command received is incorrect. (SM102/SM103)	Self-defined	Blinking	Keep
16#2022	The format of the command used in MODRW does not conform to the ASCII format. (SM102/SM103)	Self-defined	Blinking	Keep
16#2023	There is a communication timeout when MODRW is executed. (SM104/SM103)	Self-defined	Blinking	Keep
16#2024	The setting value of the communication timeout is invalid. (SM102/SM103)	Self-defined	Blinking	Keep
16#2025	There is a communication timeout when RS is executed. (SM102/SM103)	Self-defined	Blinking	Keep
16#2026	The interrupt number used in RS is incorrect. (SM102/103)	Self-defined	OFF	Keep
16#2027	The execution of FWD is abnormal. (SM102/103)	Self-defined	Blinking	Keep
16#2028	The execution of REV is abnormal. (SM102/103)	Self-defined	Blinking	Keep
16#2029	The execution of STOP is abnormal. (SM102/103)	Self-defined	Blinking	Keep
16#202A	The execution of SRDT is abnormal. (SM102/103)	Self-defined	Blinking	Keep
16#202B	The execution of RSTEF is abnormal. (SM102/103)	Self-defined	Blinking	Keep
16#202C	I/O interrupt service routine 0 does not exist.	Stop	Blinking	Keep
16#202D	I/O interrupt service routine 1 does not exist.	Stop	Blinking	Keep
16#202E	I/O interrupt service routine 2 does not exist.	Stop	Blinking	Keep
16#202F	I/O interrupt service routine 3 does not exist.	Stop	Blinking	Keep
16#2030	I/O interrupt service routine 4 does not exist.	Stop	Blinking	Keep
16#2031	I/O interrupt service routine 5 does not exist.	Stop	Blinking	Keep
16#2032	I/O interrupt service routine 6 does not exist.	Stop	Blinking	Keep
16#2033	I/O interrupt service routine 7 does not exist.	Stop	Blinking	Keep
16#2034	I/O interrupt service routine 8 does not exist.	Stop	Blinking	Keep
16#2035	I/O interrupt service routine 9 does not exist.	Stop	Blinking	Keep
16#2036	I/O interrupt service routine 10 does not exist.	Stop	Blinking	Keep
16#2037	I/O interrupt service routine 11 does not exist.	Stop	Blinking	Keep
16#2038	I/O interrupt service routine 12 does not exist.	Stop	Blinking	Keep
16#2039	I/O interrupt service routine 13 does not exist.	Stop	Blinking	Keep
16#203A	I/O interrupt service routine 14 does not exist.	Stop	Blinking	Keep
16#203B	I/O interrupt service routine 15 does not exist.	Stop	Blinking	Keep
16#203C	I/O interrupt service routine 16 does not exist.	Stop	Blinking	Keep
16#203D	I/O interrupt service routine 17 does not exist.	Stop	Blinking	Keep
16#203E	I/O interrupt service routine 18 does not exist.	Stop	Blinking	Keep
16#203F	I/O interrupt service routine 19 does not exist.	Stop	Blinking	Keep
16#2040	I/O interrupt service routine 20 does not exist.	Stop	Blinking	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#2041	I/O interrupt service routine 21 does not exist.	Stop	Blinking	Keep
16#2042	I/O interrupt service routine 22 does not exist.	Stop	Blinking	Keep
16#2043	I/O interrupt service routine 23 does not exist.	Stop	Blinking	Keep
16#2044	I/O interrupt service routine 24 does not exist.	Stop	Blinking	Keep
16#2045	I/O interrupt service routine 25 does not exist.	Stop	Blinking	Keep
16#2046	I/O interrupt service routine 26 does not exist.	Stop	Blinking	Keep
16#2047	I/O interrupt service routine 27 does not exist.	Stop	Blinking	Keep
16#2048	I/O interrupt service routine 28 does not exist.	Stop	Blinking	Keep
16#2049	I/O interrupt service routine 29 does not exist.	Stop	Blinking	Keep
16#204A	I/O interrupt service routine 30 does not exist.	Stop	Blinking	Keep
16#204B	I/O interrupt service routine 31 does not exist.	Stop	Blinking	Keep
16#2054 | 16#2127	External interrupt service routine 40~251 does not exist.	Stop	Blinking	Keep
16#2128	An action in a sequential function chart is incorrectly assigned qualifiers related to time. (SM0/SM1)	Self-defined	Blinking	Keep
16#2129	The modifier R is assigned to an action in a sequential function chart incorrectly. (SM0/SM1)	Self-defined	Blinking	Keep
16#212A	MC/MCR instructions cannot be used in interrupts or subroutines. (SM5)	Self-defined	Blinking	Keep
16#6000	Ethernet connection error (SM1106)	Continue	Blinking	Keep
16#6001	Illegal IP address (SM1107)	Continue	Blinking	Keep
16#6002	Illegal netmask address (SM1107)	Continue	Blinking	Keep
16#6003	Illegal gateway mask (SM1107)	Continue	Blinking	Keep
16#6004	The IP address filter is set incorrectly. (SM1108)	Continue	Blinking	Keep
16#6006	The static ARP table is set incorrectly. (SM1108)	Continue	Blinking	Keep
16#6007	The NTP client service is set incorrectly. (SM1380)	Continue	Blinking	Keep
16#6008	Illegal network number (SM1107)	Continue	Blinking	Keep
16#6009	Illegal node number (SM1107)	Continue	Blinking	Keep
16#600A	TCP connection failure (SM1090)	Continue	Keep	Keep
16#600B	UDP connection failure (SM1091)	Continue	Keep	Keep
16#600C	The socket has been used. (SM1109)	Continue	Keep	Keep
16#600D	The RJ45 port is not connected. (SM1100)	Continue	Keep	Keep
16#600E	An RJ45 port on AH10EN-5A is not connected to a network cable.	Continue	Keep	Keep
16#600F	Maximum Modbus TCP connection number has been reached. (SM1089)	Continue	Blinking	Keep
16#6010	BOOTP IP setting error (SM1107)	Continue	Keep	Keep
16#6011	BOOTP Gateway setting error (SM1107)	Continue	Keep	Keep
16#6012	IP address conflict (SM1107)	Continue	Blinking	Keep
16#6013	DNS address setting error (SM1107)			
16#6100	The email connection is busy. (SM1113)	Continue	Keep	Keep
16#6101	The trigger in the email is set incorrectly. (SM1112)	Continue	Blinking	Keep
16#6102	The interval of sending the email is set incorrectly. (SM1112)	Continue	Blinking	Keep
16#6103	The device containing the data specified as the attachment exceeds the device range. (SM1112)	Continue	Blinking	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#6104	The attachment in the email does not exist. (SM1113)	Continue	Keep	Keep
16#6105	The attachment in the email is oversized. (SM1113)	Continue	Keep	Keep
16#6106	The SMTP server address is incorrect. (SM1112)	Continue	Blinking	Keep
16#6107	There is an SMTP server response timeout. (SM1113)	Continue	Keep	Keep
16#6108	SMTP authentication error (SM1112)	Continue	Blinking	Keep
16#6110	The SMTP server needs to be authenticated. (SM1112)	Continue	Blinking	Keep
16#6111	The specified email address does not exist. (SM1112)	Continue	Blinking	Keep
16#6200	The remote IP address set in the TCP socket function is illegal. (SM1196)	Continue	Blinking	Keep
16#6201	The local communication port set in the TCP socket function is illegal.	Continue	Keep	Keep
16#6202	The remote communication port set in the TCP socket function is illegal.	Continue	Keep	Keep
16#6203	The device from which the data is sent in the TCP socket function is illegal.	Continue	Keep	Keep
16#6204	The transmitted data length set in the TCP socket function is illegal.	Continue	Keep	Keep
16#6205	The data which is sent through the TCP socket exceeds the device range.	Continue	Keep	Keep
16#6206	The device which receives the data in the TCP socket function is illegal.	Continue	Keep	Keep
16#6207	The received data length set in the TCP socket function is illegal.	Continue	Keep	Keep
16#6208	The data which is received through the TCP socket exceeds the device range.	Continue	Keep	Keep
16#6209	The remote IP address set in the UDP socket function is illegal. (SM1196)	Continue	Blinking	Keep
16#620A	The local communication port set in the UDP socket function is illegal.	Continue	Keep	Keep
16#620B	The remote communication port set in the UDP socket function is illegal.	Continue	Keep	Keep
16#620C	The device from which the data is sent in the UDP socket function is illegal.	Continue	Keep	Keep
16#620D	The transmitted data length set in the UDP socket function is illegal.	Continue	Keep	Keep
16#620E	The data which is sent through the UDP socket exceeds the device range.	Continue	Keep	Keep
16#620F	The device which receives the data in the UDP socket function is illegal.	Continue	Keep	Keep
16#6210	The received data length set in the UDP socket function is illegal.	Continue	Keep	Keep
16#6211	The data which is received through the UDP socket exceeds the device range.	Continue	Keep	Keep
16#6212	There is no response from the remote device after the timeout period. (Socket)	Continue	Keep	Keep
16#6213	The data received exceeds the limit. (Socket)	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#6214	The remote device refuses the connection. (Socket)	Continue	Keep	Keep
16#6215	The socket is not opened.	Continue	Keep	Keep
16#6217	The socket is opened.	Continue	Keep	Keep
16#6218	The data is being sent through the socket.	Continue	Keep	Keep
16#6219	The data is being received through the socket.	Continue	Keep	Keep
16#621A	The socket is being closed.	Continue	Keep	Keep
16#6300	Only auxiliary relays, data registers, and link registers can be used in the Ether Link.	Continue	Blinking	Keep
16#6301	The device used in the Ether Link exceeds the device range.	Continue	Blinking	Keep
16#6302	The length of the data exchanged in the Ether Link exceeds the limit.	Continue	Blinking	Keep
16#6303	The remote device in the Ether Link aborts the connection.	Continue	Keep	Keep
16#6304	The connection in the Ether Link is busy.	Continue	Keep	Keep
16#6305	The node used in the communication command is different from the local node.	Continue	Blinking	Keep
16#6309	The remote device in the Ether Link does not respond after the timeout period.	Continue	Keep	Keep
16#630A	The module ID or the setting of the module is different from the setting in the Ether Link.	Continue	Blinking	Keep
16#630B	The setting of the netmask address for the CPU or the module is different from the setting in the Ether Link.	Continue	Blinking	Keep
16#6400	The number of connections reaches the upper limit, or the flag which is related to the sending of the data is not set to ON. (EMDRW)	Continue	Keep	Keep
16#6401	The remote device aborts the connection. (EMDRW)	Continue	Keep	Keep
16#6402	There is no response from the remote device after the timeout period. (EMDRW)	Continue	Keep	Keep
16#6403	The remote IP address used is illegal. (EMDRW)	Continue	Keep	Keep
16#6404	The function code received is not supported. (EMDRW)	Continue	Keep	Keep
16#6405	The number of data which will be received is not consistent with the actual length of the data. (EMDRW)	Continue	Keep	Keep
16#6406	Modbus slave sent an error response. (EMDRW)	Continue	Keep	Keep
16#6500	An error occurs when a data exchange function is initialized. (SM699)	Continue	Blinking	OFF
16#6501	A remote device does not respond after a timeout. (SM828-SM955)	Continue	OFF	OFF
16#6502	The packet with which a remote device replies is incorrect. (SM828-SM955)	Continue	OFF	OFF
16#6700	An error occurs when a Modbus TCP data exchange is initialized.	Continue	Keep	Keep
16#6701	Modbus TCP data exchange timeout	Continue	Keep	Keep
16#6702	The data received by means of a Modbus TCP data exchange is incorrect.	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#7002	The CPU module does not support the function.	Continue	Keep	Keep
16#7203	Invalid access code	Continue	Keep	Keep
16#7401	Function code error	Continue	Keep	Keep
16#7402	The size of a packet exceeds the maximum data length.	Continue	Keep	Keep
16#7404	Packet format error	Continue	Keep	Keep
16#7405	The number of bytes is incorrect.	Continue	Keep	Keep
16#7406	Checksum error	Continue	Keep	Keep
16#7407	There are non-ASCII characters in a command.	Continue	Keep	Keep
16#7408	The PLC is running.	Continue	Keep	Keep
16#740A	Data is being written to the memory in the PLC or data fails to be written to the memory in the PLC.	Continue	Keep	Keep
16#740B	The CPU module is being reset, or the values in the laching devices are being cleared.	Continue	Keep	Keep
16#740C	The backplane number in a communication command is incorrect.	Continue	Keep	Keep
16#740D	The slot number in a communication command is incorrect.	Continue	Keep	Keep
16#740E	An error occurs when the the data in the memory in the PLC is cleared.	Continue	Keep	Keep
16#740F	Communication timeout	Continue	Keep	Keep
16#7410	The function code in a reply command is incorrect.	Continue	Keep	Keep
16#7412	Owing to the fact that SW1 is ON, data can not be downloaded to the CPU module.	Continue	Keep	Keep
16#757D	The remaining number of PLC password guesses is 0.	Continue	Keep	Keep
16#757E	The PLC password entered is incorrect.	Continue	Keep	Keep
16#8105	The program downloaded to the CPU module is incorrect. The syntax downloaded is incorrect.	Continue	Keep	Keep
16#8106	The program downloaded is incorrect. The length of the machine code exceeds the limit.	Continue	Keep	Keep
16#8107	The program downloaded is incorrect. The length of the source code exceeds the limit.	Continue	Keep	Keep
16#8230	A CPU parameter downloaded is incorrect. The IP address is illegal.	Continue	Keep	Keep
16#8231	A CPU parameter downloaded is incorrect. The netmask address is illegal.	Continue	Keep	Keep
16#8232	A CPU parameter downloaded is incorrect. The gateway address is illegal.	Continue	Keep	Keep
16#8233	A CPU parameter downloaded is incorrect. The IP address filter is set incorrectly.	Continue	Keep	Keep
16#8235	A CPU parameter downloaded is incorrect. The static ARP table is set incorrectly.	Continue	Keep	Keep
16#8236	A CPU parameter downloaded is incorrect. The NTP client service is set incorrectly.	Continue	Keep	Keep
16#8239	A CPU parameter downloaded is incorrect. The email sending function is set incorrectly.	Continue	Keep	Keep

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Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#823A	A CPU parameter downloaded is incorrect. The condition for the sending of an email is set incorrectly.	Continue	Keep	Keep
16#823B	A CPU parameter downloaded is incorrect. A TCP socket is set incorrectly.	Continue	Keep	Keep
16#823C	A CPU parameter downloaded is incorrect. A UDP socket is set incorrectly.	Continue	Keep	Keep
16#823E	A CPU parameter downloaded is incorrect. The eeb function is set incorrectly.	Continue	Keep	Keep
16#8240	A CPU parameter downloaded is incorrect. The data exchange by means of Ethernet is set incorrectly	Continue	Keep	Keep
16#8241	The setting of a DNS server is incorrect.	Continue	Keep	Keep
16#8522	A module configuration is being scanned.	Continue	Keep	Keep
16#853B	An I/O module is not configured.	Continue	Keep	Keep
16#853C	An I/O module does not exist.	Continue	Keep	Keep
16#854B	An I/O module is not configured.	Continue	Keep	Keep
16#854C	An I/O module does not exist.	Continue	Keep	Keep
16#8572	The checksum of the module configuration table is incorrect.	Continue	Keep	Keep
16#8576	The checksum of the module parameter setting is incorrect.	Continue	Keep	Keep
16#857A	The checksum of the module parameter mapping table is incorrect.	Continue	Keep	Keep
16#85E1	An I/O interrupt number is incorrect.	Continue	Keep	Keep
16#85E2	An I/O interrupt service routine does not exist.	Continue	Keep	Keep
16#860F	System restoration error	Continue	Blinking	Blinkin g
16#8611	No memory card exists, or the memory card format is incorrect.	Continue	Keep	Keep
16#8612	An error occurs when data is accessed from the memory card, or the memory card is in read-only mode.	Continue	Keep	Keep
16#9A01	The data exchange setting for data exchange connection 1 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A02	The data exchange setting for data exchange connection 2 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A03	The data exchange setting for data exchange connection 3 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A04	The data exchange setting for data exchange connection 4 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A05	The data exchange setting for data exchange connection 5 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A06	The data exchange setting for data exchange connection 6 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#9A07	The data exchange setting for data exchange connection 7 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A08	The data exchange setting for data exchange connection 8 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A09	The data exchange setting for data exchange connection 9 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A0A	The data exchange setting for data exchange connection 10 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A0B	The data exchange setting for data exchange connection 11 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A0C	The data exchange setting for data exchange connection 12 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A0D	The data exchange setting for data exchange connection 13 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A0E	The data exchange setting for data exchange connection 14 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A0F	The data exchange setting for data exchange connection 15 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A10	The data exchange setting for data exchange connection 16 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A11	The data exchange setting for data exchange connection 17 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A12	The data exchange setting for data exchange connection 18 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A13	The data exchange setting for data exchange connection 19 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A14	The data exchange setting for data exchange connection 20 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A15	The data exchange setting for data exchange connection 21 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A16	The data exchange setting for data exchange connection 22 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#9A17	The data exchange setting for data exchange connection 23 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A18	The data exchange setting for data exchange connection 24 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A19	The data exchange setting for data exchange connection 25 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A1A	The data exchange setting for data exchange connection 26 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A1B	The data exchange setting for data exchange connection 27 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A1C	The data exchange setting for data exchange connection 28 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A1D	The data exchange setting for data exchange connection 29 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A1E	The data exchange setting for data exchange connection 30 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A1F	The data exchange setting for data exchange connection 31 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A20	The data exchange setting for data exchange connection 32 in the PLC Link / COM1 Modbus is incorrect. (SM1590)	Continue	Keep	Keep
16#9A21	A communicational error occurs in data exchange connection 1 via PLC Link. A communicational error occurs in Modbus data exchange connection 1 via COM1.	Continue	Keep	Keep
16#9A22	A communicational error occurs in data exchange connection 2 via PLC Link. A communicational error occurs in Modbus data exchange connection 2 via COM1.	Continue	Keep	Keep
16#9A23	A communicational error occurs in data exchange connection 3 via PLC Link. A communicational error occurs in Modbus data exchange connection 3 via COM1.	Continue	Keep	Keep
16#9A24	A communicational error occurs in data exchange connection 4 via PLC Link. A communicational error occurs in Modbus data exchange connection 4 via COM1.	Continue	Keep	Keep
16#9A25	A communicational error occurs in data exchange connection 5 via PLC Link. A communicational error occurs in Modbus data exchange connection 5 via COM1.	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#9A26	A communicational error occurs in data exchange connection 6 via PLC Link. A communicational error occurs in Modbus data exchange connection 6 via COM1.	Continue	Keep	Keep
16#9A27	A communicational error occurs in data exchange connection 7 via PLC Link. A communicational error occurs in Modbus data exchange connection 7 via COM1.	Continue	Keep	Keep
16#9A28	A communicational error occurs in data exchange connection 8 via PLC Link. A communicational error occurs in Modbus data exchange connection 8 via COM1.	Continue	Keep	Keep
16#9A29	A communicational error occurs in data exchange connection 9 via PLC Link. A communicational error occurs in Modbus data exchange connection 9 via COM1.	Continue	Keep	Keep
16#9A2A	A communicational error occurs in data exchange connection 10 via PLC Link. A communicational error occurs in Modbus data exchange connection 10 via COM1.	Continue	Keep	Keep
16#9A2B	A communicational error occurs in data exchange connection 11 via PLC Link. A communicational error occurs in Modbus data exchange connection 11 via COM1.	Continue	Keep	Keep
16#9A2C	A communicational error occurs in data exchange connection 12 via PLC Link. A communicational error occurs in Modbus data exchange connection 12 via COM1.	Continue	Keep	Keep
16#9A2D	A communicational error occurs in data exchange connection 13 via PLC Link. A communicational error occurs in Modbus data exchange connection 13 via COM1.	Continue	Keep	Keep
16#9A2E	A communicational error occurs in data exchange connection 14 via PLC Link. A communicational error occurs in Modbus data exchange connection 14 via COM1.	Continue	Keep	Keep
16#9A2F	A communicational error occurs in data exchange connection 15 via PLC Link. A communicational error occurs in Modbus data exchange connection 15 via COM1.	Continue	Keep	Keep
16#9A30	A communicational error occurs in data exchange connection 16 via PLC Link. A communicational error occurs in Modbus data exchange connection 16 via COM1.	Continue	Keep	Keep
16#9A31	A communicational error occurs in data exchange connection 17 via PLC Link. A communicational error occurs in Modbus data exchange connection 17 via COM1.	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#9A32	A communicational error occurs in data exchange connection 18 via PLC Link. A communicational error occurs in Modbus data exchange connection 18 via COM1.	Continue	Keep	Keep
16#9A33	A communicational error occurs in data exchange connection 19 via PLC Link. A communicational error occurs in Modbus data exchange connection 19 via COM1.	Continue	Keep	Keep
16#9A34	A communicational error occurs in data exchange connection 20 via PLC Link. A communicational error occurs in Modbus data exchange connection 20 via COM1.	Continue	Keep	Keep
16#9A35	A communicational error occurs in data exchange connection 21 via PLC Link. A communicational error occurs in Modbus data exchange connection 21 via COM1.	Continue	Keep	Keep
16#9A36	A communicational error occurs in data exchange connection 22 via PLC Link. A communicational error occurs in Modbus data exchange connection 22 via COM1.	Continue	Keep	Keep
16#9A37	A communicational error occurs in data exchange connection 23 via PLC Link. A communicational error occurs in Modbus data exchange connection 23 via COM1.	Continue	Keep	Keep
16#9A38	A communicational error occurs in data exchange connection 24 via PLC Link. A communicational error occurs in Modbus data exchange connection 24 via COM1.	Continue	Keep	Keep
16#9A39	A communicational error occurs in data exchange connection 25 via PLC Link. A communicational error occurs in Modbus data exchange connection 25 via COM1.	Continue	Keep	Keep
16#9A3A	A communicational error occurs in data exchange connection 26 via PLC Link. A communicational error occurs in Modbus data exchange connection 26 via COM1.	Continue	Keep	Keep
16#9A3B	A communicational error occurs in data exchange connection 27 via PLC Link. A communicational error occurs in Modbus data exchange connection 27 via COM1.	Continue	Keep	Keep
16#9A3C	A communicational error occurs in data exchange connection 28 via PLC Link. A communicational error occurs in Modbus data exchange connection 28 via COM1.	Continue	Keep	Keep
16#9A3D	A communicational error occurs in data exchange connection 29 via PLC Link. A communicational error occurs in Modbus data exchange connection 29 via COM1.	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#9A3E	A communicational error occurs in data exchange connection 30 via PLC Link. A communicational error occurs in Modbus data exchange connection 30 via COM1.	Continue	Keep	Keep
16#9A3F	A communicational error occurs in data exchange connection 31 via PLC Link. A communicational error occurs in Modbus data exchange connection 31 via COM1.	Continue	Keep	Keep
16#9A40	A communicational error occurs in data exchange connection 32 via PLC Link. A communicational error occurs in Modbus data exchange connection 32 via COM1.	Continue	Keep	Keep
16#9A41	There is no response from data exchange connection 1 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A42	There is no response from data exchange connection 2 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A43	There is no response from data exchange connection 3 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A44	There is no response from data exchange connection 4 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A45	There is no response from data exchange connection 5 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A46	There is no response from data exchange connection 6 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A47	There is no response from data exchange connection 7 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A48	There is no response from data exchange connection 8 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A49	There is no response from data exchange connection 9 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A4A	There is no response from data exchange connection 10 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A4B	There is no response from data exchange connection 11 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A4C	There is no response from data exchange connection 12 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#9A4D	There is no response from data exchange connection 13 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A4E	There is no response from data exchange connection 14 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A4F	There is no response from data exchange connection 15 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A50	There is no response from data exchange connection 16 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A51	There is no response from data exchange connection 17 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A52	There is no response from data exchange connection 18 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A53	There is no response from data exchange connection 19 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A54	There is no response from data exchange connection 20 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A55	There is no response from data exchange connection 21 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A56	There is no response from data exchange connection 22 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A57	There is no response from data exchange connection 23 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A58	There is no response from data exchange connection 24 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A59	There is no response from data exchange connection 25 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A5A	There is no response from data exchange connection 26 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A5B	There is no response from data exchange connection 27 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A5C	There is no response from data exchange connection 28 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#9A5D	There is no response from data exchange connection 29 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A5E	There is no response from data exchange connection 30 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A5F	There is no response from data exchange connection 31 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A60	There is no response from data exchange connection 32 in the PLC Link / COM1 Modbus. (SM1591)	Continue	Keep	Keep
16#9A61	The setting of the PLC Link / COM1 MODBUS mode is incorrect. (SM1589)	Continue	Keep	Keep
16#9A62	The number of polling cycles in the PLC Link / COM1 MODBUS is incorrect. (SM1592)	Continue	Keep	Keep
16#9A63	There is a handshaking timeout when the CPU module establishes a connection with the network module. (SM1596)	Continue	Keep	Keep
16#9A64	There is no network module parameter in the CPU module. (SM1596)	Continue	Keep	Keep
16#9B21	A communicational error occurs in Modbus data exchange connection 1 via COM2.	Continue	Keep	Keep
16#9B22	A communicational error occurs in Modbus data exchange connection 2 via COM2.	Continue	Keep	Keep
16#9B23	A communicational error occurs in Modbus data exchange connection 3 via COM2.	Continue	Keep	Keep
16#9B24	A communicational error occurs in Modbus data exchange connection 4 via COM2.	Continue	Keep	Keep
16#9B25	A communicational error occurs in Modbus data exchange connection 5 via COM2.	Continue	Keep	Keep
16#9B26	A communicational error occurs in Modbus data exchange connection 6 via COM2.	Continue	Keep	Keep
16#9B27	A communicational error occurs in Modbus data exchange connection 7 via COM2.	Continue	Keep	Keep
16#9B28	A communicational error occurs in Modbus data exchange connection 8 via COM2.	Continue	Keep	Keep
16#9B29	A communicational error occurs in Modbus data exchange connection 9 via COM2.	Continue	Keep	Keep
16#9B2A	A communicational error occurs in Modbus data exchange connection 10 via COM2.	Continue	Keep	Keep
16#9B2B	A communicational error occurs in Modbus data exchange connection 11 via COM2.	Continue	Keep	Keep
16#9B2C	A communicational error occurs in Modbus data exchange connection 12 via COM2.	Continue	Keep	Keep
16#9B2D	A communicational error occurs in Modbus data exchange connection 13 via COM2.	Continue	Keep	Keep
16#9B2E	A communicational error occurs in Modbus data exchange connection 14 via COM2.	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#9B2F	A communicational error occurs in Modbus data exchange connection 15 via COM2.	Continue	Keep	Keep
16#9B30	A communicational error occurs in Modbus data exchange connection 16 via COM2.	Continue	Keep	Keep
16#9B31	A communicational error occurs in Modbus data exchange connection 17 via COM2.	Continue	Keep	Keep
16#9B32	A communicational error occurs in Modbus data exchange connection 18 via COM2.	Continue	Keep	Keep
16#9B33	A communicational error occurs in Modbus data exchange connection 19 via COM2.	Continue	Keep	Keep
16#9B34	A communicational error occurs in Modbus data exchange connection 20 via COM2.	Continue	Keep	Keep
16#9B35	A communicational error occurs in Modbus data exchange connection 21 via COM2.	Continue	Keep	Keep
16#9B36	A communicational error occurs in Modbus data exchange connection 22 via COM2.	Continue	Keep	Keep
16#9B37	A communicational error occurs in Modbus data exchange connection 23 via COM2.	Continue	Keep	Keep
16#9B38	A communicational error occurs in Modbus data exchange connection 24 via COM2.	Continue	Keep	Keep
16#9B39	A communicational error occurs in Modbus data exchange connection 25 via COM2.	Continue	Keep	Keep
16#9B3A	A communicational error occurs in Modbus data exchange connection 26 via COM2.	Continue	Keep	Keep
16#9B3B	A communicational error occurs in Modbus data exchange connection 27 via COM2.	Continue	Keep	Keep
16#9B3C	A communicational error occurs in Modbus data exchange connection 28 via COM2.	Continue	Keep	Keep
16#9B3D	A communicational error occurs in Modbus data exchange connection 29 via COM2.	Continue	Keep	Keep
16#9B3E	A communicational error occurs in Modbus data exchange connection 30 via COM2.	Continue	Keep	Keep
16#9B3F	A communicational error occurs in Modbus data exchange connection 31 via COM2.	Continue	Keep	Keep
16#9B40	A communicational error occurs in Modbus data exchange connection 32 via COM2.	Continue	Keep	Keep
16#9B41	There is no response from data exchange connection 1 in the COM2 Modbus.	Continue	Keep	Keep
16#9B42	There is no response from data exchange connection 2 in the COM2 Modbus.	Continue	Keep	Keep
16#9B43	There is no response from data exchange connection 3 in the COM2 Modbus.	Continue	Keep	Keep
16#9B44	There is no response from data exchange connection 4 in the COM2 Modbus.	Continue	Keep	Keep
16#9B45	There is no response from data exchange connection 5 in the COM2 Modbus.	Continue	Keep	Keep
16#9B46	There is no response from data exchange connection 6 in the COM2 Modbus.	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#9B47	There is no response from data exchange connection 7 in the COM2 Modbus.	Continue	Keep	Keep
16#9B48	There is no response from data exchange connection 8 in the COM2 Modbus.	Continue	Keep	Keep
16#9B49	There is no response from data exchange connection 9 in the COM2 Modbus.	Continue	Keep	Keep
16#9B4A	There is no response from data exchange connection 10 in the COM2 Modbus.	Continue	Keep	Keep
16#9B4B	There is no response from data exchange connection 11 in the COM2 Modbus.	Continue	Keep	Keep
16#9B4C	There is no response from data exchange connection 12 in the COM2 Modbus.	Continue	Keep	Keep
16#9B4D	There is no response from data exchange connection 13 in the COM2 Modbus.	Continue	Keep	Keep
16#9B4E	There is no response from data exchange connection 14 in the COM2 Modbus.	Continue	Keep	Keep
16#9B4F	There is no response from data exchange connection 15 in the COM2 Modbus.	Continue	Keep	Keep
16#9B50	There is no response from data exchange connection 16 in the COM2 Modbus.	Continue	Keep	Keep
16#9B51	There is no response from data exchange connection 17 in the COM2 Modbus.	Continue	Keep	Keep
16#9B52	There is no response from data exchange connection 18 in the COM2 Modbus.	Continue	Keep	Keep
16#9B53	There is no response from data exchange connection 19 in the COM2 Modbus.	Continue	Keep	Keep
16#9B54	There is no response from data exchange connection 20 in the COM2 Modbus.	Continue	Keep	Keep
16#9B55	There is no response from data exchange connection 21 in the COM2 Modbus.	Continue	Keep	Keep
16#9B56	There is no response from data exchange connection 22 in the COM2 Modbus.	Continue	Keep	Keep
16#9B57	There is no response from data exchange connection 23 in the COM2 Modbus.	Continue	Keep	Keep
16#9B58	There is no response from data exchange connection 24 in the COM2 Modbus.	Continue	Keep	Keep
16#9B59	There is no response from data exchange connection 25 in the COM2 Modbus.	Continue	Keep	Keep
16#9B5A	There is no response from data exchange connection 26 in the COM2 Modbus.	Continue	Keep	Keep
16#9B5B	There is no response from data exchange connection 27 in the COM2 Modbus.	Continue	Keep	Keep
16#9B5C	There is no response from data exchange connection 28 in the COM2 Modbus.	Continue	Keep	Keep
16#9B5D	There is no response from data exchange connection 29 in the COM2 Modbus.	Continue	Keep	Keep
16#9B5E	There is no response from data exchange connection 30 in the COM2 Modbus.	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#9B5F	There is no response from data exchange connection 31 in the COM2 Modbus.	Continue	Keep	Keep
16#9B60	There is no response from data exchange connection 32 in the COM2 Modbus.	Continue	Keep	Keep
16#B100	Connection in use or duplicate forward open	Continue	Keep	Keep
16#B106	Ownership conflict	Continue	Keep	Keep
16#B110	Target for connection not configured	Continue	Keep	Keep
16#B111	RPI not supported	Continue	Keep	Keep
16#B113	Out of Connections	Continue	Keep	Keep
16#B119	Non-Listen only connection not opened	Continue	Keep	Keep
16#B127	Invalid Originator to Target Size	Continue	Keep	Keep
16#B128	Invalid Target to Originator Size	Continue	Keep	Keep
16#B129	Invalid Configuration path	Continue	Keep	Keep
16#B12D	Consuming symbol does not exist	Continue	Keep	Keep
16#B12E	Producing symbol does not exist	Continue	Keep	Keep
16#B203	The connection timeout	Continue	Keep	Keep
16#B204	Unconnected request timed out	Continue	Keep	Keep
16#B302	Network bandwidth (PPS) not available for data	Continue	Keep	Keep
16#B315	Invalid segment in connection path	Continue	Keep	Keep
16#E206	The model number for the control mode CPU and the standby mode CPU are not the same.	Continue	Keep	Keep
16#E207	The firmware version for the control mode CPU and the standby mode CPU are not the same.	Continue	Keep	Keep
16#E208	Ethernet for the control mode CPU and the standby mode CPU are not in the same physical network.	Continue	Keep	Keep
16#E209	The I/O configurations of the control mode CPU is not the same as the actual I/O configurations of the standby mode CPU. (while checking the validation)	Continue	Keep	Keep
16#E20A	The I/O configurations of the control mode CPU is not the same as the actual I/O configurations of the standby mode CPU. (after the validation is checked)	Continue	Keep	Keep
16#E20B	System error	Continue	Keep	Keep
16#E20C	Synchronization error	Continue	Keep	Keep
16#E20D	Validation failed	Continue	Keep	Keep
16#E20E	I/O bus fault	Continue	Keep	Keep
16#E20F	Heart beat error	Continue	Keep	Keep
16#E210	Heart beat communication timeout	Continue	Keep	Keep
16#E211	Synchronization failed	Continue	Keep	Keep
16#E212	The standby mode CPU is being switched.	Continue	Keep	Keep
16#E213	There is no program on the PLC.	Continue	Keep	Keep
16#E214	PLC program is damage.	Continue	Keep	Keep
16#E215	Scan time out	Continue	Keep	Keep
16#E216	CPU access denied	Continue	Keep	Keep
16#E217	System busy (RST)	Continue	Keep	Keep
16#E218	System busy (CLR)	Continue	Keep	Keep
16#E219	Turning on the system	Continue	Keep	Keep
16#E21A	Initialization error	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#E21B	CPU parameters are damage.	Continue	Keep	Keep
16#E21C	Non-latched area error	Continue	Keep	Keep
16#E21D	CPU EIP parameters are damage.	Continue	Keep	Keep
16#E21E	The I/O configuration file does not exist.	Continue	Keep	Keep
16#E21F	The I/O configuration file is damage.	Continue	Keep	Keep
16#E221	PLC program error	Continue	Keep	Keep
16#E230	Ethernet connection error in a redundancy system	Continue	Keep	Keep
16#E260	Module on the main backplane slot 0 does not support a redundancy system.	Continue	Keep	Keep
16#E261	Module on the main backplane slot 1 does not support a redundancy system.	Continue	Keep	Keep
16#E262	Module on the main backplane slot 2 does not support a redundancy system.	Continue	Keep	Keep
16#E263	Module on the main backplane slot 3 does not support a redundancy system.	Continue	Keep	Keep
16#E264	Module on the main backplane slot 4 does not support a redundancy system.	Continue	Keep	Keep
16#E265	Module on the main backplane slot 5 does not support a redundancy system.	Continue	Keep	Keep
16#E266	Module on the main backplane slot 6 does not support a redundancy system.	Continue	Keep	Keep
16#E267	Module on the main backplane slot 7 does not support a redundancy system.	Continue	Keep	Keep
16#E268	Module on the main backplane slot 8 does not support a redundancy system.	Continue	Keep	Keep
16#E269	Module on the main backplane slot 9 does not support a redundancy system.	Continue	Keep	Keep
16#E26A	Module on the main backplane slot 10 does not support a redundancy system.	Continue	Keep	Keep
16#E26B	Module on the main backplane slot 11 does not support a redundancy system.	Continue	Keep	Keep
16#E270	Network module on the main backplane slot 0 does not connect to a network cable	Continue	Keep	Keep
16#E271	Network module on the main backplane slot 1 does not connect to a network cable	Continue	Keep	Keep
16#E272	Network module on the main backplane slot 2 does not connect to a network cable	Continue	Keep	Keep
16#E273	Network module on the main backplane slot 3 does not connect to a network cable	Continue	Keep	Keep
16#E274	Network module on the main backplane slot 4 does not connect to a network cable	Continue	Keep	Keep
16#E275	Network module on the main backplane slot 5 does not connect to a network cable	Continue	Keep	Keep
16#E276	Network module on the main backplane slot 6 does not connect to a network cable	Continue	Keep	Keep
16#E277	Network module on the main backplane slot 7 does not connect to a network cable	Continue	Keep	Keep
16#E278	Network module on the main backplane slot 8 does not connect to a network cable	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#E279	Network module on the main backplane slot 9 does not connect to a network cable	Continue	Keep	Keep
16#E27A	Network module on the main backplane slot 10 does not connect to a network cable	Continue	Keep	Keep
16#E27B	Network module on the main backplane slot 11 does not connect to a network cable	Continue	Keep	Keep
16#E280	The network module IP of the control mode CPU on the main backplane slot 0 cannot be detected.	Continue	Keep	Keep
16#E281	The network module IP of the control mode CPU on the main backplane slot 1 cannot be detected.	Continue	Keep	Keep
16#E282	The network module IP of the control mode CPU on the main backplane slot 2 cannot be detected.	Continue	Keep	Keep
16#E283	The network module IP of the control mode CPU on the main backplane slot 3 cannot be detected.	Continue	Keep	Keep
16#E284	The network module IP of the control mode CPU on the main backplane slot 4 cannot be detected.	Continue	Keep	Keep
16#E285	The network module IP of the control mode CPU on the main backplane slot 5 cannot be detected.	Continue	Keep	Keep
16#E286	The network module IP of the control mode CPU on the main backplane slot 6 cannot be detected.	Continue	Keep	Keep
16#E287	The network module IP of the control mode CPU on the main backplane slot 7 cannot be detected.	Continue	Keep	Keep
16#E288	The network module IP of the control mode CPU on the main backplane slot 8 cannot be detected.	Continue	Keep	Keep
16#E289	The network module IP of the control mode CPU on the main backplane slot 9 cannot be detected.	Continue	Keep	Keep
16#E28A	The network module IP of the control mode CPU on the main backplane slot 10 cannot be detected.	Continue	Keep	Keep
16#E28B	The network module IP of the control mode CPU on the main backplane slot 11 cannot be detected.	Continue	Keep	Keep
16#E290	Connection in use or duplicate forward open	Continue	Keep	Keep
16#E291	Ownership conflict	Continue	Keep	Keep
16#E292	Target for connection not configured	Continue	Keep	Keep
16#E293	RPI not supported	Continue	Keep	Keep
16#E294	Out of Connections	Continue	Keep	Keep
16#E295	Non-Listen only connection not opened	Continue	Keep	Keep
16#E296	Invalid Originator to Target Size	Continue	Keep	Keep
16#E297	Invalid Target to Originator Size	Continue	Keep	Keep
16#E298	Invalid Configuration path	Continue	Keep	Keep

Error code	Description	CPU Status	LED indicator status	
			ERROR	BUS FAULT
16#E299	Consuming symbol does not exist	Continue	Keep	Keep
16#E29A	Producing symbol does not exist	Continue	Keep	Keep
16#E29B	The connection timeout	Continue	Keep	Keep
16#E2A0	The network module IP detection of the control mode CPU on the main backplane slot 0 has not been executed.	Continue	Keep	Keep
16#E2A1	The network module IP detection of the control mode CPU on the main backplane slot 1 has not been executed.	Continue	Keep	Keep
16#E2A2	The network module IP detection of the control mode CPU on the main backplane slot 2 has not been executed.	Continue	Keep	Keep
16#E2A3	The network module IP detection of the control mode CPU on the main backplane slot 3 has not been executed.	Continue	Keep	Keep
16#E2A4	The network module IP detection of the control mode CPU on the main backplane slot 4 has not been executed.	Continue	Keep	Keep
16#E2A5	The network module IP detection of the control mode CPU on the main backplane slot 5 has not been executed.	Continue	Keep	Keep
16#E2A6	The network module IP detection of the control mode CPU on the main backplane slot 6 has not been executed.	Continue	Keep	Keep
16#E2A7	The network module IP detection of the control mode CPU on the main backplane slot 7 has not been executed.	Continue	Keep	Keep
16#E2A8	The network module IP detection of the control mode CPU on the main backplane slot 8 has not been executed.	Continue	Keep	Keep
16#E2A9	The network module IP detection of the control mode CPU on the main backplane slot 9 has not been executed.	Continue	Keep	Keep
16#E2AA	The network module IP detection of the control mode CPU on the main backplane slot 10 has not been executed.	Continue	Keep	Keep
16#E2AB	The network module IP detection of the control mode CPU on the main backplane slot 11 has not been executed.	Continue	Keep	Keep

7.1.2 Analog I / O Modules and Temperature Measurement Modules

Error code	Description	LED indicator status	
		CPU	Module
		BUS FAULT	ERROR
16#A000	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	Blinking	
16#A001	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	Blinking	
16#A002	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	Blinking	
16#A003	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	Blinking	
16#A004	The signal received by channel 4 exceeds the range of inputs which can be received by the hardware.	Blinking	
16#A005	The signal received by channel 5 exceeds the range of inputs which can be received by the hardware.	Blinking	
16#A006	The signal received by channel 6 exceeds the range of inputs which can be received by the hardware.	Blinking	
16#A007	The signal received by channel 7 exceeds the range of inputs which can be received by the hardware.	Blinking	
16#A400	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	ON	
16#A401	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	ON	
16#A402	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	ON	
16#A403	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	ON	
16#A404	The signal received by channel 4 exceeds the range of inputs which can be received by the hardware.	ON	
16#A405	The signal received by channel 5 exceeds the range of inputs which can be received by the hardware.	ON	
16#A406	The signal received by channel 6 exceeds the range of inputs which can be received by the hardware.	ON	
16#A407	The signal received by channel 7 exceeds the range of inputs which can be received by the hardware.	ON	
16#A600	Hardware failure	ON	
16#A601	The external voltage is abnormal.	ON	
16#A602	Internal error The CJC is abnormal.	ON	
16#A603	Internal error The factory correction is abnormal.	ON	
16#A800	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	OFF	
16#A801	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	OFF	
16#A802	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	OFF	
16#A803	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	OFF	
16#A804	The signal received by channel 4 exceeds the range of inputs which can be received by the hardware.	OFF	

Error code	Description	LED indicator status	
		CPU	Module
		BUS FAULT	ERROR
16#A805	The signal received by channel 5 exceeds the range of inputs which can be received by the hardware.	OFF	
16#A806	The signal received by channel 6 exceeds the range of inputs which can be received by the hardware.	OFF	
16#A807	The signal received by channel 7 exceeds the range of inputs which can be received by the hardware.	OFF	

*With regard to the errors related to the input signals' exceeding the range of inputs which can be received by the hardware and the conversion values' exceeding the limits, whether the error code generated is within the range between 16#A000 and 16#A00F, within the range between 16#A400 and 16#A40F, or within the range between 16#A800~16#A80F depends on the LED indicator status defined by users.

7.1.3 AH02HC-5A / AH04HC-5A

<table>
<tr><th rowspan="3">Error code</th><th rowspan="3">Description</th><th colspan="2">LED indicator status</th></tr>
<tr><th>CPU</th><th>Module</th></tr>
<tr><th>BUS FAULT</th><th>ERROR</th></tr>
<tr><td>16#A001</td><td>The linear accumulation in channel 0 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A002</td><td>The prescale value for channel 0 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A003</td><td>The moving average for channel 0 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A004</td><td>The comparison value for channel 0 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A005</td><td>The limit value of the alarm output for channel 0 is incorrect.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A006</td><td>The interrupt number for channel 0 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A011</td><td>The linear accumulation in channel 1 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A012</td><td>The prescale value for channel 1 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A013</td><td>The moving average for channel 1 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A014</td><td>The comparison value for channel 1 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A015</td><td>The limit value of the alarm output for channel 1 is incorrect.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A016</td><td>The interrupt number for channel 1 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A021</td><td>The linear accumulation in channel 2 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A022</td><td>The prescale value for channel 2 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A023</td><td>The moving average for channel 2 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A024</td><td>The comparison value for channel 2 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A025</td><td>The limit value of the alarm output for channel 2 is incorrect.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A026</td><td>The interrupt number for channel 2 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A031</td><td>The linear accumulation in channel 3 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A032</td><td>The prescale value for channel 3 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A033</td><td>The moving average for channel 3 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A034</td><td>The comparison value for channel 3 exceeds the range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A035</td><td>The limit value of the alarm output for channel 3 is incorrect.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A036</td><td>The interrupt number for channel 3 exceeds the range.</td><td colspan="2">Blinking</td></tr>
</table>

7.1.4 AH05PM-5A / AH10PM-5A / AH15PM-5A

<table>
<tr><th rowspan="3">Error code</th><th rowspan="3">Description</th><th colspan="2">LED indicator status</th></tr>
<tr><th>CPU</th><th>Module</th></tr>
<tr><th>BUS FAULT</th><th>Error</th></tr>
<tr><td>16#A002</td><td>The subroutine has no data.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A003</td><td>CJ, CJN, and JMP have no matching pointers.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A004</td><td>There is a subroutine pointer in the main program.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A005</td><td>Lack of the subroutine</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A006</td><td>The pointer is used repeatedly in the same program.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A007</td><td>The subroutine pointer is used repeatedly.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A008</td><td>The pointer used in JMP is used repeatedly in different subroutines.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A009</td><td>The pointer used in JMP is the same as the pointer used in CALL.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A00B</td><td>Target position (I) of the single speed is incorrect.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A00C</td><td>Target position (II) of the single-axis motion is incorrect.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A00D</td><td>The setting of speed (I) of the single-axis motion is incorrect.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A00E</td><td>The setting of speed (II) of the single-axis motion is incorrect.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A00F</td><td>The setting of the speed (V_{RT}) of returning to zero is incorrect.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A010</td><td>The setting of the deceleration (V_{CR}) of returning to zero is incorrect.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A011</td><td>The setting of the JOG speed is incorrect.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A012</td><td>The positive pulses generated by the single-axis clockwise motion are inhibited.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A013</td><td>The negative pulses generated by the single-axis counterclockwise motion are inhibited.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A014</td><td>The limit switch is reached.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A015</td><td>The device which is used exceeds the device range.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A017</td><td>An error occurs when the device is modified by a 16-bit index register/32-bit index register.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A018</td><td>The conversion into the floating-point number is incorrect.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A019</td><td>The conversion into the binary-coded decimal number is incorrect.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A01A</td><td>Incorrect division operation (The divisor is 0.)</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A01B</td><td>General program error</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A01C</td><td>LD/LDI has been used more than nine times.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A01D</td><td>There is more than one level of nested program structure supported by RPT/RPE.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A01E</td><td>SRET is used between RPT and RPE.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A01F</td><td>There is no M102 in the main program, or there is no M2 in the motion program.</td><td colspan="2">Blinking</td></tr>
<tr><td>16#A020</td><td>The wrong instruction is used, or the device used exceeds the range.</td><td colspan="2">Blinking</td></tr>
</table>

7.1.5 AH20MC-5A

Error code	Description	LED indicator status	
		CPU	Module
		BUS FAULT	ERROR
16#A002	The subroutine has no data.	Blinking	
16#A003	CJ, CJN, and JMP have no matching pointers.	Blinking	
16#A004	There is a subroutine pointer in the main program.	Blinking	
16#A005	Lack of the subroutine	Blinking	
16#A006	The pointer is used repeatedly in the same program.	Blinking	
16#A007	The subroutine pointer is used repeatedly.	Blinking	
16#A008	The pointer used in JMP is used repeatedly in different subroutines.	Blinking	
16#A009	The pointer used in JMP is the same as the pointer used in CALL.	Blinking	
16#A00B	Target position (I) of the single speed is incorrect.	Blinking	
16#A00C	Target position (II) of the single-axis motion is incorrect.	Blinking	
16#A00D	The setting of speed (I) of the single-axis motion is incorrect.	Blinking	
16#A00E	The setting of speed (II) of the single-axis motion is incorrect.	Blinking	
16#A00F	The setting of the speed (V_{RT}) of returning to zero is incorrect.	Blinking	
16#A010	The setting of the deceleration (V_{CR}) of returning to zero is incorrect.	Blinking	
16#A011	The setting of the JOG speed is incorrect.	Blinking	
16#A012	The positive pulses generated by the single-axis clockwise motion are inhibited.	Blinking	
16#A013	The negative pulses generated by the single-axis counterclockwise motion are inhibited.	Blinking	
16#A014	The limit switch is reached.	Blinking	
16#A015	The device which is used exceeds the device range.	Blinking	
16#A017	An error occurs when the device is modified by a 16-bit index register/32-bit index register.	Blinking	
16#A018	The conversion into the floating-point number is incorrect.	Blinking	
16#A019	The conversion into the binary-coded decimal number is incorrect.	Blinking	
16#A01A	Incorrect division operation (The divisor is 0.)	Blinking	
16#A01B	General program error	Blinking	
16#A01C	LD/LDI has been used more than nine times.	Blinking	
16#A01D	There is more than one level of nested program structure supported by RPT/RPE.	Blinking	
16#A01E	SRET is used between RPT and RPE.	Blinking	
16#A01F	Incorrect division operation (The divisor is 0.)	Blinking	
16#A020	The wrong instruction is used, or the device used exceeds the range.	Blinking	

7.1.6 AH10EN-5A / AH-15EN-5A

Error code	Description	LED indicator status	
		CPU	Module
		BUS FAULT	Error
16#A001	The IP address of host 1 conflicts with another system on the network.	Blinking	
16#A002	The IP address of host 2 conflicts with another system on the network.	Blinking	
16#A003	DHCP for host 1 fails.	Blinking	
16#A004	DHCP for host 2 fails.	Blinking	
16#A401	Hardware error	ON	
16#A402	The initialization of the system fails.	ON	

7.1.7 AH10SCM-5A / AH15SCM-5A

Error code	Description	LED indicator status	
		CPU	Module
		BUS FAULT	ERROR
16#A002	The setting of the UD Link is incorrect, or the communication fails.	Blinking	
16#A401	Hardware error	ON	
16#A804	The communication through the communication port is incorrect.	OFF	
16#A808	MODBUS communication error	OFF	

7.1.8 AH10DNET-5A

Error code	Description	LED indicator status		
		CPU	Module	
		BUS FAULT	MS	NS
16#A0F0	The node ID of AH10DNET-5A is the same as other node ID on the network, or exceeds the range.	The red light blinks.	The green light blinks.	The red light is ON.
16#A0F1	No slave is put on the scan list of AH10DNET-5A.	The red light blinks.	The green light blinks.	The green light is ON.
16#A0F2	The working voltage of AH10DNET-5A is low.	The red light blinks.	The red light blinks.	The red light blinks.
16#A0F3	AH10DNET-5A enters the test mode.	The red light blinks.	The orange light is ON.	The orange light is ON.
16#A0F4	The bus of AH10DNET-5A is switched OFF.	The red light blinks.	The green light is ON.	The red light is ON.
16#A0F5	AH10DNET-5A detects that there is no network power supply to the DeviceNet.	The red light blinks.	The red light blinks.	The red light is ON.
16#A0F6	Something is wrong with the internal memory of AH10DNET-5A.	The red light blinks.	The red light is ON.	The green light blinks.
16#A0F7	Something is wrong with the data exchange unit of AH10DNET-5A.	The red light blinks.	The red light is ON.	The green light blinks.
16#A0F8	The product ID of AH10DNET-5A is incorrect.	The red light blinks.	The red light is ON.	The green light blinks.

Error code	Description	LED indicator status		
		CPU	Module	
		BUS FAULT	MS	NS
16#A0F9	An error occurs when the data is read from AH10DNET-5A, or when the data is written into AH10DNET-5A.	The red light blinks.	The red light is ON.	The red light is ON.
16#A0FA	The node ID of AH10DNET-5A is the same as that of the slave set in the scan list.	The red light blinks.	The green light is ON.	The red light is ON.
16#A0FB	The data exchange between AH10DNET and AH CPU failed.	The red light blinks.	The green light is ON.	The green light is ON.
16#A0FC	Errors occur in the slaves, on the module of an AHRTU-DNET backplane, or on the AHRTU-DNET backplane connection.	The red light blinks.	The red light blinks.	The green light is ON.

7.1.9 AH10PFBM-5A

Error code	Description	LED indicator status			
		CPU	MODULE		
		BUS FAULT	RUN	SYS	DP
16#A001	The master is not set.	The red light blinks.	The green light is ON.	The green light is ON.	The green light blinks.
16#A003	The master station enters the test mode.	The red light blinks.	The green light is ON.	The green light is ON.	The green light is ON.
16#A005	A timeout occurs when chips inside the master station communicate.	The red light blinks.	The green light is ON.	The green light is ON.	The green light is ON.
16#A00B	A timeout occurs when AH10PFBM-5A exchanges data exchange with a PLC.	The red light blinks.	The green light is ON.	The green light is ON.	The green light is ON.
16#A402	The PLC does not assign the I/O mapping area to the master.	The red light is ON.	The green light is ON.	The green light is ON.	The green light is ON.
16#A404	Master initializing error	The red light is ON.	The green light is ON.	The green light is ON.	The green light is ON.
16#A406	Internal storage unit error	The red light is ON.	The green light is ON.	The green light is ON.	The green light is ON.
16#A407	Data exchange unit error	The red light is ON.	The green light is ON.	The green light is ON.	The green light is ON.
16#A408	Master serial number detection error	The red light is ON.	The green light is ON.	The green light is ON.	The green light is ON.
16#A4E2	The master detects that all the slaves are offline.	The red light is ON.	OFF	The green light is ON.	The red light is ON.
	The master detects that some of the slaves are offline.	The red light is ON.	OFF	The green light is ON.	The red light blinks.

Error code	Description	LED indicator status			
		CPU	MODULE		
		BUS FAULT	RUN	SYS	DP
16#A4E6	The master detects that an error occurs in the module connected to AHRTU-PFBS-5A.	The red light is ON.	The green light is ON.	The green light is ON.	The green light is ON.

7.1.10 AH10PFBS-5A

Error code	Description	LED indicator status		
		CPU	MODULE	
		BUS FAULT	RUN	NET
16#A4F0	The node address of AH10PFBS-5A exceeds the valid range.	The red light is ON.	The green light is ON.	The green light is ON.
16#A4F1	Internal hardware error	The red light is ON.	The green light is ON.	The green light is ON.
16#A4F2	Parameter error	The red light is ON.	The green light is ON.	The green light is ON.
16#A4F3	Configuration error	The red light is ON.	The green light is ON.	The green light is ON.
16#A4F4	GPIO detection error	The red light is ON.	The green light is ON.	The green light is ON.
16#A4F5	AH10PFBS-5A enters the mode of factory test.	The red light is ON.	The green light is ON.	The green light is ON.
16#A4F6	1. AH10PFBS-5A has not been connected to the PROFIBUS-DP network. 2. PROFIBUS-DP master has not configured AH10PFBS-5A slave or the configured node address of AH10PFBS-5A is inconsistent with that of the actually connected one.	The red light is ON.	The green light is ON.	The red light is ON.

7.1.11 AH10COPM-5A

Error code	Description	LED indicator status	
		CPU	MODULE
		BUS FAULT	ERROR
16#A0B0	AH10COPM-5A does not send a heartbeat message after a set period of time.	Blinking	The red light flashes twice.
16#A0B1	The length of a PDO that a slave station sends is not the same as the length of the PDO set in the node list.	Blinking	OFF
16#A0B2	The master station selected does not send a node guarding message after a set period of time.	Blinking	The red light flashes twice.
16#A0E0	AH10COPM-5A receives an emergency message from a slave station.	Blinking	OFF
16#A0E1	The length of a PDO that a slave station sends is not the same as the length of the PDO set in the node list.	Blinking	OFF

Error code	Description	LED indicator status	
		CPU	MODULE
		BUS FAULT	ERROR
16#A0E2	AH10COPM-5A does not receive a PDO from a slave station.	Blinking	OFF
16#A0E3	An automatic SDO is not downloaded successfully.	Blinking	OFF
16#A0E4	A PDO parameter is not set successfully.	Blinking	OFF
16#A0E5	A key parameter is set incorrectly.	Blinking	OFF
16#A0E6	The actual network configuration is not the same as the network configuration set.	Blinking	OFF
16#A0E7	The control of the errors in a slave station is not sent after a set period of time.	Blinking	The red light flashes twice.
16#A0E8	The master station address is the same as a slave station address.	Blinking	OFF
16#A0F1	No slave station is added to the node list in CANopen builder.	Blinking	OFF
16#A0F3	An error occurs in AH10COPM-5A.	Blinking	OFF
16#A0F4	The bus used is off.	Blinking	The red light is ON.
16#A0F5	The node address of AH10COPM-5A is set incorrectly.	Blinking	OFF
16#A0F6	Internal error: An error occurs in the manufacturing process in the factory.	Blinking	OFF
16#A0F7	Internal error: GPIO error	Blinking	OFF
16#A0F8	Hardware error	Blinking	OFF
16#A0F9	Low voltage	Blinking	OFF
16#A0FA	An error occurs in the firmware of AH10COPM-5A.	Blinking	OFF
16#A0FB	The transmission registers in AH10COPM-5A are full.	Blinking	OFF
16#A0FC	The reception registers in AH10COPM-5A are full.	Blinking	OFF