



Automation for a Changing World

Delta Municipal Water Treatment Solution

www.deltaww.com





Smarter. Greener. Together.

Who We Are

Delta is a market leader that has won wide recognition as a:

- Global power and thermal solution provider, with partners such as Apple, IBM, HP, Lenovo and more; No.1 in Switching Power Supplies since 2002, DC Fans since 2006.
- Leading brand in industrial automation applications for factories, processes, and buildings; with specific system solutions for textiles, packaging, machine tools and more.
- Leading telecom power system provider in Europe, Americas, Asia and emerging markets; in long term partnerships with Vodafone, T-Mobile, Orange, China Mobile, Bharti and more.

About Delta Industrial Automation

Since 1995, the Delta Industrial Automation Business Group (IABG) has focused on automation technology with quality, reliability and precision to realize our promise of “Automation for a Changing World”. Our innovative automation products include AC motor drives, power quality improvement devices, sensors, and control and motion devices.

Delta’s industrial automation solutions find application in a broad range of machinery, including: metal processing machines used in industries such as food, textiles, chemicals, electronics, and plastics; automation equipment used in pharmaceuticals and printing; and energy-saving air-conditioning and water supply facilities used in buildings.

Our mission is: “To elevate our living environment through advanced automation technology and value added innovation”. With Delta’s innovative, reliable, energy-saving automations solutions and rapid global service, we will help make the world “Smarter. Greener. Together.” with our partners and customers.

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An Expert in Municipal Water Treatment

Vital to most life on earth, water is one of our most important natural resources. With rapid social and economic development and urbanization, the supply of clean water has become a critical issue worldwide. In recent years, water quality standards have been tightened and the requirements for water treatment raised.

With the brand promise of “Smarter. Greener. Together.”, Delta provides highly reliable programmable logic controllers, human machine interfaces, Ethernet switches, motors and drives, and power quality products suitable for the process automation of water treatment plants. With years of experience in the water treatment industry, Delta provides integrated water treatment solutions for a cleaner environment and a better tomorrow.



Automation for the Water Treatment Industry

Automation for a Reason

- ▶ Ensures a high-quality treatment process
- ▶ Reduces labor-intensity for easier management
- ▶ Improves system efficiency with the least resources

Automation for the water treatment industry faces a new challenge in the growing complexity of the automation process and system structure. Besides improving production quality and quantity, lowering costs and saving energy with reduced carbon emissions is equally important.

Requirements for the Water Treatment Process

A Green Process

Going green is an inevitable trend for the water treatment industry. Through intelligent control and management of drainage and sewage treatment, and mid/low voltage variable frequency controls which replace the conventional damming or drainage bypass, sewage and contaminants can be significantly reduced. The process automation for water treatment makes proper distribution and recycling of limited water resources possible.

Excellent Quality Control

For water plants, highly reliable, stable, and safe control and power systems are guarantees of an effective process operation. With strengthened capabilities, these systems can elevate the operation efficiency of the water treatment process to meet strict water quality standards.

Reduced Expenditure

Water treatment systems must be highly open, compatible, and extendable for better cost-effectiveness. The control systems should be user-friendly and easy to maintain. For example, with the hot-swapping function of control modules, users can upgrade or backup systems through SD memory cards and can easily restore the systems once malfunctions occur, minimizing impact on the continuous water supply or sewage treatment process.

Optimized Control Processing

To reduce the use of system capacity and chemicals in the water treatment process, the control systems should provide an abundance of control processing functions. These include process control, fuzzy control, open/close loop control, variable frequency control, and others that help optimize processing efficiency and can be integrated with energy management and fluid controls.

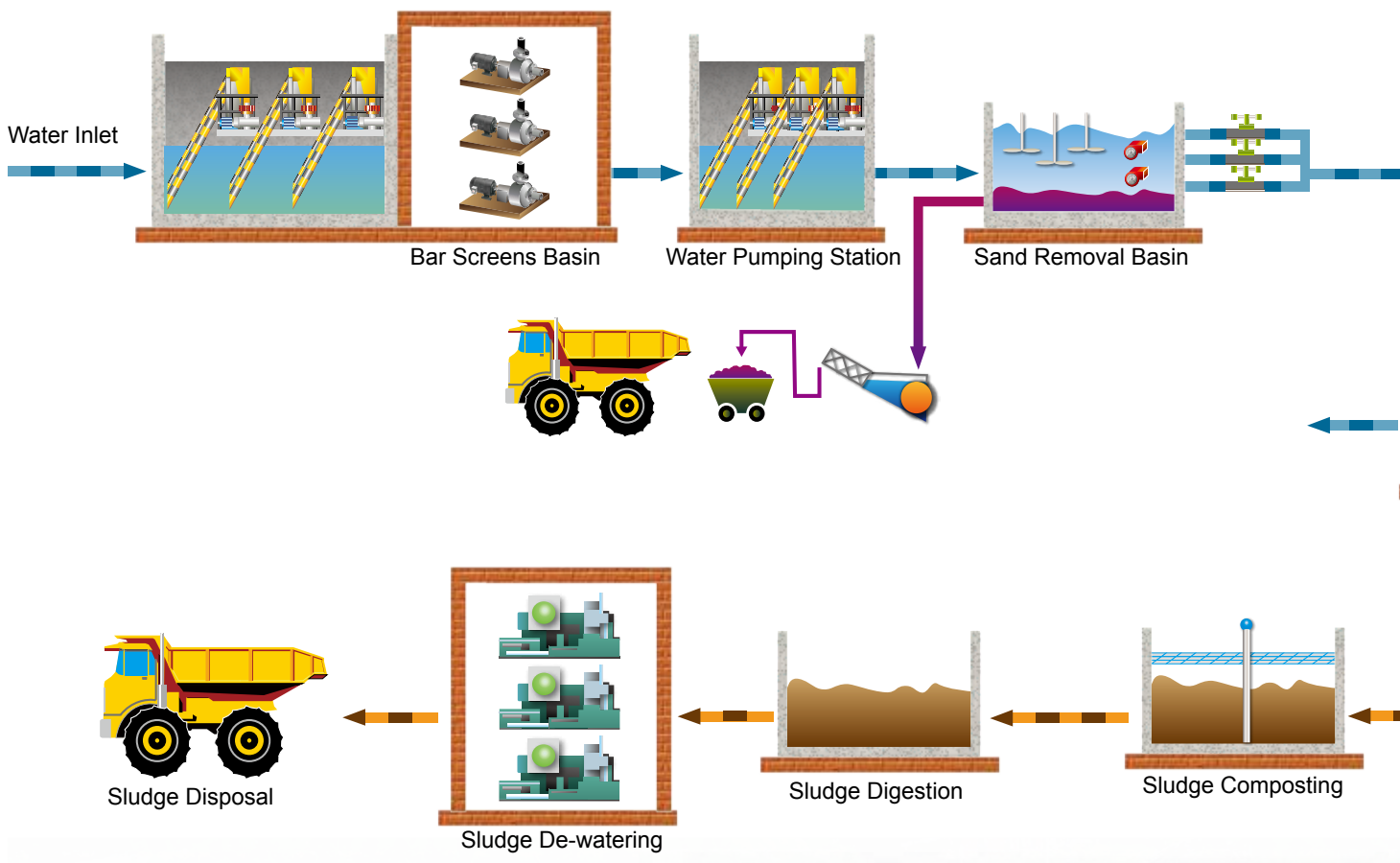
Smart and Easy Operation

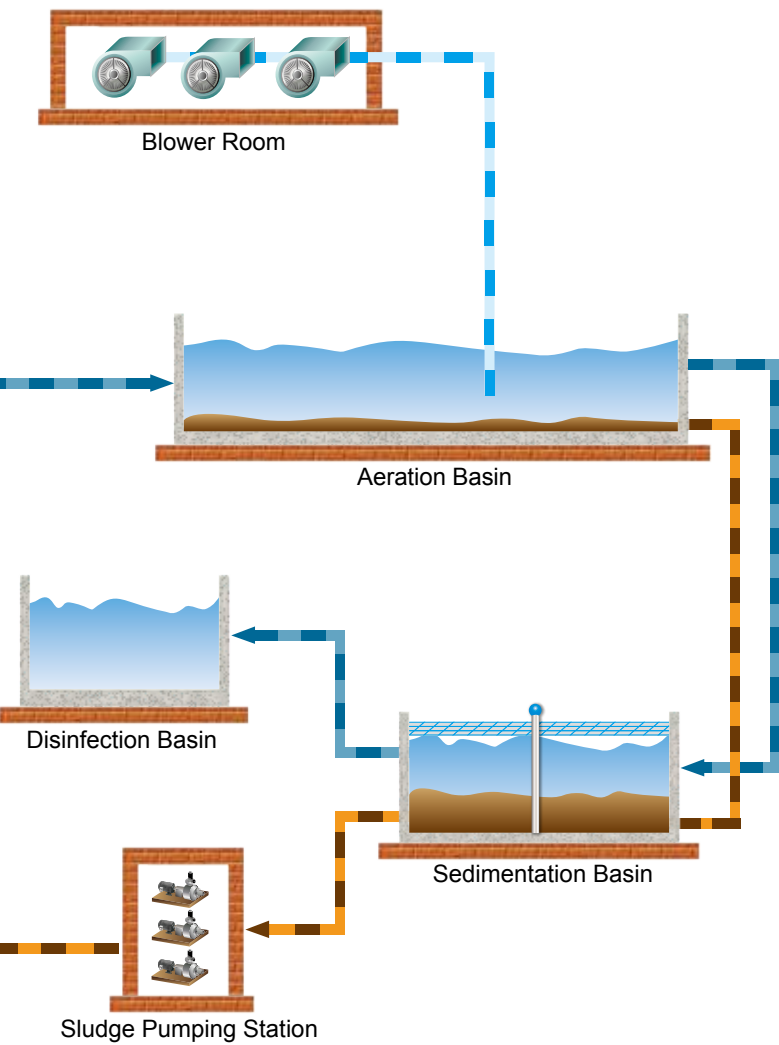
With the complexity of the water treatment process, the system operation should be as easy as possible to avoid process malfunctions. An intuitive control interface can help users quickly understand the overall processing procedures and instantly troubleshoot once malfunctions occur, for an intelligent automation system that is more stable and reliable.



Wastewater Treatment Process

- Ventilation Channel
- Sludge Channel
- Sewage Channel





Process	Facility	Effect
Primary treatment	Bar screen basin	Screens debris that can be easily collected from raw sewage to prevent possible damage or clogs in pumps, channels and facilities.
	Water pumping station	Elevates the water level to ensure water flows through the process using the force of gravity
	Mesh screen basin	Screens scum or suspended matter to ensure a smooth flow through pumps, channels and facilities.
	Sand removal	Removes sand by sedimentation to prevent possible damage to channels or valves.
	Primary sedimentation basin	Removes particles of influent in the pre- sedimentation tanks. Three common types of grit chamber are horizontal, aerated and vortex.
Secondary treatment	Aeration basin	Transforms organic matter to CO ₂ , H ₂ O, oxygen or biodegradable sludge through aerobic biochemical processes. Transfers air into basins required for biological oxidation reactions and provides the mixing required for dispersing the air and contacting the reactants.
	Secondary sedimentation basin	Settles out sewage water and sludge which flows to the sludge treatment facility.
Treated sewage drainage	Disinfection basin	Sterilizes the treated sewage.
	Drainage pumping station	Drains the effluent. Pumps are needed in some water plants.
Sludge treatment	Digestion, composting, drying stations	Reduces the amount of organic matter and de-waters the sludge before disposal, minimizing harm to the environment.

Wastewater treatment is a three level process.

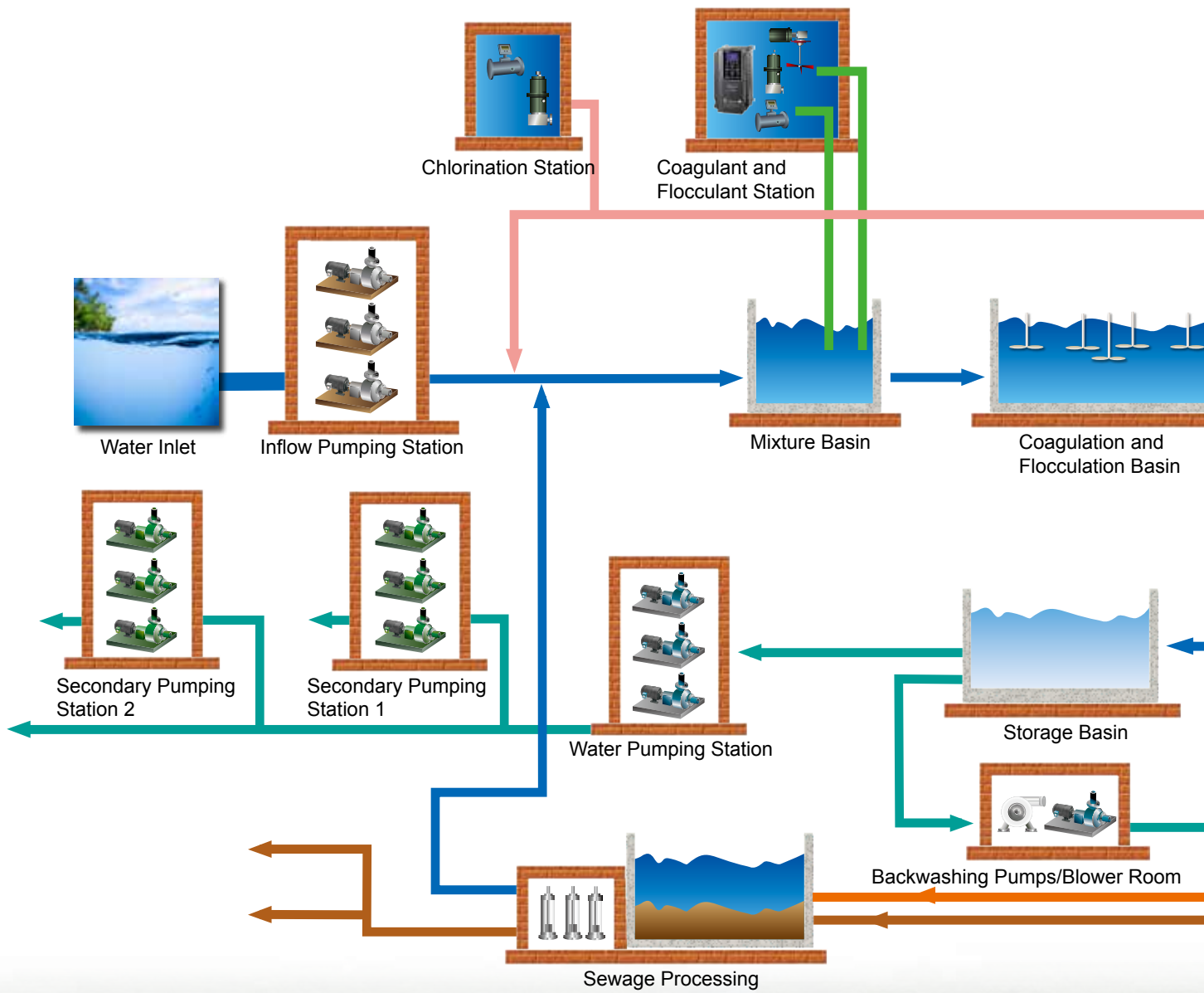
For primary treatment, materials such as stones, sand, and grit in the wastewater are screened through physical methods.

For secondary treatment, organic matter is degraded by activated sludge, through which 80%~90% of pollutants can be removed.

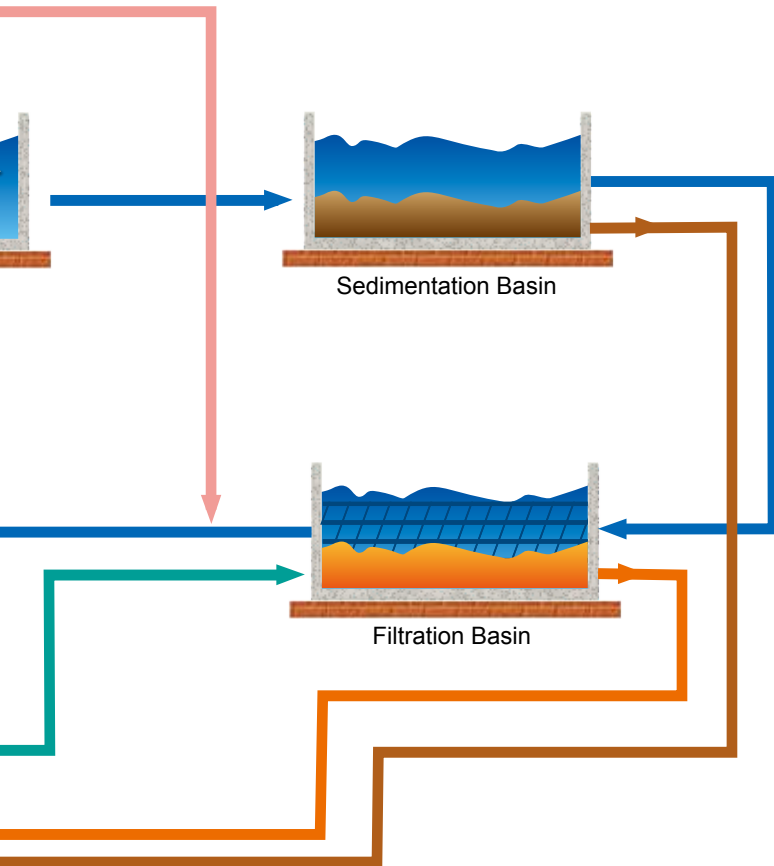
Tertiary treatment is an advanced wastewater treatment that removes the remaining nutrients and further disinfects the treated water. According to current regulations for water quality, tertiary treatment is not applied in certain water plants.



Water Purification Treatment



- Water Pipe
- Chlorination Pipe
- Coagulant and Flocculant Pipe
- Sewer
- Backwashed Wastewater Pipe



Process	Facility	Effect
Inflow	Inflow pumping station	The first processing station of a water purification plant that pumps water through the processing facilities.
Chlorination	Chlorination station	Injects chlorine, coagulants and flocculants for disinfection, coagulation and flocculation.
Coagulation and flocculation	Mixture basin	Mixes the coagulants and flocculants with water evenly.
	Coagulation and flocculation basin	Aggregates the particles and organisms into flocs that precipitate or float on water for further filtration. In general, the water quality of ground water is better than that of rivers or lakes that contain more suspended particles and parasites. Applies different types of coagulants and flocculants according to the source of inflow water.
Sedimentation	Sedimentation basin	Removes most suspended particles, parasites and flocs. Horizontal and radial flow sedimentations are commonly adopted methods.
Filtration	Filtration basin	Filters the sedimentation outflow for a better water quality that meets the standards for water supply. Multiple methods such as general filters, air/water backwash filters, and many more.
Storage	Water storage basin	Stores the processed water. Further disinfection may be applied during this process.
Distribution	Water pumping station	Powers the outflow to flow through the water distribution channels.
	Secondary pumping station	Powers the outflow from regional pumping stations to end users.

Water purification treatment is a four phase process.

The first process is coagulation and flocculation. The sources of inflow are normally ground water or surface water that contain bacteria, parasites, grit, and many more contaminants. Coagulants and flocculants are added to the inflow to aggregate matter into flocs and settled by gravity. Chlorination is also used to eliminate suspended parasites and microorganisms.

The second process is sedimentation. The water is mixed with coagulants and flocculants and streamed into the sedimentation basin. The water settles in the basin to further segregate the contaminants.

The third process is filtration. Water flows out from the sedimentation basin to the filtration basin. Particles and scum are screened and removed through filters and backwashing. Disinfection by chlorination afterwards eliminates bacteria and viruses to achieve the water quality to meet water supply quality standards.

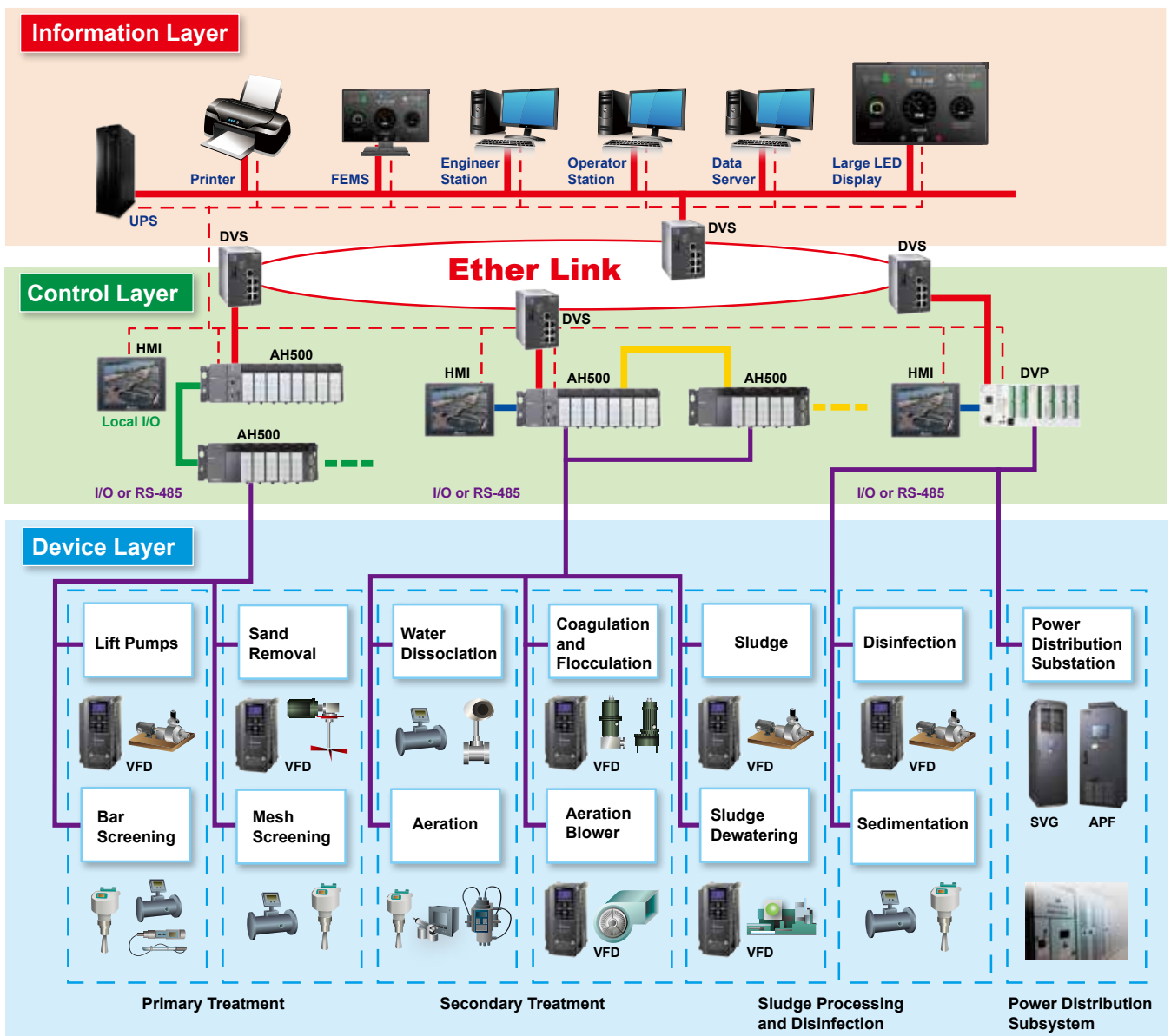
The fourth process is water supply via water pumping stations and regional secondary pumping stations. With end users located far and wide, the water plant's main and secondary pumping stations ensure the water supply reaches users in every region.



Wastewater Treatment Solution

Delta's advanced control, drive and power quality products make possible the integration of facilities and sensors, providing users with a complete, effective and integrated water treatment solution.

The applications are categorized in three layers: an information layer, a control layer, and a device layer.



The automation system for wastewater treatment is divided into three layers: an information layer, a control layer, and a device layer.

Information Layer

The data obtained onsite is centrally monitored, analyzed, and processed by a distributed control system structure. Key data and status are provided to higher-level signal networks by Delta DVS series industrial network switches. Functions such as device monitoring, data analysis and process recording, distant transmission, and trend reports can be performed with the combination of Delta’s high-end touch panel human machine interfaces and the e-Remote and e-Server software.

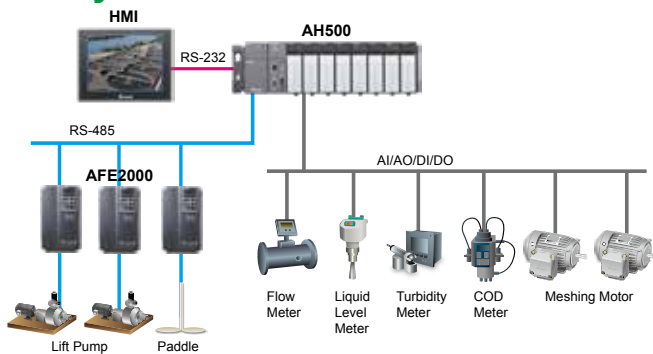
Control Layer

Delta’s AH500 series mid-range PLCs and DVP series PLCs make possible a flexible configuration and the stable operation of the system. Their versatile master, slave and distant transmission solutions can adapt to various requirements for the wastewater treatment process.

Device Layer

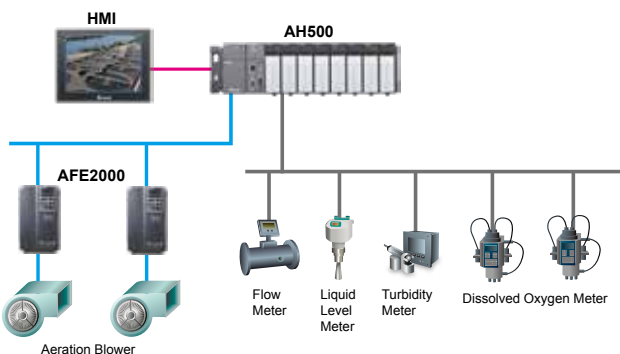
For devices that monitor the entire wastewater treatment process, such as primary treatment, secondary treatment and the sludge treatment, Delta’s variable frequency drives can control the frequency of revolutions for large-scale energy-consuming equipment, such as the aeration blowers and lift pumps, for maximum energy savings. Delta’s APF series active power filters and SVG series static var generators can manage the power quality problems of the power grid, securing a clean and stable power quality and supply for wastewater treatment.

Primary Treatment Solution



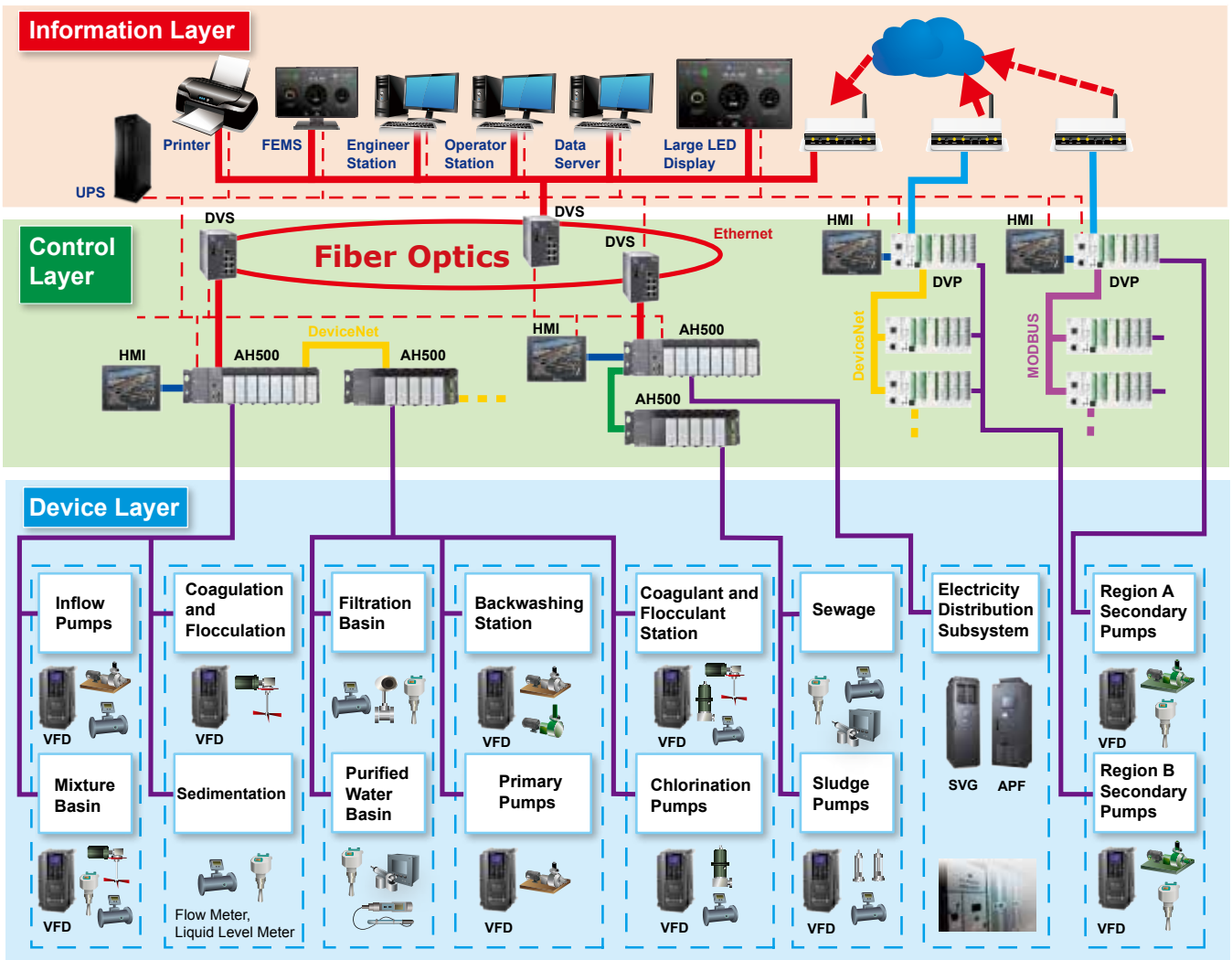
For the processing loading, a PLC performs automated control to achieve a flexible operation for the lift pumps, mesh screens and many more devices. It also performs real-time monitoring of the inflow quality, such as for turbidity, the pH scale, and the chemicals needed. When combined with a variable frequency controller which adjusts the revolution of paddles and lift pumps, it carries out significant energy savings and flexible operation of the process.

Secondary Treatment Solution



The aeration process generates dissolved oxygen sufficient for the aerobic microorganisms to exist and dissolves organic particles in the water. The PID frequency control can be adjusted according to the volume of dissolved oxygen in the water, satisfying the living conditions for microorganisms while maximizing the energy savings.

Water Purification Treatment Solution



The water purification treatment automation system is divided into three layers: an information layer, a control layer, and a device layer.

Information Layer

The data obtained onsite are centrally monitored, analyzed, and processed by a distributed control system structure. Key data and status are provided to higher-level signal networks by Delta DVS series industrial network switches. Functions such as device monitoring, data analysis and process recording, distant transmission, and trend reports can be performed with the combination of Delta's high-end touch panel human machine interfaces and the e-Remote and e-Server software.

Control Layer

According to the geographical features and requirements of each process, each control station within this layer is in charge of the signal collection and the operation control of devices. Substations communicate with the main station via protocols such as DeviceNet or CANopen, while each substation can connect multiple slave stations through local or remote extension. Filtration basins and backwashing stations, for example, can be connected to the main control station by local extension or via DeviceNet.

Device Layer

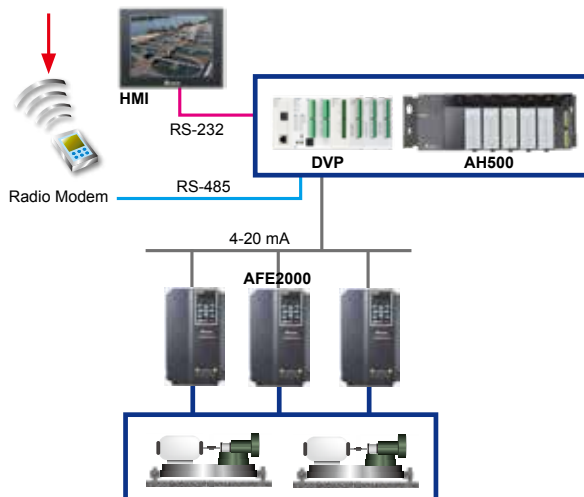
The on-site inflow pumps, outflow pumps, backwash pumps and other devices are connected to Delta's C2000/CP2000 series frequency control drives, PIC series variable frequency control cabinet or other OEM equipment for chlorination or disinfection by fieldbus via high-speed communication protocols, such as DeviceNet or CANopen. The control systems also support a variety of protocols, such as Profibus and Modbus, providing system openness with an easy connection to other smart meters or instruments. Delta's APF series active power filters and SVG series static var generators for power quality management help to secure a clean and stable power supply for water purification treatment.





Benefits of Variable Frequency Operation

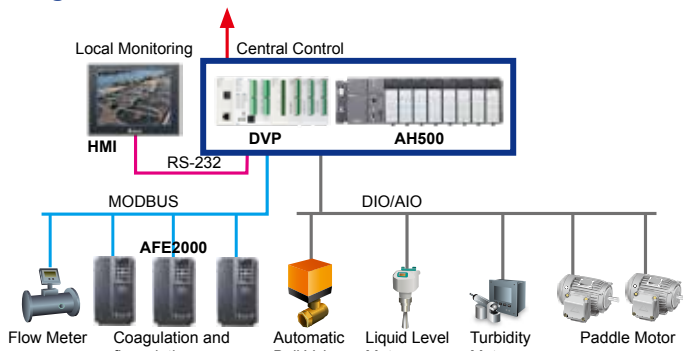
Inflow Pumping Control



The first step for water purification is to stream the flow of water into the water plant through water inlets. For central control and monitoring, the process data is provided to the control center for process oversight. Water inlets can be quite distant from the control center, making data transmission difficult and costly.

By adopting PLCs and Ethernet switches, more effective and economical wireless data transmission is possible. This method can be applied to secondary water pumping stations or other stations/processes that are located in remote places. A number of wireless RTUs constitute a communication network, commonly known as SCADA for distribute data collection and with centralized management control. Delta's C2000/CP2000 series frequency control drives can be applied for flow velocity.

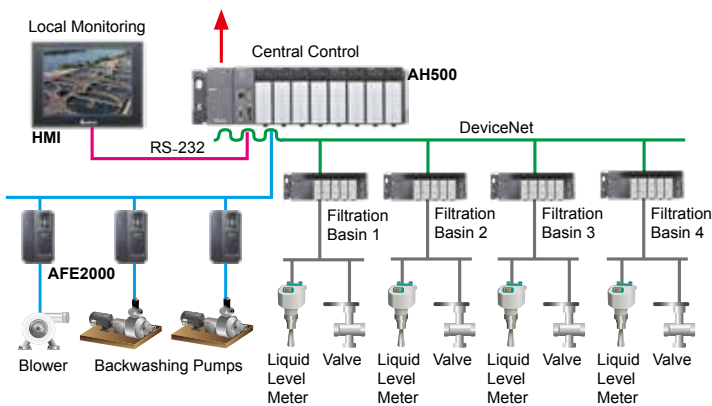
Coagulant and Flocculant Control



Coagulation and flocculation is the key to water purification. It can be controlled by one integrated system that combines inverters, measure pumps, lift pumps, paddles, control valves of various types, and monitoring instruments. Delta's AH500 series PLCs can collect the turbidity signals of the inflow and outflow. Based on the turbidity level and water flow, the AH500 series PLCs can then control the variable frequency of the measuring pumps by the PID auto-tuning function and adjust the amount of coagulants and flocculants used. The parameters and operation of the facilities can be monitored in real-time.

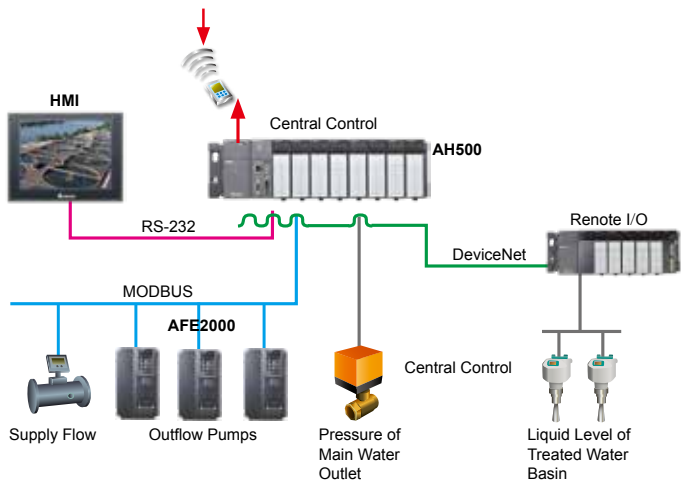


Backwashing Control for Filtration Basin



Filter backwashing plays a key role in the whole water purification process as it is directly relevant to the outflow quality. The traditional manual or semi-manual approach can no longer satisfy today's system requirements for control. Delta's PLCs and inverters can help with the coordination and control of inflow valves, outflow valves, backwashing inlet valves, ventilation valves, and the air distribution systems for the distributed control and central management of the filtration basin.

Outflow Pumping Station/ Secondary Pumping Station



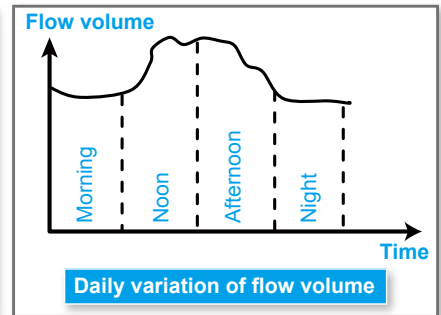
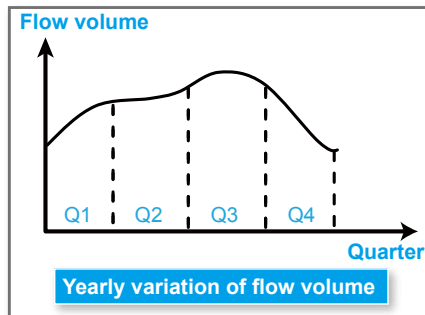
For water supply pumping stations, Delta's automation system provides the AH500 series PLCs for the control of pumping valves, operation of the power distribution system, and the monitoring of power switches. With Delta's Human Machine Interfaces, local monitoring of the water level, water quality, water flow, and power consumption are also possible. Wireless communication (digital transmission or GPRS) is adopted for distant communication among pumping stations and the control center which directs and coordinates the operation of each pumping station. In addition, Delta's C2000/CP2000 control drives help with the flexible adjustment of operating frequency and saving energy. The control systems and the control drives can communicate through protocols such as DeviceNet or Ethernet, for a fully intelligent automation system.



A Perfect Solution

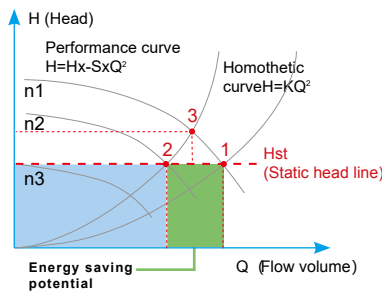
With many years of experience in energy-saving solutions, Delta provides a professional energy-saving solution for the water treatment process as well as facilities such as blowers and water pumps, with precise and actual energy-saving results.

*Traditional blowers with fixed control functions adopted for wastewater treatment systems often lead to over aeration.



By applying variable frequency control drives, the operation frequency of water pumps can be flexibly and effectively controlled according to the real-time change of flow volume, bringing optimized system efficiency and energy savings.

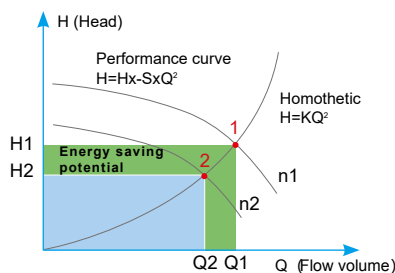
Constant Pressure Water Supply



When variable frequency control is not adopted, the common approach to release the extra pressure is through differential pressure bypass valves. The power generated when the water flows through the bypass valves is wasted energy that can be saved, refer to the green area in the figure where

$P1/P2 = Q1/Q2 \approx n1/n2$.

When the water pumps supply water at constant pressure, the pressure at the supplying end varies from time to time, causing an unstable pressure variation.



Variable Frequency Control Solution for Blowers and Water Pumps

Delta's C2000/CP2000 control drives provide outstanding features and benefits for equipment such as water pumps and blowers, as listed below.

Advantages of variable frequency operation

- ▶ Reduces inrush current for automatic speed adjustment
- ▶ Avoids the impact of starting voltage to grids
- ▶ Protects motors and peripherals for a prolonged lifespan
- ▶ Decreases noise interference to equipment during operation
- ▶ Provides flexibility and precision for equipment control

Benefits of Variable Frequency Operation for Blowers and Water Pumps

- ▶ Improves energy-saving efficiency significantly
- ▶ Reduces the amount of valves needed for simplified pipelines
- ▶ Avoids the water leakage and energy loss caused by the increased pipeline pressure of traditional flow adjustment valves
- ▶ Lowers the pressure caused by the mechanics of blowers, water pumps, pipeline and ventilation channels



Delta provides the PIC series integrated solution of stand-alone variable frequency control cabinets

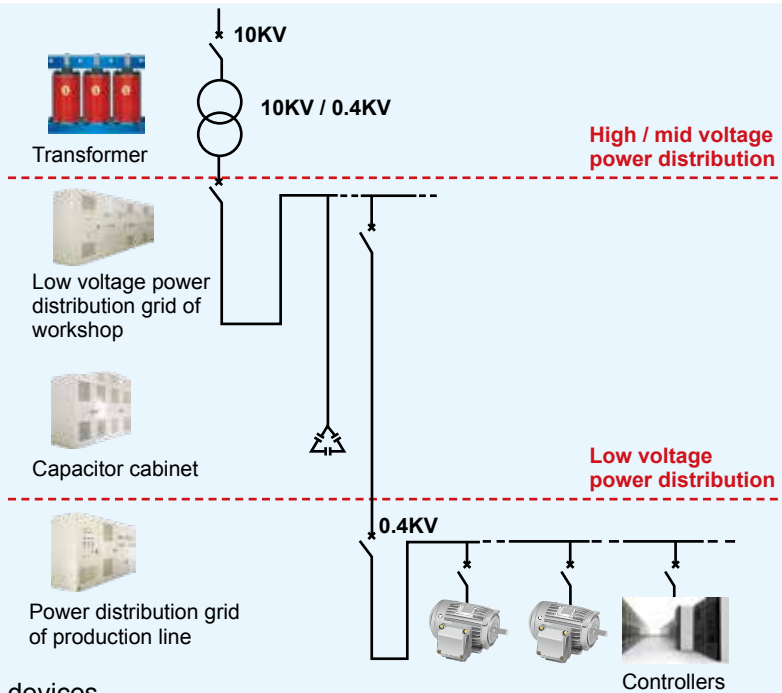
- ▶ Embedded with C2000/CP2000 series control drives
- ▶ Supports multiple communication protocols including MODBUS for easy integration with various building control systems
- ▶ The integrated solution provides clients with a simplified interface and better service



Delta's Power Quality Solution



Building, Server Room, Factory

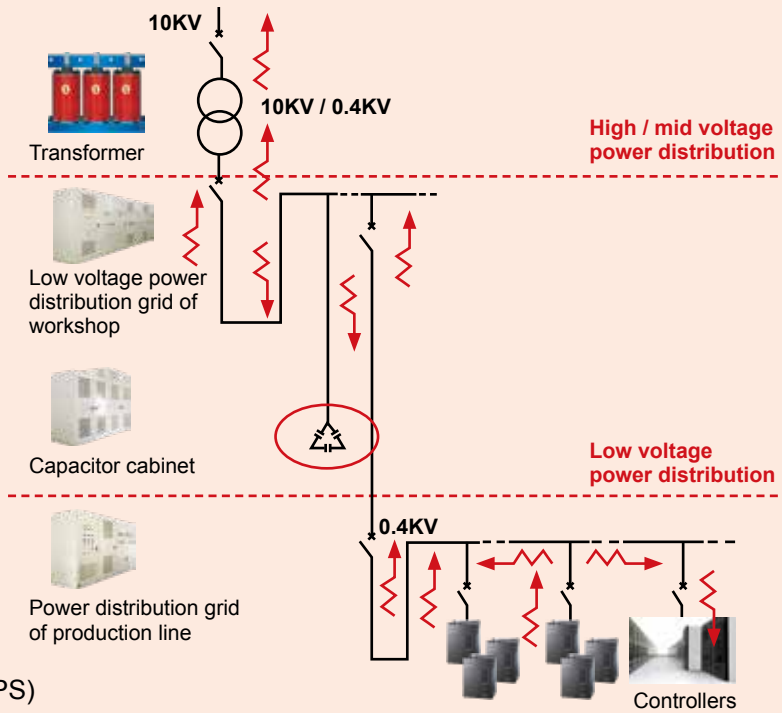


- ▶ Main loads: motors and linear load devices
- ▶ Main power quality problem: static reactive power
- ▶ Solution:

A simple power distribution system using capacitors successfully solves all power quality problems.



Building, Server Room, Factory



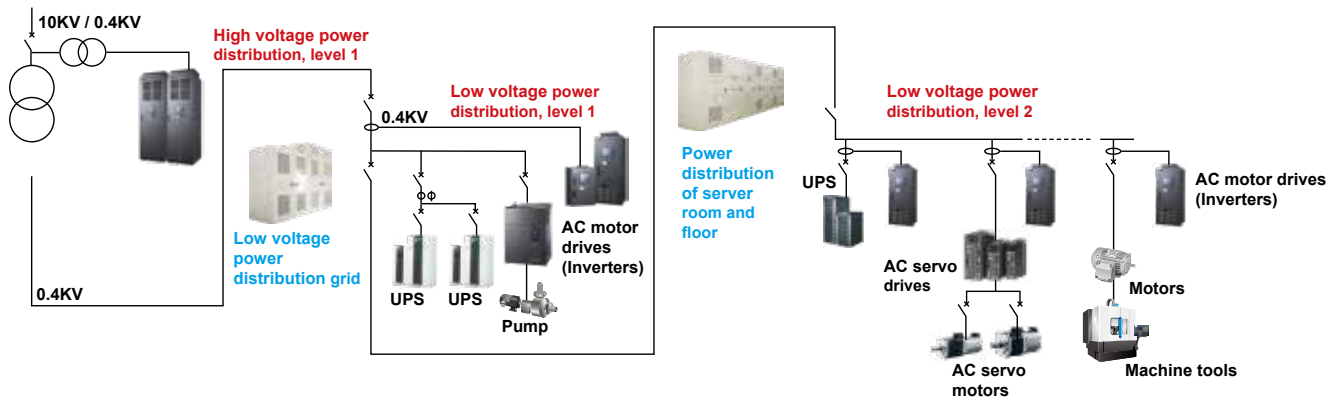
- ▶ Main loads: rectifiers (inverters, UPS)
- ▶ Main power quality problem: harmonics and reactive power
- ▶ Solution:

A more complex power distribution system using capacitors results in new power quality problems.

In the past, the major power quality problem was reactive power which could be solved using compensation capacitor cabinets. With the development of power electronics, a great number of non-linear loads caused by inverters, UPSs, switching power and many other devices, lead to massive harmonics of the power grids. For today's power quality problems, compensation capacitor cabinets are no longer a sufficient solution as they can generate more problems including harmonic distortion, resonance, and eventually, system malfunction.

Delta's APF2000 series active power filters and SVG2000 series static var generators can effectively solve today's power quality problems.

System Structure

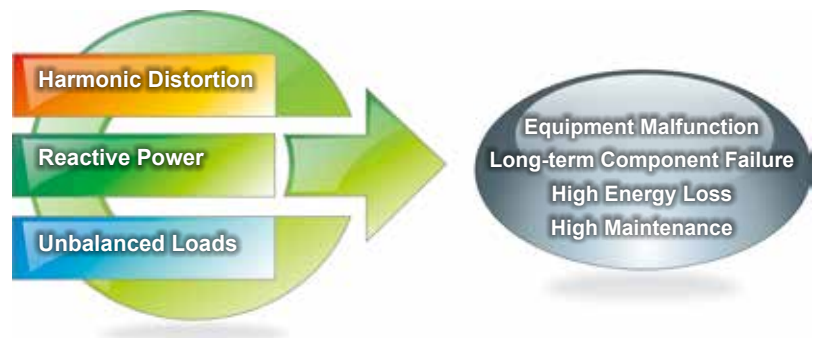


Active Power Filters - AFE2000 Series

Solutions	High voltage centralized control	Low voltage centralized control	Group control	Individual control
Location	Input side of transformer	Output side of transformer	At different districts or different floors	Install before any device that causes interference
Product	APF2000	APF2000	APF2000	APF2000
Performance	THDI<5% THDU<3% Power factor> 0.96	THDI<5% THDU<3% Power factor> 0.96	THDI<5% THDU<3% Power factor> 0.96	THDI<5% THDU<3% Power factor> 0.96

Static Var Generators - SVG2000 Series

- ▶ Provides reactive power and harmonics compensation to private low voltage distribution system
- ▶ Available with large capacity
- ▶ Reactive power compensation and filters up to 13th order harmonics
- ▶ Provides dynamic and precise compensation to leading & lagging reactive power
- ▶ Replaces or complements the capacitor cabinet



General Field Oriented Control Drive C2000 Series Intelligent Sensorless Vector Control Drive CP2000 Series



With our strong position in the industrial automation market, Delta's own brand AC Motor Drives have evolved rapidly. Each Drive series is designed to meet specific application needs. Our AC Motor Drives accurately control speed and torque, smoothly handle an increased load, and provide numerous custom control and configuration operating modes. Our AC Motor Drive product line provides a full range of motor control technologies and is used throughout a wide range of industries, to enhance and improve machine automation.

Industrial Ethernet Switch IES Series



Delta's Industrial Ethernet Switches feature enhanced hardware design, a user-friendly software interface, packet protection and compatibility with multiple industrial communication standards. With the advantages of high speed, high stability and high compatibility, Delta's Industrial Ethernet Switches help customers construct an industrial Ethernet system that will satisfy their requirements in a wide range of applications. All of Delta's Ethernet products are certified to UL, CE and FCC standards.

Programmable Logic Controller DVP Series and AH500 Series



Delta's Programmable Logic Controllers (PLCs) offer high-speed, stable and highly reliable applications in all kinds of industrial automation machines. In addition to fast logic operation, bountiful instructions and multiple function cards, Delta's cost-effective PLCs also support various communication protocols. Delta's line of industrial products offer a complete "Delta Total Solution" in the field of industrial automation control.

Human Machine Interface DOP Series



Delta's DOP series Human Machine Interface (HMI) provides various touch screens with multiple dimensions and colors. It also offers fast and convenient control functions for industrial automation machines. In addition, Delta Windows-based and user-friendly DOPSoft Screen Editor and Programming Software can configure the whole DOP Series. With DOPSoft, users can quickly edit images and graphs and easily set suitable communication protocols. Many applications can be created, edited, downloaded and uploaded.

Power Quality Solution

In today's metallurgy industry, people are demanding more reliable and stable power supplies with better quality. Power quality has become a key factor for power efficiency. To solve new power quality problems generated at metal production sites, buildings and server rooms, Delta has launched innovative new power quality solution to efficiently solve power quality problems and enhance the operation of metal plants with more efficient production and greater convenience. Delta's Power Quality Solution can gradually replace traditional capacitors to overcome the problems of voltage or current distortion, reactive power impact, and unbalanced loads.



Active Front End
AFE2000 Series



Active Power Filter
APF2000 Series



Static Var Generator
SVG2000 Series



Temperature Controller DT Series



Delta's DT series Temperature Controllers have fast output response, accurate PID parameter auto-tuning, support the MODBUS communication protocol and have various built-in output types, allowing different systems to quickly reach a stable control status. All series comply with international installation dimensions and CE, UL international safety approvals.

Industrial Fieldbus Solutions



Delta has developed numerous communication modules and solutions, which can be integrated into various combinations to meet the demands of complex and harsh industrial sites. These solutions offer high speed as well as stable and highly cost-effective choices for small to large system applications. For industrial automation applications of drive, motion and control, we provide general MODBUS RS-232, RS-422 and RS-485 serial communication modules, and offer advanced CANopen, DeviceNet, Ethernet, EtherNet/IP and PROFIBUS fieldbus solutions.

Industrial Power Supplies



The latest offering from Delta Electronics include the new DVP series, CliQ series, CliQII series, PMC series, and PMT series highly efficient and stable industrial power supplies. These products offer a nominal output voltage of 48V / 24V / 12V / 5V, a wide temperature range from -20°C to +75°C and a minimum holdup time of 20ms. The state-of-the-art design is made to withstand harsh industrial environments. The rugged, ultra-compact case material is shock and vibration resistant according to IEC 60068-2. The power supplies provide overvoltage, overload and thermal protection. The wide input voltage ranges from 85 to 264VAC (1 phase) and 320 ~ 575VAC (3 phase), and the multiple terminals are for fast wiring and easy installation.



Smarter. Greener. Together.

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