



Automation for a Changing World

Delta Transportation Automation Solution

www.deltaww.com

 **DELTA**
Smarter. Greener. Together.



Smarter. Greener. Together.

Who We Are

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

- Global power and thermal solution provider for Apple, IBM, HP, Lenovo and more; No.1 in Switching Power Supply since 2002, DC Fans since 2006.
- Leading telecom power system provider for telecom carrier in Europe, Americas, Asia and emerging markets; Long term partnership with Vodafone, Orange, China Mobile, Telefonica and more.
- Leading brand in industrial automation application, factory, process, machine and robot; specific solutions for textile, packaging, machine tools and more.

About Delta Industrial Automation

Since the launch of our first AC motor drive in 1995, the Delta industrial Automation Business Group (IABG) has focused in automation technology with quality, reliability and precision to realize our promise of "Automation for a Changing World". We provide innovative automation products that include AC motor drives, power quality improvement devices, sensors, and control and motion devices. With enhanced integration and industrial network development, our industrial automation solutions find application in a broad range of machinery, including: metal processing machines used in the food industry, textile industry, chemical industry, electronics industry, plastic industry and more; automation equipment used in the pharmaceutical industry and printing industry; 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 automation solutions and rapid global service, we help make the world "Smarter. Greener. Together." with our partners and customers.

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Overview of the Transportation Industry

Transportation and communication play an important role in the economy, government policies, our livelihoods, and our daily lives. Delta has been dedicated to transportation automation technologies for many years, and its automation system and solutions have been successfully applied to airports, railroads, harbors, highways and urban public transportation nets in China. With the growing popularity of transportation system informatization in cities, Delta provides best solutions for the power systems of four main transportation industries, creating a safe and reliable transportation experience for all.

Harbor Crane Solution

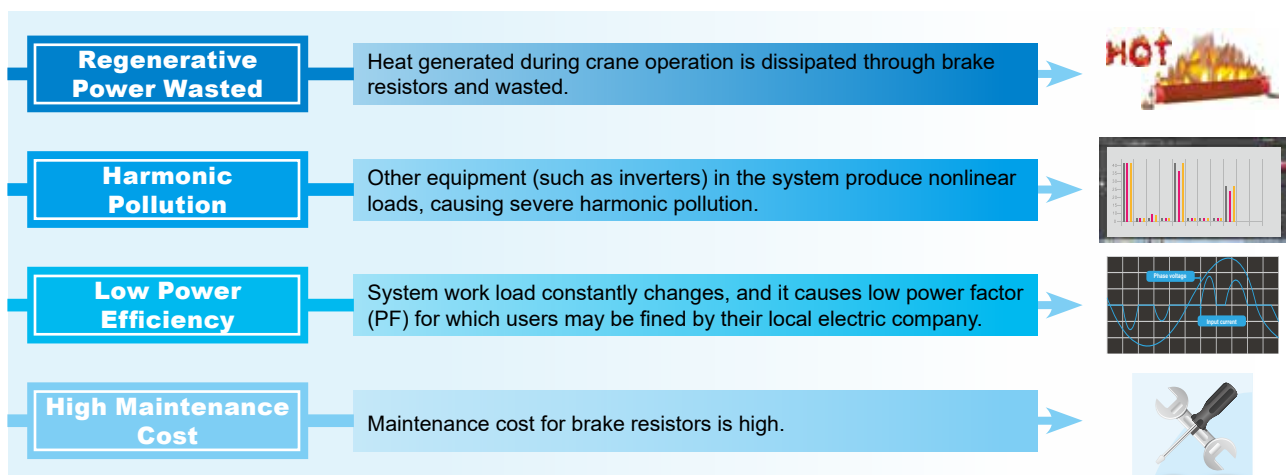
Delta offers energy-saving harbor crane solutions that are ideal for harbor transportation, especially the popular rubber tyred gantry crane (RTG crane) and gantry crane.



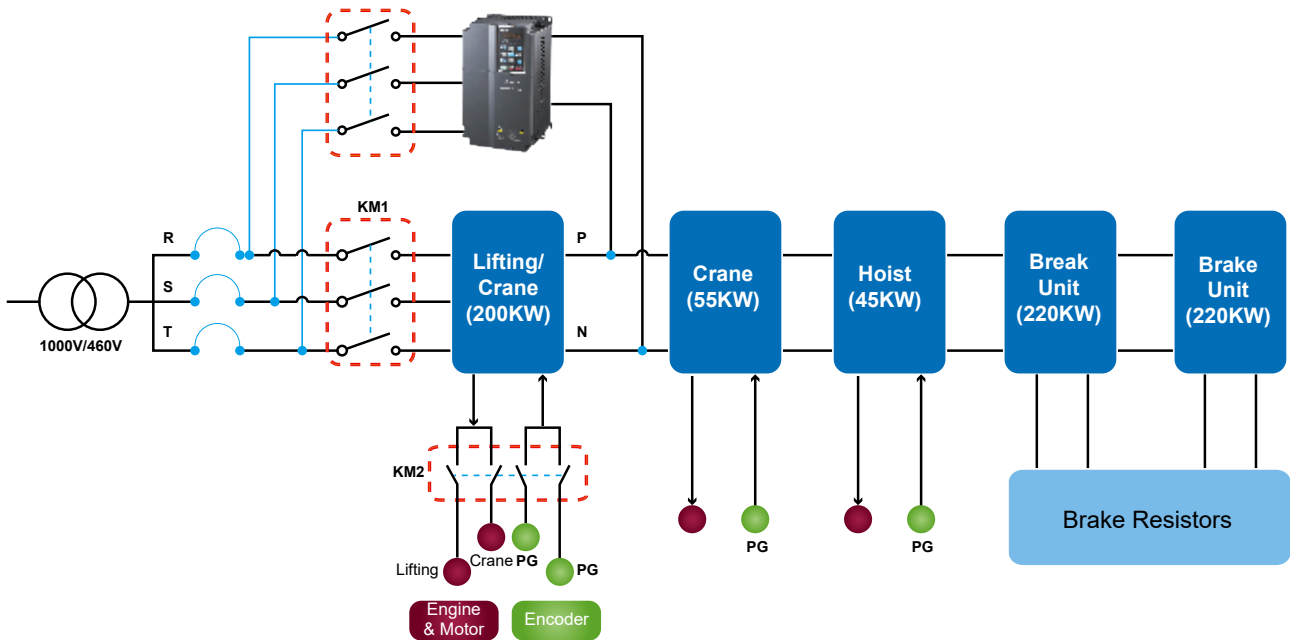
Traditional Rubber Tyred Gantry Crane (RTG Crane) System

Traditionally, diesel generators have provided the power for RTG cranes. Diesel generators offer flexible operation, but have several major issues: low power conversion efficiency, high power consumption, high cost, as well as severe pollution, noise and vibration.

With the trend toward environmental protection, energy saving, and CO₂ emission reduction and faced with high oil prices, many RTG crane users have started to look for more power efficient solutions or to modify their current RTG crane systems. They often replace diesel power with electric power to address the issues of current RTG crane systems; however, without an active front end, the new electrical RTG crane systems still have several major problems.



Delta's RTG Crane Solution

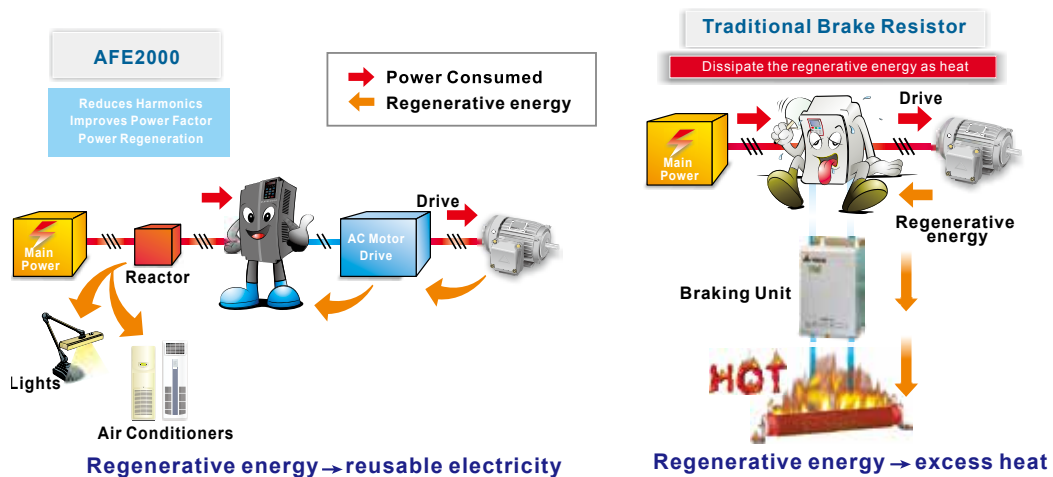


Delta Industrial Automation adopts Delta's AFE2000 Series active front end for RTG crane systems to improve the power factor (PF) while collecting regenerative power. In the original system, power is provided to the DC BUS through the power factor correction rectifier. Delta's solution adds an AFE2000 Series to the original system. The AFE2000 Series conducts a self-diagnosis every time the system starts operation. If the diagnosis result is normal, it automatically transfers power to the DC BUS via the AFE2000 Series instead of the power factor correction rectifier.

During RTG crane system operation, the AFE2000 Series will detect and transform the heat generated into power, conduct reactive power compensation and then return the regenerated power to the grid system for reuse. This is how it replaces a brake resistor. When the AFE2000 needs troubleshooting or maintenance, it sends commands for the system to operate in the original way with power provided to the DC BUS through the power factor correction rectifier, assuring normal and safe system operation.

Features and Advantages

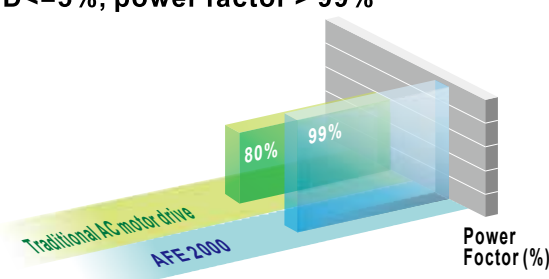
- Replace traditional brake resistors with the AFE2000 to convert regenerative energy (excess heat) into reusable electricity.



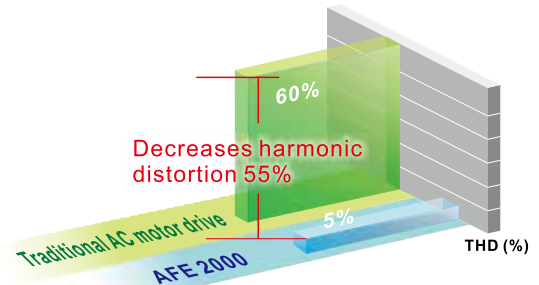
Features and Advantages

- Improves power factor and decreases harmonic distortion.

- THD ≤ 5%, power factor > 99%

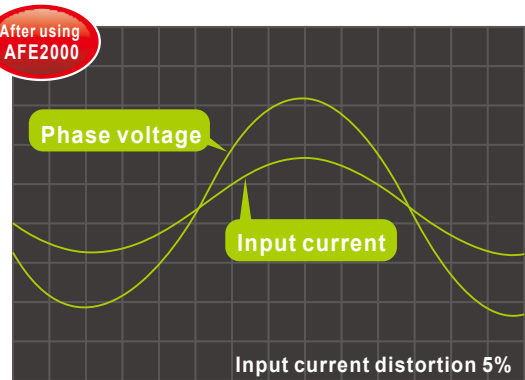
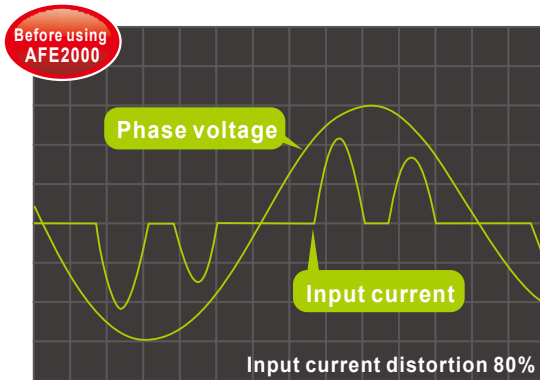


Improves power factor 20%



Decreases harmonic distortion 55%

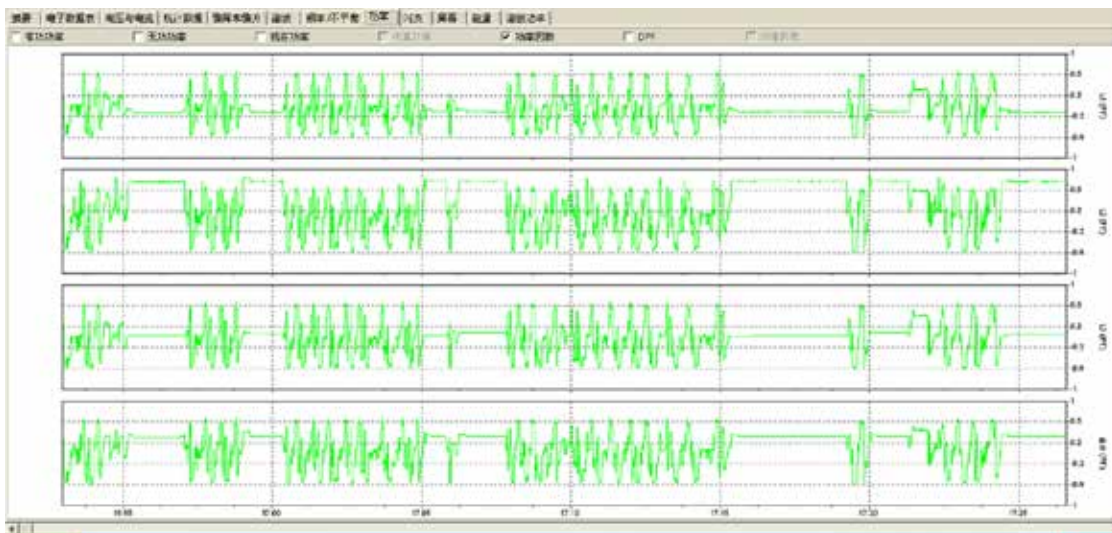
- Improve power factor, lower harmonic distortion, and decrease energy consumption to reduce energy costs and protect the environment.



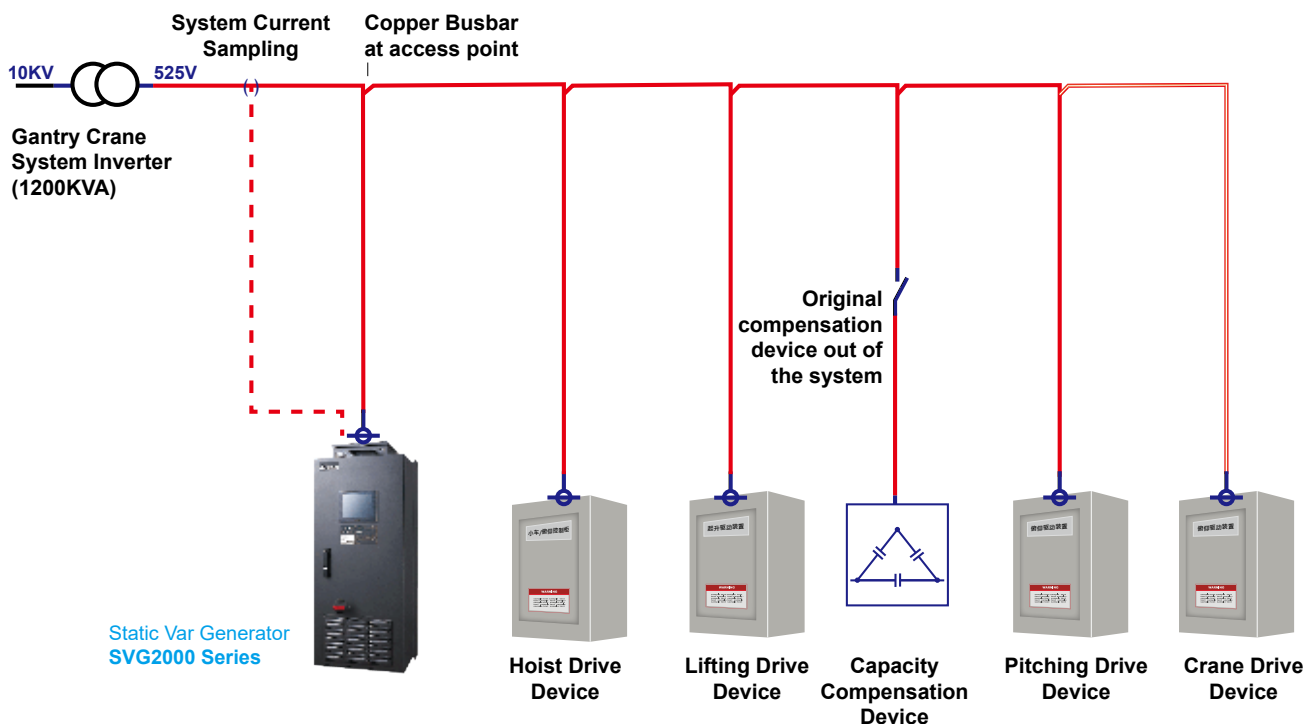
	Delta	Feature	Other Brand	Feature
Cabinet Material	SUS304 (Stainless steel)	Harder and stronger 4 times more expensive than SPCC No rust when cabinet paint wears off	SPCC	Normal hardness Rust occurs when cabinet paint wears off
Cabinet Surface	Wire-drawing	Paint wears off rarely	Unprocessed	Paint wears off easily
Paint	Light	Highly reflective Low heat absorbing	Light or dark	
Supportive Component	SGLCC		SGLCC	

Traditional Gantry Crane System

For traditional gantry crane systems, the operation speed of the cranes and hoists changes rapidly and constantly, and so does the power usage. Unstable electricity causes a large amount of harmonics, resulting in severe damage to the reactive compensation capacity. Once the reactive compensation capacity is damaged, it may fail to compensate current normally, and power voltage may fluctuate severely as well. With unstable power and harmonic pollution, the gantry crane system can easily breakdown, threatening the power system and safety of the harbor.



Delta's Gantry Crane Solution



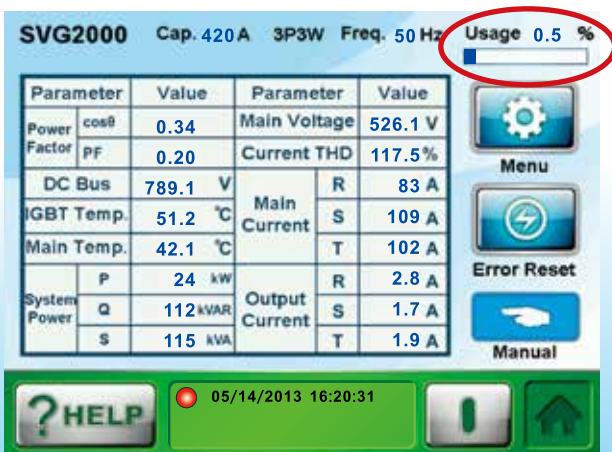
Delta's gantry crane solution adopts Delta's SVG2000 Series static var generator to perform highly efficient power compensation and to decrease harmonics. The SVG2000 Series is able to effectively solve power issues and increase the stability and safety of the gantry crane system.

Features and Advantages



- ▶ Improves power quality and power factor (PF) to 0.99
- ▶ Suppresses voltage fluctuation
- ▶ Reduces total harmonic distortion (THD) to $\leq 5\%$
- ▶ Prolongs system durability to over 10 years

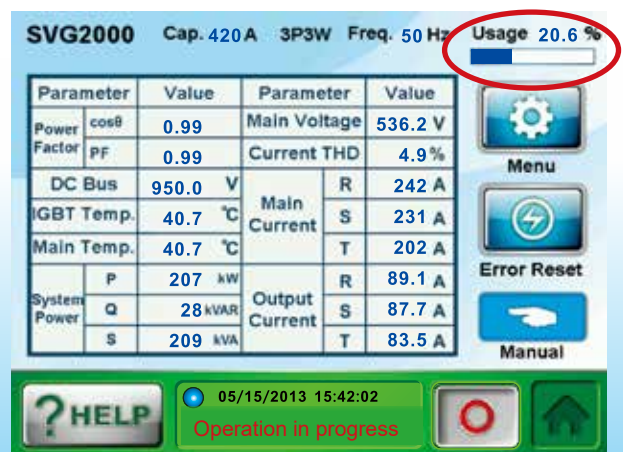
Original System without SVG2000



PF: 0.2 Series Current THD: 117.5%

- ❑ Low Power Efficiency
- ❑ High Power Consumption
- ❑ Severe Harmonic Pollution

Delta's Solution with SVG2000 Series



PF: 0.99 Current THD: 4.9%

- High Power Efficiency
- Low Power Consumption
- Low Harmonic Pollution

Smart Traffic Control Solution

Delta offers innovative smart traffic control solutions for fulfilling the requirements of a smart city. A smart city is the archetype for a smart earth. It represents today's innovative urban development affecting city management, social development, living environment, public connections, daily operations, livelihood, entertainment and social activities. Smart traffic control is an important aspect of a smart city, which also extends to cyber city, digital city or U-city developed using internet information. The application of smart traffic control can be closely and innovatively combined with people's behavior patterns, habits, economic growth, policies, laws, and more.



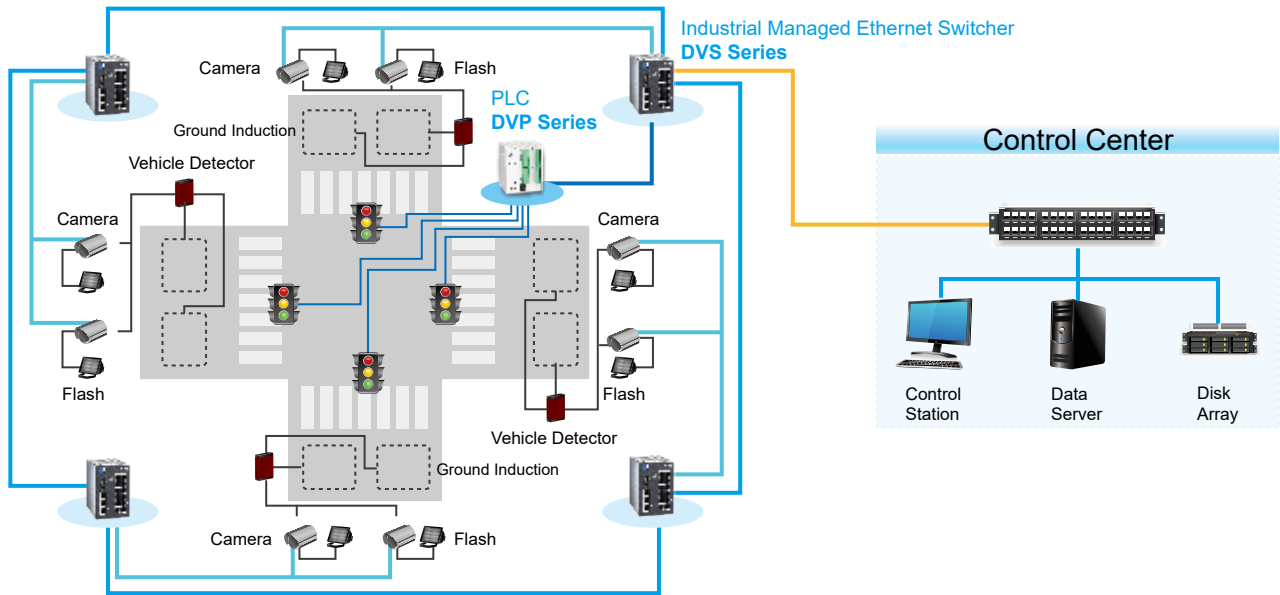
Requirements for Smart Traffic Control

To assure the smooth operation of smart traffic control, the solution system and equipment require:

- ▶ High reliability
- ▶ Alarm functions with intelligent system monitoring to avoid system damage
- ▶ Effective management for users to easily master the operation of industrial Ethernet connections
- ▶ Rapid system reconnection after interruption for equipment safety and normal operation

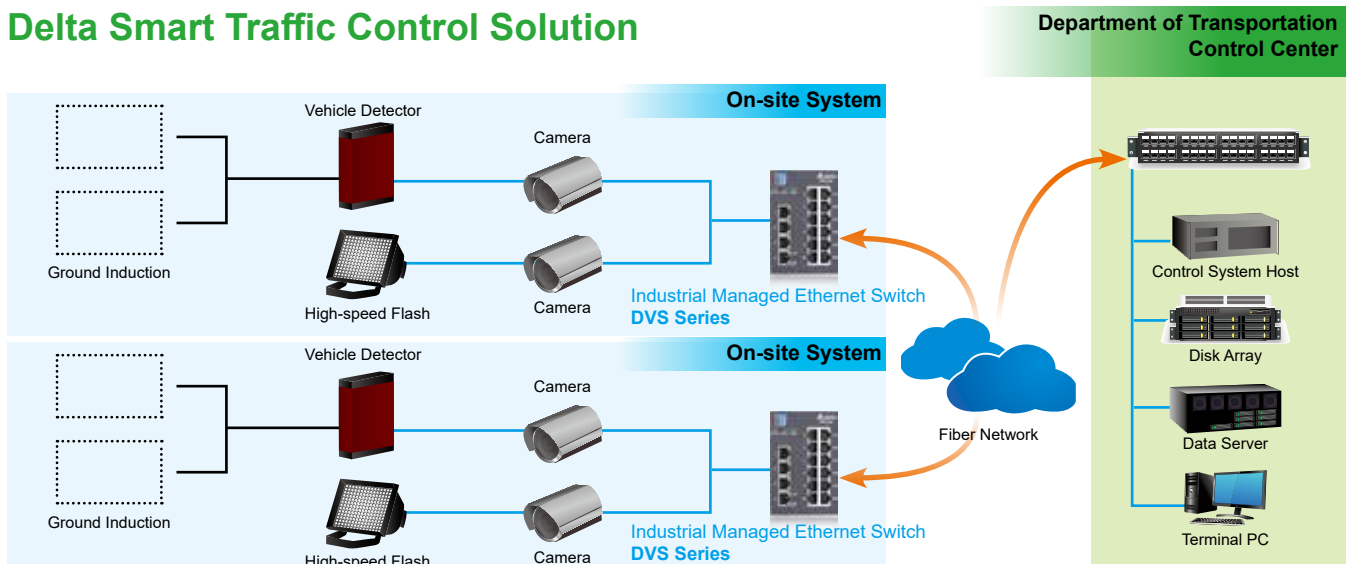
Smart traffic control systems and equipment find application in harsh environmental conditions, such as hot, cold or dusty locations with electromagnetic interference, lightning, static electricity, vibration, or impact. As a result, it requires automation solutions and communication devices with high reliability and safety, such as automatic fault alarms, automatic trouble shooting devices, backup power supplies, and more.

Delta's Red Light Drive-through Detection and Photo-shooting Solution



Delta's red light drive-through detection and photo-shooting solution sets four Delta DVS Series managed industrial Ethernet switches, with each connected to the camera in opposite directions. Through a ring network structure, four managed industrial Ethernet switches are connected. When the vehicle detector triggers ground induction and a camera to capture a vehicle's information going through a red light, the industrial Ethernet switch uploads the data to a control center through optical fiber via a built-in Gigabit fiber port. This ring network structure is based on a Gigabit internet with transmission speed ten times faster than the standard internet. It does not require a fiber transceiver and needs much fewer network nodes than traditional systems. The simple structure of Delta's solution successfully reduces system defaults.

Delta Smart Traffic Control Solution



With a double star network structure, Delta's smart traffic control solution adopts DVS Series managed industrial Ethernet switches for an onsite system to send out violation signals to cameras for photo shooting through an embedded-controller. The captured photos and information are transferred to the control center, and the server identifies the vehicle's identity. The double star network structure easily supports extension, and with the DVS Series' built-in fiber ports, the traffic control system has strong anti-interference ability to solve system issues caused by multiple fiber network nodes. The high operation temperature toleration and back-up power design of the DVS Series can greatly enhance system reliability and safety, forming a complete traffic control solution

Tunnel Control Solution

Taiwan is a narrow and mountainous island, where many highways, roads, and railways must go through tunnels. Currently there are more than 300 tunnels with a total length of around 150 km in Taiwan. In general, tunnels over 1 km in length require a control system for ventilation, lighting, monitoring, traffic signs, fire alarms, closed-loop surveillance systems, emergency telephones and radio, and power control to assure safe and smooth traffic in the tunnel.



Requirements for Tunnel Control

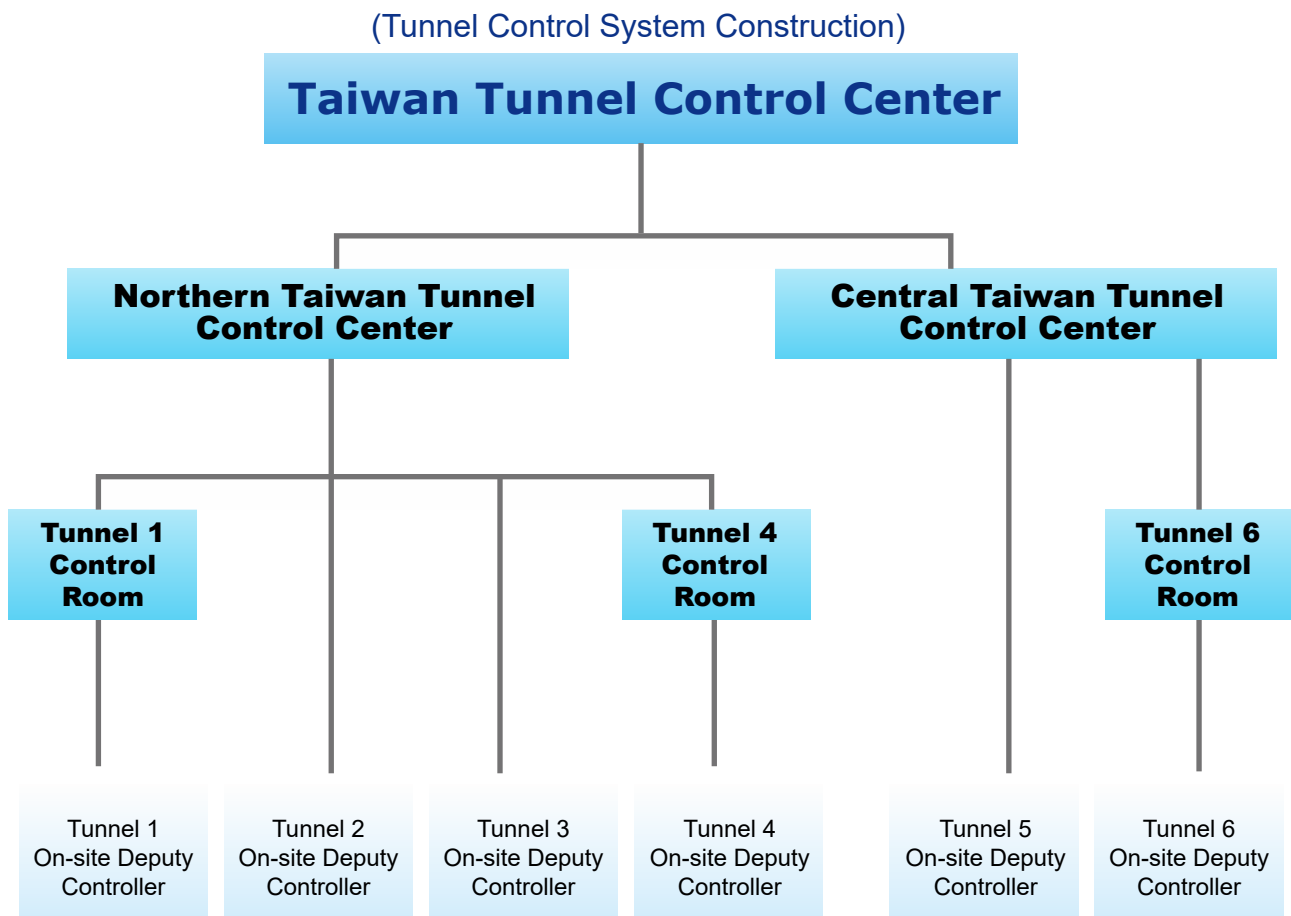
Electromechanical control for each tunnel is divided into three layers: the top layer is the main controller in the control center, the middle layer is the deputy controller in the tunnel, and the bottom layer is the detection devices. The controllers in the control center and tunnel must be connected to all the detection devices distributed in the tunnel, so there are high requirements for internet communication, which include:

- ▶ High-speed communication that guarantees mass data transportation
- ▶ Fault tolerance for high communication reliability

If the tunnel control system adopts a programmable logic controller (PLC) as its control core, the PLC requires:

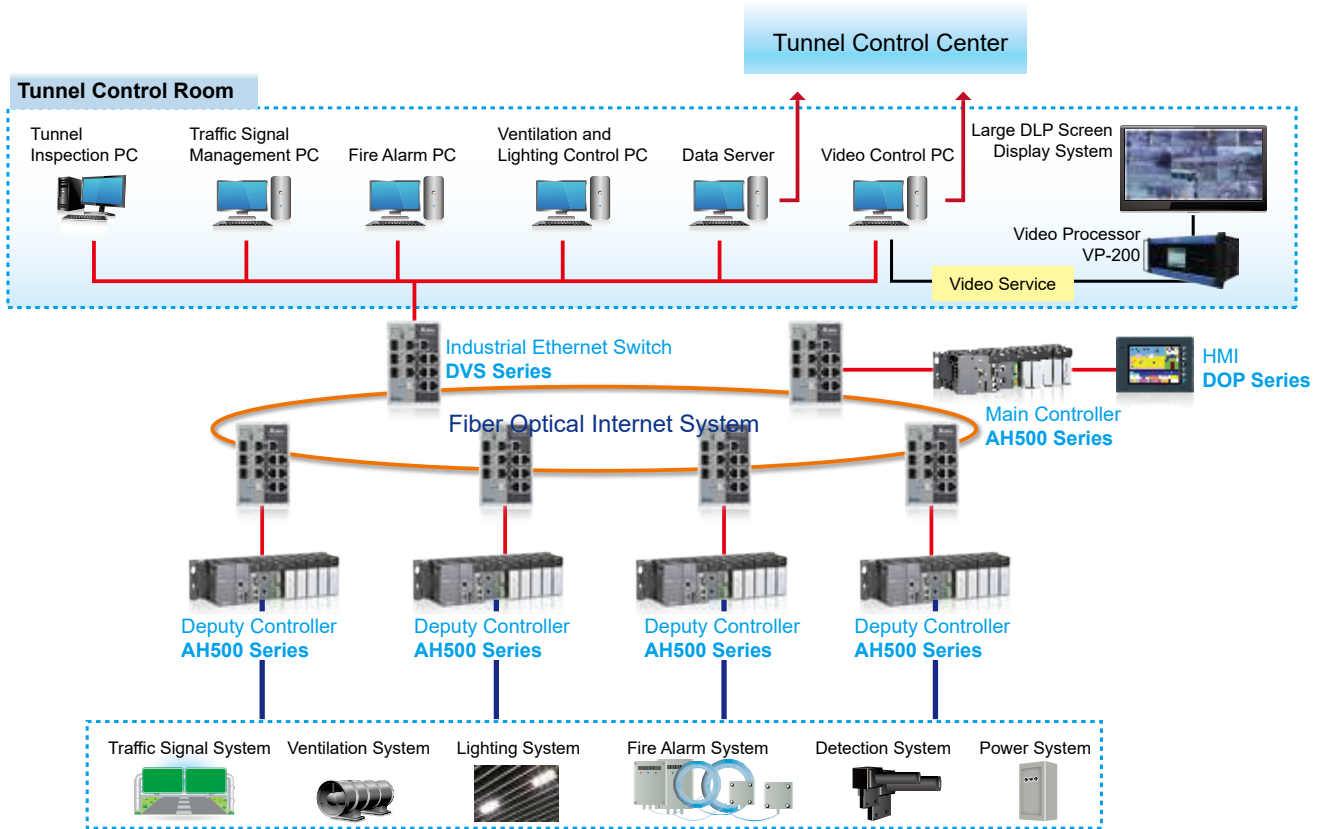
- ▶ Stability and reliability
- ▶ Data processing capability and fault protection
- ▶ Local processing capability for deputy controllers to avoid operation interference during a main controller breakdown
- ▶ Data exchange between deputy controllers
- ▶ Internet communication
- ▶ Fault tolerance and self-diagnosis functions
- ▶ Touch panel

Delta's Tunnel Control Solution



Delta's tunnel control solution adopts Delta's AH500 Series PLC for the deputy controllers in tunnels. Delta sets an AH500 Series every 400 meters in each tunnel to monitor on-site equipment and traffic signals through wire or RS232/480. The monitoring data is transferred to the main controller, which uses an AH500 Series with human machine interface in the control room through a fiber optic internet system composed of MODBUS TCP industrial Ethernet. The data is analyzed and commands are sent out to deputy controllers for tunnel control.

- ▶ **On-site equipment:** ventilation, lighting, traffic signals, traffic information panels, CO/VI sensors, light intensity detectors, wind speed/direction sensors, vehicle detectors and more.
- ▶ **On-site deputy control:** adopts Delta's AH500 Series that are connected to all control rooms and centers with a fiber optic internet system composed of MODBUS TCP industrial Ethernet
- ▶ **Control Center:** includes dual hot standby server, communication computer and monitoring computer
- ▶ **Internet management:** composed of on-line monitoring data center server and terminal computer to upload and release data on the website



Features and Advantages

- ▶ Adopts Delta's middle-ranged AH500 Series PLC with dual-core multi-tasking processing and high reliability
- ▶ Supports extension and multiple communication, includes Ethernet, RS-232/485/422, PROFIBUS, and DeviceNet
- ▶ Improved maintainability: Hot-swapping function keeps the system running



Railway Transportation Control Solution

The development and distribution of transportation networks deeply affects overall city construction and development, which impacts our daily lives. Delta continues to develop more innovative and advanced railway transportation control solutions.

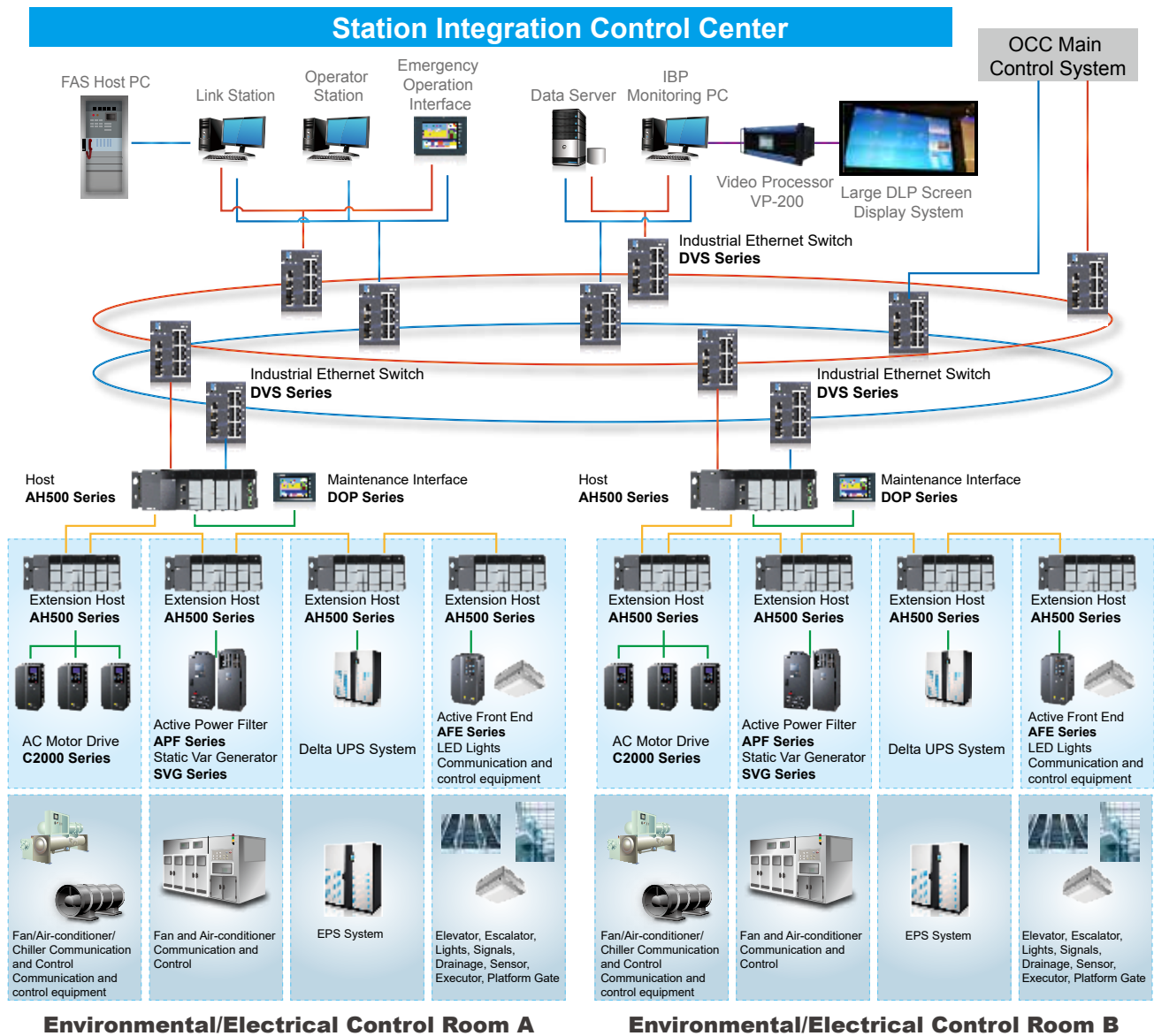


Requirements for Railway Transportation Control

- ▶ Brake Assist System (BAS) with a reaction time in station ≤ 1 second
- ▶ Mean Time between Failure (MTBF) of each device in the BAS ≥ 50000 hours
- ▶ Mean Time to Repair (MTTR) of the BAS ≤ 30 minutes
- ▶ BAS remains in normal operation with signal failure
- ▶ BAS has an anti-electromagnetic interference function and complies with the relevant standards and specifications
- ▶ The system automatically restarts and resumes operation within 2 minutes after a power interruption
- ▶ Adopts internationally accepted open network communication
- ▶ Control equipment with input port for fast and convenient wiring supports program upload/download, system diagnosis, and data collection without affecting data transmission; no need for complex editing program or software/hardware

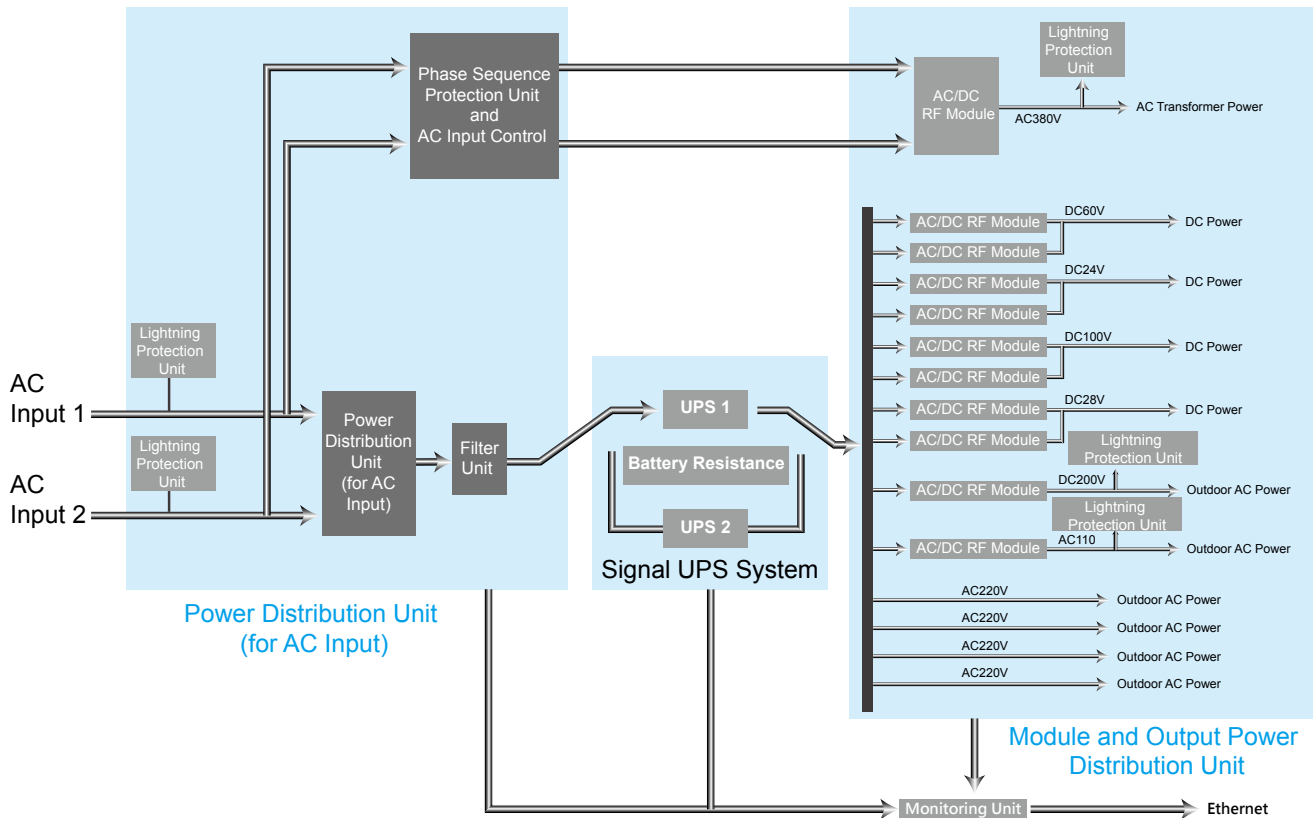
Delta's Railway Transportation Control Solution

The railway transportation environment and equipment surveillance control system mainly covers environment regulation and device control for stations, parking lots, cars, temporary monitoring centers, and all devices in tunnels such as for ventilation, air-conditioning, drainage, lights, as well as emergency rescue facilities such as a smoke detection system, emergency lighting system, and more. If an accidental fire occurs in an underground railway station, the emergency protection system ensures the safety of passengers. Delta's railway transportation control solution performs real-time monitoring and control to assure operation and passenger safety.



Delta's railway transportation control solution adopts Delta's DVS Series industrial Ethernet switch to build the local area network (LAN) for the Brake Assist System (BAS). Delta sets two DVS Series with built-in optical fiber port in the station integration control center and environmental/electrical control room A/B and builds an optical fiber network among six DVS Series to connect a PLC and integrated substation control system (ISCS). The PLC collects and uploads data to the ISCS, integrating the BAS and ISCS. Delta's railway transportation control solution sets a dual BUS between environmental/electrical control rooms A and B to connect various remote I/O, smart communication devices, such as a small traffic signal system controller, and small on-site controllers for operation monitoring and management.

Delta's Railway Transportation Uninterrupted Power Supply (UPS) Solution




To ensure high-speed railway traffic safety, Delta adopts two NT Series UPSs, especially designed for public transportation signals, to provide series power supply and backup power according to different operations. For railway stations with on-duty maintenance staff, Delta's UPS provides backup power for around 30 minutes; for those without on-duty maintenance staff, the UPS provides backup power for around 2 hours.

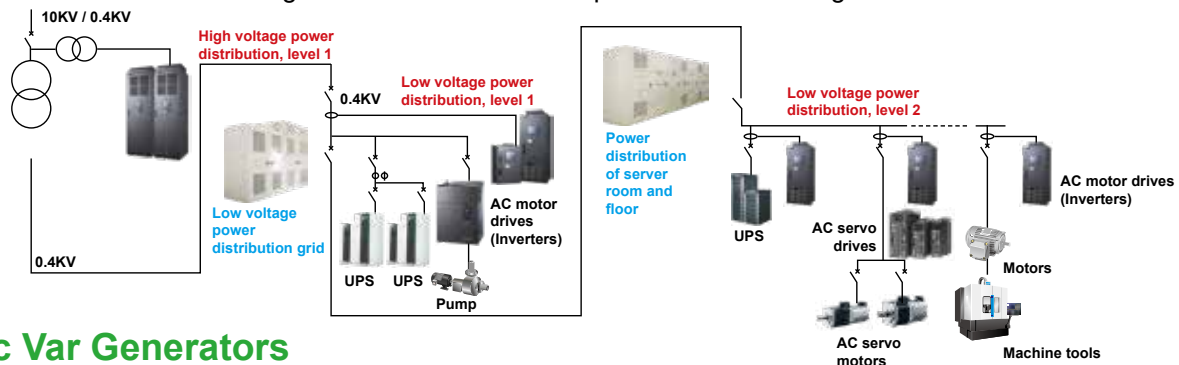
Features and Advantages

- ▶ Two UPSs share the backup power of two batteries to reduce installation space and improve battery utilization
- ▶ Delta's NT Series UPS is equipped with a standard dual-loop input to raise system reliability: MTBF >300,000 hours and reliability >99.99% (standard power supply) / 99.999% (series power supply)
- ▶ Smart battery management functions effectively extend battery life and improve system operation safety
- ▶ Fans with wind speed control reduce power consumption and operation cost, improve system reliability and effectiveness, lower noise, and extend fan life
- ▶ UPSs equipped with the standard output isolation transformer have strong overload capacity and impact resistance to isolate and avoid harmonic interference, reducing zero voltage and providing stable, reliable and clean power

Delta's Railway Transportation Power Quality Improvement Solution

Background	Load	Power Quality Issues	Existing Risks in System
 <p>With railway travel growing more popular everyday, better railway power quality has become an important issue. A major issue of railway travel is system loads are heavy during the day and current is an inductive load, while system loads at night are light and current is a lagging load.</p>	Traction Rectifier Transformer	Adopts 24-pulse rectifier transformer, causing 23 or 25 pulse harmonic in 35KV (higher than standard)	<ul style="list-style-type: none"> • Low system power factor (PF) for which users may be fined by local electric company • Harmonics cause LED screen blinking and breakdown and TV screen jitter • Neutral current overload resulting in electrical fires • Large amounts of harmonics in the system causing skin effects and serious temperature rises • High harmonic voltage can damage electromechanical and electronic devices • Harmonics interfere with weak power systems and signal transmission, affecting normal operation of terminal devices
	LED and Fluorescent lighting	Current distortion rate up to 80% (inductive load) and low PF (0.5-0.8), causing phase imbalance	
	Signal and Communication UPS and Power Supplies /Switching Power Supplies	Low power factor (Current distortion rate up to 30%)	
	Fans and Water Pumps (Inverter Control)	Large electric power and high absolute harmonic current (Current distortion rate about 30%)	
	Large LED Screens and Vending Machine Power	Large LED screens are easily affected by harmonic interference, causing screen blinking and breakdown (Current distortion rate up to 30%)	
Escalators and Elevators (Inverter Control)	Current distortion rate up to 30%		
		Low power factor (PF) for which users may be fined by local electric company	

Delta's railway transportation power quality improvement solution adopts the AFP2000 Series active power filter and SVG2000 Series static var generator to solve current power issues of the grid.



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

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

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.

Global Operations

ASIA (Taiwan)



Taoyuan Technology Center (Green Building)



Taoyuan Plant 1



Tainan Plant (Diamond-rated Green Building)

ASIA (China)



Wujiang Plant 3



Shanghai Office



ASIA (Japan)



Tokyo Office

ASIA (India)



Rudrapur Plant
(Green Building)

EUROPE



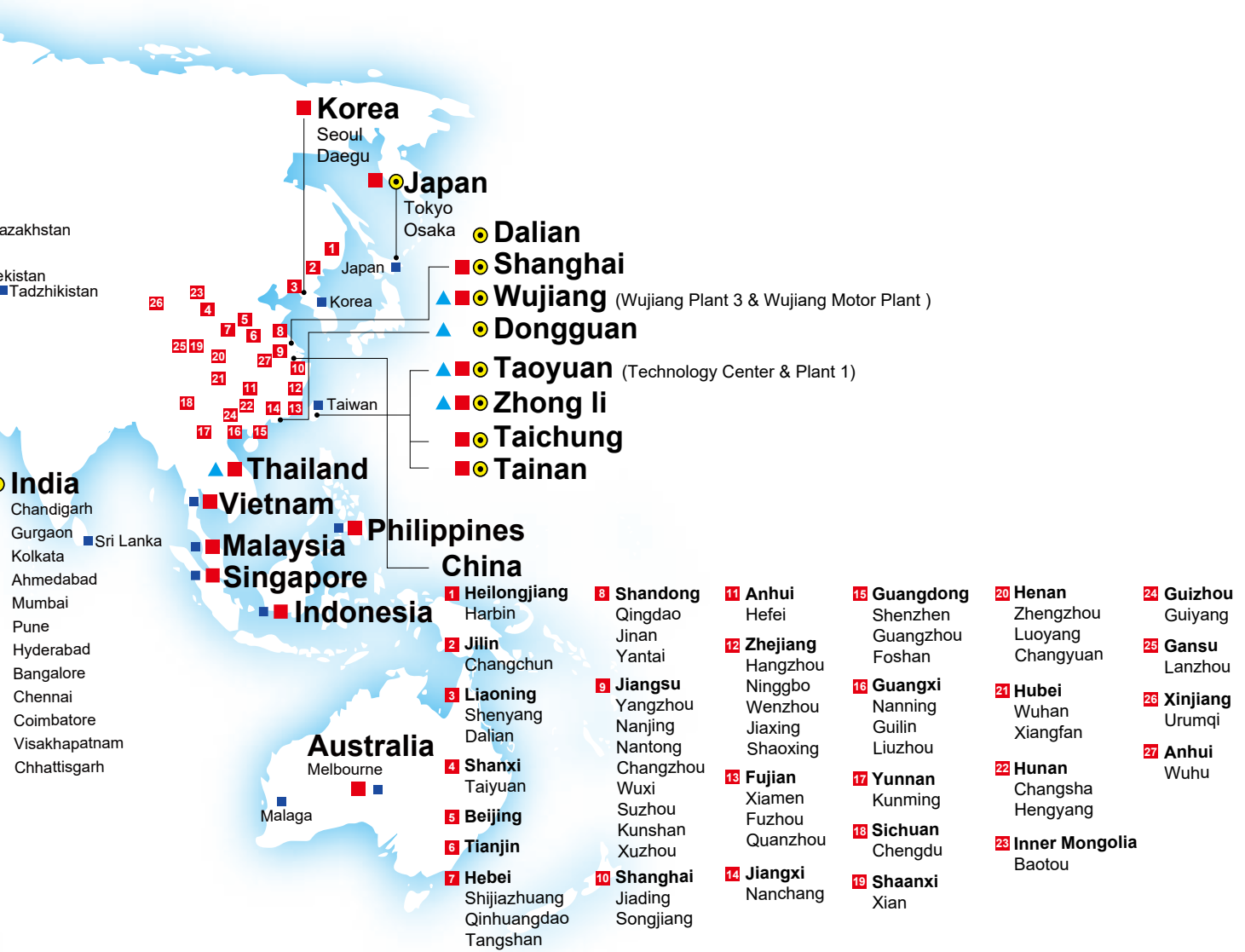
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AMERICA



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▲ 6 Factories ■ 117 Branch Offices ● 13 R&D Centers ■ 915 Distributors





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