ToyoDenki

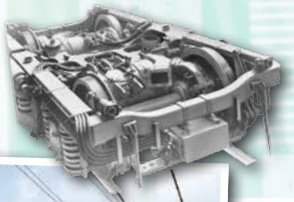
TOYO DENKI SEIZO'S TRACTION SYSTEM & EQUIPMENT FOR RAILWAYS



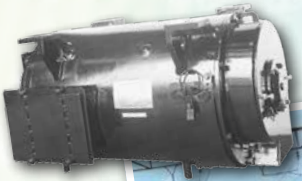

TOYO DENKI SEIZO K.K.
www.toyodenki.co.jp/en/

Our History

Toyo Denki was established in 1918 to manufacture electrical equipment for trains in Japan. Ever since, we have worked to create products that deliver the safety and reliability required for railway applications in the world. We are committed to providing products and services that answer our customers constantly diversifying needs for more advanced technology. We always strive to provide superior technology with the minimum possible environmental footprint, thereby contributing to an environmentally friendly society and overall social progress.

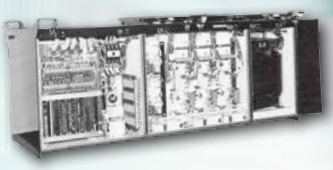


1918	Technical cooperation with the British firm, Dick, Kerr & Co., and establishment of the company
1920	Our first control equipment and traction motors delivered directly to Keihan Electric Railway Co. in Japan
1921	Completion of domestically produced pantograph, first in Japan
1926	Start of manufacturing of three-phase commutator motor (AS motor) Completion of electric cam shaft controllers, first in Japan
1927	Completion of our first door operating equipment
1930	Completion of electric locomotives with dynamic & regenerative brake
1952	Development of Cardan shaft driving device, first in Japan
1958	Completion of traction motors with compensating windings, first in Japan Completion of traction motor and controller for the Japan National Railways “Kodama” limited express
1959	Completion of automatic train stop system Completion of equipment for regenerative brake for EMU
1964	Delivery of electrical equipment for Shinkansen (High-speed train)
1967	Implementation of field test of armature chopper with regenerative brake, first in the world
1968	Completion of inverter for mass-production vehicles, first in the world Completion of field chopper control system, first in Japan
1972	Completion of brushless motor generator (BLMG), first in the world



Our Heart and Technology for the Future

1982 Completion of armature chopper control system for electric locomotives, first in Japan



1983 Completion of monitoring system with optical fiber, first in Japan

1984 Completion of superposed excitation control system, first in Japan

1985 Start of operation with VVVF traction system

1987 Start of operation with equipment for magnetic levitation for HSST

1988 Completion of world-first heat-pipe type 8-unit motor batch control VVVF inverter and delivery of it to Tokyu Electric Railway Co.

1991 JR groups renew maximum speed records for their trial Shinkansen trains one after another (equipped with our most compact traction

1992 motors, reduction gear units and pantographs)

1994 Development of low sonic noise pantographs for Shinkansen

1995 Completion of VVVF traction system with regenerative/ rheostatic blending brake

Delivery of IGBT-VVVF traction system and SIV for series production

1998 Delivery of electric equipment for VVVF traction system for Beijing subway, first in China

2002 Start of operation with mass-produced VVVF car without PG-sensor, first in Japan

Delivery of electric equipment for towing electric locomotive of Panama Canal Authority

2003 Start of operation of parallel-phase-operation-type SIV

2004 Delivery of propulsion equipment for the first 100% low floor LRV in Japan

2005 Delivery to Aichi Rapid Transit Co., Ltd., of electric equipment for Linimo, the normally-conductive magnetic levitation train line at Aichi Expo

Delivery of electric equipment for Dallas Area Rapid Transit (DART)

Contents

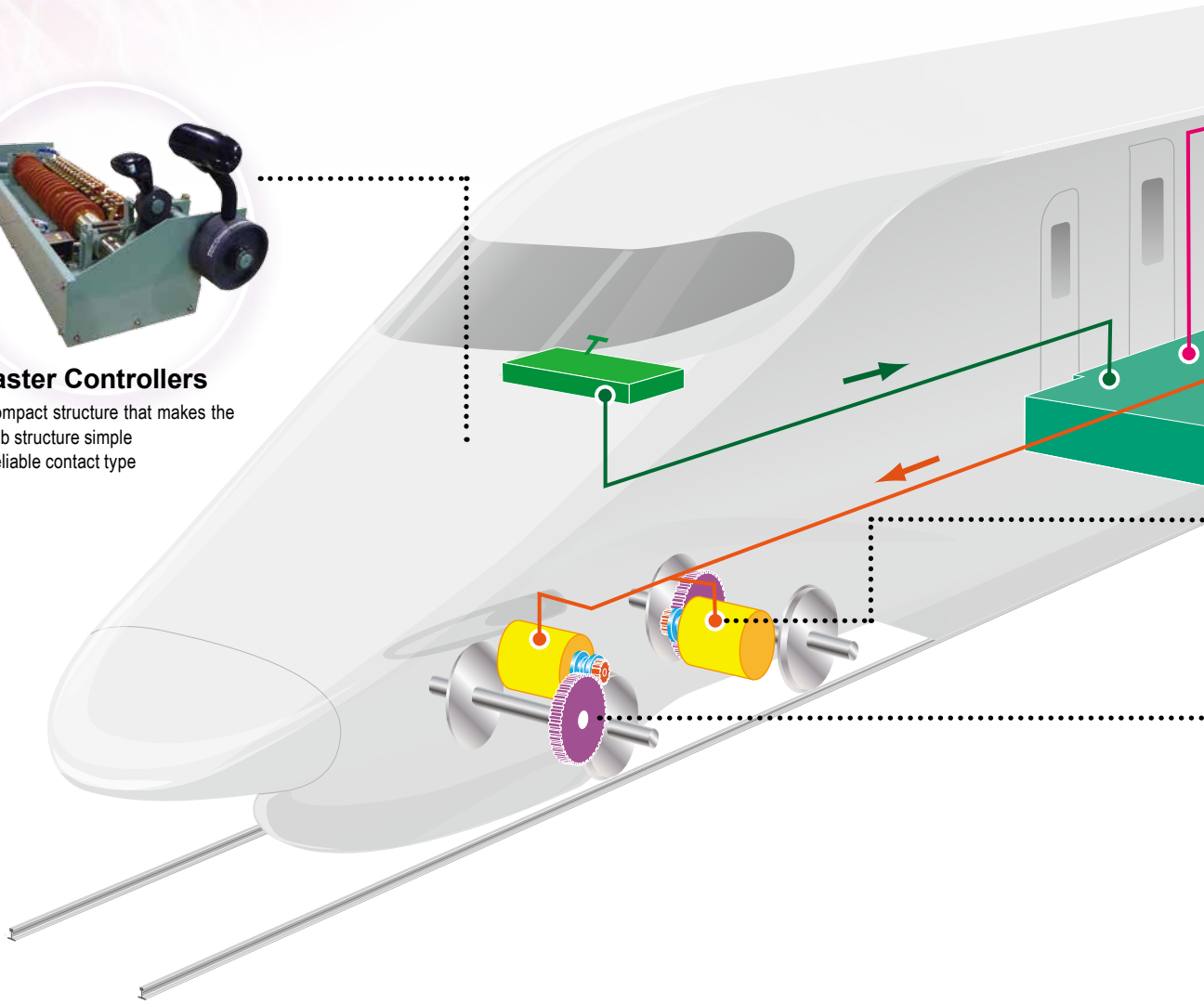
Electrical Equipment for High-Speed Trains

High speed train

Toyo Denki's compact electrical equipment for high-speed trains has been used on the Shinkansen bullet trains in Japan since the Tokaido Shinkansen started operation in 1964. Our products are also used on high-speed trains in the world.

Master Controllers

- Compact structure that makes the cab structure simple
- Reliable contact type

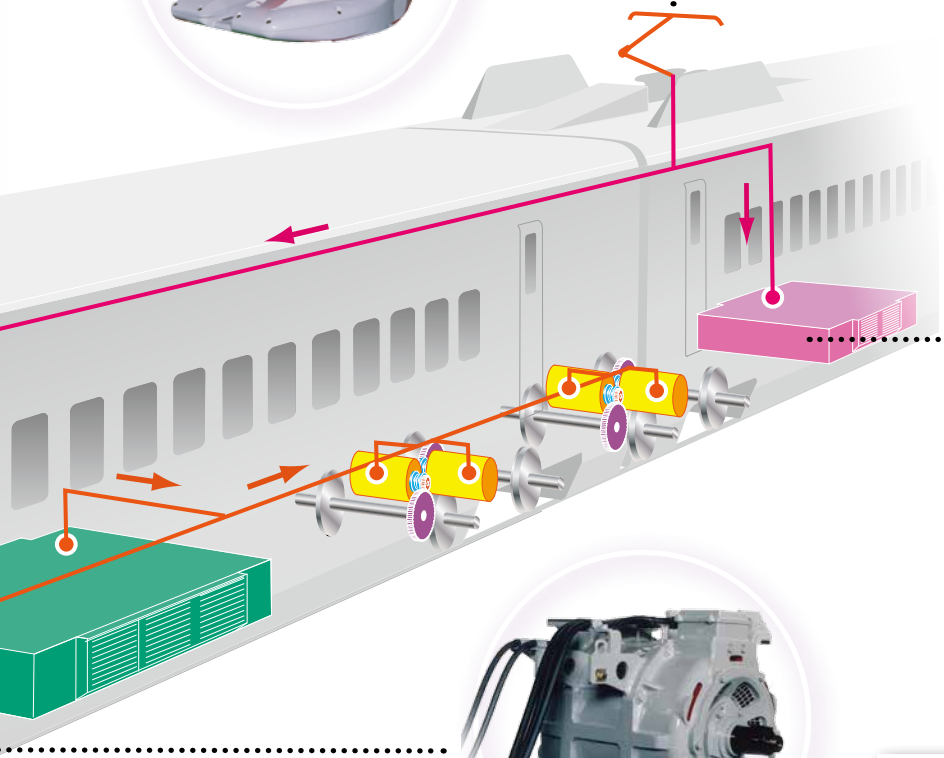


Series E6 EMU
East Japan Railway Company

Series N700A EMU
Central Japan Railway Company

Current Collectors

- Structure designed for reduced aerodynamic noise, incorporates a cover to protect protruding features
- Simple, single arm structure with pantograph head that suppresses aerodynamic lift
- Multi-segmented contract strip to suppress loss of contact with overhead line



Auxiliary Power Supply

- Employ high frequency link method for a compact design that achieves reduced noise
- Cover is integrated to side cowl for improved mounting efficiency

Traction Motors

- Employ aluminum alloy bracket and frameless structure to reduce weight
- Lightweight, but still high output

Driving Gear Units

- Employ aluminum alloy gear case to reduce weight
- Gear case is nearly perfect circle shape to reduce oil lubrication loss

Series 700T EMU

Taiwan High Speed Rail Corporation

Series N700-7000 EMU

Kyushu Railway Company

Series 800 EMU

Kyushu Railway Company

Interurban/Commuter/Subway

Toyo Denki's highly reliable electrical equipment and system configurations for high-density transport enable safe, comfortable transportation in intercity express trains and metro subway networks.

E^3 Solution System

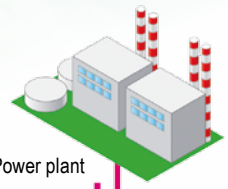
Electrical equipment that utilizes a stationary storage battery to improve operating conditions by providing effects such as the following:

- Compensation for line voltage drop
- Absorption of regenerative power

Train Control Management Systems

Accelerated intelligent evolution in the latest information control technologies accomplishes:

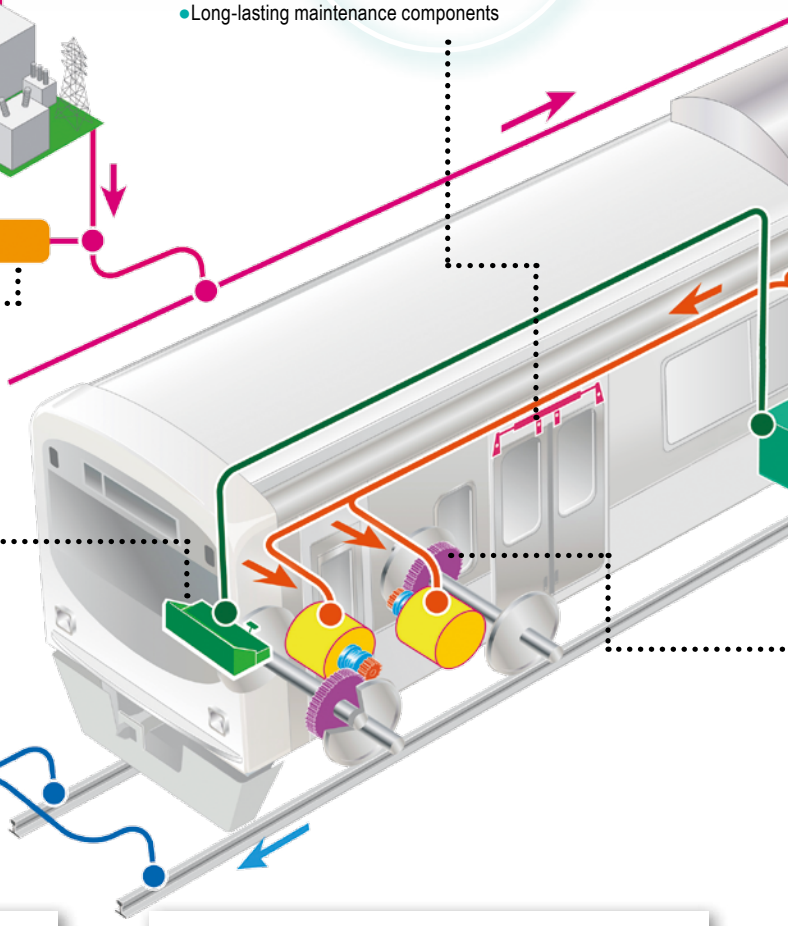
- Advanced train control system
- Information for passengers



Door Operating Equipment

Backed by our many years of experience and performance, we support high-density, stable transportation by delivering:

- Safe and sure door operation
- Long-lasting maintenance components



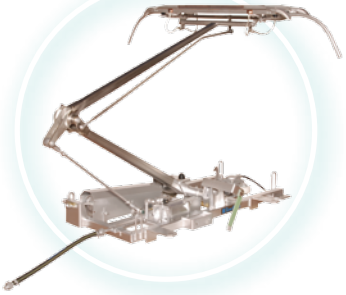
Series AE

Keisei Electric Railway Co., Ltd.

Series E259 EMU

East Japan Railway Company

IRIS Certification



Current Collectors (Pantographs)

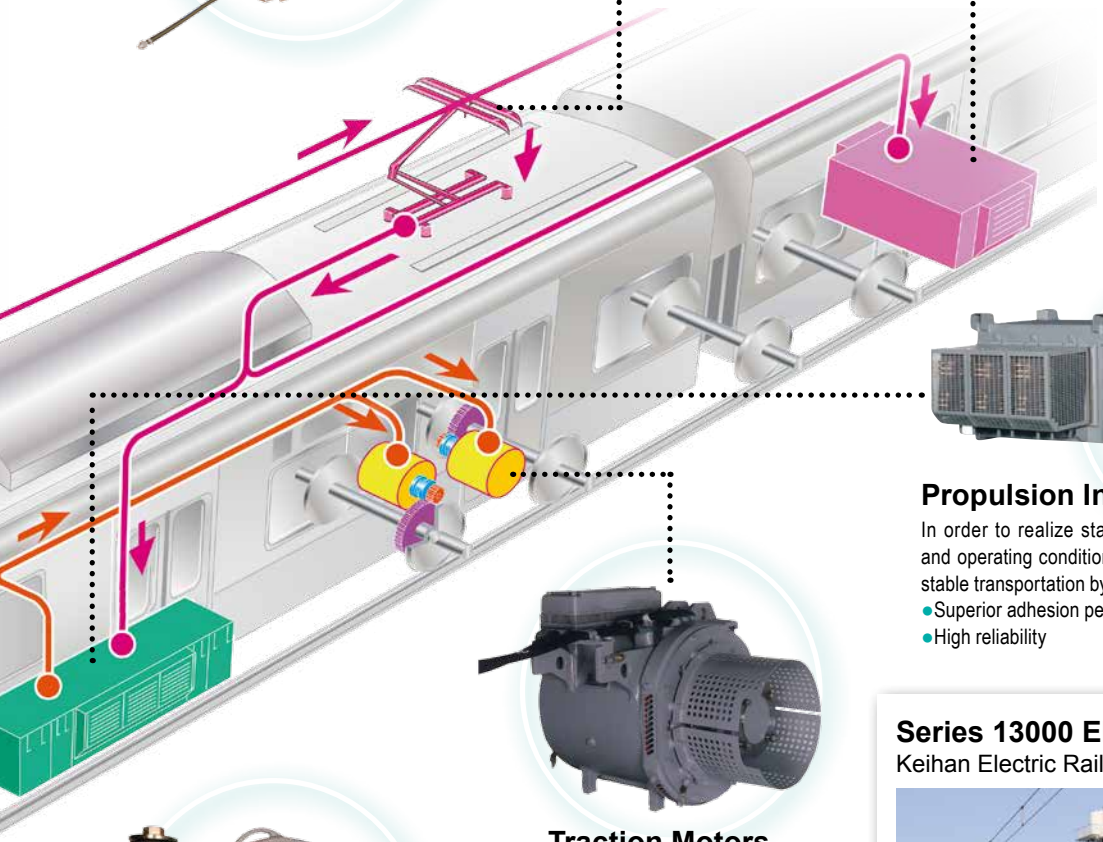
As a comprehensive supplier of railway equipment and systems, we support high-density, stable transportation by delivering:

- Compatibility of vehicle electrical equipment and lines
- Superior tracking and maintainability

Auxiliary Power Supply

In order to maintain stable output despite constant fluctuation in the input voltage and load current, we support comfortable, high-density, stable transportation by incorporating the following features:

- Superior control
- High reliability
- Low noise



Propulsion Inverter

In order to realize stable performance in all manner of route and operating conditions, we support comfortable, high-density, stable transportation by incorporating the following features:

- Superior adhesion performance
- High reliability

Traction Motors

We support comfortable, high-density, stable transportation by incorporating the following features required by railway applications:

- High reliability, long life
- Compact, lightweight
- Low noise

Driving Gear Units

As a comprehensive supplier of train system devices, we provide the maximum performance within the limited space of truck:

- Integrated design with motors, coupling and driving gear units

Series 13000 EMU

Keihan Electric Railway Co., Ltd.

Series SFM04 EMU

Beijing MTRC

Series N1000 EMU

Keikyu Corporation

Electrical Equipment for LRV

LRV

Toyo Denki's electrical equipment for smart, streamlined light rail vehicles (LRVs) for the modern city are compatible with both low- and high-floored trains.

Current Collectors
(Pantographs)

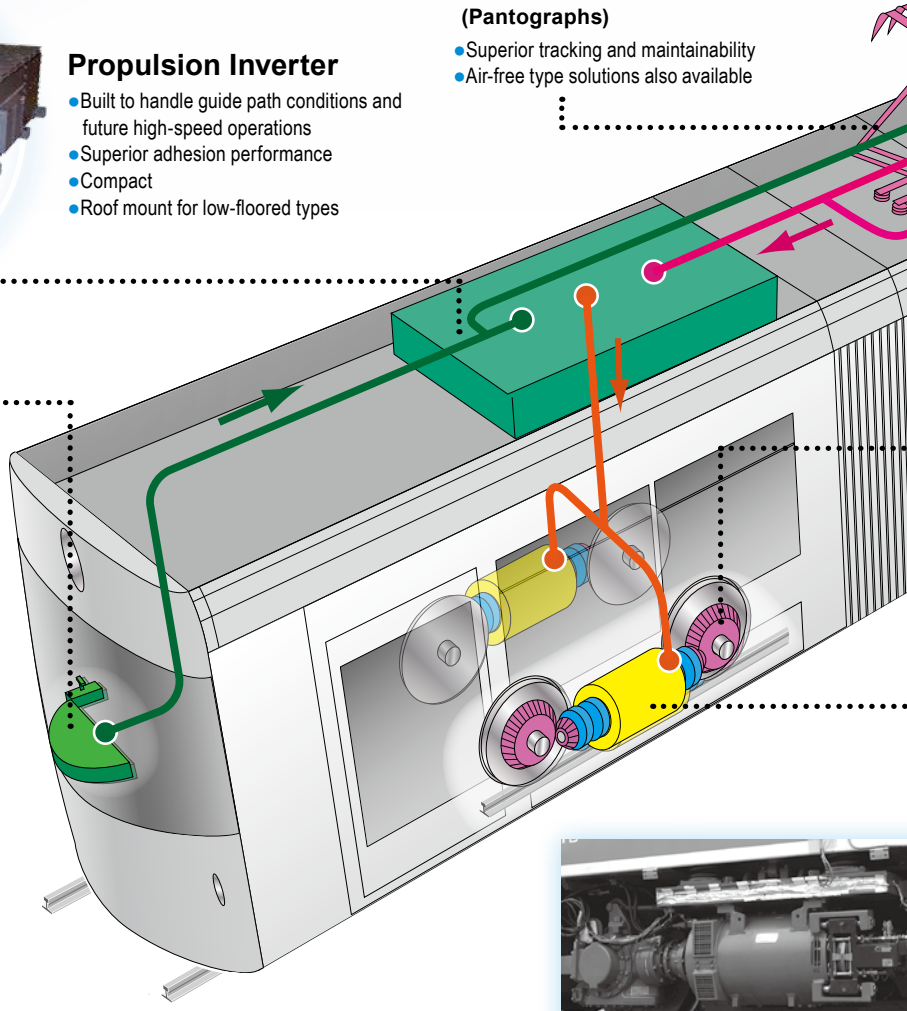
- Superior tracking and maintainability
- Air-free type solutions also available

Propulsion Inverter

- Built to handle guide path conditions and future high-speed operations
- Superior adhesion performance
- Compact
- Roof mount for low-floored types

Master Controllers

- Compact shape
- Solutions for single- and two-handed types, etc.
- Solutions for direct contact type, PWM output method, etc.



Train Control Management Systems

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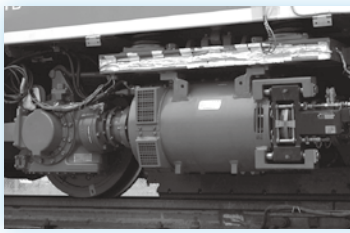
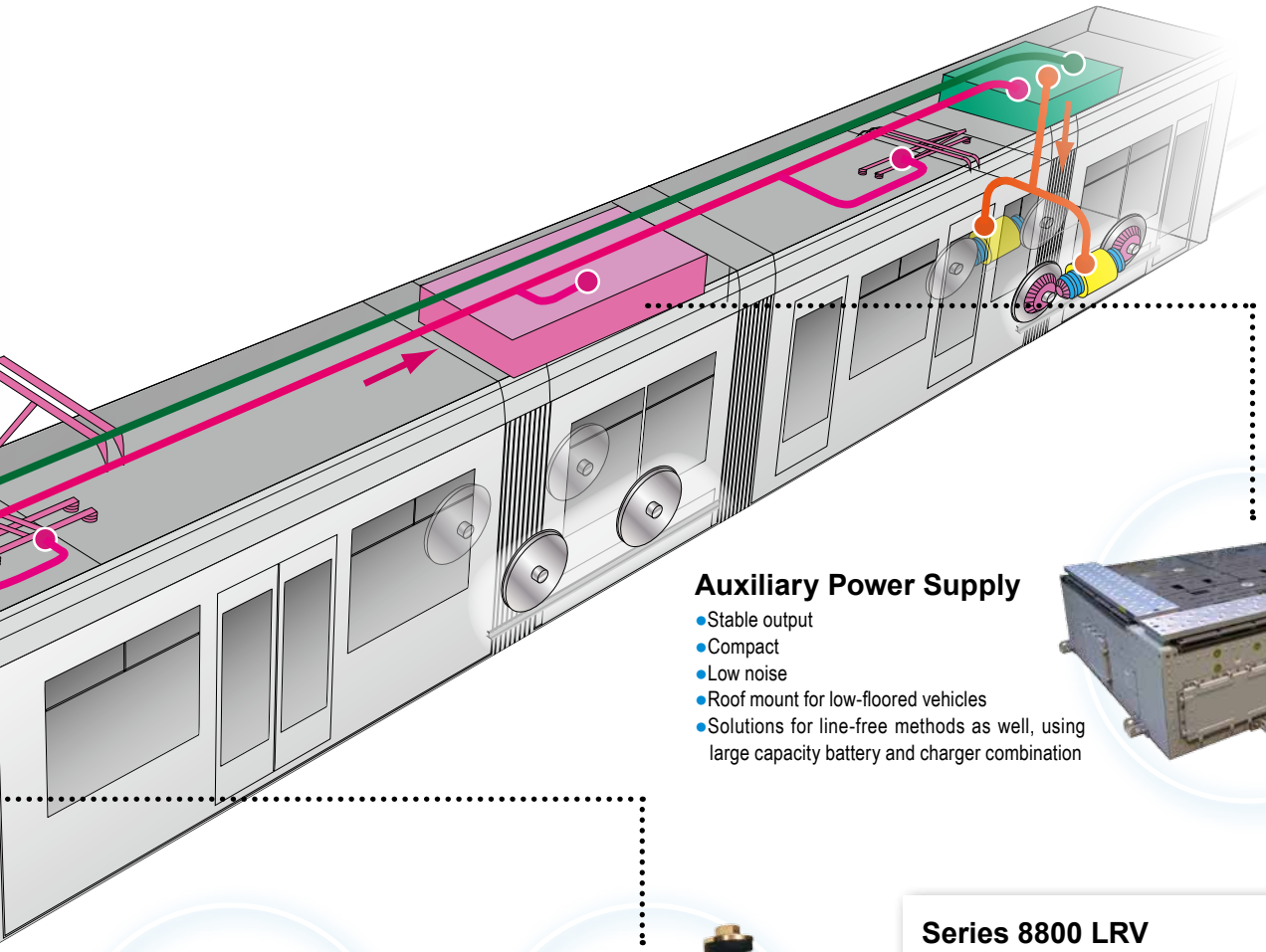


Series 1000 LRV
Hirosima Electric Railway Co., Ltd.

Series 7000 LRV
Kagoshima City Transportation Bureau



Auxiliary Power Supply

- Stable output
- Compact
- Low noise
- Roof mount for low-floored vehicles
- Solutions for line-free methods as well, using large capacity battery and charger combination

Traction Motors and Driving Gear Units

- High reliability, reduced maintenance
- Compact, lightweight
- Low noise
- Solutions for parallel Cardan method, truck-mount method, frame-side mount method, etc.

Series 8800 LRV

Bureau of Transportation.
Tokyo Metropolitan Government.

SLRV

Dallas Area Rapid Transit

Series 5000 LRV

Nagasaki Electric Tramway Co., Ltd.

Electrical Equipment for APM & HSST

APM&HSST

For APM

Automated people movers (APMs) utilize rubber tires and a guided path.
APMs are typically completely automated, but there are some that are manually operated.
Toyo Denki's first real APM installation was the Nanko Port Town Line operated by the Osaka Municipal Transportation Bureau in 1961.
Our APMs use either 3-phase AC with converter/inverter control or DC with variable voltage variable frequency (VVVF) inverter control.

Converter/Inverter

AC line APM propulsion control device
- Input: 600 VAC, 3-phase input
- Output: 1C3M control

Auxiliary Power Supply

DC line APM auxiliary power supply
- Input: 750 VDC
- Output: 45 KVA

Propulsion Inverter

DC line APM propulsion control device
- Input: 750 VDC
- Output: 1C2M control

Current Collectors

Current collector for APM applications
- For rigid line (3-phase AC)
- Collector current: 400 A

Traction Motors

Traction motors for APM applications
- Output: 125 kW 3-phase induction motor
- Body-loaded method
- Cooling method: self-ventilated
- The photograph depicts unit equipped with parking brake

Series 2000 APM
Saitama New Urban Transit Co., Ltd.

Series 2000 APM
Yokohama New Urban Transit Co., Ltd.

For HSST

High-speed surface transport (HSST) is a type of people mover that utilizes normal conduction magnetic levitation.
Toyo Denki participated in the experimental stages, and our first application was with Aichi Rapid Transit for a system that went into operation in March 2005.

Linear Motors (primary side)

Linear motor for HSST applications
- 3-phase, 8-pole linear motor
- Cooling method: natural cooling

Auxiliary Power Supply

Auxiliary power supply for HSST applications (high-voltage converter)
- Input: 1500 VDC
- Output: 275 VDC 85kW

Propulsion Inverter

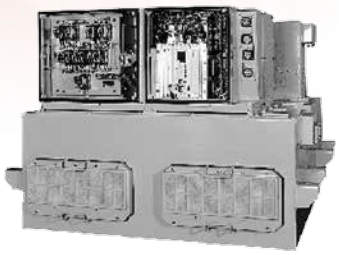
Propulsion control device for HSST applications (VVVF)
- Input: 1500 VDC
- Output: 1C10M (5S2P) control

Series 100 HSST(Maglev) EMU
Aichi Rapid Transit Co., Ltd.

Electrical Equipment for Electric Locomotives

Electric Locomotive

Toyo Denki began supplying electrical equipment for electric locomotives and diesel electric locomotives in its second year of operation (1920) to private railways, Japanese Government Railways, Japanese National Railways, each of the JR companies and overseas companies, as well.
We have even had some experience in supplying a whole electric locomotive as the primary contractor. The second- and third-generation towing locomotives for the Panama Canal (as introduced below) utilized Toyo Denki electrical equipment.

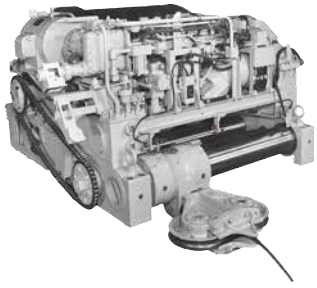


Converter/Inverter

Locomotive propulsion control device
- Input: 450 VAC, 3-phase input
- Output: 1C1M (2 sets)

Traction Motors

Traction motors for locomotive
- Output: 216 kW 3-phase induction motor
- Forced-air cooling



Windlass

Rope hoisting device for piloting boats being towed by a locomotive
- Maximum tensile force: 155.6 kN
- Hydraulic drive

2 units per locomotive

Series 100 Towing Electric Locomotive
ACP(Autoridad de Canal de Panama)

Propulsion Inverter/ Auxiliary Power Supply

Unified configuration of the locomotive propulsion control device and auxiliary power supply
- Input: 600 VDC
- VVVF inverter: 2MIC (two sets)
- Static inverter output capacity: 16.5 kVA

Traction Motors

Traction motors for locomotive
- Output: 45 kW 3-phase induction motor
- Drive method: nose suspension
- Cooling method: totally enclosed natural cooling

4 units per locomotive

Series EDV Electric Locomotive
The Kurobe Gorge Railway Co., Ltd.

Propulsion Inverter

These systems control the acceleration and deceleration of the drive motor of electric rolling stock. Control is achieved through inverter-based variable voltage variable frequency (VVVF) output. Our product lineup covers a wide range of performance needs, from intercity express trains, suburban trains, subways, light rail vehicles (LRVs), and all types of people movers, to electric locomotives. Our propulsion systems maintain a strong reputation among our customers for their superior reliability, maintainability and energy efficiency.

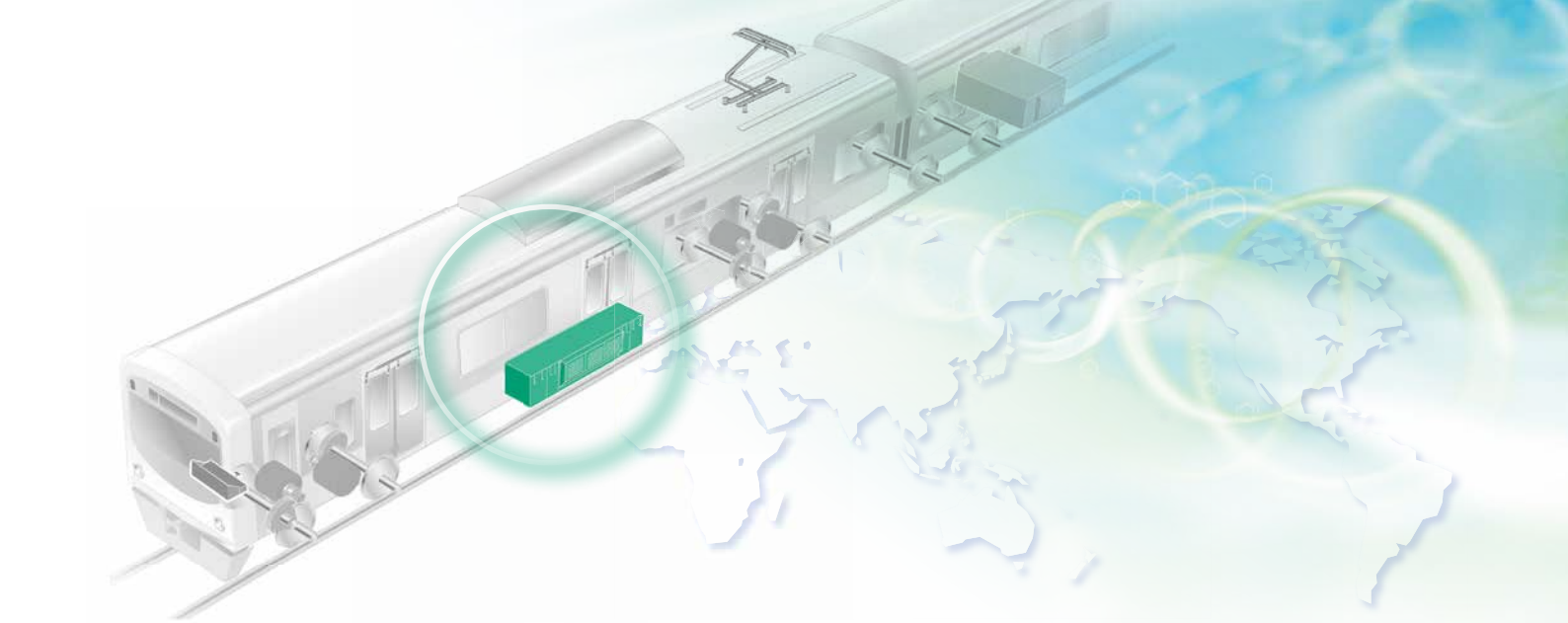
Features

- Two-level inverter that utilizes a reduced power loss, high voltage insulated gate bipolar transistor (IGBT). Compact, lightweight, simple main circuit configuration for high reliability.
- Our speed sensor less vector control provides comfortable ride quality on rainy and snowy days, and high wheel slip system efficiency.
- Wide variety of product specifications to accommodate selection of cooling method (natural cooling or forced-air cooling) based on application, mounting location and mounting space, enclosure shape variations (long enclosure, integrated enclosure), etc.
- Optimized life design with consideration for maintainability and favorable lifecycle costs.

Natural Cooling VVVF Inverter

Mounting location		Under floor
Enclosure shape		Integrated long enclosure (2 bank)
Application		Intercity express trains, suburban trains, commuter trains Subways
Specification sample	Line voltage	1500 VDC
	Control unit	1C4M (2 bank)
	Control capacity	175 kW traction motor x 4 (2 bank)

Mounting location		Under floor
Enclosure shape		Integrated enclosure contained (high-speed circuit breaker/line switches) (2 bank)
Application		Intercity express trains, suburban trains, commuter trains Subways
Specification sample	Line voltage	1500 VDC
	Control unit	1C2M (2 bank)
	Control capacity	200 kW traction motor x 2 (2 bank)



Scope of Possible Specifications/Configurations

- Standard input voltage of 1500 VDC, 750 VDC and 600 VDC
  (Three-phase 600 VAC for people movers is also available. For any other specifications, please feel free to contact us.)
- Sample specifications delivered:
  1C1M (one-hour rated output capacity of traction motor; up to 220 kW) (2 bank)
  1C2M (one-hour rated output capacity of traction motor; up to 275 kW)
  1C2M (one-hour rated output capacity of traction motor; up to 275 kW) (2 bank)
  1C4M (one-hour rated output capacity of traction motor; up to 190 kW)
  1C4M (one-hour rated output capacity of traction motor; up to 190 kW) (2 bank)

  We also manufacture integrated units that combine brake choppers, AC input converter/ inverter or auxiliary power supply.
- Besides the VVVF inverters on this page, propulsion inverters comprise high-speed circuit breaker (deion grid high-speed circuit breaker; can be housed in the control device or line breaker), line breaker (houses line switch box; line switches can be housed in the inverter box), and a filter reactor (can be housed in the inverter box), etc.

Forced-air Cooling VVVF Inverter

Mounting location		Under floor
Enclosure shape		Long enclosure (contained brake chopper built in)
Application		High floored LRV, automated people mover (APM) Subways
Specification sample	Line voltage	750 VDC
	Control unit	1C2M
	Control capacity	150 kW traction motor x 2

Mounting location		Roof
Enclosure shape		Integrated enclosure (high-speed circuit breaker/line switches/filter reactor/brake chopper contained)
Application		Low-floored LRV
Specification sample	Line voltage	600 VDC
	Control unit	1C1M (2 bank)
	Control capacity	100 kW traction motor (2 bank)

Traction Motor

These are drive motors for electric rolling stock. Control is achieved through inverter-based variable voltage variable frequency (VVVF) output. Our product lineup covers a wide range of performance needs such as high-speed trains, intercity express trains, suburban trains, subways, super low-floored trams/ LRVs, automated people movers(APMs) and electric locomotives. Our traction motors maintain a strong reputation among our customers for their superior reliability, maintainability and energy efficiency.

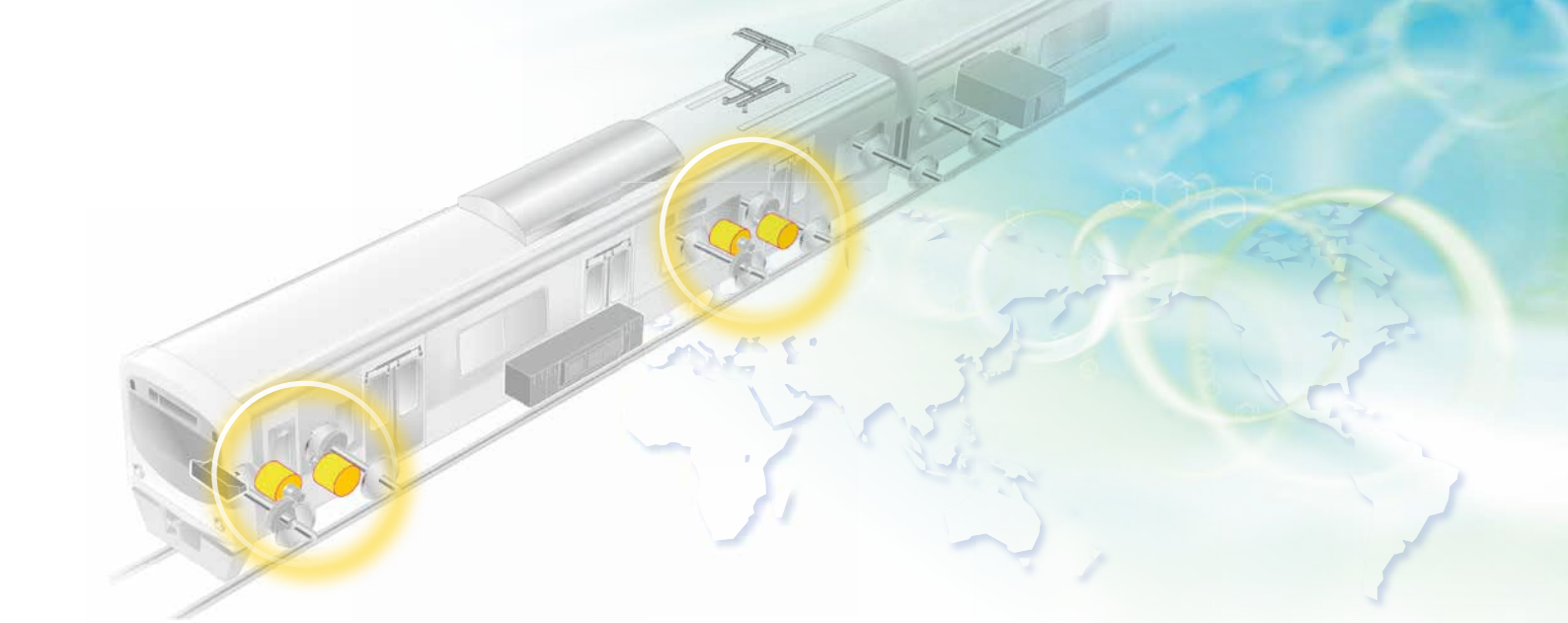
Features

- Simple-construction, 3-phase squirrel cage induction motor. Compact, lightweight for high reliability.
- Self-ventilating strainer available in filter type, gravity type, centrifugal separator type (clean strainer), etc.
- Improved bearing structure helps to maintenance interval, intermediate fueling structure and other measures extend time before unit must be opened for maintenance.
- Main insulation is Class 200, which is better suited for temperature rises.
- Optimized life design with consideration for maintainability and favorable lifecycle costs.

Traction Motor

Method		Truck-mounted, solid axle parallel Cardan drive
Shape		Frame-less forced-air
Application		High-speed trains
Specification sample	Line voltage	25 kV AC
	Capacity	305 kW continuous
	Weight	393 kg

Method		Truck-mounted, solid axle parallel Cardan drive
Shape		Self-ventilated
Application		Suburban trains, commuter trains, subways
Specification sample	Line voltage	1500 VDC
	Capacity	1-hour 155 kW
	Weight	615 kg



Scope of Possible Specifications/Configurations

- Depending on the truck and body construction, there are a variety of methods possible such as truck-mounted solid axle parallel Cardan drive, suspension method, frame side attachment method, frame-loaded, etc. These motors can be applied to high-speed trains, electric multiple units (EMUs), super low-floored trams/LRVs, APMs, etc. We can also offer linear motors (propulsion coils) for magnetic levitation linear motor cars, or high-speed surface transport (HSST) systems.
- We not only provide self-ventilating type motors (open type) that enable high cooling efficiency, we also can offer traction motors configured with a sealed structure with totally enclosed inner fans to prevent the introduction of dust and maintain low noise levels. It is also possible to configure a sealed structure with totally enclosed outer fans for self-ventilation of the outer side of the stator.

Sample specifications delivered:

- High-speed trains
  Line voltage: 25 kV AC; Continuous rated capacity: 300 to 405 kW
- Intercity express trains, suburban trains, commuter trains, subways
  Line voltage: 1500 VDC; One-hour rated capacity: 80 to 207 kW
- Streetcars, super low-floored trams/LRVs
  Line voltage: 750 VDC, 600 VDC; One-hour rated capacity: 60 to 100 kW
- APMs
  Line voltage: 3-phase 600 VAC, 750 VDC; One-hour rated capacity up to 125 kW

Method		Truck-mounted, solid axle parallel Cardan drive
Shape		Fully-enclosed inner fans
Application		Suburban trains, commuter trains, subways
Specification sample	Line voltage	1500 VDC
	Capacity	1-hour 190 kW
	Weight	705 kg
Bearing lubrication		Oil (same maintenance as the driving gear unit) or grease

Method		Body-mounted solid axle straight Cardan drive
Shape		Self-ventilated
Application		Super low-floored trams/LRVs, APMs
Specification sample	Line voltage	600 VDC
	Capacity	1-hour 85 kW
	Weight	400 kg

Driving Gear Units

These drive units function to transmit torque to the traction motor. Our product lineup covers a wide range of performance needs, including those for high-speed trains, intercity express trains, suburban trains, subways and super low-floored trams/LRVs. Our driving gear units maintain a strong reputation among our customers for their superior reliability, maintainability and energy efficiency.

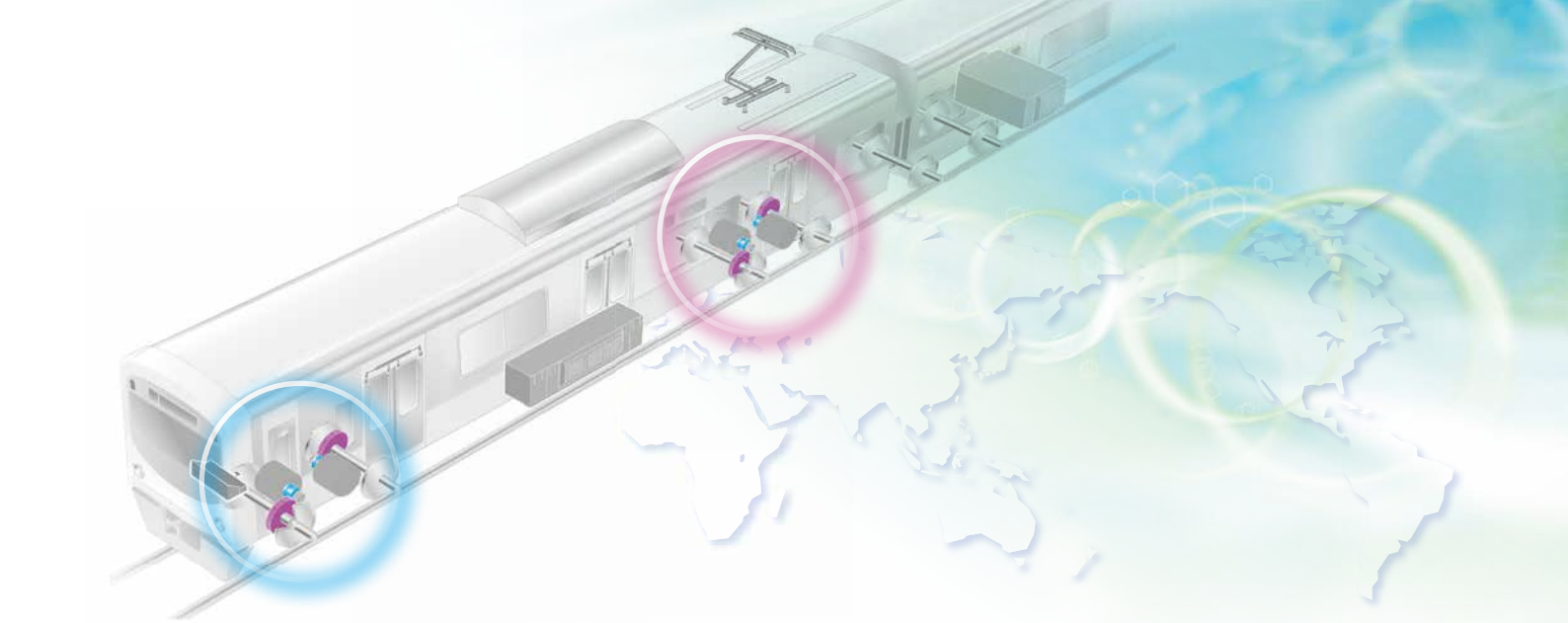
Features

- Simple construction using truck-mounted drive method parallel Cardan drive unit, right-angled Cardan drive unit, etc. Compact, lightweight for high level of reliability.
- Our products enable effective and efficient use of oil in the gear case by employing the splash lubrication method for bearing lubrication and an improved method for lubricating the pinion bearing for start-up in low temperature conditions (lubrication through the back of the pinion bearing).
- For the TD coupling (flexible plate coupling), CFRP is used in place of traditional steel plate for a flexible plate allowing for increased ability to absorb deflection. This makes it possible to eliminate the coupling cover on the traction motor side for an integrated structure wherein the coupling flange covers the flexible plate.

Driving Gear Unit

Method		Truck-mounted, solid axle parallel Cardan drive
Shape		Integrated; vertically suspended
Coupling		WN coupling, TD coupling
Application		High-speed trains
Specification sample	Gauge	1435 mm
	Gear ratio	81/29 = 2.79
	Wheel diameter	860 mm
	Maximum operation speed	300 km/h

Method		Truck-mounted, solid axle parallel Cardan drive
Shape		Integrated; diagonally suspended
Coupling		TD coupling
Application		Suburban trains, commuter trains, subways
Specification sample	Gauge	1067 mm
	Gear ratio	97/16 = 6.06
	Wheel diameter	860 mm
	Maximum operation speed	120 km/h



Scope of Possible Specifications/Configurations

- The gear case is the split type for convenience of axle replacement. The structure is simple and integrated. It is available in cast steel, sound reducing ductile cast iron (FCD), lightweight aluminum alloy, etc.
- Suspension methods available: vertical and diagonal
- Coupling methods available: TD (flexible plate coupling) and WN (flexible gear coupling)

Sample specifications delivered:

- High-speed trains
  Gear ratio: Approx. 2 to 3; Operation speed: 250 to 500 km/h
- Intercity express trains, suburban trains, commuter trains, subways
  Gear ratio: Approx. 5 to 7; Operation speed: Up to 160 km/h
- Street cars, super low-floored trams/LRVs
  Gear ratio: Approx. 5 to 7; Operation speed: Up to 85 km/h

Method		Truck-mounted, right-angled Cardan drive
Shape		Split; vertical suspended
Coupling		Universal joint
Application		LRVs
Specification sample	Gauge	1067 mm
	Gear ratio	64/11 =5.82
	Wheel diameter	610 mm
	Maximum operation speed	40 km/h

TD Coupling

Shape	Integrated cover
Application	High-speed trains, suburban trains, commuter trains
Flexible plate	CFRP

Shape	Normal
Application	Suburban trains, commuter trains
Flexible plate	CFRP

Auxiliary Power Supply

High voltage power input from the overhead catenary or the third rail typically has a wide range of voltage fluctuation. The auxiliary power supply (APS) converts this power to a stable, low-voltage power supply for such uses as air conditioning and lighting in the train. It keeps providing stable power even when there is voltage fluctuation on the supply or load side. Our product lineup covers a wide range of performance needs in terms of capacity, mounting location, etc. Our APS inverters and converters maintain a strong reputation among our customers for their superior reliability, maintainability and energy efficiency.

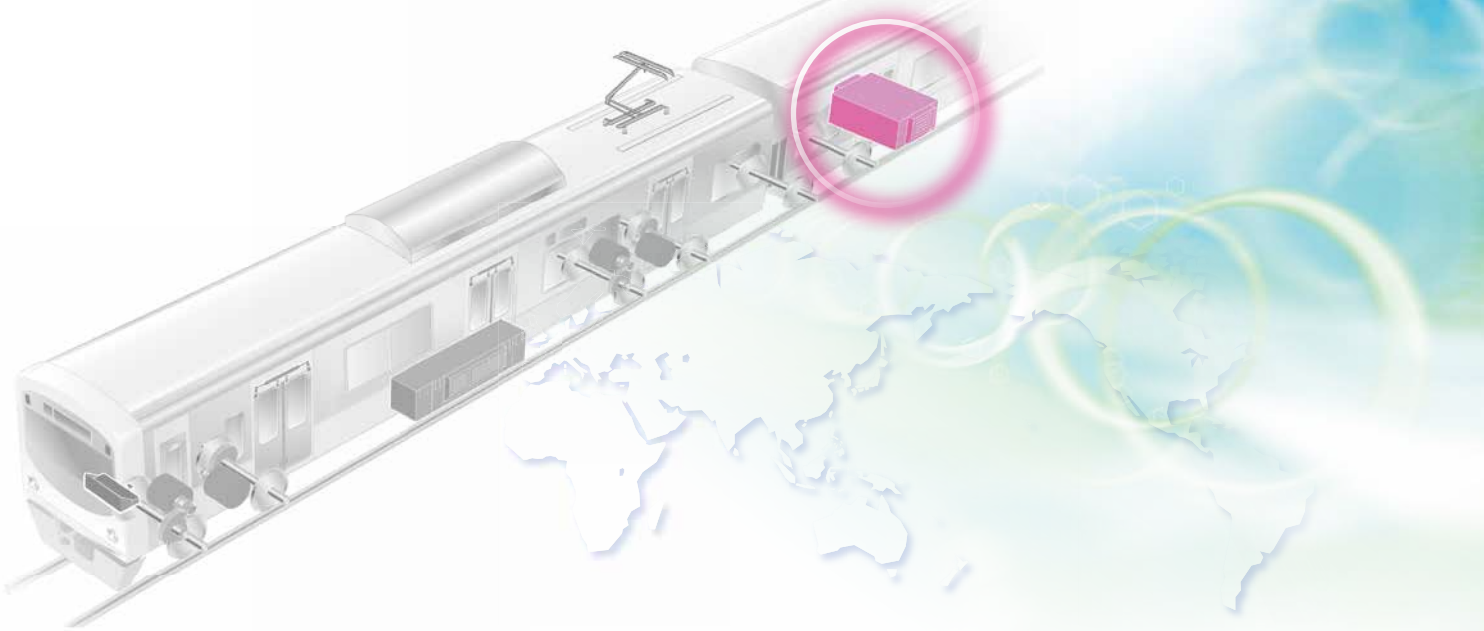
Features

- Two-level and three-level inverters that utilize a reduced power loss, high voltage IGBT. Compact, lightweight, simple main circuit configuration for high level of reliability.
- We also have a lineup of high-frequency DC/DC link method series for high-speed trains, LRVs and APM applications that especially require compact, lightweight solutions.
- Wide variety of specifications to accommodate selection of cooling method (natural cooling or forced-air cooling) and enclosure shape variations (long enclosure, integrated enclosure), based on application, mounting location and mounting space, etc.
- We also can supply parallel synchronous and standby redundancy solutions for single equipment applications if a high level of reliability is required in particular.

Natural cooling APS

Mounting location		Under floor
Enclosure shape		Long enclosure type (high speed circuit breaker, transformer and filter are installed separately)
Application		Intercity express trains, EMUs, subways
Specification sample	Method	Direct conversion PWM inverter
	Line voltage	1500 VDC
	Control capacity	150 kVA
	Output type	3-phase 200 VAC 60 Hz

Mounting location		Under floor (low floor compatible)
Enclosure shape		Integrated enclosure (transformer filter equipment built-in; high-speed circuit breaker and rectifier are installed separately)
Application		Intercity express trains, EMUs, subways
Specification sample	Method	Direct conversion PWM inverter
	Line voltage	1500 VDC
	Control capacity	120 kVA
	Output type	3-phase 200 VAC 60 Hz, 100 DCV



Scope of Possible Specifications/Configurations

■ Standard input voltages are 1500 VDC, 750 VDC and 600 VDC
(Three-phase 600 VAC for APM is also available. In addition, we can also manufacture an APS that connects to main transformers tertiary winding or the intermediate link of the propulsion C/I under AC power supply system. Please feel free to contact us.)

■ Sample specifications in delivered APS products using the general inverter method:

Input voltage: 1500 VDC

- Single output capacity: Up to 260 kVA
- Parallel synchronous output capacity: Up to 140 kVA + 140 kVA
- Standby redundancy capacity: Up to 260 kVA

Input voltage: 600 and 750 VDC

- Single output capacity: Up to 180 kVA

We also manufacture integrated types containing both propulsion system and APS for AC input or DC input as well.

Forced-cooling APS

Mounting location		Under floor
Enclosure shape		Integrated enclosure (auxiliary transformer built-in)
Application		High-speed trains
Specification sample	Method	High frequency DC/DC link method
	Input voltage	Single-phase 400 VAC 50 Hz
	Control capacity	65 kVA + 20 kVA (auxiliary transformer)
	Output type	100 VDC, single-phase 100 VAC (constant voltage), single-phase 100 VAC (auxiliary transformer output)

Mounting location		Roof
Enclosure shape		Integrated enclosure (inverter switch, inverter fuse, inverter contact or transformer filter device built-in)
Application		Low-floored LRV
Specification sample	Method	Direct conversion PWM inverter
	Line voltage	600 VDC
	Control capacity	45 kVA
	Output type	3-phase 440 VAC 60 Hz, 24 VDC

Current Collector

We currently supply a wide range of current collectors, the single arm type for EMUs, in particular, but also those for the Shinkansen high-speed trains, suburban trains, LRVs, various types of APMs and electric locomotives. We maintain a high reputation among our customers for the superior compactness, minimum maintenance and low aerodynamic noise of our products.

Features

- For high-speed trains such as the Shinkansen, the framework is sleekly covered, only one shoe is used, and holes are made on the main horn to suppress aerodynamic noise.
- For EMUs, we have reduced the number of parts compared to that of conventional diamond-type pantographs and made it endurable against falling snow, more compact and lighter.

Single Arm Type Pantograph

Shinkansen (High-speed Train) Application

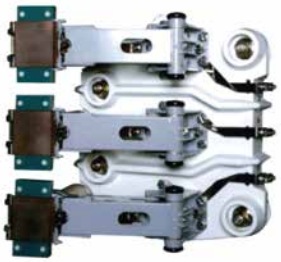
Method	Raised pneumatically, spring-lowering
Line voltage	25 kV AC/20 kV AC
Collector current	500 A
Lifting force	54 N
Range of working height	500 to 1000 mm
Weight	180 kg

EMU Application

Method	Spring-raised, lowered pneumatically
Line voltage	1500 VDC / 750 VDC / 600 VDC
Collector current	1000 A
Lifting force	54 N
Range of working height	500 to 2000 mm
Weight	150 kg

Overseas

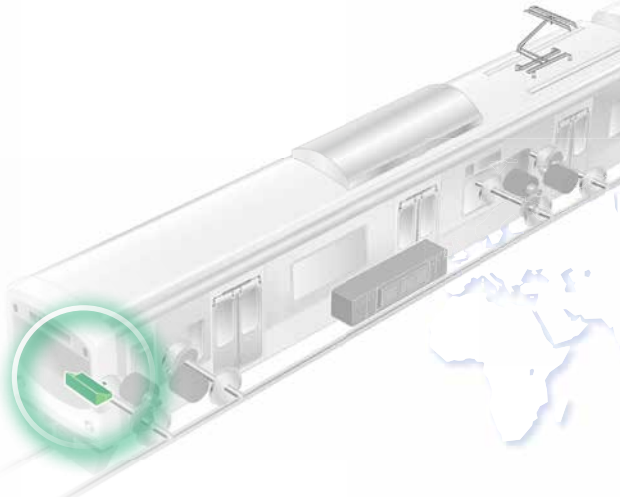
Method	Application raised pneumatically, self-lowered
Line voltage	25 kV AC/1500 VDC
Collector current	800 A (at DC)
Lifting force	54 N
Range of working height	500 to 2500 mm
Weight	180 kg



APM Application

Method	Spring contact method for side rigid contact line
Line voltage	3 φ 600 VAC
Collector current	400 A
Lifting force	59 N
Range of working height	-500 mm
Weight	30 kg

Master Controller



These devices enable output from the train operator's commands, such as forward, reverse, powering, neutral and braking, to the electric train's control device, etc. Our product lineup covers a wide range of methods, including the one handle with brake valve function and a controller that detects the main handle position without contact.

Features

- Since this is a very critical device for the train operator, we have thoroughly implemented consideration for safety and reliability into the design. Thanks to our many years of experience, our master controllers maintain a strong reputation among our customers for their superior operability and reliability.
- We can accommodate the needs of a variety of systems. For example, we also manufacture converter units that convert the output signal from the master controller to each type of signal for application to control transmission systems, which have been increasing in recent years.

Master Controllers and Output Signal Converters

Shinkansen (High-speed Train) Application

Method	Right-handed operation dedicate horizontal-axis master controller
Control voltage	100 VDC
Number of notches	13-step powering, OFF
Other	The reverse handle is equipped with a solenoid type interlock mechanism

EMU Application

Method	One-handle horizontal-axis master controller
Control voltage	100 VDC
Number of notches	5-step powering, OFF, 5-step braking, emergency brake
Other	Equipped with a parallel link type main handle operation mechanism. Equipped with dead-man switch

LRV Applications

Method	Right-handed one-handle horizontal-axis master controller
Control voltage	24 VDC
Number of notches	Non-step powering, OFF, non-step braking, emergency brake
Other	Utilizes a non-contact potentiometer main handle position sensor. Equipped with dead-man switch.

Master Controllers and Output Signal Converter

Control voltage	37.5 VDC
Input signal	Potentiometer for main handle position, cam switch state voltage signal
Output signal	P-signal : 0 to 100 mA B-signal : 0 or 100 mA
Other	Equipped with disconnection detection function

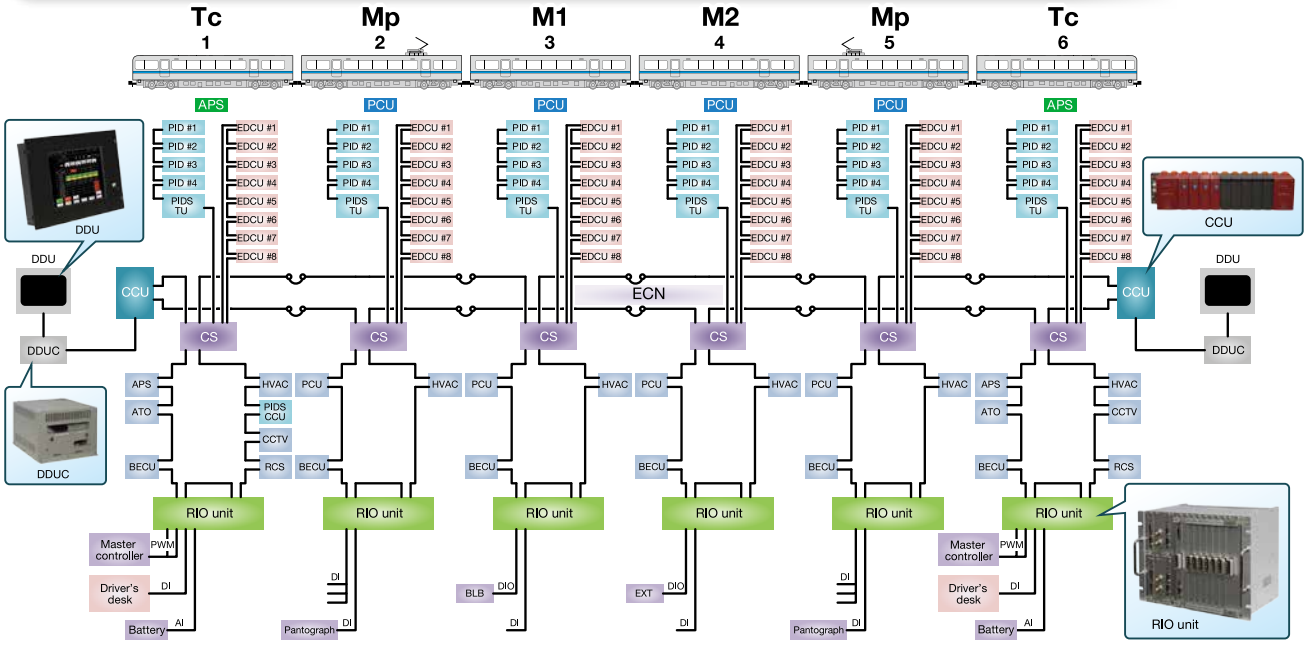
Train Control Management Systems

In 1983, Toyo Denki became the first company to develop a train-monitoring device using optical fiber. At the time, monitoring functions were limited to detecting and recording failures in onboard equipment. Since then, however, we have moved into having some control functions for sending control command signals, and nowadays we are making our system with faster, higher -capacity streamlined controls for communication within the train using highly reliable train communication technology. By improving the system's functionality, we are bettering train operability, maintenance and passenger service.

Features

- Compatible with the next version of Train Communication Network (TCN) International Standard IEC61375
- The train communication network uses Ethernet Consist Network (ECN) for a ring network with built-in redundancy.
- The subsystems such as the train control system, passenger information display system (PIDS) and door operation control system can be integrated and connected via the network for complete control over all the devices in the train.
- Devices using conventional interfaces (digital, analog I/O or RS485) connect to the ring network via the remote I/O device.
- Network topology can be selected from such options as redundant, single, tree, ring and star, based on the importance of the applied subsystems.

Configuration Example of Next-generation Train Control Management System



CCU	Central Control Unit	HVAC	Heating, Ventilating and Air Conditioning unit	PID	Passengers Information Display
DDU	Drivers' Display Unit			BLB	Bus Line Breaker
DDUC	DDU Controller	CCTV	Closed Circuit TeleVision	EXT	EXT ended power supply unit
PCU	Propulsion Control Unit	RCS	Radio Communication System	RIO	Remote I/O unit
APS	Auxiliary Power Supply	PIDS	Passengers Information Display System	CS	Consist Switch
BECU	Brake Electric Control Unit				
EDCS	Electric Door Control System	PIDS CCU	PIDS Central Control Unit		
EDCU	Electric Door Control unit	PIDS TU	PIDS Terminal Unit		

DI	digital input
DO	digital output
DIO	digital input/output
AI	analog input
AO	analog output
PWM	PWM signal
485	RS-485 interface(HDLC)
ETH	Ethernet

Ultrawide (32.5 inch) Display of PIDS (lintel area above door)

High Speed Circuit Breaker with Deionizing-Grids
Unit Switch with Deionizing-Grids

Advantages of High Speed Circuit Breaker

- Superior breaking ability and quiet breaking.
- The arc does not scatter from the enclosure due to electromagnetic closing system.
- The breaker can be fit without any insulator since the enclosure is insulated with FRP.

High Speed Circuit Breaker

Rated Voltage	DC1500V/DC750V,600V
Rated Current	DC1000A/800A Continuous
Rated Control Voltage	DC110V/100V/24V
Breaking Capacity	DC1800V 10kVA 1-20mH
Auxiliary Contacts	3a3b
Mass	For DC1000A 76kg (with suspending frame) For DC800A 75kg (with suspending frame)

Advantages of Unit Switch

- The arc does not scatter from the arc chute due to electromagnetic closing system.
- For convenient maintenance, the breaker can be set upright, or be laid horizontal with the arc chute facing up.

Unit Switch

Rated Voltage	DC1500V/DC750V,600V
Rated Current	DC800A Continuous
Rated Control Voltage	DC110V/100V/36V/24V
Auxiliary Contacts	3a3b
Mass	15.1g (Breaker 9.9kg, Arc Chute 5.2kg)

Train Event Recorders

In Japan a number of years ago, there was a train accident that occurred due to a train rounding a bend in the track at an excessive speed. This led to a revision of technical standards and to the mandatory installation of recording devices to log data in the event of an accident. In response, we did more than simply develop a device for analyzing the state of operation during an accident; we went beyond by developing and commercializing multifaceted products that, for example, can assess the state of operation for rolling stock with no monitoring equipment.

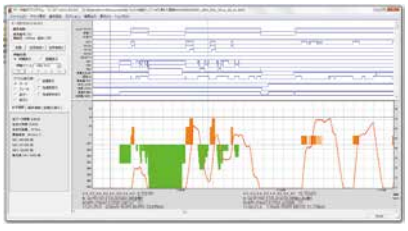
Features

The analysis software is easy to use for train business operators; production configuration is suited to installation in existing rolling stock. Also, thanks to the integration our many years of achievement in train electronics, we have succeeded in producing a highly reliable, highly satisfactory system for the train business operators who use our products.

Installation image of train event recorder

Standard Specifications

Power	24 VDC, 100 VDC
Consumption power	Less than 5 W
Recording media	CF card (256 MB to 512 MB)
Recording interval	Every 200 milliseconds
Recording duration	Approx. 270 hours (if a 256 MB CF card). After that, it records over the oldest data first.
Recorded data	Time (GPS time adjustment function equipped) Speed (acquired from the speedometer generator) Analog signal, digital signal, serial signal (RS485, RS232C) (Analog signals and serial signals are options)



Analysis software
Screen example

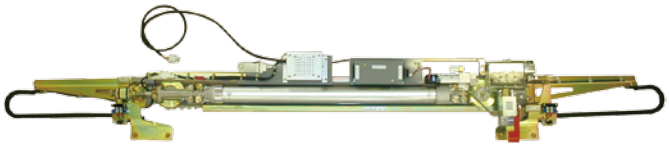
Door Operating Equipment

This system is used to open and close the side doors and cabin doors of electric and diesel trains. Our door operating equipment maintains a strong reputation among our customers for its superior compactness, light weight and low required maintenance. We have optional accessories such as conductor switches and one-man vehicle open/close switches. We also provide portable slope devices for closing the gap between the platform and door to make it easier for wheelchair users to get on and off the train.

Features

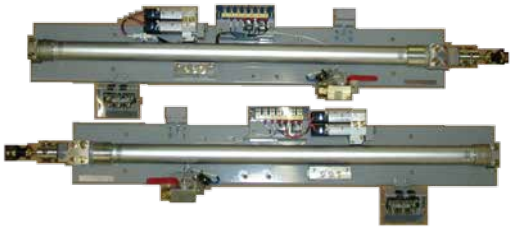
- Available types: Lintel mounting type; double-door interaction type, and single-side opening type
- We also have a platform door controller device system and a control device for weakening the closing force of the door for a set amount of time in the event that a passenger's clothing article or belonging gets caught in the door.
- Operation can be powered by either a pneumatic cylinder or electric cylinder.

Door Operation Equipment



Double-door interaction type (Y4)

Method	Air-cylinder + belt
Operation air pressure	490 kPa
Electromagnetic control voltage	100 VDC or 24 VDC
Door opening width	1300 mm (standard)
Door closing force	560 N
Manual release	Air cock
Weight	14 kg



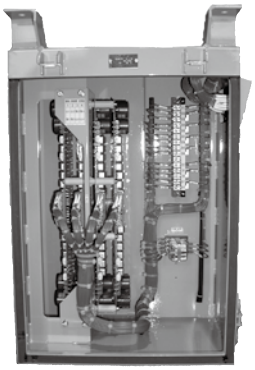
Single-side opening type

Method	Air-cylinder
Operation air pressure	490 kPa
Electromagnetic control voltage	100 VDC or 24 VDC
Door opening width	700 to 1000 mm
Door closing force	560 N
Manual release	Air cock
Weight	15 kg

Double-door interaction type (YE4)

Method	Electric cylinder (ball screw drive) + belt
Control voltage	100 VDC
Door opening width	1300 mm (standard)
Door closing force	560 N (can be changed)
Manual release	Release lever
Weight	17 kg

Door Force Weakening Control Device



Door Force Weakening Control Device

Control voltage	100 VDC
Number of doors that can be controlled	6 or 8 door per car
Mount	Under the floor or seat

E^3 Solution System (Railway Energy Storage System)

Conserving the environment is a high priority global concern. This system is designed as an effective means of further reducing the energy used in railway systems through the application of a power storing device.

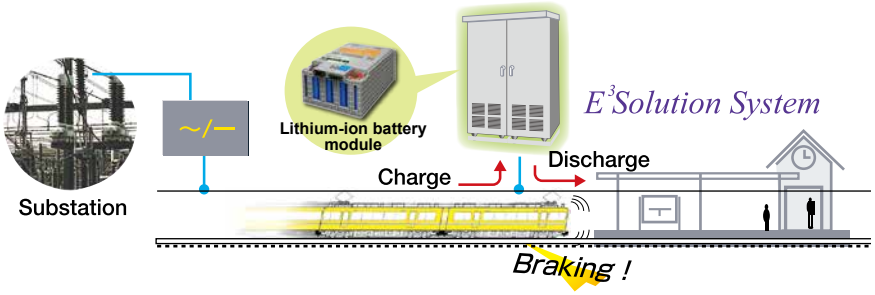
Features

- Energy: Effective use of energy resources
- Ecology: Use of efficient lithium ion batteries
- Economy: No construction cost for more transformers, no increase in contracted power, no capacity up for power receiving equipment

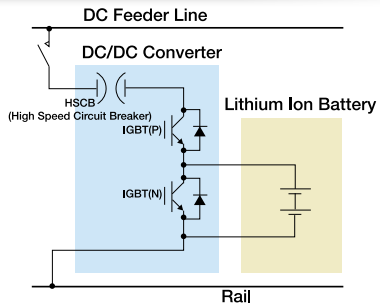
∗ E^3 Solution System is the product of joint development with GS Yuasa International, Ltd.

Three Functions

Compensation of Voltage dropping **Power peak cut** **Absorption of Re-generating Power**



System Composition



Installation Example

Line voltage 1500 VDC, system capacity 920 kW

Line voltage 600 VDC, system capacity 360 kW

System Capacity

Line Voltage	System Capacity
for 600V 750V	180kW
	360kW
	540kW
for 1500V	360kW
	720kW
	1080kW

※ Please inquire detailed system dimension,weight,etc.
※ System Capacity is 30sec.-rating.

Test Equipment for Railway Use

We perform the design and manufacturing for all types of testing equipment related to electronic devices for electric trains.

Features

- Portable Test Unit: Controlled equipment for setting and read-out in the event of a failure
- Traction motor rotation tester; driving gear unit rotation tester

Global

- Sales for Transportation systems
- Manufacturing
- Liaison office

Chengdu Metro

Beijing Subway

TOYO DENKI(BEIJING)CO., LTD.

Changzhou Ruiyang Transmission Technology Co., Ltd.

TOYO DENKI SEIZO K.K.
DELHI LIAISON OFFICE

Hunan Xiangyang Electric Co., Ltd.

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TOYO DENKI USA, INC.

Changzhou Taiping Zhanyun Automatic Door Co., Ltd.

TOYO DENKI SEIZO K.K.
Tokyo Head Office

Dallas Area Rapid Transit

Towing Electric Locomotive
ACP(Autoridad de Canal de Panama)

Yokohama Plant

Site area : 55,300㎡
Total floor area : 43,900㎡
Operation commenced : June 1985

Shiga Factory

enki.co.jp/en/

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