

Highlights

Social Infrastructure Systems

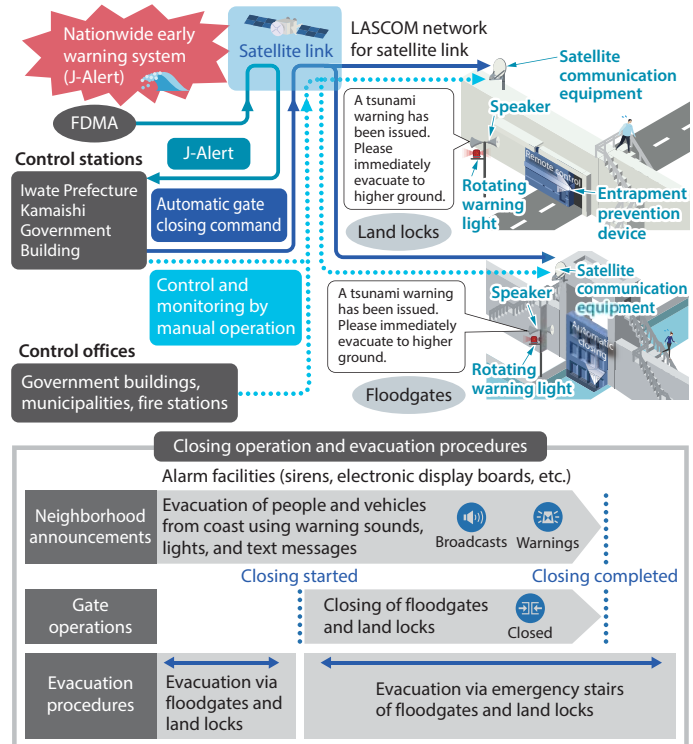
Commencement of Operation of Automatic Closing System for Floodgates and Land Locks in Iwate Prefecture

An automatic closing system for some of the floodgates and land locks in Iwate Prefecture has commenced operation. Covering the entire area of the prefecture, this system uses a satellite link to close all floodgates and land locks from two control stations, which receive tsunami warnings from J-Alert, a nationwide early warning system activated by the Fire and Disaster Management Agency (FDMA).

Toshiba Infrastructure Systems & Solutions Corporation used the all-call Local Authorities Satellite Communications Organization (LASCOS) network for the satellite link, which is known for its robustness and reliability in the event of a disaster.

Many fire officers who headed to coastal areas to close floodgates perished in the tsunami that occurred in the wake of the 2011 Great East Japan Earthquake. This experience revealed the urgent need for a remote-controlled gate closing system.

We will continue to contribute to the creation of a safe, secure, and dependable society through the installation of automatic gate closing systems that protect people from tsunami.



Overview of automatic closing system for floodgates and land locks, Iwate Prefecture

SSR-15 Type Secondary Surveillance Radar for Japan Civil Aviation Bureau

Toshiba Infrastructure Systems & Solutions Corporation has delivered Japan's first secondary surveillance radar (SSR) equipped with the downlink aircraft parameters (DAPs)^{(*)1} function^{(*)2} to the Japan Civil Aviation Bureau. SSRs play an important role in air traffic surveillance by obtaining data on the identification, altitude, and location of aircraft. In recent years, SSRs with DAPs functionality have been developed and evaluated mainly in Europe. The utilization of DAPs is expected to improve the level of air traffic surveillance and contribute to the safety and efficiency of the air traffic control system.

The effectiveness of utilizing DAPs will be evaluated by the Japan Civil Aviation Bureau. We will actively support the deployment of systems with DAPs capability in Japan.

(*)1 Aircraft information such as magnetic heading, ground speed, and selected altitude

(*)2 As of April 2017 (as researched by Toshiba Infrastructure Systems & Solutions Corporation)



SSR-15 type SSR transmitter/receiver system and local control and monitoring system

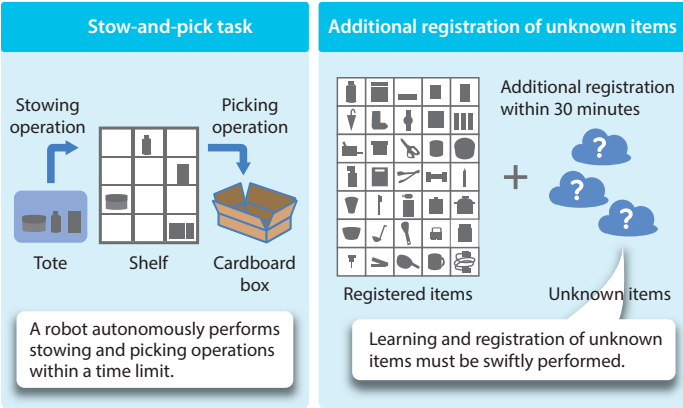
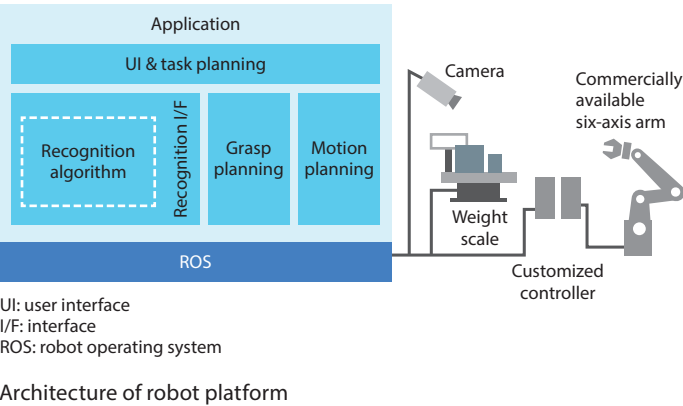
Development of Logistics Robot Platform for Amazon Robotics Challenge Competition

The labor shortage due to the decrease in the working-age population combined with the increasing logistics workload is becoming a social issue. To resolve this issue, Toshiba Infrastructure Systems & Solutions Corporation has developed a logistics robot capable of handling various types of items. The robot demonstrated its autonomous picking performance at the Amazon Robotics Challenge, an international robot contest organized by Amazon Robotics LLC.

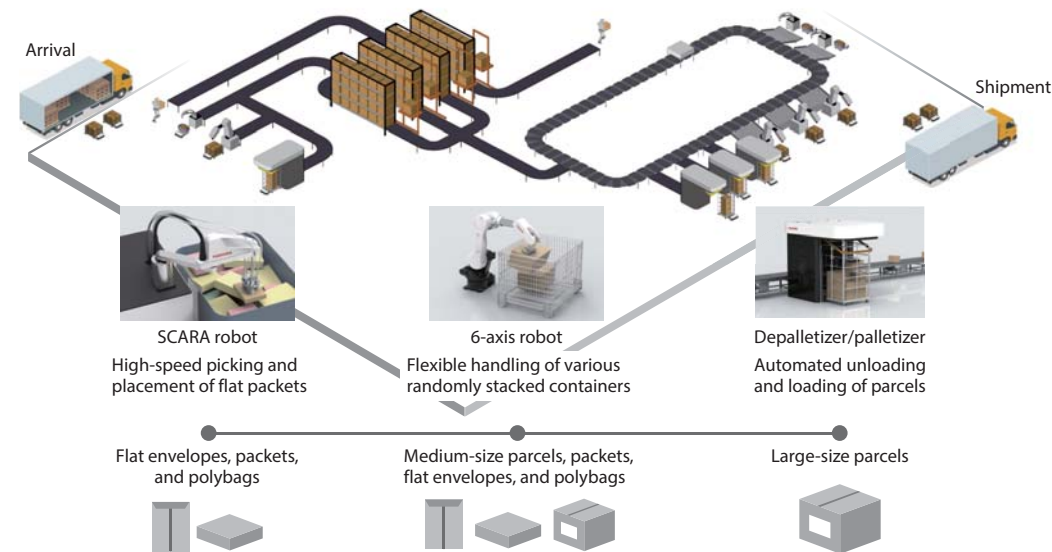
Since the types and sizes of items handled at a distribution site change every day, logistics robots cannot be programmed to perform predefined movements. To solve this problem, our autonomous robot recognizes the situation in real time to adaptively handle various items in the optimal manner. Our robot recognizes the features of each item by means of multiple cameras and moves flexibly to pick up even tilted items or those hidden by other items similarly to human operators.

We have leveraged our mechatronics and pattern recognition technologies to help our customers save labor in various fields for many years. Our engineers versed in these technologies developed the autonomous robot in a short period using open-source software. In addition, we have developed a platform for future robot development.

We will continue to develop and improve our robot technologies so as to contribute effective solutions to the challenges facing the logistics industry.



Rules of Amazon Robotics Challenge



SCARA: selective compliance assembly/articulated robot arm

Automation and labor saving at distribution site

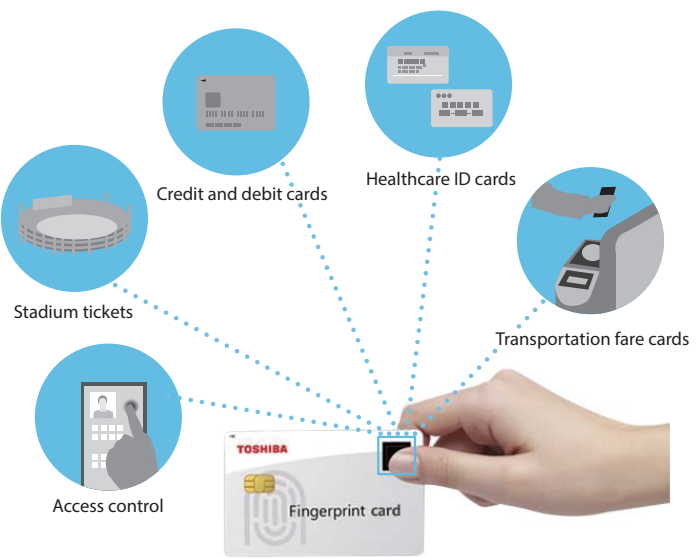
Smartcard Incorporating Fingerprint Sensor

Toshiba Infrastructure Systems & Solutions Corporation has developed a smartcard incorporating a fingerprint sensor, which captures a fingerprint from the sensor on the card and matches it with the information stored in the embedded integrated circuit (IC) chip.

This smartcard has no internal battery. The size, thickness, and strength of the smartcard are the same as those of conventional payment cards. Moreover, since it is compliant with the ISO/IEC standards, it can be used with existing payment terminals and card readers.

Spoofing and fraud crimes are increasing every year due to the leakage or lending of personal identification numbers (PINs). Our smartcard with its fingerprint sensor provides a simpler and more rigorous means of personal identification as an alternative to PIN entry and can be used for various purposes including financial settlements, access control, and identity certification.

ISO: International Organization for Standardization
IEC: International Electrotechnical Commission



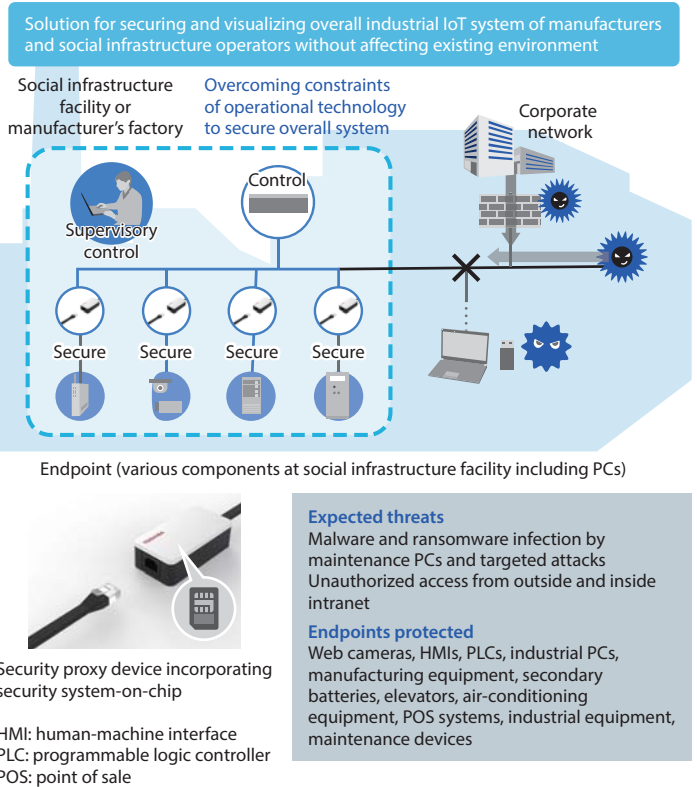
Smartcard incorporating fingerprint sensor

Application of Smartcard Security Technology to IoT

Toshiba Infrastructure Systems & Solutions Corporation is working on the application of smartcard security technology to enhance the security of the Internet of Things (IoT), which is gradually becoming pervasive. As an example of these efforts, we have developed a basic security solution for industrial IoT for manufacturers and social infrastructure operators.

We separated security functions from Web cameras, PCs, and other devices at the endpoints of a network and consolidated them into a security proxy device. All endpoint devices can be monitored from a high-level system simply by inserting the security proxy device into the Ethernet connector of each device to be monitored. It is therefore easy to secure a network and realize various security services. Legacy devices and PCs can also be included in a network since it is secured by external security proxy devices.

We will propose the security proxy device to system operators and integrators running a network with a mix of old and new endpoint devices to which it is difficult to apply security patches.



Overview of security proxy device at endpoint and control system for social infrastructure and manufacturing facilities

TSR-1600 Culler-Facer-Canceller for Australian Postal Corporation

Toshiba received an order for 12 sets of the TSR-1600 culler-facer-canceller (CFC) from the Australian Postal Corporation in February 2015, and commenced the installation of the first machine in June 2016. As the successor to this project, Toshiba Infrastructure Systems & Solutions Corporation handed over the final machine in November 2017. Compared with conventional CFCs, the TSR-1600 is equipped with advanced features including a large-capacity, high-speed local feeder (mail picking mechanism) and a large number of stackers (256).

In addition to the conventional CFC functions of culling mail pieces according to their size then facing and cancelling them, the TSR-1600 can sort letters according to their address and thus further simplifies postal operations. Due to its very high throughput (32 000 pieces/hour), the TSR-1600 significantly improves the efficiency of postal operations.



TSR-1600 culler-facer-canceller for Australian Postal Corporation

FA2100T Model 700 Slim Type Industrial Computer

Toshiba Infrastructure Systems & Solutions Corporation has developed the FA2100T model 700, the latest model of our slim type industrial computers.

While maintaining the characteristics of the conventional models cultivated through our experience in the development of industrial computers, including robustness; ease of maintenance; reliability, availability, and serviceability (RAS); and long-term supply and support, the FA2100T provides approximately double the computing performance of the previous model. In addition, the FA2100T has higher storage capacity as well as physical security features such as an optional security key lock, a security lock slot, and so on.

The FA2100T not only supports the long-term stable operation of conventional general industrial, broadcast communication, and semiconductor manufacturing systems, but will also play a new role in smart factories and plants where demand for edge computing terminals has been increasing in recent years.



FA2100T model 700 slim type industrial computer

Specifications of processor, main memory, and storage devices

Item		Specification
Processor	Main processor	Intel® Xeon® E3-1268L v5 2.4 GHz
	Number of CPU sockets	1
Main memory	Capacity	4 GB minimum, 16 GB maximum
	Type	DDR4 SDRAM
	Operating speed	DDR4-2133 (PC4-17000)
Number of storage units		2

CPU: central processing unit

DDR4 SDRAM: double data rate fourth-generation synchronous dynamic random-access memory

Security-Enhanced Unified Controller nv series™ Certified as Compliant with ISASecure® EDSA

The Unified Controller nv series™ "type2" from Toshiba Infrastructure Systems & Solutions (hereinafter referred to as the "type2 controller") has acquired ISASecure® EDSA (Embedded Device Security Assurance) certification for the first time in the Toshiba Group.

ISASecure® EDSA certification, which is expected to be integrated into the IEC 62443 series standards, is attracting attention from various industries. The ISASecure® EDSA certification program of the Control System Security Center Certification Laboratory (CSSC-CL) has three main elements: Communication Robustness Testing (CRT), Functional Security Assessment (FSA), and Software Development Security Assessment (SDSA). The type2 controller was evaluated as complying with the requirements of all of these elements. The use of the type2 controller as a backbone controller will therefore secure a control system against cyber-attacks.

We will continue to obtain ISASecure® EDSA certification for other models and further enhance our security technology to provide control system components with even higher levels of security.

ISASecure is a registered trademark of the ISA Security Compliance Institute.



Unified Controller nv series™ type2 certified as compliant with ISASecure® EDSA

"typeFR" Industrial Controller with Microsoft Windows Operability Using Virtual Machine Technology

Toshiba Infrastructure Systems & Solutions Corporation uses the Linux kernel optimized for the platform of its Unified Controller nv-pack series "typeFR" industrial controller. We have added a computer function based on virtual machine technology to the typeFR.

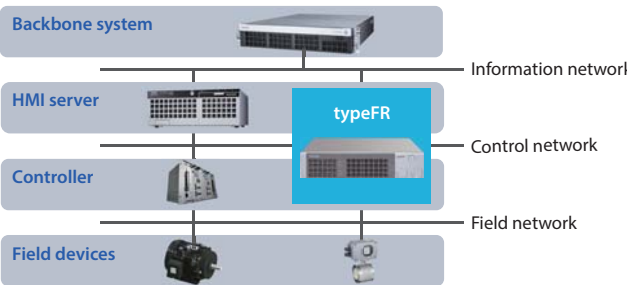
The typeFR can execute conventional controller functions in parallel with applications (computer functions) running on Windows 10 in a virtual machine environment using resources isolated from the Linux host.

The computer and controller functions share data using a shared memory. In order to access the shared memory, the typeFR includes the standard Windows application programming interface (API).

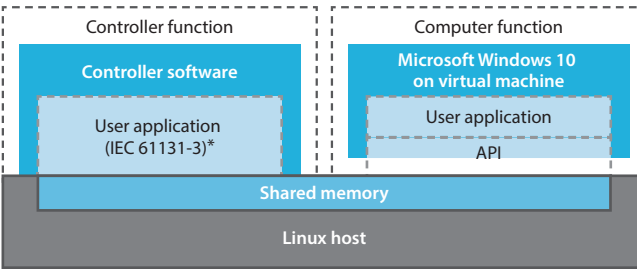
Consequently, the typeFR makes it possible to create compact IoT systems that incorporate the controller of a conventional control system and computer functions such as a human-machine interface (HMI).

Microsoft and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

Linux is a registered trademark of Linus Torvalds in the U.S. and other countries.



Configuration of control system using Unified Controller nv-pack series typeFR



* An International Electrotechnical Commission standard for Programmable controllers - Part 3: Programming languages

Configuration of typeFR incorporating computer functions

SCiB™ Battery System Compliant with SIL 3 of RAMS Standards

Accompanying the expanding use of batteries for electric power and automotive applications, battery technologies are also attracting attention in the railway industry. As mass transit systems, railways have stringent safety requirements. Overseas railway systems, particularly those in Europe, often require compliance with the EN (European Norm) 50126 standards, which are also known as the reliability, availability, maintainability, and safety (RAMS) standards and include functional safety requirements.

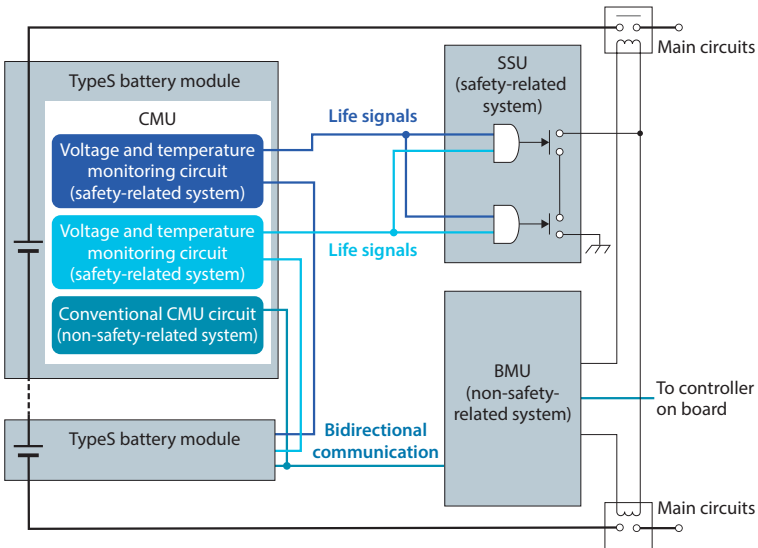
Under these circumstances, Toshiba Infrastructure Systems & Solutions Corporation has developed battery system components incorporating its SCiB™ lithium-ion rechargeable batteries compliant with safety integrity level 3 (SIL3) of the RAMS standards, with a view to releasing them in the European market. We have been making efforts to obtain third-party certifications of the battery system components for compliance with EN 50126 for basic RAMS requirements and generic processes and EN 50129 for safety-related electronic systems. Our battery systems incorporate redundant battery monitoring as required by the EN standards for rolling stock.

The battery system consists of a battery management unit (BMU), a safety supervisor unit (SSU), “TypeS” battery modules, and contactors. The BMU provides railway cars with information on the battery voltage and temperature, while the SSU monitors the functional safety operation of each battery module to meet the RAMS requirements. A maximum of 28 TypeS battery modules can be connected in series. Each module is equipped with a cell monitoring unit (CMU), which is composed of a non-safety-related system for the BMU and a safety-related system for the SSU. To ensure compliance with RAMS, the safety-related systems of the SSU and the CMU are configured with redundancy and operate only with hardware, with no software control.

It is expected that these components will be utilized for various RAMS-compliant battery systems for rolling stock.



TypeS battery module

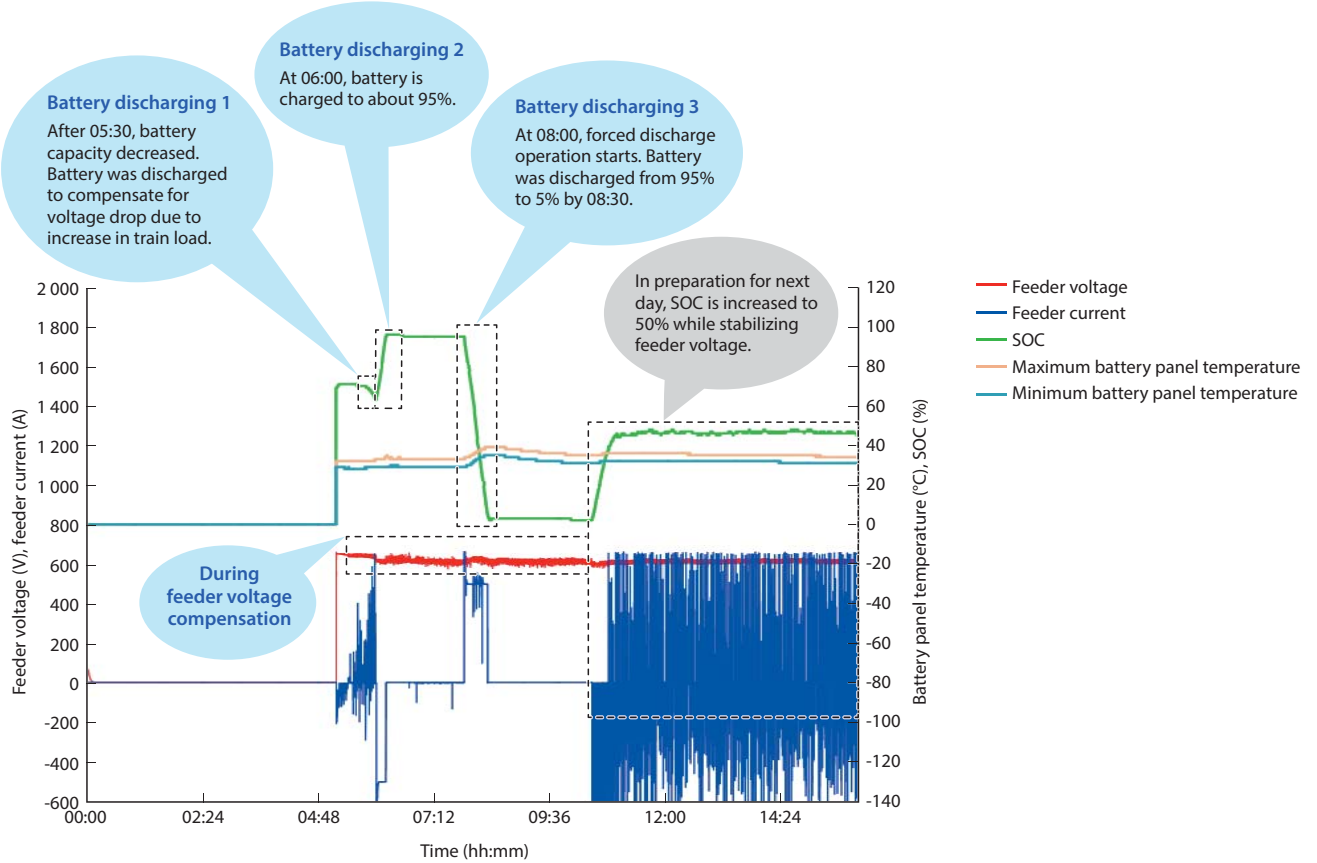


Block diagram of battery system

Main specifications of battery system components

Item		Specification
TypeS battery module	Nominal voltage	27.6 VDC
	Rated capacity	40 Ah
	Maximum current (continuous)	160 A
	Maximum allowable current	350 A within 10 seconds
	Battery voltage range	18.0 to 32.4 VDC
	Cell configuration	2 parallel x 12 series
	Dielectric strength voltage	1 000 VDC
	Maximum number of modules connected in series	28 series
Battery system	Nominal voltage	773 VDC maximum (with 28 modules connected in series)
	Voltage fluctuation range	504 to 907 VDC (with 28 modules connected in series)

Field Test of 600/750 VDC TESS on Operating Railway Lines of Hiroshima Electric Railway Co., Ltd.



Example of state of power distribution in peak-cut operation mode of TESS

Toshiba Infrastructure Systems & Solutions Corporation has developed a traction energy storage system (TESS) as a regenerative energy storage solution for substations and other on-ground wayside applications. The TESS incorporates our SCiB™ rechargeable lithium-ion battery to prevent regenerative braking failure, stabilize line voltage, and promote energy saving. Following the development of a TESS for 600/750 VDC electrified railway systems, we performed a field test on operating railway lines in cooperation with Hiroshima Electric Railway Co., Ltd. for two months, starting on July 19, 2017.

The major purpose of this field test was to evaluate the continuous discharge characteristics of the new TESS. From the results obtained, it was confirmed that a continuous discharge of 90% of the maximum output capacity of 194 kWh (from a state of charge (SOC) of 95% to 5%) helps to cut peak power use during morning rush hours on weekdays. It was also found that the TESS can supply a maximum energy of 175 kWh for 30 minutes while stabilizing the feeder voltage. The TESS operated at the same performance level every day during the test period without any problem.

The field test of the new 600/750 VDC TESS has confirmed that it achieves a significant reduction in peak power in addition to the conventional benefits of TESS application.

Delivery of Propulsion System for "Train Suite Shiki-shima" Luxury Cruise Train of East Japan Railway Company

Toshiba Infrastructure Systems & Solutions Corporation has delivered a propulsion system, including diesel generators, for East Japan Railway Company's flagship luxury cruise train, the "Train Suite Shiki-shima," which mainly makes round-trip journeys around eastern Japan.

The Train Suite Shiki-shima consists of dual-mode electro-diesel cars so as to run on both electrified and non-electrified tracks under its own power. Our propulsion system accommodates various power supply standards, enabling the Train Suite Shiki-shima to maintain stable self-supported operation on all railway sections. Specifically, our propulsion system allows the Train Suite Shiki-shima to run on all of the electrified tracks in Japan (20 kVAC–50/60 Hz, 25 kVAC–50 Hz, and 1 500 VDC) with electric power supplied from the catenary as well as on non-electrified tracks using its engine and diesel generator system.



Delivery of Hybrid Propulsion System for "Twilight Express Mizukaze" of West Japan Railway Company

Toshiba Infrastructure Systems & Solutions Corporation has developed a compact hybrid propulsion system (i.e., a motor propulsion system using electricity from a diesel generator and a battery-assist system) and delivered it to West Japan Railway Company for installation on the "Twilight Express Mizukaze" luxury sleeper train.

The equipment for a train propulsion system is generally mounted under the train floor. Since equipment specific to sleeping cars is also installed on the Twilight Express Mizukaze, a compact propulsion system was required.

We collaborated with West Japan Railway Company to develop a compact and lightweight main converter to control motors and batteries adopting a water cooling system. Since the newly developed propulsion system is compact, the main converter can be installed on the train roof without affecting the overall train design.

We utilized our large-capacity SCiB™ lithium-ion secondary batteries for the battery system, which is charged during braking and releases energy during acceleration. Therefore, the battery system improves the energy consumption of the train. Furthermore, the totally enclosed structure of the main motor allows bearing replacement without disassembling it, thereby minimizing maintenance requirements and achieving silent operation.



Electric System for HELMS Hybrid Locomotives of DB Cargo AG in Germany

In a project led by Deutsche Bahn AG, Toshiba Infrastructure Systems & Solutions Corporation has developed a traction system for HELMS (Hybrid Electro-Mechanical Shunter), a hybrid electromechanical drive system for the modernization of diesel shunting locomotives. Upon conclusion of a contract for the HELMS system in 2015, Toshiba organized an international project team comprising Japanese and European experts. The Japanese experts collaborated with Deutsche Bahn AG to create the basic design, drawing on hybrid traction technology developed through various projects in the Japanese market. The European experts led the design modification work to make the system compliant with European railway standards such as EN 50126, EN 50128, and EN 50129 (RAMS and functional safety) as well as EN 45545 (fire protection).

The traction system consists of the following subsystems: a power converter cubicle (PCC) equipped with a power converter unit (PCU) and a traction control unit (TCU) that provides series-parallel hybrid control, a traction battery system (TBS) equipped with our highly safe SCiB™ rechargeable battery modules and a supervisory system certified as complying with SIL3 of the RAMS standards, and a generator and traction motor applying proven induction technology.

Following the installation of the traction system on two prototype HELMS locomotives in Cottbus, Germany, we have commenced a commissioning test.



PMSM Propulsion System for 40 New Cars (Five 4M4T Trainsets) of Busan Metro Line 1 in South Korea

Permanent magnet synchronous motor (PMSM) propulsion systems have been installed on 40 new cars of Busan Metro Line 1 for the first time in South Korea.

In Busan, the second-largest city in South Korea, Metro Line 1 is an important means of transportation for both commuters and tourists. The new cars are designed as 1 500 VDC commuter trains. The PMSM propulsion system is expected to consume approximately 30% less energy than the conventional induction motor (IM) propulsion system.

Toshiba Infrastructure Systems & Solutions Corporation, in collaboration with Woojin Industrial System Co., Ltd., demonstrated the performance of the PMSM propulsion system for three months, replacing the IM system on the existing cars with the PMSM system. As a result, it was confirmed that the PMSM propulsion system contributes to a reduction of the energy consumption of the new cars.

In addition to high efficiency, a feature of the PMSM is its totally enclosed, naturally cooled structure, which allows swift bearing replacement without requiring disassembly. The new cars with the PMSM propulsion system commenced commercial operation in July 2018 and are expected to improve the energy efficiency and maintainability of Busan Metro Line 1.



Delivery of PMSM Propulsion Systems for C651 Series Trains Operated by SMRT Trains Ltd. in Singapore

Toshiba Infrastructure Systems & Solutions Corporation has delivered PMSM propulsion systems to be installed on the C651 series trains operated by SMRT Trains Ltd. in Singapore.

The C651 series trains are in the midst of midlife upgrading. Singapore Rail Engineering Pte. Ltd., a subsidiary of SMRT Corporation Ltd., is leading the refurbishment work on the C651 series trains.

Toshiba previously delivered PMSM propulsion systems for the C151 series trains, and the refurbished C151 series trains have been in revenue service since the end of July 2015. PMSMs consume less energy, produce less noise, and require less maintenance than conventional propulsion motors because of their totally enclosed structure, resulting in higher efficiency.

The C651 refurbishment project is now at the testing and commissioning stage, and the refurbished C651 series trains are expected to start revenue service in the middle of 2018.

We will continue to evaluate and improve the energy efficiency of our PMSM propulsion systems.



PMSM



C651 series trains

PMSM for C651 series trains of SMRT Trains Ltd., Singapore

Commencement of Demonstration Operation of Electric Bus System in Malaysia

In August 2017, Toshiba Infrastructure Systems & Solutions Corporation commenced the demonstration operation of a large electric bus system in the city of Putrajaya, the federal administrative center of Malaysia. The demonstration has been conducted under the Putra-NEDO EV Bus Demonstration Project, an international demonstration project for introducing electric vehicle (EV) buses with a fast-charging system in Putrajaya that is being implemented by the New Energy and Industrial Technology Development Organization (NEDO) using Japanese technologies and working in cooperation with local companies.

Electric buses traveling on a 30 km route can be automatically recharged by 320 kW chargers installed at the bus termini through a pantograph in approximately 10 minutes. The demonstration system consists of three subsystems: 10 large electric buses equipped with our SCiB™ long-life lithium-ion rechargeable battery, four super-quick chargers, and a cloud information system using IoT technology.

The objectives of this project are to verify the operating life characteristics of the SCiB™ battery and to demonstrate the operating performance of super-quick-charging electric bus systems in a tropical climate.



Electric buses equipped with SCiB™ lithium-ion rechargeable batteries at charging station in Putrajaya, Malaysia

Short-Afterglow Fluorescent Screen for X-Ray Baggage Inspection Systems

X-ray baggage inspection systems at airports and elsewhere convert X-rays that have passed through baggage into visible light and use photodetectors to convert it into electrical signals to obtain X-ray images of the baggage. In recent years, manufacturers of X-ray baggage inspection systems have been under pressure to reduce the time required for inspection due to the construction of new airports in emerging countries and an increase in the number of air travelers.

In response, Toshiba Materials Co., Ltd. has developed a phosphor with 1/230th the decay time and 1/125th the afterglow of the conventional phosphor for medical applications, and commercialized short-afterglow fluorescent screens with the optimal particle size, particle size distribution, and screen thickness. The newly developed fluorescent screens enable accurate inspections without being affected by the residual image of the previous baggage, making it possible to increase the speed of inspection lines and reduce costs.



Short-afterglow fluorescent screens

Application of fluorescent screens	Newly developed screen for baggage inspection	Screen for medical applications
Material	Gd ₂ O ₂ S:Pr	Gd ₂ O ₂ S:Tb
Maximum emission wavelength (nm)	512	545
Decay time (μs)	3	700
Afterglow at 10 ms (%)	0.008	0.1

Gd₂O₂S:Pr is gadolinium oxysulfide (Gd₂O₂S) doped with praseodymium (Pr).
Gd₂O₂S:Tb is Gd₂O₂S doped with terbium (Tb).

Characteristics of fluorescent screen with short afterglow time for X-ray baggage inspection systems

Large Flexible Printed Circuit Board for Space Debris Sensors

Toshiba Hokuto Electronics Corporation has developed a flexible printed circuit board (FPCB) for space debris sensors to measure the size of space debris.

The newly developed FPCB is large, thin, and double-sided, with an external size of 500 mm square and a thickness of 24 μm. Approximately 4 000 linear conductors (with a thickness of 6 μm) are formed with a 100 μm pitch on the detection area of 410 mm by 340 mm. The sensor made with this FPCB measures the size of space debris by detecting the electrical disconnections that occur when debris collides with the linear conductors.

The conventional double-sided FPCB with a thickness of about 60 μm uses 18 μm copper foil. However, a space debris sensor requires a much larger FPCB with 40% less thickness. To satisfy the target specifications, we have developed a unique process for efficiently performing partial half-etching on a large area.



FPCB to measure size of space debris

e-STUDIO 3508LP/4508LP/5008LP Series Monochrome MFPs with Erasable Blue Printing Function

Toshiba TEC Corporation has developed a range of hybrid multifunctional peripherals (MFPs) that can drastically reduce carbon dioxide (CO₂) emissions by making it possible to reuse paper multiple times.

In 2013, the Intergovernmental Panel on Climate Change (IPCC) announced that global warming was progressing due to human greenhouse gas emissions and called for urgent action to reduce CO₂ emissions.

MFP manufacturers are competing with each other to reduce the power consumption of MFPs. However, since approximately 80% of CO₂ emissions are generated by the use of paper, simply reducing the power consumption of MFPs is insufficient.

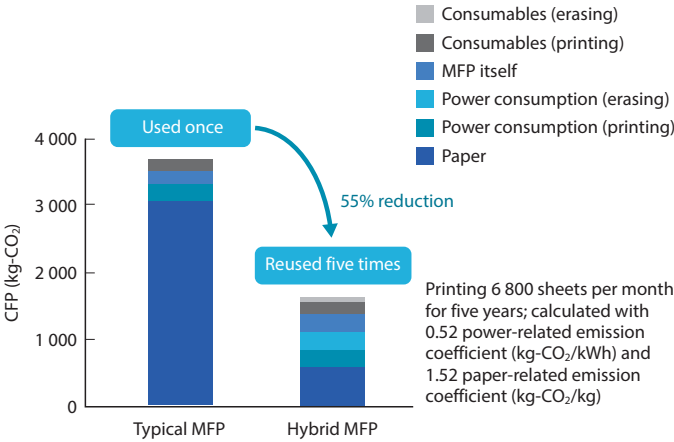
Under these circumstances, we released the e-STUDIO 30L in 2013, the first-generation MFP that allowed paper to be reused. The e-STUDIO 30L received various awards including the 2013 Green IT Award from the Minister of Economy, Trade and Industry, and the 2013 Cho Monozukuri Innovative Parts and Components Award. Since its release, the e-STUDIO 30L has been used by customers whose workflow benefits from paper reuse.

While supplying the e-STUDIO 30L, we frequently received requests for an MFP that would allow both regular and erasable printing. In response, we have developed the e-STUDIO 3508LP/4508LP/5008LP series, which combines erasable blue printing and conventional monochrome printing while maintaining energy-saving performance. We realized the new MFPs by drawing on our unique capsulation toner technology for producing toner from erasable color materials, world-leading low-temperature fusing technology, and fine fusing temperature control technology.

Erasable blue printing allows paper to be reused. Users can monitor the amount of paper reduction via visualization software. When paper is reused five times, the CO₂ emissions generated by printing are reduced by 55%. This is a significant contribution toward environmental load reduction.



e-STUDIO 3508LP/4508LP/5008LP series monochrome MFP with erasable blue printing function



CFP: carbon footprint

Reduction of CO₂ emissions achieved by reusing paper

Scan-at-Once RFID Self-Service POS Kiosk for G.U. Co., Ltd.

Toshiba TEC Corporation has developed a scan-at-once radio-frequency identification (RFID) self-service point-of-sale (POS) kiosk for G.U. Co., Ltd., which allows customers to scan RFID-tagged items and pay for them on their own.

This user-friendly self-service POS kiosk incorporates our core RFID scanning technology. When the customer places RFID-tagged items in the integrated box, the POS kiosk immediately and accurately scans them in a single operation.

Our self-service POS kiosk dramatically reduces the time required for checkout, by up to two-thirds. Since the self-service POS kiosk can reduce waiting times during busy periods, shops can expect an increase in the customer turnover rate.



Scan-at-once RFID self-service POS kiosk for G.U. Co., Ltd.

UF-2200 Series Handheld RFID Readers

Toshiba TEC Corporation has developed the UF-2200 series of handheld RFID readers. The newly developed RFID readers can be used for inventory management, circulation management, and many other purposes in the apparel and distribution industries.

This RFID reader series has the following key features:

- Increased read range due to high power
The UF-2200 series provides an increase in the read range to 7 m, improving inventory-taking accuracy. The long read range has been achieved using our unique tag searching protocol.
- High read speed
Incorporating a high-performance feature, the UF-2200 series can read 600 tags per second.
- Expanded applicability
The newly added barcode scanner expands the applicability of the UF-2200 series.



UF-2200 series handheld RFID readers

New Kindmover Escalator for Commercial Facilities in Chinese Market

In response to the requirement of the Chinese market for enhanced safety, Toshiba Elevator and Building Systems Corporation released a Kindmover escalator for commercial facilities in August 2017.

This elevator provides the following new safety functions stipulated by GB 16899, a Chinese national standard for escalators:

- The inlet guard brush prevents passengers from being caught in the handrail inlets (standard equipment).
- A safety device automatically stops the escalator when it detects an object caught in a gap between a step and a skirt guard panel (optional).
- Another safety device also automatically stops the escalator when it detects an object caught in a gap between neighboring steps (optional).

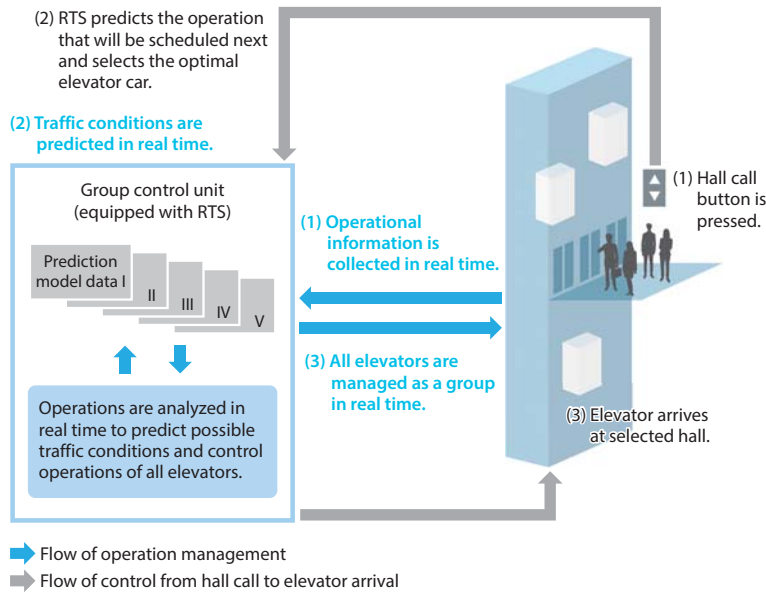


Kindmover escalator for commercial facilities in Chinese market

Elevator Group Control System Realizing Optimal Traffic and Further Energy Saving

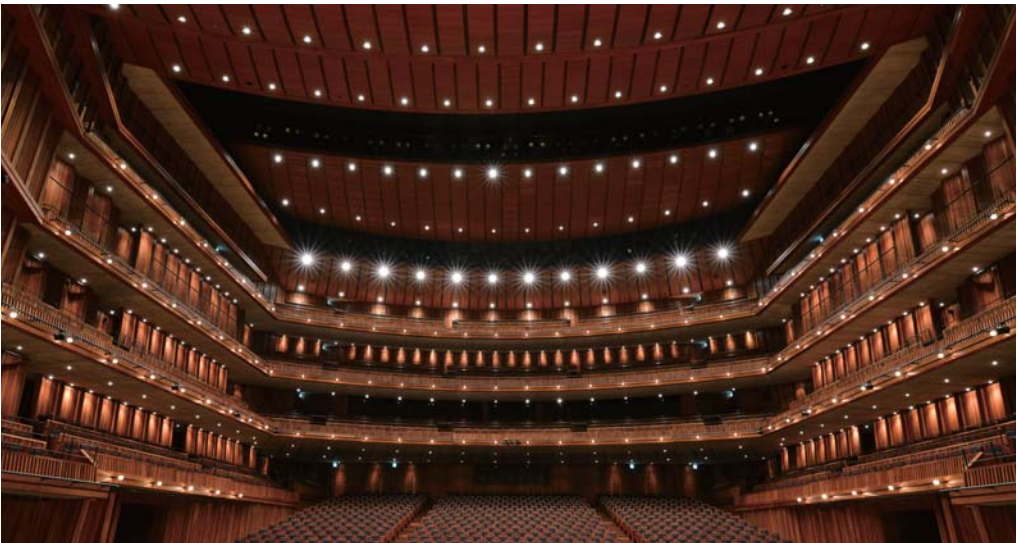
Toshiba Elevator and Building Systems Corporation released an elevator group control system incorporating a real-time scheduling (RTS) algorithm, in July 2017. RTS analyzes the movements of individual elevators in real time while predicting their future movements and thereby helps to reduce waiting times compared with conventional models. In addition, to achieve savings in overall power consumption, RTS incorporates an allocation function that reduces the number of elevators in operation according to the traffic demand.

We are also supplying the FLOORNAVI destination control system, which makes it possible to provide optimal and comfortable elevator rides by recognizing passengers' destinations beforehand.



Outline of RTS control system

LED Color-Changing and Dimming System Operated with DC Supply for Theaters



LED lighting for Grand Hall of Hyogo Performing Arts Center

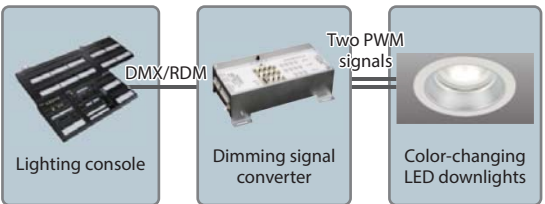
Toshiba Lighting & Technology Corporation has developed a new light-emitting diode (LED) lighting system for the Hyogo Performing Arts Center that makes it possible to produce light traditionally realized with halogen luminaires. Halogen lamps in the acoustic reflection plates, walls, and ceilings of the theater were replaced with LED bulbs.

In theaters, halogen lamps are generally dimmed using phase-cut dimmers. Although it is desired to replace existing lamps or luminaires with LED lighting, there have been several problems due to the following differences between LED lighting and halogen lamp systems: (1) unlike incandescent lamps, it is difficult to change the color temperature of white LEDs with a dimmer; and (2) phase-cut dimmers can cause flickering due to malfunction.

The newly developed LED system resolves these problems by means of the following features:

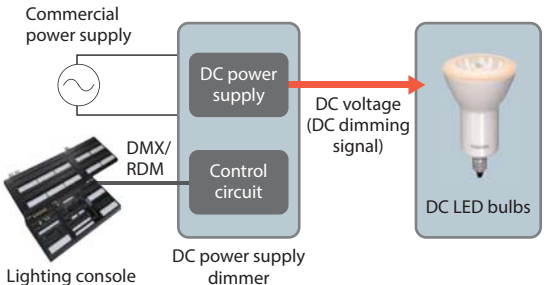
- Configuration of dimming and color-changing LED system
The luminaires are composed of two LEDs with different color temperatures. The color mixture ratio of the two LEDs can be controlled with two pulse-width modulation (PWM) signals. Consequently, the color temperature of the luminaires, particularly the downlights for the theater house lighting, can be varied between 1 800 K and 2 700 K, making it possible to produce halogen-like light.
- Dimming system for LED bulbs operated with DC supply
Since a DC supply voltage provides more stable dimming, we have developed a dedicated DC dimmer and DC LED bulbs. The DC LED bulbs dim according to the voltage output by the DC dimmer. Regulation of the DC power voltage enables flicker-free dimming of the LED bulbs. Furthermore, we reduced the size of the circuit board in the LED bulbs by using gallium nitride (GaN) power devices.

The new LED dimming system has been in operation since April 2017, producing light comparable to that of halogen lamps. This LED dimming system is expected to promote the replacement of existing halogen lamps in theaters with LED lamps.



DMX: digital multiplex
RDM: remote device management

Configuration of LED dimming and color-changing system



Dimming system for LED bulbs operated with DC supply

Compact LED Spotlight for Museums

Toshiba Lighting & Technology Corporation has released a compact LED spotlight incorporating a power source for museums. The main features of this LED spotlight are as follows:

- A phosphor-based LED converts violet light into continuous-spectrum white light with excellent rendering of sunlight.
- Since the compact cylindrical shape with a diameter of 50 mm is unobtrusive, museum visitors can concentrate on exhibitions. The compact spotlight can also be easily installed and removed.
- The integrated remote communication module allows the spotlight to be dimmed remotely.



Compact LED spotlight incorporating power source for museums

Water Sterilization Module Equipped with Deep-Ultraviolet LED

Toshiba Lighting & Technology Corporation has developed a water sterilization module for the medical and food industries that produces safe water. This module incorporates a deep-ultraviolet LED to provide mercury- and chemical-free water treatment.

The water sterilization module has two structural features. The first feature is its compact size, achieved through the optimal LED light distribution design and a unique water flow path design. The other feature is a water pressure resistance of 1 MPa, due to the use of a metal housing.

In order to improve irradiation efficiency, a deep-ultraviolet LED has been combined with high-reflectance reflectors in the flow path. It has been confirmed that this water sterilization module provides a sterilization rate of 99.9% for *Escherichia coli* (*).

By increasing the capacity of the water sterilization module, its applications are expected to be further expanded to other fields such as water supply and sewage systems requiring mercury- and chemical-free water treatment.

(*) According to the inspection standard of Japan Food Research Laboratories for a single-pass system with a flow rate of 2 L/min



2 L/min type water sterilization module equipped with deep-ultraviolet LED

Universal Smart X EDGE Series Air-Cooled Heat Pump Chilling Units with Industry-Leading Compactness and Efficiency

In the Japanese market for central heat source equipment, the ratio of large-capacity models is increasing year by year. The requirements for central heat source equipment include compactness, large capacity, and high efficiency.

In response to these needs, Toshiba Carrier Corporation has developed the Universal Smart X EDGE Series^(*) air-cooled heat pump chilling units, expanding the limits of size and efficiency.

With a newly developed compressor providing a capacity per footprint 50% higher than the previous series, and an integrated part-load value, cooling (IPLV_c) of 6.0, the Universal Smart X EDGE Series is one of the most compact and energy-efficient heat pump chilling units in the industry^(*).

The HEATEDGE model provides a 45% higher heating capacity under low outdoor air temperature conditions than the conventional model and a lower operating outdoor temperature limit of -25°C compared with the -15°C limit of the conventional model. Since the HEATEDGE model expands the application of heat pump chilling units to cold areas, it will contribute to the prevention of global warming.

(*)1 The Universal Smart X EDGE Series consists of the following three models:

- AIREEDGE: 60 horsepower (hp) high-efficiency model
- HEATEDGE: Model with enhanced heating performance
- POWEREDGE: Large-capacity model with reduced footprint.

(*)2 As of October 2017 (as researched by Toshiba Carrier Corporation). The footprint comparison is based on POWEREDGE. The energy-efficiency comparison is based on the coefficient of performance (COP) of AIREEDGE.



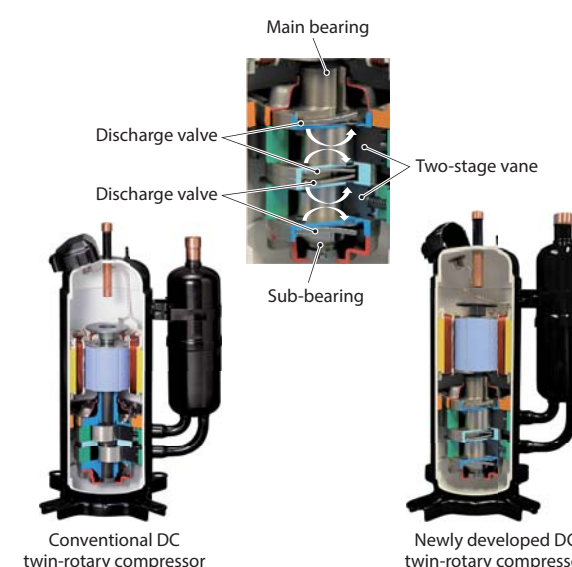
Universal Smart X EDGE Series air-cooled heat pump chilling unit

A4 100 cc DC Twin-Rotary Compressor

In order to realize a 70 hp air-cooled heat pump chilling unit with the largest-class capacity in the Japanese market, Toshiba Carrier Corporation has developed the A4 100 cc DC twin-rotary compressor, with the world's largest capacity^(*). Its main distinctive characteristics are as follows:

- High capacity
We optimized the shaft-bearing structure and adopted our unique two-stage vane to increase the displacement volume without changing the housing dimensions, thereby increasing the capacity by 25%.
- High efficiency
We incorporated a motor with high-density windings and our unique PWM converter into the new twin-rotary compressor to improve the drive efficiency, and employed a new four-valve discharge structure to reduce losses. The performance of the new twin-rotary compressor is consequently 6% higher than that of the conventional twin-rotary compressor under IPLV_c operating conditions. As a result, the new twin-rotary compressor provides the industry's highest energy-saving performance^(*).

(*) As of September 2017 (as researched by Toshiba Carrier Corporation)



Newly developed A4 100 cc DC twin-rotary compressor

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