Co-innovating tomorrow™

YOKOGAWA

Yokogawa in the water industry

Bulletin 53W01A03-01E

Clear path to the operational excellence for sustainable future

Water resources are finite, and therefore contributing to a sustainable water cycle is one of the Sustainable Development Goals (SDGs).

Yokogawa has been providing advanced digital control solutions for various water applications in the water supply chain.

With our leading-edge technologies, dependable products and extensive expertise and experience of diverse water projects around the world, we work with you to provide sustainable water solutions that boost your business and add value throughout the plant lifecycle.

Global coverage on the water supply chain

Water treatment

- Integrated monitoring system
- Water quality monitoring
- Chemical injection optimization
- Pump operation management
- Advanced water treatment management
- Demand forecasting
- Operator training simulator

Water distribution

- Water leakage management
- Water distribution management
- Distribution pump management
- Water quality monitoring
- Demand forecasting
- Advanced water leakage detection

Desalination

- Emergency shut-down system
- Power consumption optimization
- Energy management system
- Membrane filtration flux control
- Chemical injection optimization
- Water quality monitoring
- Operator training simulator

System on systems

- Distributed control system
- Blower control optimization
- Sludge control
- Operation efficiency support system
- Water quality monitoring

Wastewater treatment

- Water transmission management
- Pump station monitoring
- Leak detection
- Water quality monitoring
- Reservoir monitoring

Pipeline

- Industrial water distribution management
- Dynamic simulation
- Realtime diagnostics forecasting system
- Water quality monitoring

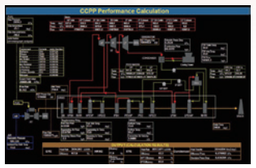
Industrial water

Your single-source partner for operational excellence

OpreX™ Transformation

Production Management

Plant Information Management



Exaquantum

Data Driven Modeling system for Optimization

Data Driven Modeling system for Optimization (DDMO)

Water Leakage Management System

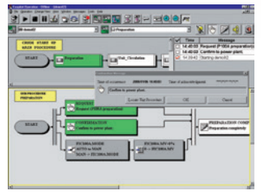
Water Leakage Management System (WLMS)

Asset Management and Operation Efficiency

Plant Resource Manager

Plant Resource Manager (PRM)

Operation Guidance

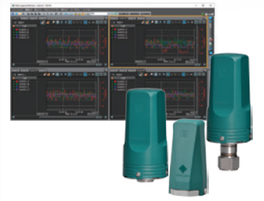


Exapilot

Operator Training Simulator

Operator Training Simulator (OTS)

IIoT Wireless Solution



Sushi Sensor*

OpreX™ Control

Control and Safety System

Integrated Production Control

CENTUM VP

Integrated Safety Control

ProSafe-RS series

Hybrid PLC/RTU

STARDOM

SCADA

FAST/TOOLS, CI Server**

Control Devices

PLC

FA-M3V

Industrial AI Platform

e-RT3 Plus

Controllers & Indicators

UTAdvanced / YS1000

OpreX™ Measurement

Field Instruments

Flow

Multi-variable

Pressure

Level

Temperature

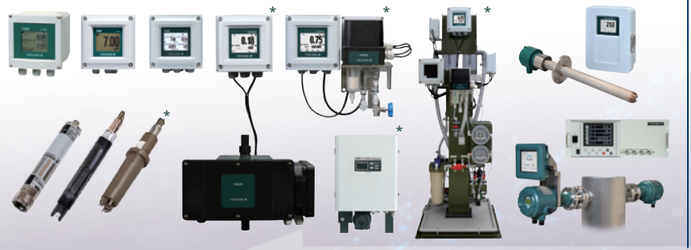
Wireless

Distributed Temperature Sensors

Handheld Instruments

Analyzers

Analyzers



Data Acquisition

Data Acquisition Equipment

SMARTDAC+

Life Science

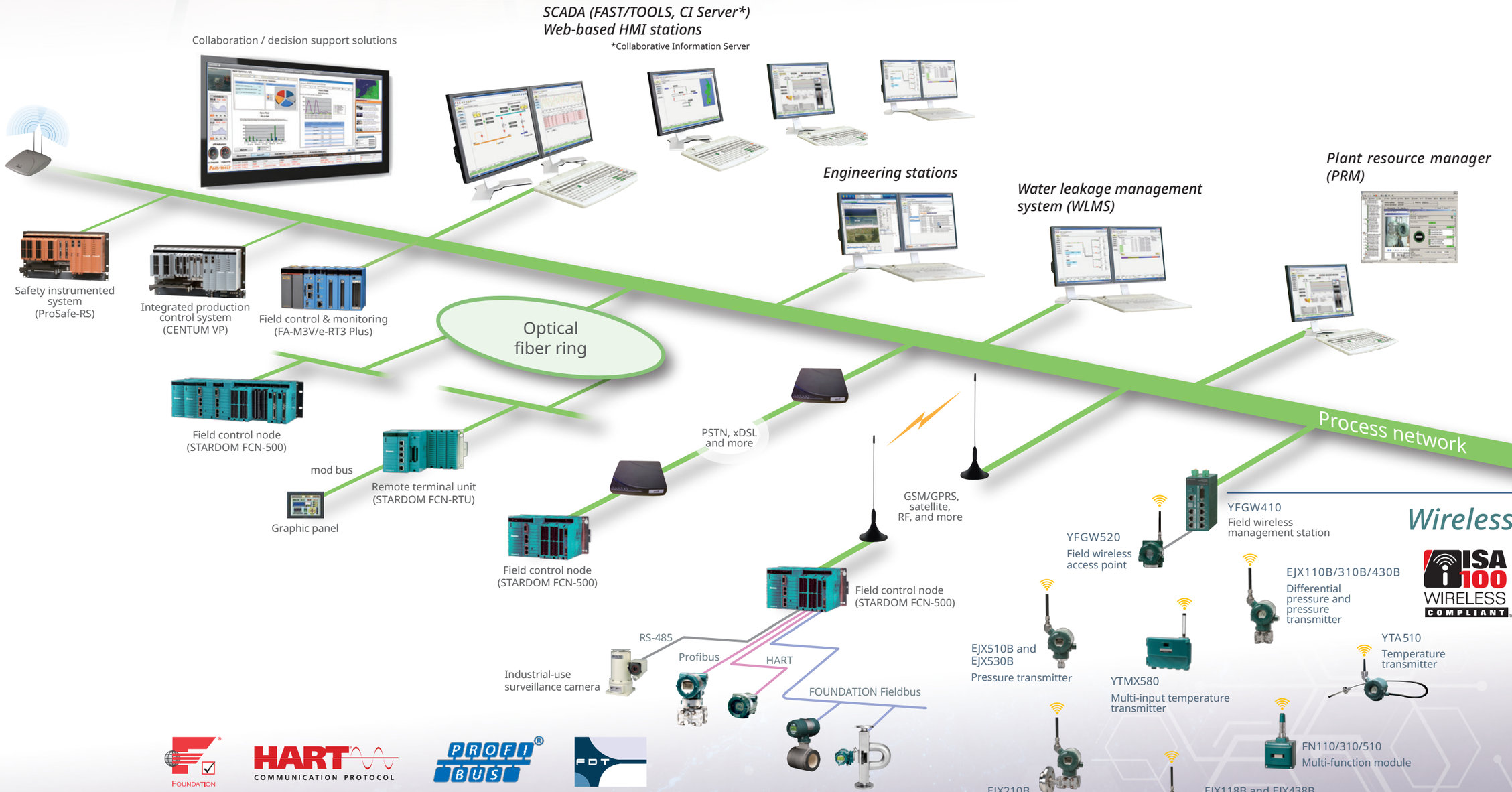
Flow Imaging

FlowCam

* Please confirm availability in your area with Yokogawa.
** Collaborative Information Server

Dependable & scalable control solution platforms

Yokogawa offers a wide range of control solutions that embody our outstanding technologies, product quality, and application know-how to improve your operation of municipal and industrial water/wastewater plants.



Water treatment plant

Water intake

■ **Raw water quality management**
- VOC analyzer, trace oil-in water monitoring, UV, conductivity analyzer
- Turbidity analyzer, pH sensor, alkalinity analyzer

■ **Water intake flow control**

■ **Activated carbon injection control**

Water treatment

■ **Chlorine injection feedforward control**
- Automatic ammonium nitrogen analyzer

Chemical injection equipment

■ **Coagulation control**
- Turbidity analyzer, pH sensor, alkalinity analyzer, temperature

■ **Sedimentation basin water quality control**
- Alkaline agent, pH sensor, residual chlorine analyzer

■ **Ozone and activated carbon filtration management**
- Dissolved ozone, waste ozone

■ **Sand filtration management**
- Turbidity analyzer
- Residual chlorine analyzer

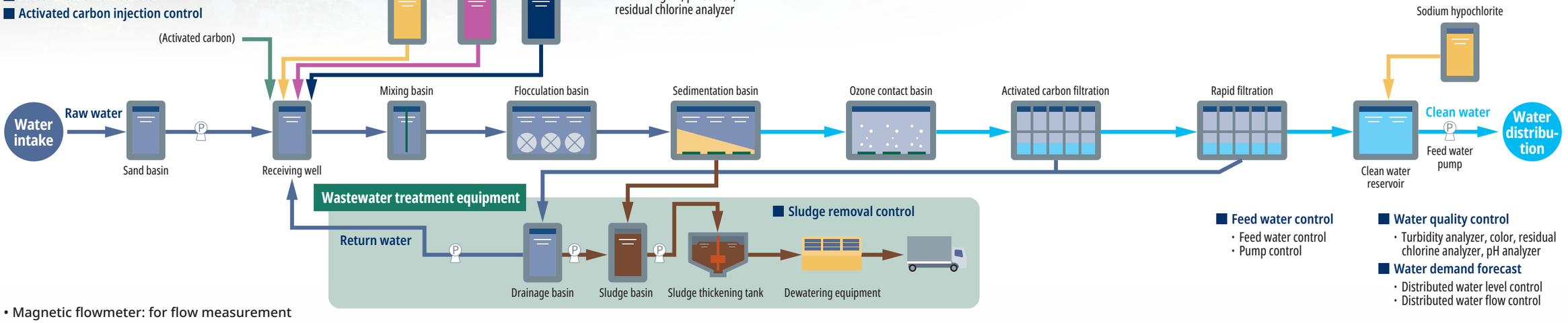
■ **Filtrated water flow control**

■ **Filtration basin wash control**

Feed water / water distribution

■ **Chlorine injection control**
- Residual chlorine analyzer

■ **Clean water quality control**
- Turbidity analyzer, color meter, pH sensor



■ **Feed water control**
- Feed water control
- Pump control

■ **Water quality control**
- Turbidity analyzer, color, residual chlorine analyzer, pH analyzer

■ **Water demand forecast**
- Distributed water level control
- Distributed water flow control

- Magnetic flowmeter: for flow measurement
- Differential pressure transmitter: for level, pressure, and flow measurement

Sea Water Reverse Osmosis (SWRO) desalination

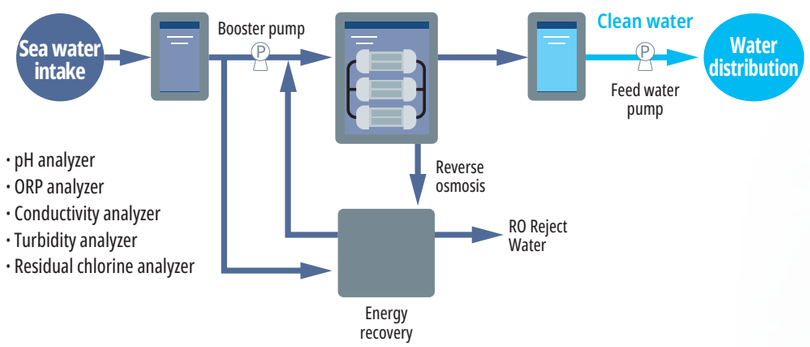
■ **Sea water intake control**

■ **Pretreatment control**

■ **SWRO (Sea Water Reverse Osmosis) control**

■ **BWRO (Brackish Water Reverse Osmosis) control**

■ **Post treatment control**



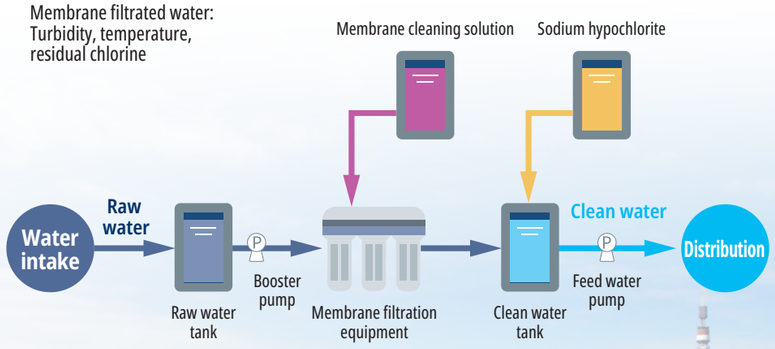
Membrane filtration

■ **Water quality control**

Raw water:
Turbidity, temperature, pH

Membrane filtrated water:
Turbidity, temperature, residual chlorine

■ **Membrane cleaning, chemical injection control**
- Membrane cleaning solution
- Sodium hypochlorite injection control



■ **Membrane filtration flux management**

■ **Membrane differential pressure management, membrane disruption detection**
- Primary side membrane pressure, secondary side membrane pressure

Wastewater treatment plant

Sewer and pump stations

■ **Influent wastewater monitoring**
- P-B flume
- pH sensor
- Conductivity analyzer

■ **Wastewater pump control**

Wastewater treatment

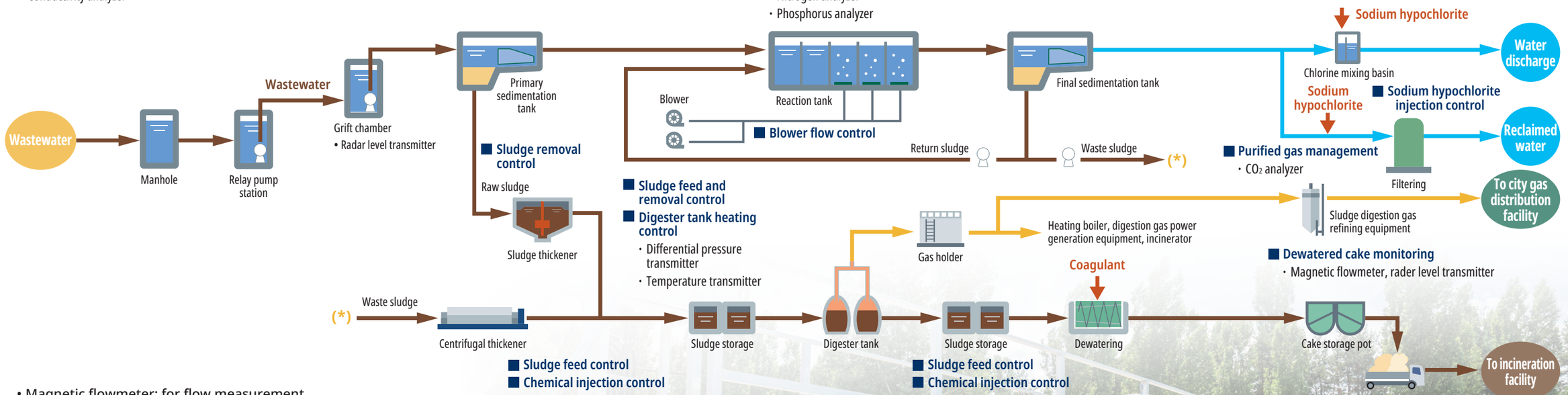
■ **Raw sludge removal control**

■ **Operation monitoring**
- DO sensor, ORP sensor, MLSS analyzer, pH sensor

■ **Advanced treatment**
- Nitrogen analyzer
- Phosphorus analyzer

■ **Return sludge control**
■ **Waste sludge removal control**

■ **Effluent water monitoring**
- UV analyzer, nitrogen analyzer, phosphorus analyzer
- Flowmeter



- Magnetic flowmeter: for flow measurement
- Differential pressure transmitter: for level, pressure , and flow measurement

Sludge treatment

Operation

- Operator training simulator
- Digital twin for predictive suitable operation
- Billing system for SWRO desalination plants
- Remote monitoring
- Water leakage management for water distribution
- Demand forecasting for water treatment plant
- Water quality monitoring
- Leak detection system for pipelines
- Energy saving modeling system for aeration tank at wastewater treatment plants

Disaster prevention

- Tsunami detection
- Water-gate control
- Storm water control
- Flood level monitoring
- Dam level monitoring
- Detection of illicit connections in sewer and stormwater systems

Digital & IIoT solutions and plant security

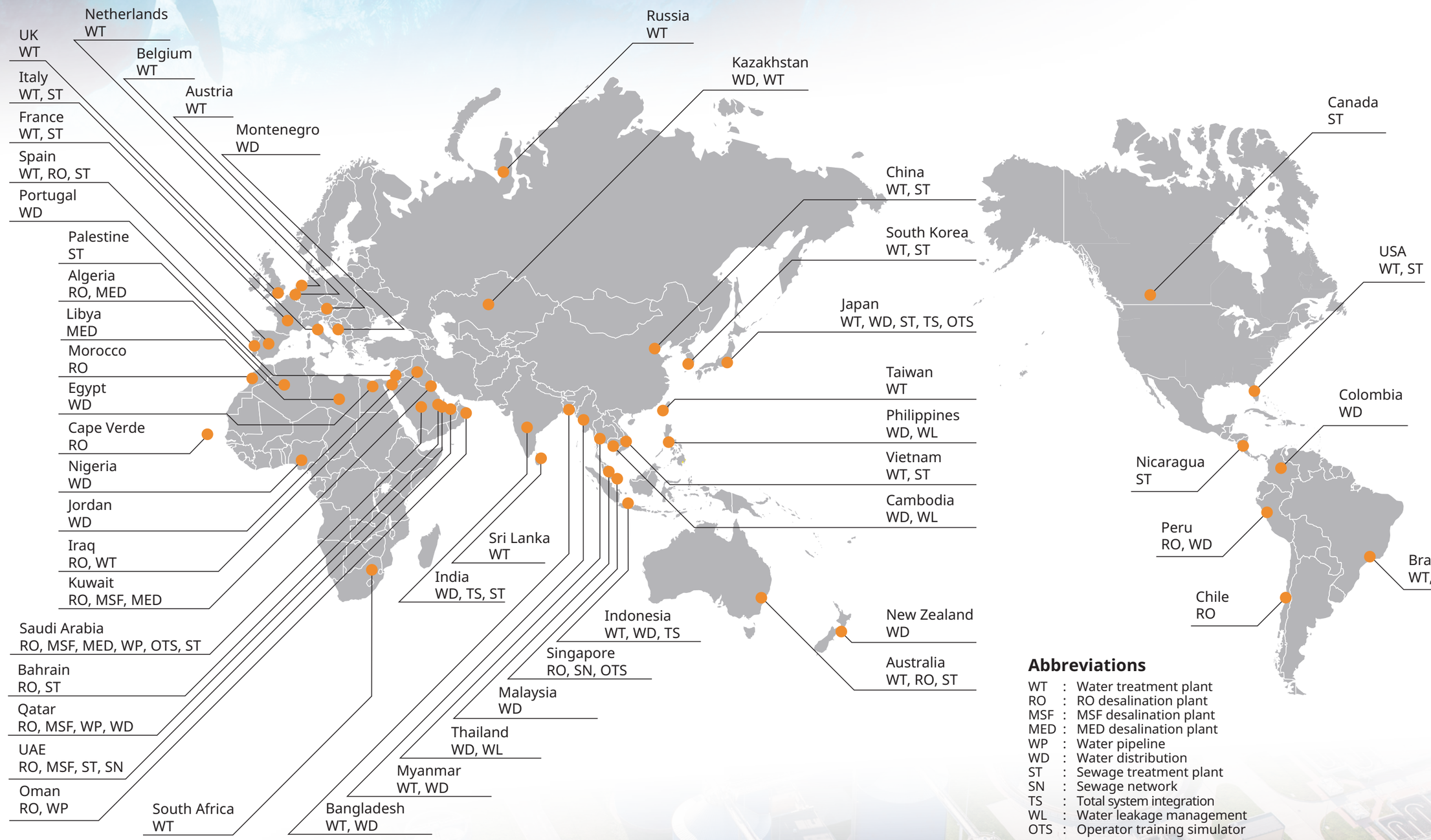
- Plant asset management
- Vibration analysis of rotating machines
  - Wireless vibration sensor
  - Pump cavitation detection
- Augmented reality (AR) for safe & efficient sitework
- Computerized maintenance management system (CMMS)

Maintenance

- Security assessment
- Security audit
- Security information service
- Antivirus & OS patch improvement
- Malware inactivation service
- Operating system hardening
- Secure network design
- Network health check
- Virus check service
- Backup & recovery

Cyber security

Representative global water projects



Abbreviations

WT	:	Water treatment plant
RO	:	RO desalination plant
MSF	:	MSF desalination plant
MED	:	MED desalination plant
WP	:	Water pipeline
WD	:	Water distribution
ST	:	Sewage treatment plant
SN	:	Sewage network
TS	:	Total system integration
WL	:	Water leakage management
OTS	:	Operator training simulator

Indonesia

Water treatment

Project Outline

- Customer: Perusahaan Daerah Air Minum (PDAM)
- Location: Bali, Indonesia
- Application: Water treatment
- Completion: 2013
- Products: SCADA, RTUs, flowmeters, transmitters and analyzers

Key Solutions

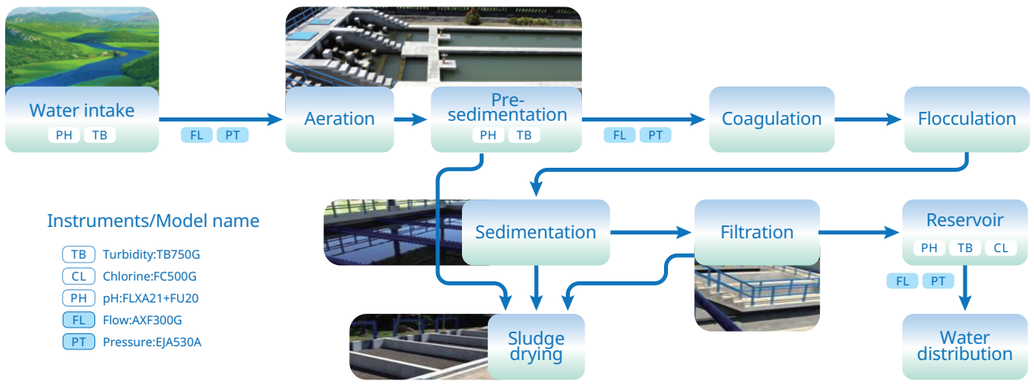
- Centralized operation by SCADA system
- Local engineering support
- Sophisticated operator training

Executive Summary

The new Petanu water treatment plant is designed to produce 300 L/s (25,920 m^3/day) of clean water. The plant started operation in September 2013 and its production capacity is being steadily increased.

PDAM and PT. Waskita Karya (Persero) Tbk selected Yokogawa's process automation system as a one-stop solution which includes the FAST/TOOLS SCADA (supervisory control and data acquisition) system, STARDOM™ network-based control system, and various field instruments. To meet urgent demand, Yokogawa Indonesia was asked to deliver the instruments and systems within just three months, and executed the entire project from product supply to engineering, installation, and commissioning as a one-stop solution.

PDAM is familiar with conventional panel operation in their existing water treatment facilities in Bali. However, for the new plant at Petanu, they decided to employ the latest reliable control system to increase the availability and quality of operation and facilitate maintenance and future expansion. Learning the new technologies was a major challenge, but the plant has been supplying safe and clean water to the southwest of Bali since successful start-up in 2013 thanks to the great efforts of both customers and Yokogawa Indonesia.



Process flow diagram

Singapore

SWRO Desalination

Project Outline

- Customer: YTL PowerSeraya Pte. Limited
- Location: Pulau Seraya Power Station, Singapore
- Application: Seawater Reverse Osmosis Desalination
- Completion: 2007
- Products: SCADA, RTUs, transmitters, flowmeters and analyzers

Key Solutions

- One-stop provider for successful installation on a tight schedule
- Reliable SCADA system for steady power generation and water supply
- Accurate field instruments and analyzers for reducing total cost of ownership

Executive Summary

YTL PowerSeraya's desalination plant converts seawater into potable drinking water and service water for its existing boiler plants and utilities operations, producing up to 10,000 m^3 of water per day. All operations are monitored and controlled by an integrated STARDOM and FAST/TOOLS SCADA system.

The first challenge in the YTL PowerSeraya desalination project was a very tight schedule. Yokogawa Engineering Asia was able to meet this challenge from start to finish as a one-stop provider of not only STARDOM controllers and the FAST/TOOLS human machine interface (HMI), but also various field instruments.

Yokogawa also provided comprehensive engineering services, from formulation of the control strategy to installation and commissioning of the integrated system. Approximately 1,400 I/O points were wired in/out at the STARDOM controller panels in the desalination plant's main control room. With this integrated system, all real-time process data can now be monitored from the administration and turbine buildings via a dual redundant fiber optic cable network.

YTL PowerSeraya needs a constant supply of water for its boiler plants in order to generate power steadily 24/7. The quality of this service water is carefully monitored and controlled by Yokogawa conductivity and pH meters. Accurate measurements of the conductivity and pH readings in the sea water reverse osmosis (SWRO) membranes are important for quickly detecting any seawater leakage. This prolongs SWRO membrane life and reduces total cost of ownership. Meanwhile, Yokogawa's magnetic flowmeters help keep costs down by accurately measuring the consumption of many different types of chemicals.

Installed on a very tight schedule, this system has been in operation since September 2007 with no major problems. This highly reliable SCADA system is managed by the O&M staff of YTL PowerSeraya.

Conductivity/pH meters

Magnetic flowmeters

Main control room for field operations

Philippines

Water distribution

Project Outline

- Customer: Metro Cebu Water District
- Location: Cebu, Philippines
- Application: Water distribution
- Completion: 2016
- Products: SCADA, water leakage management software, RTUs, flowmeters and transmitters

Key Solutions

- Real-time monitoring of water networks
- Water leakage management to reduce NRW

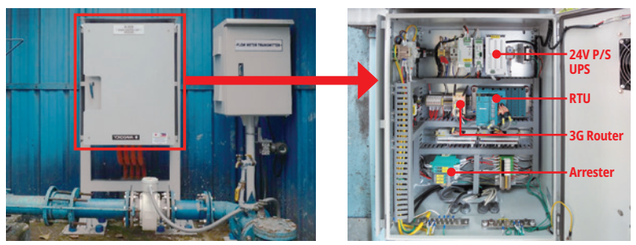
Executive Summary

The Metropolitan Cebu Water District (MCWD), a government body covering a very large water district in Cebu, needed to improve its water supply system to keep up with the growing demand. Accordingly, MCWD decided to construct a water supply monitoring system in a project funded by the Japan International Cooperation Agency.

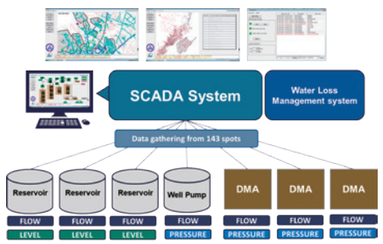
The project involved installing a Supervisory Control and Data Acquisition (SCADA) system so that operators in MCWD's main office can remotely monitor and control the status of water supply in its service area.

Yokogawa Solution Service Corporation was responsible for engineering the SCADA system, setting up a water leakage management system, and installing flowmeters and other field instruments at 143 locations such as dams, reservoirs, pressure points, water pump stations, and district metered areas (DMA), throughout MCWD's service area.

All monitoring points such as DMAs and pumping stations, as well as pressure points installed with remote terminal units (RTU) for collecting data on flow, pressure, and pump status, transmit the data to MCWD's main office.



Monitoring box at pumping station



System overview

Yokogawa's solution visualizes the water distribution network to allow:

1) Real-time monitoring of operations of pumping stations to detect shutdown; and
2) Water leakage management by monitoring of historical flow and pressure data in each DMA to detect water leakage, analyze the actual pressure points and dispatch staff in order to reduce non-revenue water (NRW).

One effective way to increase the water supply is to reduce NRW, which also boosts revenues for MCWD. The combination of Yokogawa's SCADA system and water leakage management software helped MCWD reduce water losses and increase profit.

New Zealand

Irrigation

Project Outline

- Customer: Rangitata Diversion Race Management Ltd.
- Location: Canterbury Plains, New Zealand
- Application: Irrigation
- Completion: 2018
- Products: SCADA and RTUs

Key Solutions

- Reliable SCADA system under all conditions
- Intuitive web-based HMI for effective maintenance
- Data security in case of network failure

Executive Summary

Rangitata Diversion Race (RDR) Management Ltd. is responsible for the effective operation and maintenance of the Race including environmental management, forecasting, future planning and development.

When the company undertook a major project to improve control and visibility of the gate flows and take-offs on the Rangitata Diversion Race in the late 2000s, they selected Yokogawa New Zealand due to their reputation for quality, active presence on the South Island and ability to minimize total cost of ownership.

The Race comprises over 600 farms and 25 main gates and take-offs, connected via a radio network back to the FAST/TOOLS central monitoring station at Ashburton. Covering 110,000 square hectares, this huge project is prone to extremes of weather. The Race must operate year-round (more for power generation in winter), so all equipment must maintain utmost reliability under all conditions. STARDOM RTUs are renowned for high availability and advanced functionality allowing local web services for in-field activities as well as connectivity back to the FAST/TOOLS operations center for overall performance monitoring. The web HMI client provided by FAST/TOOLS reduced the administrative overhead of maintaining client software within RDR's operations team, with its graphics system providing a modern, intuitive interface.

STARDOM RTUs also proved ideal thanks to their low power consumption and tight integration with FAST/TOOLS for 'store and forward' of data. This complemented the wireless networking approach, providing data security for when the network was unavailable.

As an evolving system that can meet the changing needs of the Rangitata Diversion Race, FAST/TOOLS and STARDOM provides a firm foundation for operations and maintenance.

China

Wastewater treatment

Project Outline

- Customer: Beijing Etechwin Electric Co., Ltd.
- Location: Shuyang County, Jiangsu Province, China
- Application: Wastewater treatment
- Completion: 2018
- Products: DCS and Data Driven Modeling System (DDMO)

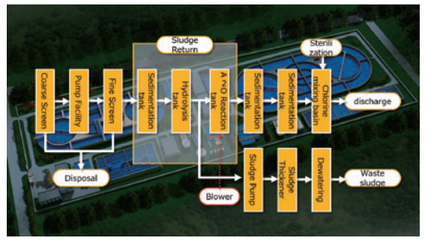
Key Solutions

- DDMO to optimize air-blowing rate of aeration tanks
- Interlink between DCS and DDMO to maximize energy saving

Executive Summary

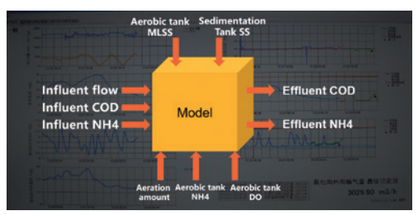
Yokogawa used its control technology and Data-Driven Modeling for Optimization (DDMO) solution to boost the efficiency of a sewage treatment plant owned by Goldwind Environmental Protection Co., Ltd.

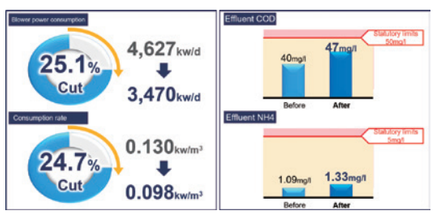
The plant is located in the northeast of Shuyang County, and its Phase I and II facilities treat 79,000 tons of sewage per day. As the plant serves an industrial area, almost the entire influent is industrial wastewater. This imposes a heavy load with large daily fluctuations, making it difficult to treat and hindering operation and maintenance. In addition, the Chinese government recently tightened regulations on effluent discharged from sewage treatment facilities, with severe penalties for violations. To meet the statutory limits, the sewage treatment process must be operated appropriately and stably.



In particular, proper aeration of each reaction tank is crucial because it affects the quality of discharged effluent. The air-blowing rate is usually controlled with a safety margin to ensure that the statutory limits are never exceeded, but this wastes power. As the aeration tanks account for at least 40% of total power consumption, optimizing the power consumed by these tanks will greatly help save energy for the entire plant.

To reduce excessive power consumption, a DCS was added to automatically control the blowers for the reaction tanks as well as the return sludge pumps, digestion liquid circulation pumps and sludge withdrawing pumps, while a DDMO solution estimates the quality of discharged effluent. DDMO performs sophisticated calculations using historical data on water quality and flow as well as the retention time in each process, and then determines the optimum air-blowing rate while maintaining effluent quality within statutory limits. This optimum rate is sent to the DCS, which then sets the air flow control setpoint. As a result, wasted energy at the aeration tanks is minimized; the electric power consumed by the blowers was successfully reduced by 25%.





India

Total system integration

Project Outline

- Customer: Bangalore Water Supply and Sewerage Board
- Location: Bengaluru, India
- Application: Total system integration
- Completion: 2015
- Products: SCADA and RTUs

Key Solutions

- SCADA system integration of the BWSSB water and sewage facilities over VHF and GPRS
- Stable Centralized SCADA Monitoring Center (CSMS) operation

Executive Summary

The Bangalore Water Supply and Sewerage Board (BWSSB) was one of the first water supply and sanitation utilities in India, having been set up in 1964 to meet the water supply and sewage disposal needs of the city covering an area of about 800 sq. km.

To supply clean water and treat sewage water, BWSSB has been developing various treatment facilities such as the new Centralized SCADA Monitoring Center (CSMC) in Bengaluru. This CSMC, partly funded by the Japan International Cooperation Agency, integrates BWSSB's existing water facilities in Bengaluru, allowing them to be monitored in real time.

Yokogawa India Ltd. (YIL) received a turn-key contract from BWSSB. YIL delivered the FAST/TOOLS SCADA system and STARDOM network-based control to CSMC. YIL was responsible for the design, supply, installation, testing, and commissioning, including a seven-year operation and maintenance contract for products delivered by Yokogawa.

The main facilities monitored by CSMC are:

- Water treatment plant/intermediate water pumping stations
- Ground level reservoirs
- Sewage treatment plants
- Intermediate sewage pumping stations
- More than 500 District Metered Area (DMA) data from third parties through an OPC server

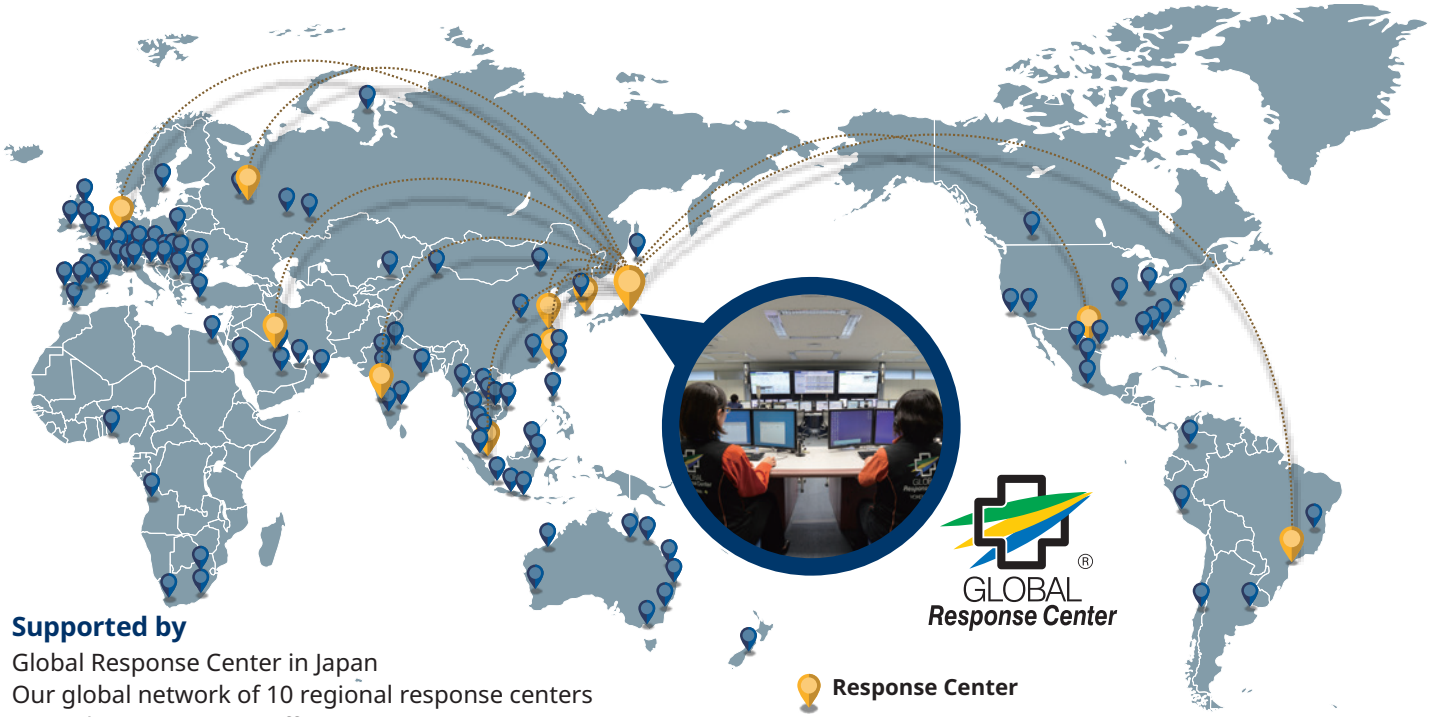
To integrate BWSSB's widely dispersed facilities, telecommunication links are mandatory for SCADA. FAST/TOOLS can handle various telecommunication links and protocols, enabling remote facilities to integrate with CSMC over VHF and GPRS, achieving total system integration and data transmission. The total number of configured tags exceeds half a million.

As a key infrastructure for both water and sewage related facilities, CSMC is required to run 24/7 without failing. To ensure stable monitoring, the SCADA servers and communication lines are all redundant. Firewalls protect cybersecurity, an access control system enhances security, and CSMC is monitored by CCTV. In addition to a UPS and battery backup, a diesel generator is on standby in case of power outages. Prompt service and support under the seven-year operation and maintenance contract keep CSMC running stably.
With the powerful and stable SCADA system integration, BWSSB can monitor water supply and sewage treatment in Bengaluru in real time.

Antenna tower

Global Service Network

Our comprehensive global service network supports you 24/7.



GLOBAL Response Center

Supported by

Global Response Center in Japan
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More than 230 service offices in over 80 countries
Around 2,000 service engineers internationally

Response Center
Service Office
Network

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