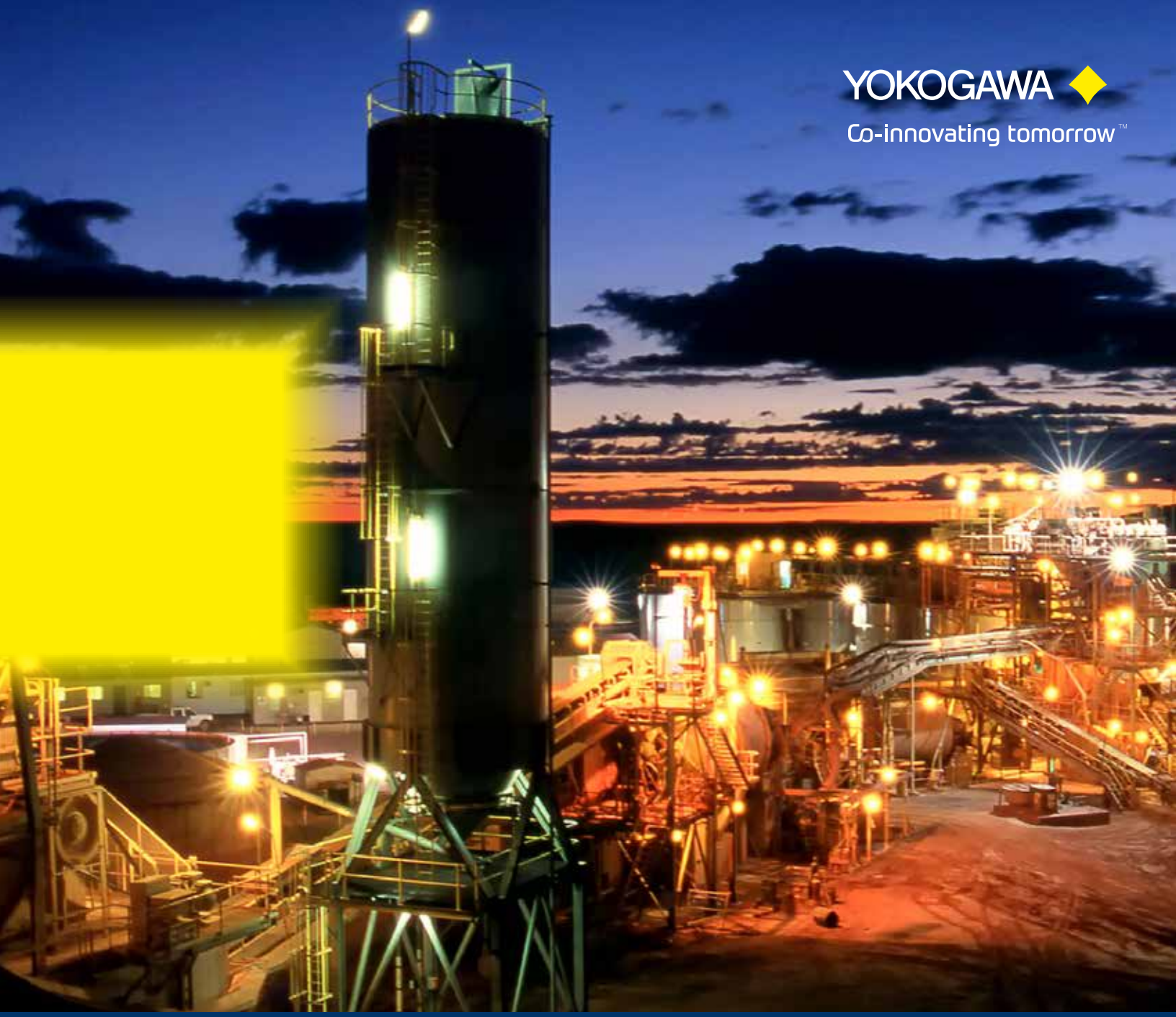



# Mining Solutions

## Solutions to Boost Profitability in Mining, Mineral Processing and Metals

BU-P-20230226-01

YOKOGAWA
Co-innovating tomorrow™

# Yokogawa and Mining

## Local partnership, Global capabilities

*A worldwide network of committed experts supports your operations 24/7 for life-cycle optimization.*

### Model Based Mining

For decades, mining industry management has faced the challenge of limited visibility of operations. Adoption of new and innovative information technologies has helped but significant room for improvement still remains. Surviving and thriving in today's evolving business ecosystem require safe, cost-effective, highly-integrated operations across the entire mining enterprise.

Yokogawa takes a completely new approach in which we co-innovate with the industry to realize much greater value than traditional automation. We deploy multiple techniques and technologies with the objective of providing integrated solutions to specific issues in mining and optimizing processes in multiple levels such as material flow, interaction between multiple processes, and customer objectives

| Connected Processes | Basic Mining Principles | Process Visibility | Reduced Variability |
|---|---|---|---|

Best Practices in Mining and a Range of Industries

### Proven Applications, Reliable Products

Yokogawa's approach comes from decades of best practice development and Co-innovation from a diverse range of industries, merged with the best of mining. Many have common challenges related to safety, visibility, streamlining, cost and supply chain management. We believe in keeping complexity to a minimum through providing guidance on operational excellence, technology improvement and the replacement of disjointed reporting systems with streamlined management dashboards that report on actual operational performance.

The following information describes Yokogawa's specific solutions, which differentiate the company in working with our clients.


### Workforce Digitalization

The human side of mining presents significant challenges. Skilled workers moving to other industries and generational changes which have seen large-scale retirement of established mining engineers combined with a lack of suitable replacements, diminish the industry's skills base. The pressure for cost control in a high cost environment means mining companies must do more with less, while making better use of the experience of remaining skilled workers. Traditional methods of operation are being challenged in ways never before experienced and the industry needs support to address the evolving business environment.

Generating actions through insights made through implementation of an effective digitalization strategy on a well operated mine can address many of these challenges. However, many of the insights necessary to complete the jigsaw can only be identified through experience. With a diminishing engineering skills base though, mechanisms to capture that knowledge need to be put in place.

**Enhance efficiency and flexibility through a sustainable co-innovative business model.**

YOKOGAWA
Co-innovating tomorrow™

# Mining Operations Support

## Enhance agility and flexibility of processing workflow through Operational Automation

*Yokogawa is an automation supplier with extensive hands-on understanding of the usage of information for complex and varied mineral processing production processes. Yokogawa is a premier supplier of integrated automation solutions that deliver agility and flexibility to all process workflows.*

### Advanced Decision Support

Through collaboration and Co-innovation with our customers, Yokogawa are leading a market driven, standards-based, integrated approach to help alleviate skills shortages and cost issues across all industry segments, including Mining. Advanced Decision Support provides an integrated consulting solution that brings together existing concepts, standards and capabilities to help improve the effectiveness of all operators.

While industry has focused much thought and effort on automating procedures, alarm management and human machine interface individually, insufficient attention has been paid to how they can all work together to help improve operator effectiveness. Such an approach not only reduces manning requirements, but also improves process consistency, operational efficiency and safety.

### Integrated Operations

Technology is already playing a growing role in the mine of the future and is set to transform it further still. Enabling technologies such as IIoT and Intelligent Operations are being deployed by Yokogawa in response for a need to improve overall visibility and increase safety on distributed processes and plants. Key to achieving this is the re-evaluation of how large scale automation projects are implemented along with how they can be leveraged to increase value through optimisation and improving plant performance. This is especially challenging where multiple operations over a wide geographical area are concerned.

Yokogawa's intelligent operations provide a framework for realising business objectives at the operations level by addressing such drivers as total cost of ownership, enterprise level information management and production management.

Improve effectiveness of operator decisions to support, rather than replace operator judgement

Optimize human automation path planning and decision support

Integrate existing, but separate, industry standards into a cohesive solution

# Mining Edge to Insight

## Adopting sustainable improvements for long term endurance and simplified compliance

*Focusing on improving efficiency rather than reacting to and managing an erratic process, OpreX™ allows mining executives to reduce variability and boost profitability through knowing which data to ignore and which to utilise.*

### Digital Transformation

Digital Transformation is the adoption of digital technologies that enable companies to integrate and synthesize data, information and systems horizontally in an enterprise and vertically across the supply chain.

It has the potential to allow mining companies to adopt new and more efficient work processes, developing new business models and a step change in performance. Viewed holistically, you can align performance expectations with a clear and insightful representation of current status, allowing you to develop an enduring model for long term and sustainable improvement. Digital transformation technologies are not a silver bullet. If implemented poorly they can actually destabilizeplant performance. However, approached holistically on a well-run mining process, sustainable improvements in performance can be recognized. OpreX™ from Yokogawa focuses on the co-creation of customer value, addressing specific needs within the business. Visibility of all aspects of the process can be attained providing high levels of insight from field level to boardroom. Mining executives now have clarity of process performance allowing them to identify first hand whether their improvement directives are bearing fruit.

Measure Financial & Non-Financial Indicators

Uncover Underlying Costs

Minimize Downtime

Improve Decision Making

Generate Demand Reports for Asset Utilization

Reduce Number & Severity of Safety Incidents

# Pit to Port/Sensor to Enterprise

## Mining life-cycle experts, planning at every step of the process

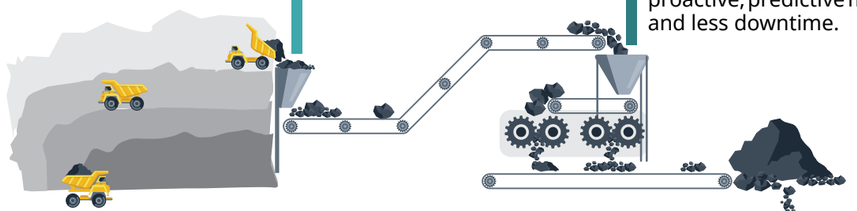
When reviewing a client's process improvement journey, Yokogawa's principles have always remained the same in ensuring the basics are done well as a first step. This underpins all future activities from new device introduction, control system upgrades all the way up to a holistic revamp of data collection and reporting methods.

### Mineral Extraction

Advanced Process Control to optimize and stabilize processes

### Ore Crushing

Asset Management Software and tools to remotely monitore field device performance resulting in proactive, predictive maniteneance and less downtime.



### Shipping

Plant information Management System (PIMS) based on open standards to analyze data in real time and improve decision making.

Modular Procedural Automation (MPA) tools and systems to eliminate human error.

Automation technologies to optimise energy and water consumption.

### Processing

Operator Training Simulators to improve workforce skills in a virtual plant environment.



# Active North American Mines

## Major metal & mineral operations in the United States, Canada and Mexico

More miners choose Yokogawa as a co-innovating partner through their digital transformation to implement solutions for these specific mining challenges throughout North America.


### Processing Capabilities

Our end-to-end services encompass automation and energy management, systems integration, water management, and risk management, as well as process control. Our expertise in these areas enables us to help you produce safe, intelligent, and dependable outcomes throughout your mining operations. We recommend control systems, flow meters, pressure transmitters, temperature controllers, and analytical products and solutions in these specialized mining operations. Discover where Yokogawa devices are used, talk with an expert today.

- Gold
- Copper
- Silver
- Nickel
- Iron
- Boron
- Platinum
- Lithium
- Phosphate
- Coal

**Expert mining solutions from start to finish**

# Sulphuric Acid Leak Detection

## Environmental responsibility, taken seriously with advanced tech

*Yokogawa's expert sulphuric acid leak detection solution covers the selection of optical fiber, detailed engineering, supplies, field implementation and commissioning.*

In sulphuric acid transport pipelines, product leaks are absolutely undesirable conditions, since they can cause environmental damage and injury to employees and others.

Due to the layout of these pipes (which are mostly long and relatively unattended runs), their inspection is tedious and requires special attention.

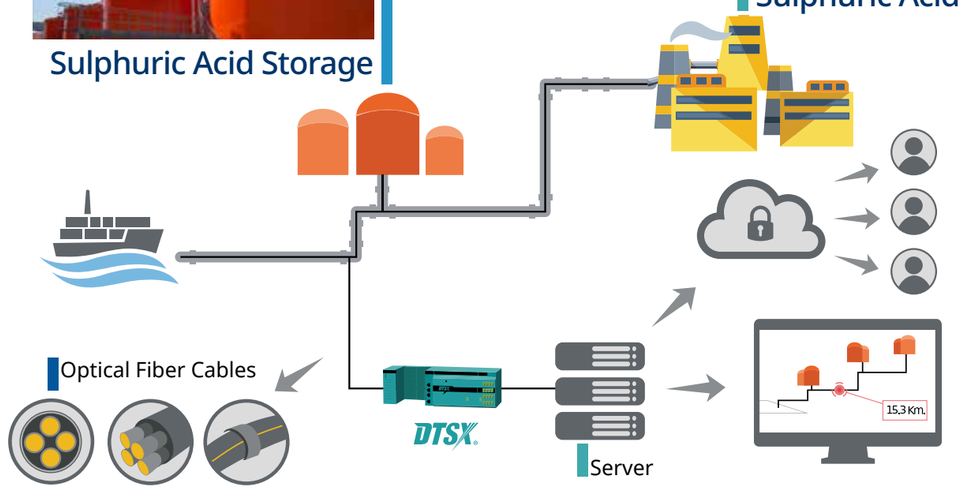
Using optical fiber and DTSX technology, it is possible to detect sulphuric acid leaks with a precision and spatial resolution of 1m along the pipeline, allowing rapid containment and repair action.

### Areas of Interest

- **Sulphuric Acid Plant**
- **Sulphuric Acid Transportation**
- **Sulphuric Acid Storage**
- **Leaching**
- **Solvent Extraction**

Sulphuric Acid Plant

Sulphuric Acid Storage




Continuous monitoring pipeline & equipment for storage or transportation

Leak detection with a spatial resolution of 1m along the pipeline

Incorporated trends and alarms

Simple, user friendly interface

# Leak Detection in Tailings

## Reliably audit for accountability, implement controls early

*Yokogawa's complete leak detection in tailings solution covers the selection of optical fiber, detailed engineering, supplies, field implementation and commissioning.*

Tailings dumps or tailings storage facilities (TSF) are civil works that allow tailings to be contained in exclusive areas for disposal. Leaks in these, imply structural damage, environmental damage and in some cases can put communities at risk.

Due to the size of the dumps, their inspection over time is complex and many months can pass between inspections.

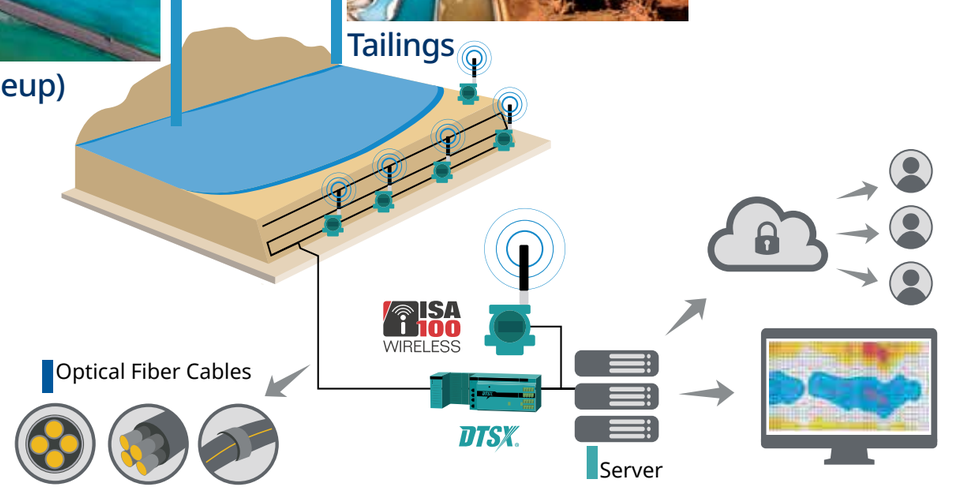
Using optical fiber, DTSX and ISA100 technology it is possible to detect leaks by regularly measuring temperature changes in check points, thus allowing the real-time monitoring of these structures.

### Areas of Interest

- **Tailings Dump**
- **Tailings Dam**
- **Tailing Storage Facility (TSF)**

Tailings (closeup)

Tailings




Continuous tailings dump monitoring

Leak detection with a precision of 1m

Incorporated trends and alarms

Simple, user friendly interface

# Conveyer Belt Conditions Monitoring

## Real-time health diagnostics and reporting, preventive system

*Yokogawa's conveyor belt conditions monitoring solution covers the selection of optical fiber, detailed engineering, supplies, field implementation and commissioning.*

Conveyor belts have hundreds or thousands of idlers depending on their length, the early detection of the operational status of each one of them is a tedious and expensive task to perform for the maintenance and operation team.

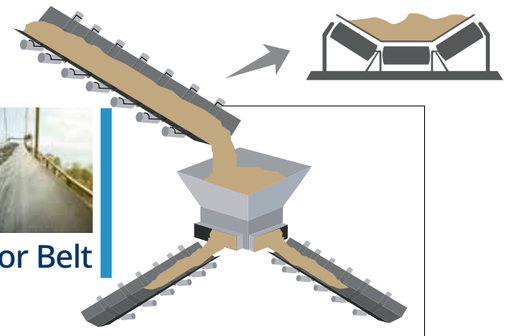
Using optical fiber and DTSX technology it is possible to measure and detect the state of each of the idlers in real time, reducing inspection and repair time.

In short, a diagnostic tool that allows to detect failures before reaching undesirable condition or damage, with the consequent loss of production.

### Areas of Interest

- **Crushing**
- **Material Handling**

Conveyor Belt




- Continuous conveyor belt idler monitoring
- Specific idler status identification
- Compatible with Enterprise ERP (SAP or Maximo)
- Incorporated trends & alarms
- Simple, user friendly interface



# Thermal Profile in Furnaces & Converters

## Validation, through continous temperature data measurement

*Yokogawa's thermal profile in furnaces and converters solution covers the selection of optical fiber, detailed engineering, supplies, field implementation and commissioning.*

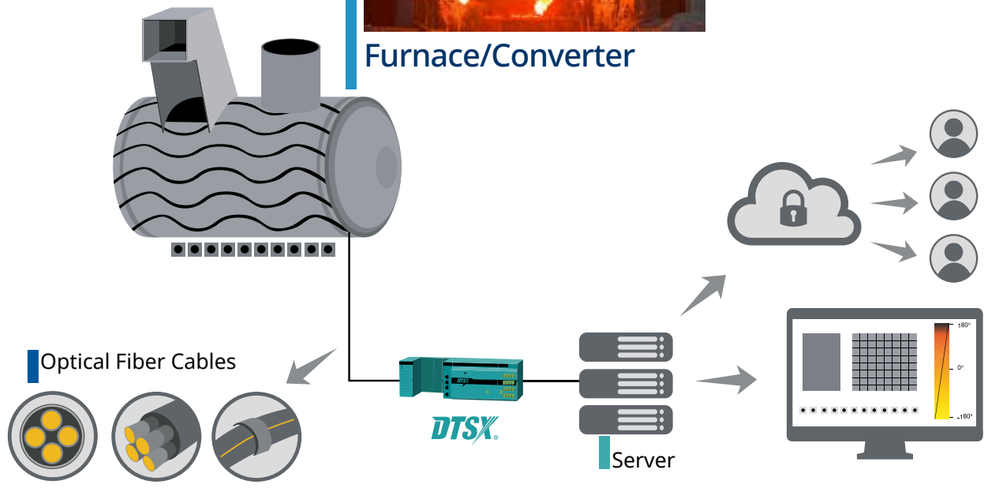
In furnaces and converters, internal thermal insulation can suffer mechanical damage over time due to different factors, causing a possible risk situation for the people operating around them or the process.

Thermography or spot measurements are commonly used to perform the detection. Using optical fiber and DTSX technology, it is possible to monitor the surface temperature of the equipment in real time, producing a thermal map that allows the early detection of the areas where the insulation has been damaged.

### Areas of Interest

- **Smelting**
- **Converters**
- **Roasting**

Furnace/Converter




- Continuous thermal profile monitoring
- Hot/cold zone detection
- Incorporated trends & alarms
- Simple, user friendly interface

# Electrowinning/Electro-Refining Monitoring

## Producing very high purity metals, economically and straightforward

*Yokogawa's electroextraction solution covers equipment selection, detailed engineering, supplies, field implementation and commissioning.*

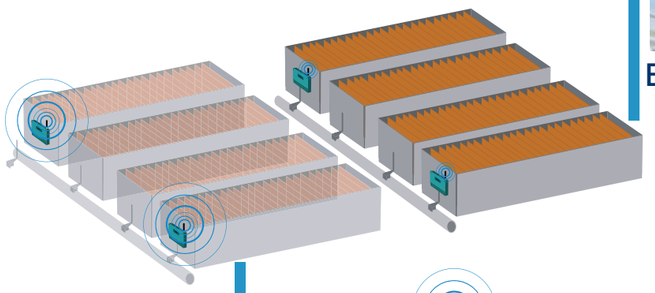
For electrowinning or electro-refinery cells, determining the correct operational condition is a routine and tedious task. By measuring the voltage in the bars and the temperature of the electrolyte in its discharge, it is possible to precisely determine its state, detecting short circuit condition, bad contacts or unexpected flows. In the case of electrowinning, the nonoptimal operation of the cell in mid to long term can cause damage to cathodes.

Using ISA100 technology it is possible to perform these measurements in real time, allowing operators to know the precise place of short circuit or abnormal flows for each one of the cells, increasing the utilization of the plant.

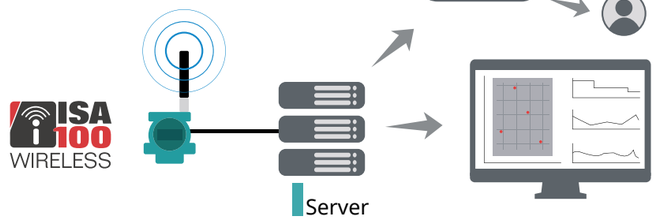
### Areas of Interest

- **Electrowinning**
- **Electro-refinery**
- **Electroextraction**

Electrowinning cells



Electrowinning (closeup)




- Continuous electrowinning operational condition monitoring
- Inventory calculation inside each cell & facility
- Energy calculation for each cell & total of facility
- High density & real time information display
- Incorporated trends & alarms
- Wireless system & Simple, user friendly interface

# Control Loop Lifecycle

## Continuous improvement, time saving operational performance

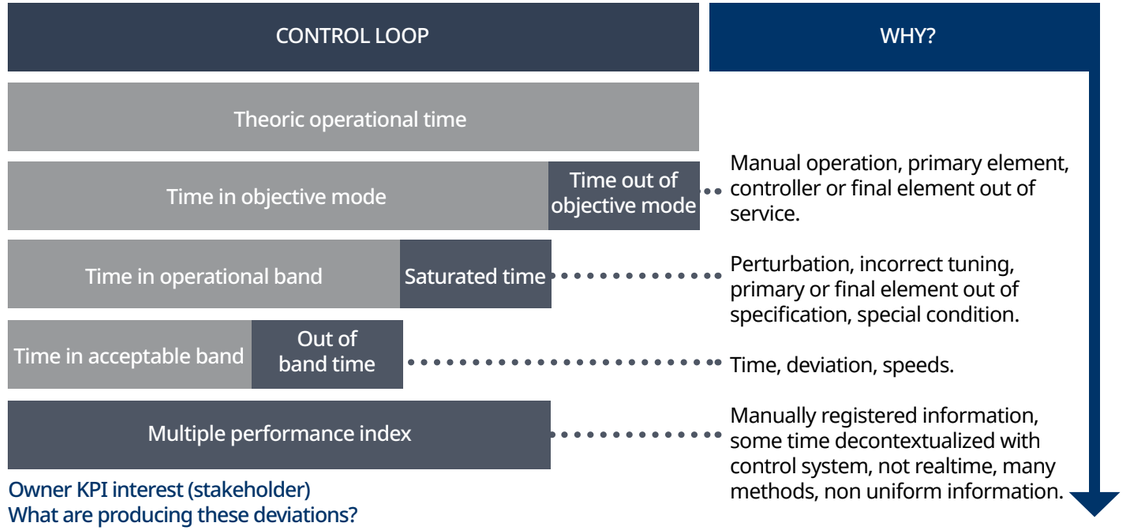
*Yokogawa's control loop lifecycle solution implements an effective system of monitoring continuous improvement, covering the areas of surveying, implementation of metrics, study of dynamic behaviour, tuning, reporting and optimization.*

Hundreds of control loops daily support plant operations to achieve production and/or safety objectives. The proper tuning and monitoring of their performance over time, leads to an improvement of production, reducing the variability and disturbance issues that are a natural part of the process.

Tracking each loop over time is an important task that consumes resources from the maintenance and operations teams. A control loop management system promotes continuous improvement, detecting loop behaviour over time and allowing maintenance and operations teams to focus on other aspects of plant management.

### Areas of Interest

- **General Plant**




- Control loop life cycle implementation for continuous improvement
- Implementation of key performance related indicators and a tracking system
- High density and real time visualization control loop tuning tool
- Incorporated trends & alarms
- Simple, user friendly interface

# Cause/Effects Plant Shutdowns

## Real-time tracking field solution, to achieve operational excellence

*Yokogawa's cause/effects plant shutdowns solution implements effective real-time tracking, considering equipment supply, detail engineering, field solution implementation and commissioning.*

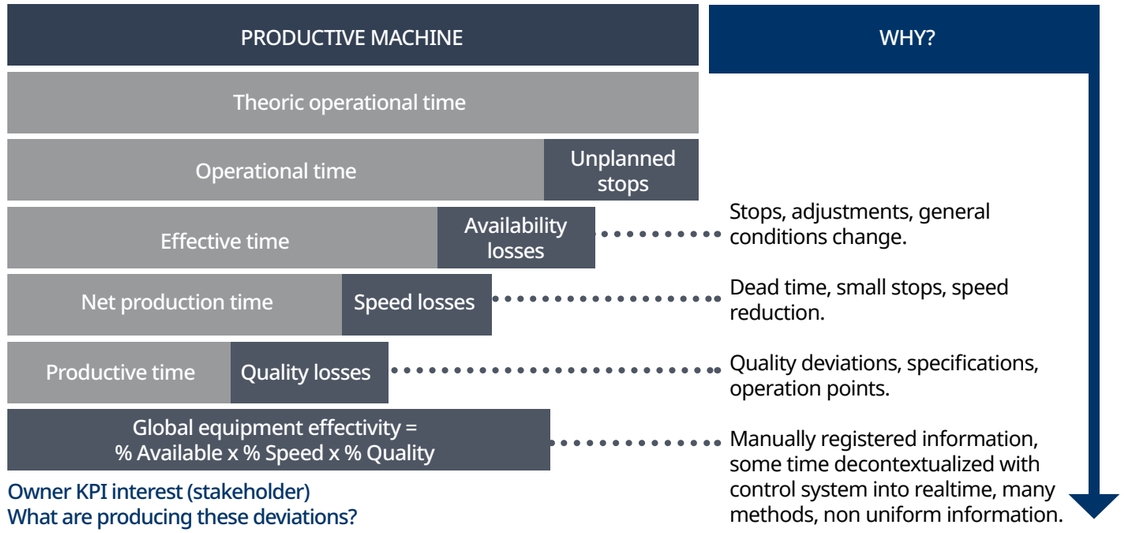
Day by day there is equipment within the process which stops without necessarily stopping the production chain. To achieve operational excellence, determining the root cause with its economic impact is crucial to the application of continuous process improvement.

The correlation between cause and economic effect is often a long-term task requiring multiple disciplines within the enterprise.

By implementing Exaquantum DTA, it is possible to perform cause-effect analysis in a short time, with clear metrics that will guide the efforts required within the company to achieve operational excellence.

### Areas of Interest

- **General Plant**




- Monetary losses determined due to operations and equipment failure
- Failure and shutdown cause/effect correlation and production impact
- KPI implementation and tracking system
- Simple, user friendly interface

# Operational Improvements & Procedures

## Retain knowledge, standardize operations and continue to grow

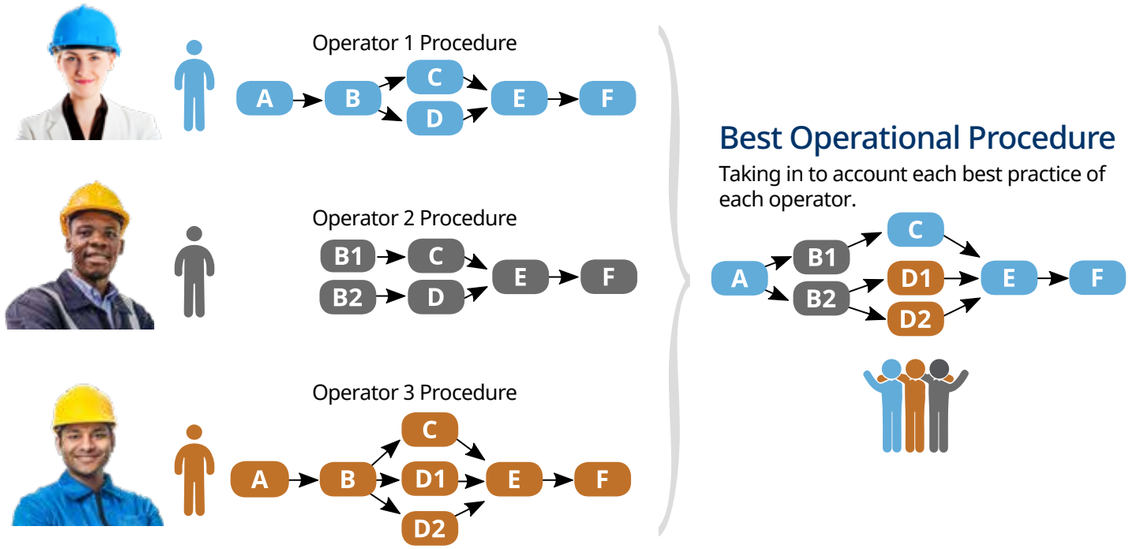
*Yokogawa's operational improvements and procedures solution implements a system of management of best practices, considering the supply, detail engineering, solution implementation, start-up and training.*

As time progresses, there will be changes to operational procedure and staff complement. Retaining the knowledge of task performance is crucial to standardizing operations. Knowledge and procedures are usually stored in hard copy or text format, which require continuous updating.

With Exapilot it is possible to translate this knowledge into digital format, which then becomes an integral part of the control system, allowing operators to access previously programmed sequences to take any action required for specific situations (e.g. plant shutdown, changes in production levels, plant startup, emergency shutdown sequences, etc.)

### Areas of Interest

- **General Plant**




- Best practices implementation across the operational environment
- Assisted operational sequences (starts, stops, production changes, ramp-up, others)
- Decrease knowledge lost due to operator change or rotation
- Simple, user friendly interface

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# Alumina/Aluminium & Zinc Lead Refining

## Exceptional durability and reliability, measuring caustic slurries

Slurry flow measurement is one of the most difficult applications for magnetic flowmeters. Slurry causes the noise for flow detector. Abrasive aluminum slurry shortens the life time of liner and electrodes. Bauxite and zinc lead are also highly abrasive, caustic and corrosive which makes measurement extremely difficult.

Caustic slurries cause huge fluctuations in readings and erodes the liner, and eventually bulging of the liner in any standard flowmeter. A typical model would not last for long under this stress, requiring frequent replacement. For steady and accurate measurement, one must determine how to cancel the noise influence simultaneously while maintaining the basic steady measurement.

Yokogawa's magnetic flow meters are designed to continue working for years with exceptional accuracy. Dual frequency, suppresses slurry noise and gives good zero stability. Reinforced PFA liner provides excellent protection against abrasion, corrosion and bulging.

Aluminum

Bauxite

Zinc

## Applications

- **Bauxite slurry + caustic at a temperature of 120 C flow to be measured. The line size is typically 400mm.**
- **Zinc Lead slurry. The line size is typically 400mm.**

AXG Magnetic Flow meter
Integral Type

AXG Magnetic Flow meter
Remote Sensor

AXG4A Magnetic Flow meter
Remote Transmitter

**Dual Frequency –** Suppress slurry noise and gives good zero stability

**Reinforced PFA Liner –** Excellent against abrasion and corrosion & bulging

Ideal for slurry, mining applications and conductive fluids

Robust design, longer life-time of flowmeter, available in 4 or 2 wires



# Hydrocyclone Inlet Feed for Copper & Gold Mines

## Optimal slurry partical classification for maximized cyclone overflow

In the mining industry, hydrocyclones are mineral processing equipment used in slurry pulps to separate coarse and fine particles according to their size and density. These hydrocyclone inlet feed lines contain coarse and fine materials, which rapidly cause major abrasive damage to the flow meters.

For steady and accurate measurement, one must determine how to cancel the noise influence simultaneously while maintaining the basic steady measurement. The right flowmeter must be robust not only for the slurry, but able to give stable and reliable output signal regardless the slurry volume, without jeopardizing the response speed or zero stability. The optimal slurry particle classification in cyclones will help to maximise cyclone overflow quantity.

Yokogawa's ADMAG flow meters are the most suitable magnetic flowmeter for mining applications like the flow with slurry, proving a longer life-cycle and in-line verification, and an optional microSD for off-line data analysis.

Gold

Copper

## Applications

- **Hydrocyclone inlet feed lines contain coarse and fine materials, which rapidly cause major abrasive damage to the flow meter.**

ADMAG AXF Flow meter

ADMAG CA Flow meter

**Dual Frequency –** Suppress slurry noise and gives good zero stability

**Reinforced PFA Liner –** Excellent against abrasion and corrosion & bulging

**ADMAG AXF –** PFA liner with Metal Hat Earthing ring for line size >200 mm

**ADMAG CA –** Ceramic liner for line size <=200 mm

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# Field Instruments Industrial Automation

## Increase profitability and enhance health, safety and the environment

*The accurate and stable measurement of the process value with Yokogawa Field Instruments supports the safe and reliable operation in your plant.*




## Reliable, safe and accurate measurements

### Pressure Transmitters – DPHarp EJX/EJA Series

The EJX range of transmitters is Yokogawa's premium performance line of DPHarp pressure transmitters. Released in 2004, it offers the most technologically advanced solution with class leading performance and stability specifications. In addition, the EJX family offers unique features such as standard IEC61508 certification, optional contact output, advanced diagnostics, multivariable mass flow measurement and ISA100 wireless capability. Suitable for harsh mineral processing environments.

### Magnetic Flowmeter: ADMAG Series AXF™

AXF/RXF magnetic flowmeters are sophisticated products with outstanding reliability and ease of operation, developed on the basis of decades of field experience. The ADMAG AXF™ employs the fluid noise free "Dual Frequency Excitation Method," achieving excellent stability for instrumentation. A variety of liners enable you to choose a meter suitable for applications such as water, acid and slurry.

### Coriolis Mass Flowmeter: RotaMass Series 3

AXF/RXF magnetic flowmeters are sophisticated products with outstanding reliability and ease of operation, developed on the basis of decades of field experience. The ADMAG AXF™ employs the fluid noise free "Dual Frequency Excitation Method," achieving excellent stability for instrumentation. A variety of liners enable you to choose a meter suitable for applications such as water, acid and slurry.

### Vortex Flowmeter: VY Series

The VY Series Vortex Flowmeter is developed with two key technologies, the digital technology and inherited unique structure from YEWFLO series. Digital technology is utilized to enable remote maintenance and self-diagnosis, to easily check the health of your equipment at any time. The VY series supports various standards such as SIL2, local Ex proof. It has various calculation functions such as temperature pressure compensation and energy calculation. The VY series vortex flowmeter provides accurate and stable measurement, even in harsh process conditions, and has a highly reliable and robust design that delivers improvements in plant efficiency and reduced operating costs.

### Variable Area Flowmeter: RAMC

The short-stroke Rotameter RAMC allows for the measurement of high flow rates using a relatively short metering tube. It is a stainless steel armoured construction for the safe measurement of a variety of liquids, gases and steam. Its special application is for hazardous, dangerous or aggressive fluids, for high temperatures and high pressure rates. It has an electronic transmitter and Hart® communication that offers a high degree of safety thanks to the patented float blockage detection function.

### Field Wireless System – Pressure Transmitter DPHarp EJX B Series

The high performance differential pressure and pressure transmitters EJX feature a single crystal silicon resonant sensor and are suitable to measure liquid, gas or steam flow as well as liquid level, density and pressure. These transmitters send not only process variables, but also the setting parameters, using wireless signal. The transmitters are powered by internal batteries and the installation cost can be decreased as hard-wiring is not required. Communication is based on ISA100.11a protocol specifications

### Field Wireless System: Multi-input Temperature Transmitter YTMX580

The YTMX580 can accept inputs from up to 8 points of measurement such as thermocouples (8 types: K, E, J, etc.) or RTD signals (3 types: Pt100, etc.), converting the corresponding measurement input values to a wireless signal. It can also accept DC voltage, resistance and 4 to 20 mA DC signal input. In addition to temperature signals, it can also wirelessly send and receive setting parameters. Internal battery power means eliminating not only signal wires, but also power cables—this offers great installation cost reductions. The communication is compliant with ISA100.11a protocol specifications.

### Fiber Optic Temperature Sensor: Distributed Temperature Sensing DTSX

The DTSX3000 Distributed Temperature Sensor provides temperature monitoring over any area where temperature change can indicate process abnormalities. simply by connecting the DTSX Distributed Temperature Sensor to a fiber-optic cable laid over the area up to 50 km long distances. This makes it suitable for measuring the surface temperature distribution of large operations and enables an early response to minimize any damage. The DTSX uses Optical Fiber as a sensor, which is safe to use in potentially explosive and hazardous environments. It is immune from electrical induction and noise vibrations.

### Field Wireless System: Temperature Transmitter YTA510

The YTA510 is the high performance temperature transmitter that accepts thermocouple, RTD, ohms or DC millivolt inputs. The dual input type independently measures and calculates process values for Sensor 1 and Sensor 2. YTA510 transmits not only process variables, but also the setting parameters, using wireless signals. The transmitters run on internal batteries and installation costs may be decreased as hard-wiring is not required. The communication is compliant with ISA100.11a protocol specifications.

### Temperature Transmitters: YTA110 and YTA70

The YTA110 is a high performance temperature transmitter that accepts thermocouple, RTD, ohm, or DC millivolt input and converts it to a 4 to 20mA DC signal for transmission. It supports either BRAIN or HART communication protocol. The YTA70 is a head mount type temperature transmitter andconforms to the standard DIN form B head mounting.

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# Liquid Analyzers for Mining

## Monitoring pH levels is vital in several mining treatment processes

In flotation, pH control is a vital method to control selective mineral separation. This is a very important measurement for the flotation operator. Some minerals like iron pyrite will not float well in an alkaline flotation circuit. It is possible to manipulate the attraction of collectors to their surfaces by pH adjustment, but accurate measurement is required.

Cyanide-bearing wastewater from mining and electroplating facilities and certain types of chemical plants is toxic and must be treated by oxidation with chlorine or chloride to bring the cyanide concentration within regulatory limits. The waste materials contain alkaline, rare earth metals, and other heavy metals such as iron, nickel, zinc, cadmium, copper, silver and gold. As well as sometimes can contain the deadly poison, cyanide.

As the speed of the oxidation reaction is closely tied to the pH value, a pH analyzer is used together with an ORP (oxidation-reduction potential) analyzer to monitor the completion of the reaction. The use of these analyzers also ensures that excessive amounts of chemicals (e.g., chlorine) are not used to produce the reaction. Yokogawa's 2-wire and 4-wire analyzers are suitable for this measurement system.

FLXA202 2-Wire Transmitter

All-in-One pH/ORP Sensor Series FU20


Gold


Iron


Copper


Nickel


Silver


Zinc

## Applications

- **Oxidation Monitoring in the Cyanide Wastewater Treatment Process**
- **Separating Minerals by Floatation**
- **Sencom Monitoring**
- **Stable, continuous measurement**
- **Reduction in operating costs**
- **Eliminates manual cleaning, Jet cleaning is possible**

High-precision measurement is possible

Reduces operating costs

Measures pH/ORP of cyanide wastewater continuously

Calibration certificate delivered with each sensor

# Continuous Emission Monitoring System (CEMS)

## Reliable, robust performance, reporting the accuracy you need

We believe the mining sector has the power to keep the communities in which they operate safe. Emissions monitoring obligations vary depending on your process, your fuel, your permit and your local authority. You will need a CEMS solution that is tailored to your specifications from a supplier who understands the intricacies of emissions monitoring and reporting. The good news is we have experts that know what applies to a range of mineral commodities in diverse physical environments.

Yokogawa's Continuous Emission Monitoring System (CEMS) Analyzers are able to provide a complete solution from tapping to reporting with a complete system solution including a data logger, data acquisition system and remote access via EPA. Comply with EPA guidelines while meeting your own specific monitoring needs with confidence, pre-approved during site testing of emission control equipment and emissions analysis to ensure we deliver what you need.

IR400 CEMS NDIR Analyzer

CEMS System

## Applications

- **Complete solution, from tapping to reporting**
- **Meets maximum component coverage regulations**
- **Optimised for measurement of NO, SO2, CO2, CO, CH4 and O2 furnace gases**
- **Measures 5 components including O2 simultaneously and continuously**
- **Dust/Opacity measurement by In-situ directly in exhaust gas flow**
- **Can design the system to meet EPA regulations 40 CFR part 60 & 75**
- **Complete system solution including Datalogger, Data Acquisition system and remote access with EPA**

On-site survey/ consulting/front end engineering

Large, easy-to-see LCD unit

ISO 9000 Certified

Quick-Release adapter available for the FU20

YOKOGAWA
Co-innovating tomorrow™

# Analytical Instruments Industrial Automation

## Increase profitability and enhance health, safety and environment

*The accurate and stable measurement of the process value with Yokogawa Field Instruments supports the safe and reliable operation in your plant.*




## High-precision data under any circumstances

### Liquid Analytical: FLXA21

The FLXA21 is a next-generation modular liquid analyzer that can be flexibly configured to measure pH/ORP, contacting conductivity, inductive conductivity, or dissolved oxygen. The FLXA21 also supports the installation of up to two sensors of the same type, thereby reducing installation costs and saving space in addition to enabling the configuration of a highly reliable backup system.

### Electrodes and Sensors

The heart of an analytical measuring loop is the electrode system. Yokogawa has designed a wide range of sensors to ensure this heart keeps beating under the most severe conditions.

### In-Situ Gas Analyzer: TDLS8000

The most trusted laser analyzer designed specifically to meet all of your requirements in one robust device that is easy to operate and maintain. The TDLS8000 houses all of the industry's leading features in one robust device, proven for the measurements of O2, CO, CH4, NH3, H2O and many more NIR absorbing gases. The platform design is for in situ measurements that eliminate the need for sample extraction and conditioning. The non-contacting sensor allows for a variety of process types including corrosive, abrasive, and condensing.

### In-Situ Zirconia Oxygen Analyzer: ZR22G, ZR802G

The ZR22G, ZR802G Zirconia Oxygen Analyzer features a touch screen LCD with excellent operability for settings,calibration and trend graph viewing. The probe uses a highly reliable zirconia sensor and a fieldreplaceable heater assembly.

### Temperature Controller Series: UT35/55 Advanced®

The UT35/55 Advanced® Digital Indicating Controllers offer the following features as a standard: Built-in control functions, ladder sequence control, fuzzy logic control, complete networking capabilities – Modbus TCP/RTU, CC Link and DeviceNet. These controllers present ideal low cost solutions for modular and remote plants within mines.

### Data Acquisition: SMARTDAC+™

A fresh approach to data acquisition and control, with smart and simple touch operation as a design priority. Measure, display and archive process data with greater levels of clarity, intelligence and accessibility. The SMARTDAC+™ concept begins with the all-new GX/GP, an integrated I/O and recording system with a familiar touch operator interface. The new GX/GP is highly adaptable, very capable and easy to operate.

### Data Logger: Modular GM10

The Data Logger that can be used flexibly according to the equipment, employing multiple data acquisition systems to monitor the health of assets and facility infrastructure. The GM10 is a scalable modular block I/O data acquisition system and data-logging platform that is designed for easy installation and maintenance and requires no programming. It supports remote web-based or wireless configuration and monitoring via Bluetooth connection. The unit can be DIN rail mounted, wall mounted or act as a standalone desktop application.

### Digital Indicator with alarms: UM33A

The UM33A is a newly-released digital indicator with alarms, providing up to 9 alarm outputs and input correction functions (PV bias, Polygonal line approximation, polygonal line bias). A 24V DC sensor power supply is available as an option.

### Versatile Device Management Wizard: FieldMate™

FieldMate™ is a PC-based configuration tool that performs tasks including initial setup, daily maintenance, troubleshooting and configuration backup for device replacement. These tasks are streamlined by FieldMate's™ intuitive operation and integrated environment which is independent of communication protocols and device vendors. FieldMate™ incorporates the open FDT/DTM standard and is compliant with DTM's per the FDT 1.2 standard. Additionally, FieldMate™ supports both HART® and Foundation Fieldbus H1 devices.

### Handheld Communicator: YHC5150X FieldMate™

The YHC5150X FieldMate™ Handheld Communicator is the latest HART® Communicator from Yokogawa. All HART® field devices can be configured, polled and trimmed utilizing a Windows Embedded CE™ based system for faster processing and greater storage capacity. All options are standard and no subscription is required. The YHC5150X is a full function, DD Direct, HART® Communicator supporting universal, common practice and device specific commands for commissioning, configuration and maintenance operations.

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# Yokogawa Services & Solutions

## A long-term partnership with Yokogawa will help provide the highest total value of ownership for automation solutions

*Forging a partnership with Yokogawa will undoubtedly yield the utmost in comprehensive value for automation solutions, securing unparalleled ownership benefits over the long haul.*


### Sensing and Actuation

- Flow meter Solutions
- Pressure & Level Solutions
- Temperature Solutions
- Analytical Solutions

#### Flow meter Solutions

Smarter more accurate next-gen measuring devices with less need for physical contact and exceed expectations.

#### Pressure & Level Solutions

Get accurate, reliable pressure measurement to the data user quickly.

#### Temperature Solutions

Moving from manual processes to digital solutions that add value, plants inherently become safer, and processes are optimized.

#### Analytical Solutions

Give critical process information to operators and control systems, to optimize your operation process in real-time.


### Production Control and Asset Management

- CENTUM VP
- PXiSE
- Digital Twin
- IA2IA

#### CENTUM VP (DCS)

Most advanced, integrated process control system, providing enhanced productivity and optimization.

#### PXiSE Energy Solutions

Reach organization clean energy goals by giving grid operators the control they need while still providing safe and reliable power.

#### Digital Twin

Drive effective decision-making and determine strategies to maximize safety, reliability, and profitability.

#### IA2IA

Embrace emerging digital technologies, transform operations, control costs, reduce downtime, and improve profitability.


### Environmental and Safety Systems

- Permit to Work System
- CyberSecurity Manageme
- Water Management
- Energy Management

#### Permit to Work System

Control the risks, ensure worker safety and significantly increase efficiencies, the most effective RAP[4] Digital Permit to Work System.

#### CyberSecurity Management

Achieve long-term, stable, and secure operations and new digitalized world security innovations.

#### Water Management

Contributing to a sustainable water cycle, ensuring compliance standards and protecting the environment.

#### Energy Management

Protecting the environment by supporting the effective use of energy and contributing to a sustainable society.

# Mining Recovery & Operational Control

## Enhancing supervision by incorporating integration into Smelting & Refining Operations

*Today, North American Smelters and Refineries require a high degree of certainty and confidence to achieve timely production, as well as the flexibility to make changes in product and material specifications. Yokogawa's latest solutions enables an effective response to intense global competition and major market shifts.*

DTSX®

STARDOM™

## Distributed Temperature Sensing

Yokogawa DTSX enhances Site Safety, Asset Monitoring & Facility Maintenance functions. DTSX can be used for any area where temperature change can indicate process abnormalities, allowing for early detection and corrective action for safety. DTSX uses Optical Fiber as a sensor, which is safe to use inpotentially explosive and hazardous environments. It is immune from electrical induction and noise vibrations.

Applications:

- Well bore temperature distribution monitoring
- Heat buildup detection along conveyor system
- Cable tunnels, ducts, trays, rack, MCC where heat buildup could become a fire hazard
- Pipeline leak detection
- Furnace chamber deterioration diagnosis via external wall surface temperature profiling

**Prevention is better than the cure**

## Autonomous Controller

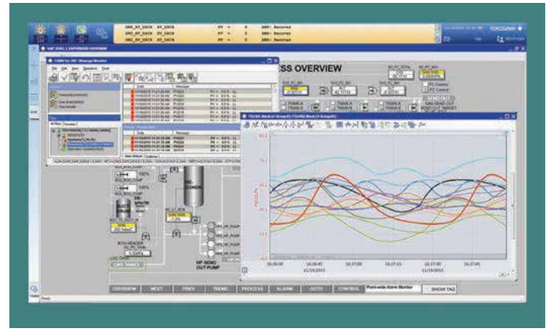
Next generation platform for secure fault tolerant operation of intelligent assets and strengthen your core compentencies. STARDOM control system provides openness, general versatility, low implementation cost and has been designed to make it possible to decrease the long term Total Cost of Ownership (TCO).

Applications:

- Reduces engineering and maintenance hours by reuse of program components
- Increases uptime and reduces inventory by use of hot-swappable modules shared between single and redundant configurations
- Adapts to complex applications with a high speed CPU and gigabit Ethernet communication
- Supports all five IEC 61131-3 programming languages
- Supports industry standard open communications protocols for third party interfaces - Modbus , DNP 3.0
- Avoids loss of critical data during network interruptions with data buffering automatically backfilled to host system
- Robust design for harsh environments including wide operating temperature options -20 C to 70 C.

> *CENTUM VP provides an excellent platform for the comprehensive and coordinated control of Mining assets and Mineral Processing plants.*
>
> *— Mining Industry Expert*

Distributed Control Systems
CENTUM VP
Release 6



## Distributed Control System (DCS)

CENTUM VP is Yokogawa's latest integrated production control system, also known as a distributed control system (DCS). Nearly 40 years of knowledge and experience with DCSs has gone into its development. The enhanced CENTUM VP becomes the platform for delivering four new innovations; Hyperintuitive Operation, Total Automation Management, Intelligent Plant Conductor, and Sustainable Plant Operation.

Applications:

- Suitable for conducting real-time processes
- True Global Distributed architecture
- Intuitive and user-friendly HMI with guaranteed 1 sec graphic update and refresh rate
- The World's First 1 Giga-bit fully Deterministic and Realtime Control Network
- Alarm Management System compliant to EEMUA191 and ISA-18.2 standards, integrated Alarm window for DCS, Safety and Asset Management System
- Wide protocol support based on OPC, Modbus, Ethernet, Profibus, FF, ISA100.11a etc.
- In-built Test function and Simulation capabilities
- Unique Pair and Spare Technology with special diagnostics and unprecedented reliability
- High availability process controller, Seven 9's (99.99999) hardware availability
- Redundancy at all levels (communication bus, CPU, I/O module), autonomous control stations
- Supports Smart Configurable IO Modules which reduces project schedule by decoupling of Application
- Development & Hardware design,
- Smart IO concept eliminates Marshalling and reduce overall system Footprint and Cost
- Enhanced Engineering Environment ensures consistent Engineering Information and data Integrity, manage Change and support Automation Lifecycle
- Supports Independent Field Wiring check without actual System Hardware, HMIs or Controllers
- Certified Marine Standards ABS, Lloyds, BV standards
- Cyber security Certified by ISA Secure® EDSA
- 25,000 plus System Install base Worldwide & backward compatibility with the earlier CENTUM systems

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# Success Stories

## We are co-inventors, optimization experts, safety architects and integrators of mining projects

*Yokogawa has an established proven track record why miners choose us.*

### SEAMLESS SYSTEM MIGRATION

**Customer:** Solvay Soda Ash
**Location:** Green River, Wyoming
**Project:** Trona ore mine and refinery upgrade, from Yokogawa CENTUM CS3000 to CENTUM-R5 involved two domains, 21 RIO and FIO field control stations, 17 operator stations, 6 engineering stations and 8 different plant servers.
**Highlights:** The World's Largest Trona Trove experienced no loss of production, the plant came back online without any problems, the total upgrade covers processes that are up to 20 miles apart.

### CONTROL CAPABILITY OF FIELD INSTRUMENTS

**Customer:** Minera Escondida
**Location:** Chile, South America
**Project:** Install vertical temperature system.
**Highlights:** Yokogawa installed a distributed temperature sensor solution, the DTSX200, to measure temperature distribution over the length of Minera Escondida's optical fibre cable. The low power consumption DTSX200 was chosen for it's ability to be installed in remote areas, operate on solar power and offer control capability.

### CENTRALIZED ACCESS TO ALL DEVICES

**Customer:** Nedmag Industries
**Location:** Veendam, The Netherlands
**Project:** Install HART and end-to-end FDT technology to give users centralized access to all devices.
**Highlights:** Nedmag is using an integrated asset management system that combines FDT technology with a device management tool to achieve real productivity advantages and savings in its maintenance and service operations with plant asset management system that provides central access to all instruments.

### FULLY INTEGERATED SAFETY CONTROLLER

**Customer:** Kalgoorlie Consolidated Gold Mines (KCGM)
**Location:** Kalgoorlie, Australia
**Project:** Replace legacy system with Yokogawa's latest DCS, CENTUM VP System for gold mine operation.
**Highlights:** KCGM produces up to 800,000 ounces of gold every year from the ore taken from its Super Pit open pit mine, and is by far the largest gold mining operation in Australia. The plant long relied on a CENTUM CS distributed control system (DCS), and experienced no major failures while it was in use. Yokogawa successfully installed this new system and it has continued to perform reliably.

### RELIABLE CONTROL SYSTEMS

**Customer:** DeBeers Marine
**Location:** Cape Town, South Africa
**Project:** Install a distributed control system (DCS) for five marine diamond mining vessels owned by Debmarine Namibia.
**Highlights:** De Beers Marine, a specialist technical engineering support specialist to the diamond mining industry, chose Yokogawa's CENTUM VP DCS based upon the faultless performance of the system under harsh operating conditions and the low cost of ownership from Yokogawa's long-term migration policies.

### ZERO UNPLANNED DOWNTIME

**Customer:** Evolution Mining
**Location:** West Wyalong, Austrailia
**Project:** Optimize a distributed control system (DCS) for the Cowal Gold Mine - Processing Plant.
**Highlights:** Evolution increased gold production by 220% and achieved zero unplanned downtime over 10 years by optimising their CENTUM VP distributed control system (DCS) from Yokogawa.

# Other Publications

## VARIETY OF MINING APPLICATION NOTES

Gain a comprehensive understanding of mining & mineral processing, smelting, refining and recovery solutions through successful applications that offer reliable results, achieve long-term business success and more.

DOWNLOAD

## MINING BROCHURES

Industry leaders striving for operational excellence will benefit from Yokogawa's approach to plant automation solutions that help measure, control and optimize your processes, ensuring plant-wide integration and maximize total value of ownership.

DOWNLOAD

## MINING INDUSTRY & DTSX EBOOK

Pivoting from a reactive to a predictive and proactive monitoring and asset management system is essential. Proactively prevent abnormal situations, reduce production loss and maximize productivity in your mining operation.

DOWNLOAD

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Yokogawa Corporation of America
12530 W. Airport Blvd.,
Sugar Land, TX 77478
www.yokogawa.com/us

Yokogawa Canada, Inc.
Bay 4, 11133 40th Street SE,
Calgary, AB T2C 2Z4
www.yokogawa.com/ca

Yokogawa de México, SA de CV
Urbina No. 18
Parque Industrial Naucalpan
Naucalpan de Juarez, Estado de México
C.P. 53370
www.yokogawa.com/mx

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