YOKOGAWA

Co-innovating tomorrow™

Processing Minerals & Metals in the Mining Industry

Solutions to Maximize Asset Availability and Maintain Automation System Reliability

BU-P-20230225-01

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Reliability is in our DNA

Global Expertise, Deployed Locally

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

Trusted Applications, Dependable 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.

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Influencing Factors in Mining

North America's miners play an indispensable role in powering and building our nations.

North America's mining industry supplies the essential materials necessary for nearly every sector of our economy — from technology and healthcare to energy, transportation, infrastructure and national security. Yokogawa brings the global expertise with local support you need to succeed, along with an understanding of the influencing factors effecting the market, including rising environmental, social and governance, or ESG.

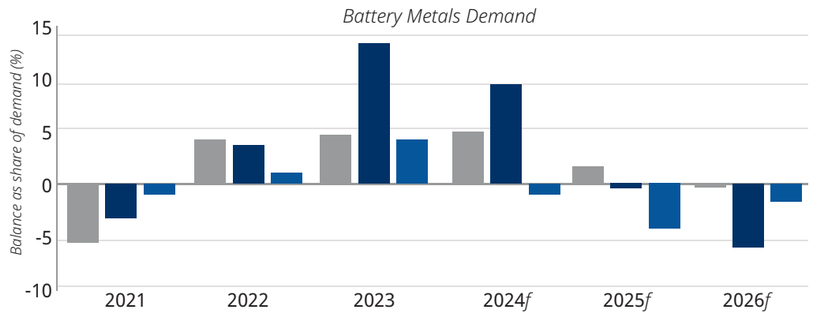
Metals to produce batteries demand to outpace supply starting in 2024

Global efforts to decarbonize are driving the rollout of technologies that are increasing demand for raw materials, bringing about near-term challenges in the commodities sector. Battery component supply pipelines will struggle to keep up with such a sharp rise in demand - resulting in a deficit forcasted in 2025.

28 Ni NICKEL Nickel

27 Co COBALT Cobalt

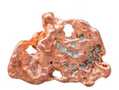
3 Li LITHIUM Lithium



Energy transition needs will drive up demand of industrial commodities

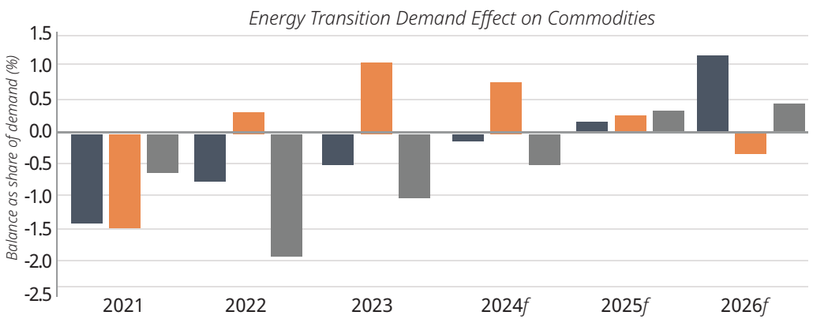
Energy transition efforts will also drive up demand for iron ore, zinc and copper. Recent reports indicate a doubling of copper demand by 2035 based on decarbonization initiatives aimed at meeting the goal of net zero emissions by 2050. As governments increase their energy transition efforts, many existing operations will be hard-pressed to expand production.

26 Fe IRON Iron



29 Cu COPPER Copper

30 Zu Zinc Zinc

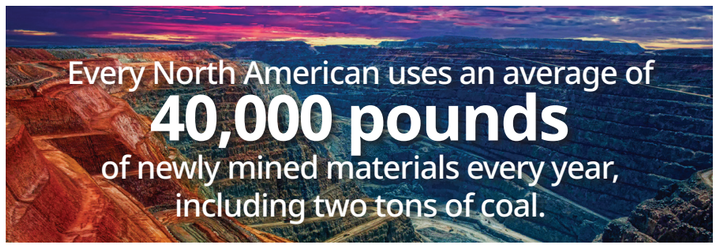


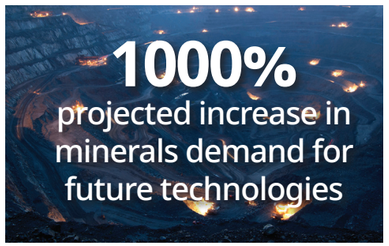
Green Mining is estimated to be $23.4B by 2032

Sustainable green mining practices rise in North America

Green mining helps conduct operations in a manner that is safe and meaningful for employees and harmless to local residents and the environment, by extracting essential resources while improving social, economic and surrounding the mining area is controlled within manageable limits, ensuring the availability of mineral resources for future generations, which requires long-term investment in mineral exploration techniques.

Mining in North America at a Glance





Statisitcs Source: The National Mining Association - 2023 Mining Market Intelligence Report

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Active Mines

Major Metal & Mineral Operations in North America, 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.

Industry Knowledge & Project Execution Solutions

Mining is thriving, the value added by the mining industry from sand and gravel, stone, and coal to the domestic economy alone from the over 12,714+ active mines in the North Americas amounted to nearly $57 billion. Higher-priced commodities and precious metals, like hundreds of tons of gold and silver, as well as millions of tons of iron ore and copper are extracted from over 278+ metal mines and there is still more undiscovered sources to explore. Massive support is needed for this endevour.

Yokogawa delivers a total automation solution, covering the entire lifecycle of projects, as your automation partner. This proven method brings experience, engineering, technology, safety, and lifecycle support, while at the same time reducing risk and lowering overall costs.

Yokogawa's **Project Execution Team** applies excellent communications with all parties including the Contractor, End user, Licensor, etc. to ensure successful project delivery. Yokogawa has the advantage of a local and global knowledge base and resourcing for project execution.

Yokogawa's Engineering Capabilities

- **Green Field Projects Execution**
- **Main Automatic Contractor "MAC"**
- **Front End Engineering Design "FEED"**
- **Functional Safety Management**
- **Systems Migration/Replacement**

Combining a full understanding of customer requirements with professional management of multiple vendors, Yokogawa is strongly positioned to deliver the set objectives of any project.

Extract with precision and maximize operations with expertise

Active Mine Key

79 Au GOLD — Gold

29 Cu COPPER — Copper

47 Ah SILVER — Silver

28 Ni NICKEL — Nickel

26 Fe IRON — Iron

5 B BORON — Boron

78 Pt PLATINUM — Platinum

3 Li LITHIUM — Lithium

PO_4^{3-} PHOSPHATE — Phosphate

6 C CARBON — Coal

Start to Finish, Dependable Outcomes

Mining Lifecycle Experts at Every Step of the Process

Strategically integrated support and guidance implementing solutions

Improving a client's process journey, in order to achieve those sustainable goals and reach your target, our team of experts bring co-innovating processes and solutions to advance your mining operation through digital transformation, boost production, increase safety, maximize processing and beyond.

- Plan and Design
- Audit and Advise
- Design and Engineer
- Training
- Building
- Installation
- Testing
- Monitoring
- Optimization
- Ore Production
- Drill and Blast
- Excavation
- Load and Haul
- Crushing and Sizing
- Processing
- Chemical Separation
- Cyanidation
- Flotation
- Electrolysis
- Loading and Shipping
- Analysis
- Diagnostics
- Predictive Maintenance
- Preventive Maintenance

Mineral Extraction

Advanced Process Control to optimize and stabilize processes

Ore Crushing

Asset Management Software and tools to remotely monitor field device performance resulting in proactive, predictive maintenance 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.

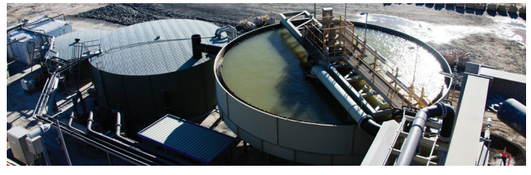
Chainwide mining consultive expertise

Plan, Design, Build & Extract

Improving drilling and blasting, excavation, loading, and hauling processes can boost productivity and profitability in mining operations. Explore innovative solutions for cost-effective and sustainable mining practices.

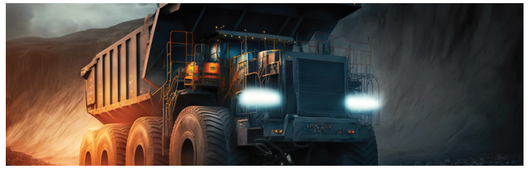
Ore Crushing & Sizing

Discover the latest solutions to optimize crushing and sizing processes for better mineral recovery rates and increased productivity. Learn how advanced technologies and innovations can improve the efficiency of mineral processing, reduce downtime, and minimize energy consumption.



Operations & Processing

Discover the benefits of incorporating automation into mineral processing operations. From chemical separation and cyanidation to flotation and electrolysis, automated processes can improve efficiency, reduce downtime, and enhance consistency.



Quality Control & Sustainability

Proper discharge and rejects controls are crucial for the success of mining operations. By implementing efficient controls, companies can improve the quality of discharged materials, minimize waste generation, and enhance environmental compliance.

Automation is the Future of Mining

Why is automation the utmost key prerequisite for mining assests and mineral processing?

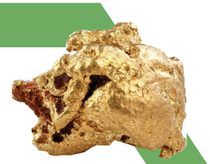
The mining and mineral processing industry is an industry with many challenges. Not only does it need to be flexible to the internal problems arising from changing ore bodies, it must be able to respond to the pressures put on it by global competition, global prices and highly mobile capital and people.

One of the most fundamental and often overlooked factors for maximizing revenue in mining is the reliability and maintainability of automation systems. It is key. Economical recovery often requires high throughput and high availability of the process with low operation costs in the mining industry, and stringent safety and environmental regulations, utilizing robust field instruments and automation solutions increases profitability and enhances health, safety and environment.

Yokogawa's core operating platform, CENTUM VP, empowers users to compose workflows ensuring maximum efficiency and profitability, always allowing total insight and control of the process chain. From mining, materials handling, mineral processing, smelting, refining and recovery, all production capabilities and statistics are easily available.

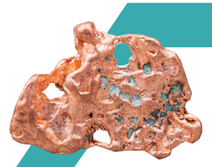
Plant Availability → Business Agility & Flexibility → Profitability, Safety → Long-Term Business Success

01 Reliability and Maintainability



"Reliability and maintainability" of automation systems maximizes plant availability.

02 Plant-wide Automation



"Plant-wide automation" enhances agility and flexibility of mineral processing production workflow.

"Lifetime partnership" maximizes total value of ownership.

04 Lifetime Partnership

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"Production efficiency improvement" increases profitability and enhances health, safety and environment.

03 Production Efficiency Improvement

Comprehensive mining solutions from start to finish

Total Mining, Mineral Processing and Metals Plant Control System

Automation maximizes asset availability

All automation suppliers take system reliability, a key factor for mineral processing plant availability, seriously. However none matches Yokogawa in its extreme commitment. At the heart of all the company's systems is the unique "Pair and Spare" controller architecture, consisting of a redundant set of CPU modules that, in turn, contains two microprocessors. These two microprocessors constantly compare each other's outputs, initiating a seamless switchover if any mismatch is detected.

Dependable outcomes throughout your mining operations

Operation & Optimization

Ongoing adaptation and optimization requires continued collaboration. Yokogawa keeps in close touch with your investment through 24/7 operational support and expert consultation services

Maintenance & Upgrade

Be it diagnosis, root cause analysis, or predictive maintenance, practical solutions are in short supply. Yokogawa brings you the tools and services that help you take concrete actions to improve the effectiveness of your plant assets

Installation & Commissioning

Good coordination between multiple suppliers and engineering teams is the key success factor in commissioning. Yokogawa ensures both human collaboration and technical integration throughout the project lifecycle.

Revamp & Expansion

Complex revamp/expansion projects test the alertness, care and skill of both the user and the supplier of automation. Yokogawa delivers practical engineering solutions with professional care, modernizing and expanding your plant with minimum disturbance to your business.

Design & Engineering

Early involvement and collaborative project execution lowers the overall risk of the project. Yokogawa strives to understand the goals of each project upfront and to secure a firm platform for on-going teamwork. Throughout execution, Yokogawa secures strict quality gates based on proven procedures.

Future Upgrades & CyberSecurity

One of the most fundamental and often overlooked factors for maximizing revenue is the reliability and maintainability of automation systems. Utmost system availability is a key prerequisite for mining assets and mineral processing plants.

Total Mining, Mineral Processing and Metals Plant Control System

Enhance agility and flexibility of processing workflow through Plant-wide 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 plant-wide automation solutions that deliver agility and flexibility to all process workflows.

Production Control Systems

We provide our customers with a range of systems that support the safe and efficient operation of their plants. These include highly reliable production control systems for the control and monitoring of plant operations, safety instrumented systems that are fully integrated with plant production control systems to achieve the highest levels of safety, and network-based control systems and programmable logic controllers that are both highly reliable and versatile. Yokogawa PLCs offer the fastest update rates for high speed applications and are electrically and environmentally robust.

Distributed Control Systems CENTUM VP Release 6

STARDOM

Yokogawa offers multiple automation and control strategies, architectures, and solutions for every application size and complexity. Our distributed control system (DCS) is designed for large, complex industrial processes, and geographically distributed applications. The DCS can employ advanced process/supervisory control applications, operator-centric, enterprise-integrated information, configuring disparate systems into a holistic process overview and coordinated control strategy.

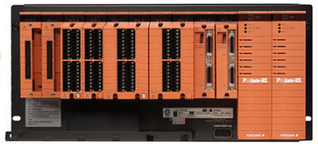
CENTUM VP is the latest generation of the CENTUM DCS series. CENTUM VP features unrivaled 99.99999% availability along with an intuitive human machine interface and a versatile field control station suitable for both large and small scale data processing tasks.
To date, more than 25,500 CENTUM series systems have been delivered around the world.

Safety Instrumented Systems

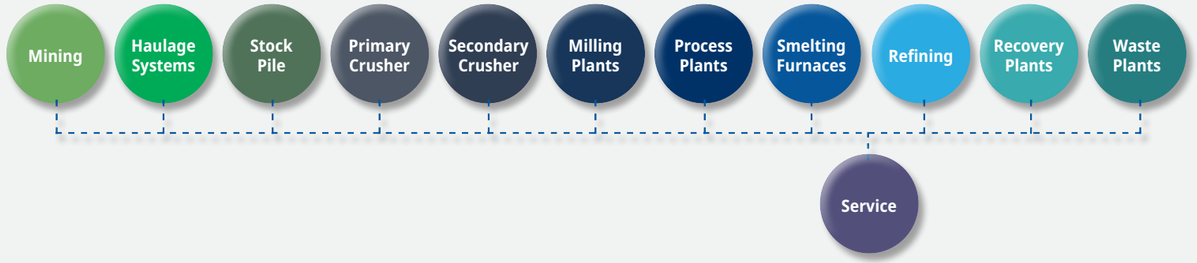
Yokogawa has over 50 years of experience in the development and implementation of safety systems. The world's first truly integrated safety controller was released by Yokogawa in 2005, achieving absolute integrity between distributed control systems (DCS) and safety instrumented systems (SIS) for plant automation.

The ProSafe-RS is certified by the German certification organization, TÜV, to meet Safety Integrity Level (SIL) 3 specified in IEC 61508. Our expertise covers all major applications such as ESD (Emergency Shut Down), F&G or FGS (Fire and Gas Systems), BMS (Burner or Boiler Management Systems) as well as HIPPS or HIPS (High Integrity (Pipeline) Protection Systems).

ProSafe-RS



Mining and Mineral Complex



Management Information Systems (MIS) / Management Execution Systems (MES)

Yokogawa's MIS / MES systems consistently ensure fast return on investment and help operators to keep their plant operating environments optimized for years after the initial implementation.

Yokogawa's MIS / MES platform applications collect and store largevolumes of process data providing actionable information that can be viewed and analysed by key personnel.

Common to all Yokogawa products is our commitment to ensuring there is always a clear migration path available for all our customers.

Advanced Process Solutions

Safety Excellence
- Advanced Decision Support
- Alarm Rationalisation
- Regulatory Control Stabilisation
- Control Room Design
- Incident Analysis
- Integrated Closed Circuit Television (CCTV)
- Cyber Security

Asset Management
- Optimise Plant Asset Effectiveness
- Maximise Plant Uptime
- Plant Asset Management

Production Excellence
- Energy Management Solutions
- Best Practice Pilot
- Regulatory Control Stabilisation
- Platform for Advanced Control and Estimation (APC)
- Blend Property Control
- Real-time Production Organiser
- Operator Training System

STARDOM Network Based Control and CI Server Platform

Embrace new digital technology in reliable hardware and inherit the rugged DNA Yokogawa's DCS with evolved SCADA solutions.

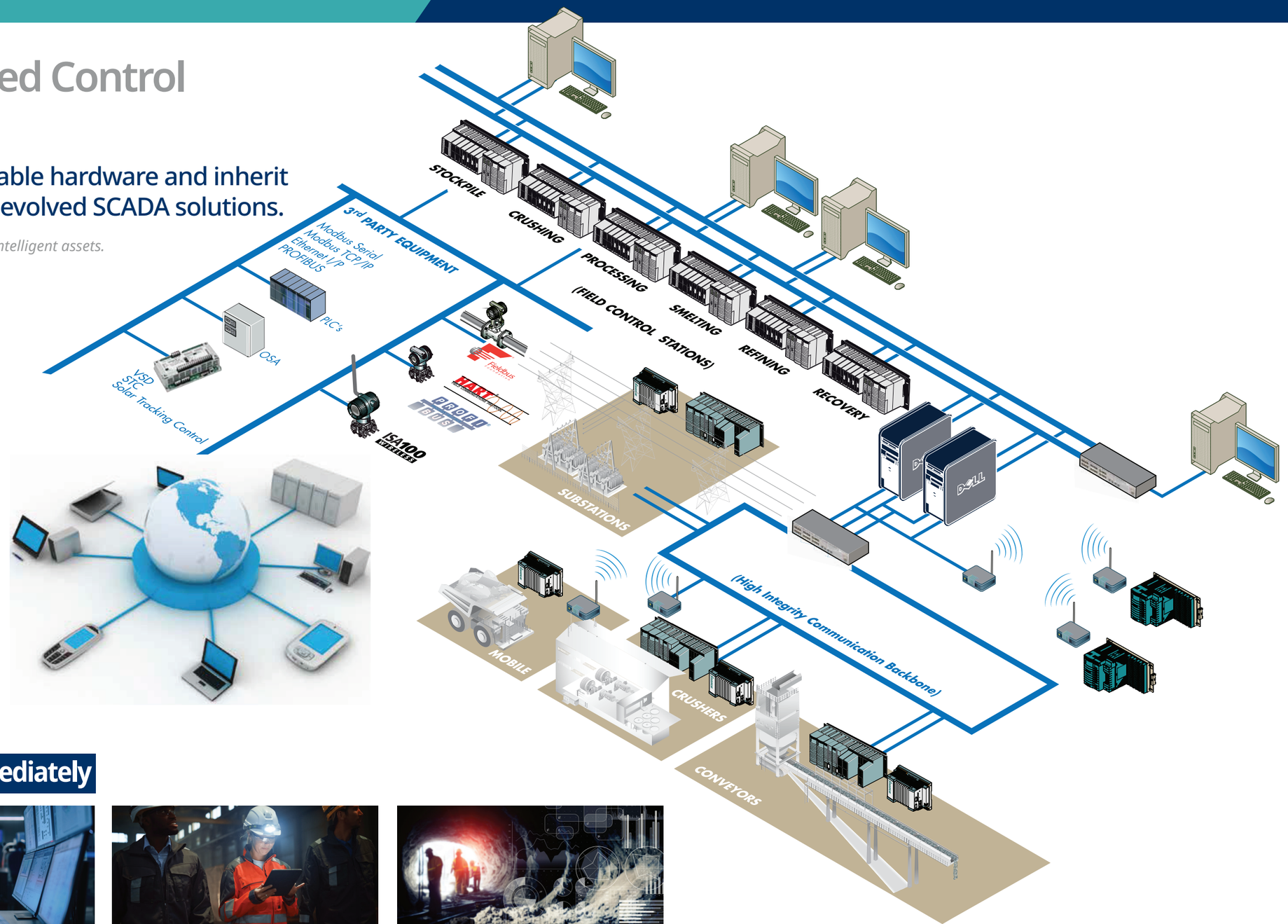
Next generation platforms for secure fault tolerant operation of intelligent assets.

Network Control Systems

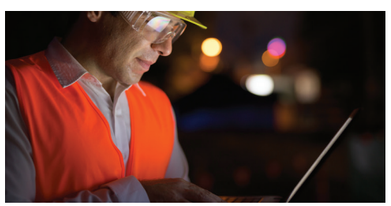
Supervisory Control and Data Acquisition (SCADA) Systems are typically used for supervisory monitoring and control of remotely and geographically distributed assets. They provide more open platform for interface with several makes and types of equipments and extend user friendly and flexible GUI environment.

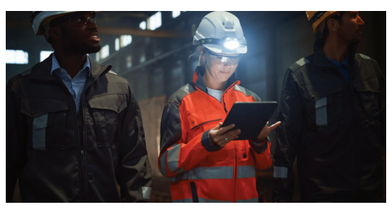
By embracing new digital and information technology in reliable hardware and inheriting the rugged DNA of the Yokogawa DCS, STARDOM offers evolved SCADA solutions.

Building a manufacturing system that can immediately respond to the diverse needs of today's globally networked society, an electronic Real Time Manufacturing (e-RMTM) system is required. This is a new concept that promotes the standardization of system configurations and component-based applications, using IT networks to link resource planning, manufacturing systems and control throughout the enterprise.



A system package that responds immediately






Field 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.




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

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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.

Analytical Instruments Industrial Automation

Respond to change quickly and efficiently, optimize your operation in real time

Yokogawa analyzers give you confidence in getting the critical process information to the operators and control systems to support operations.




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.

Operational Excellence

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.

Shift your focus towards optimizing efficiency rather than dealing with an erratic workflow

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 corporate 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 Management
- 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.

Environmental & Safety Solutions

Lifecycle Sustainability and Environment Monitoring Service

Yokogawa prides itself in providing customer centric solutions. We partner with our customers to find optimum outcomes for process plant and provide holistic and tailored service solutions.

Yokogawa's **Lifecycle Agreement "Sustainable Plan"** provides a wide range of maintenance services based on our long-term maintenance plan which we call the lifecycle plan. This maintenance plan provides more than just peace of mind; it provides tangible safety benefits for your assets. A quick and effective recovery from potential failures can be achieved and a long-term, cost-effective maintenance plan is attainable.

Minimize Loses
Quick, effective recovery from potential failures.

Preserve Assets
Tangible safety benefits for your assets.

Sustain Performance
Prevent failures, optimize with accurate data.

Maximize Profits
Maintaining the long-term viability.

We would like to prevent any troubles caused by environmental factors in advance by getting a good understanding of the potential adverse effects on the system due to environmental stress, such as temperature, humidity, floating dust, etc. Yokogawa's **Asset Health Check Service** can prevent failures caused by deterioration due to environmental stress, any sign of degradation in the system can be detected early on, allowing us to effectively maintain the health of the system's hardware.

Long-term operational success needs a long-term strategy.

Layers of Safety with Risk Assessment Process (RAP) System

The most effective Permit to Work system needs to engage the workforce and keep them focused on the important issues that keep people safe.

Yokogawa's **RAP⁴ Digital Permit to Work** is your front-line documented method of keeping people safe whilst undertaking any form of work that needs to be controlled in potentially hazardous environments. It represents the combination of formal risk identification, isolation, management & control, communication, and authorization which forms a key component of an integrated safe system of work (ISSOW) for efficient Digital Control of Work.

- **Enhanced productivity**
- **Cost Benefits from greater efficiencies**
- **Links to MMS for enhanced planning and preparation**
- **Enhanced communications with mobile technology**
- **Quickly close the loop on corrective actions learned**
- **Overall Improved Safety Culture**

Operational Risk Management Solutions

Minimizing Risks and Maximizing Corporate Values

Solutions that help companies avoid catastrophic losses and make their businesses more robust by managing safety, health, and environmental risks for specific business processes and the individuals engaged in those processes.. The valuable service lineup includes cybersecurity management/consulting and product security services.

Operations Management System

Operations Management solution helps to ensure Safe, Reliable and Efficient plant operations and regulatory compliance by digitization of information related to key Operations Management Practices. This results in improved productivity through standardized work practices, streamlined processes, plus improved communications and coordination across departments, these key reports and KPIs to improve decision making on a daily basis.

- **Integrated approach to operations management**
- **Improve retention of expert knowledge**
- **Fast, efficient change of operations processes**
- **Reduce cost of operations & maintenance activities**
- **Better integration of critial applications & systems**
- **Enforce standards operating procedures & practices**
- **Improve collaboration and internal communications**
- **Improve decisions with real-time access to critical info**
- **Ensure statutory compliance to Health, Safety, Security and Environment**

Cybersecurity Lifecycle Management

Yokogawa's cybersecurity services take a lifecycle approach to help customers control the security risks and manage to achieve the highest business continuity plan throughout the plant's entire lifecycle. We focus on long-term lifecycle services while understanding customers' challenges and working continuously for improvements in a close partnership. Yokogawa follows one overall objective: to minimize risk and maximize corporate values according to our self-commitment as a lifecycle value partner. We aim to become your #1 trusted partner and achieve long-term, stable, and secure operations.

Cybersecurity Awareness & Training

Despite the best cyber defenses, human error leads to many cyber incidents, due to a lack of cybersecurity knowledge and awareness. Yokogawa supports customers with tailored training programs, either remotely or on-site as needed, addressing appropriate content based on IEC62443 global security standard for ICS while also considering required national and specific industrial standards.

YOKOGAWA
Co-innovating tomorrow™

Enhance Recovery & Operational Control

Incorporating Integration into Smelting & Refining Operations

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.

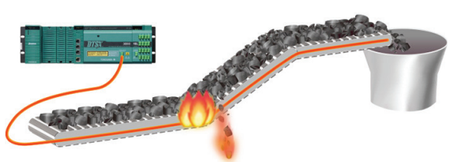
DTSX®

Distributed Temperature Sensing (DTS)

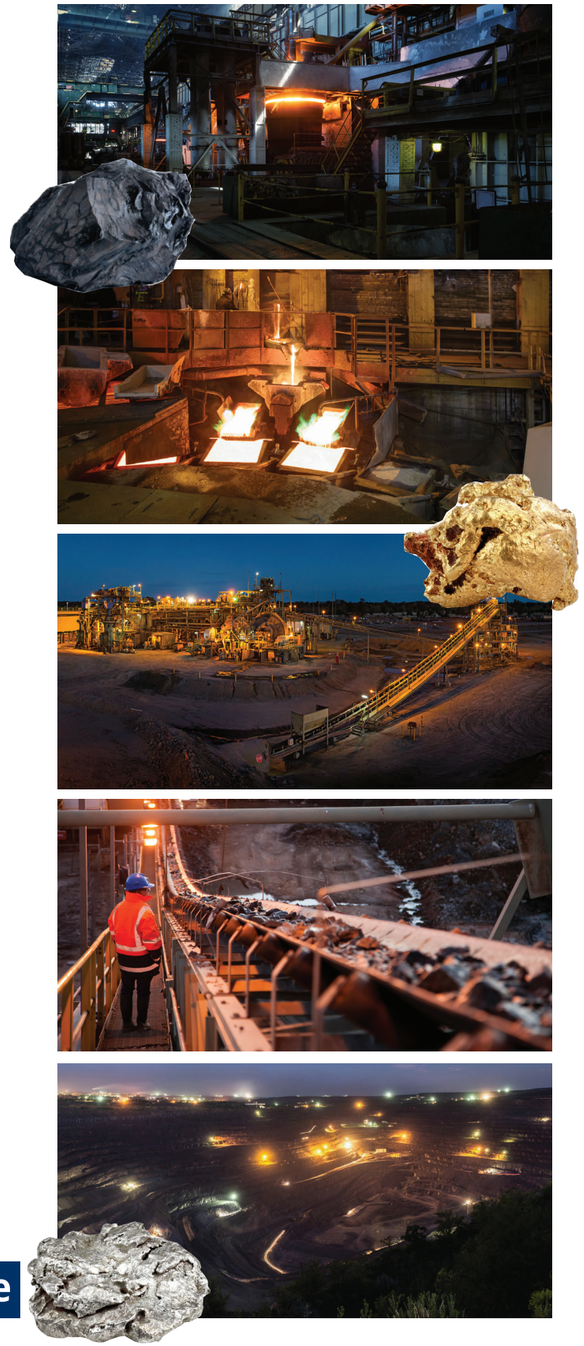
Yokogawa DTSX enhances Site Safety, Asset Monitoring & Facility Maintenance functions. DTSX can be used for any area where temperature change can indicate process abnormalities, allowing for early detection and corrective action for safety. DTSX uses Optical Fiber as a sensor, which is safe to use inpotentially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



> *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

YOKOGAWA
Co-innovating tomorrow™

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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