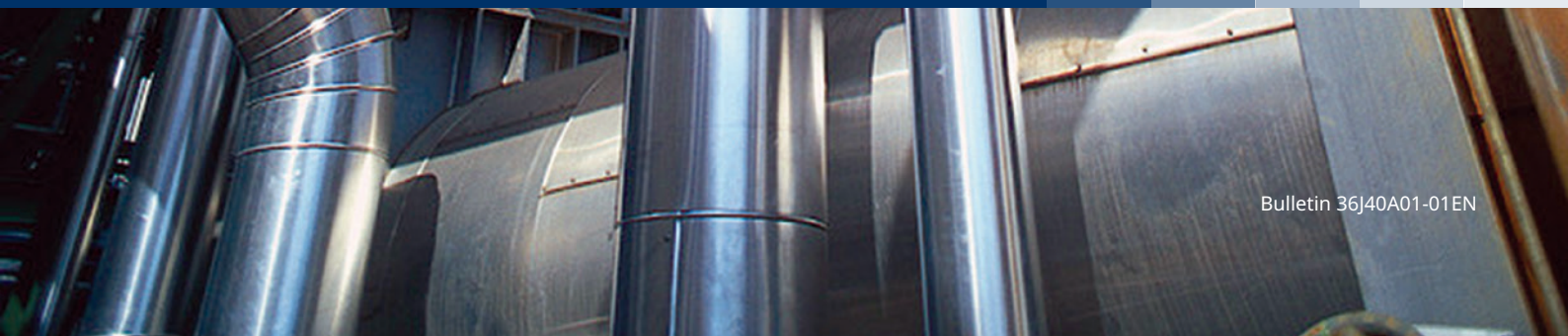**OpreX**™ Asset Operations and Optimization

Exaquantum delivers Production Excellence
Exaquantum

Production Excellence

Yokogawa's Exaquantum Solutions enable continuous improvements in production environments to provide agility and flexibility, asset optimization, quality improvements, whilst ensuring safe and secure operations.

Functional Solutions

Production Management

- Plant and Enterprise Historians
- Data Visualization Dashboard
- Performance Monitoring
- Production Accounting
- Batch Production Analysis
- Downtime Analysis
- Yield Accounting
- Environment Monitoring
- Mass and Energy Balancing
- Data Reconciliation

Data Integration

- Global System Integration
- Business and ERP Integration
- Laboratory and Quality Information Integration
- Maintenance and Asset Management Integration
- Remote Facility Integration
- Standards Based Integration (ISA-95, OPC)
- Legacy System Integration
- Web Services

Alarm Management

- EEMUA 191, ISA-18.2 and IEC 62682 based Alarm Reporting, Management and Analysis
- Sequence of Events and Trip Analysis
- Master Alarm Database

Safety Management

- Sequence of Events and Trip Analysis
- Safety Function Monitoring
- Override Safety Advisor
- Subsea Wells Monitoring

Energy Management

- Operational Cost and Performance Optimization
- Power and Performance Calculations
- Utility Management Performance Visibility

Operator Effectiveness

- Electronic Logbook
- Production Execution and Instructions
- Performance Monitoring

Industry Solutions

Oil & Gas Production

- Remote Performance Monitoring
- Subsea Valve Performance Monitoring
- Safety Function Monitoring
- Override Safety Advisor
- Operator Guidance

Oil & Gas Midstream

- Pipeline Monitoring
- Energy Management
- Material Monitoring
- Leak Detection

Refining & Petrochemicals

- Mass and Energy Management with Data Reconciliation
- Utility Management
- Offsite Movements Monitoring
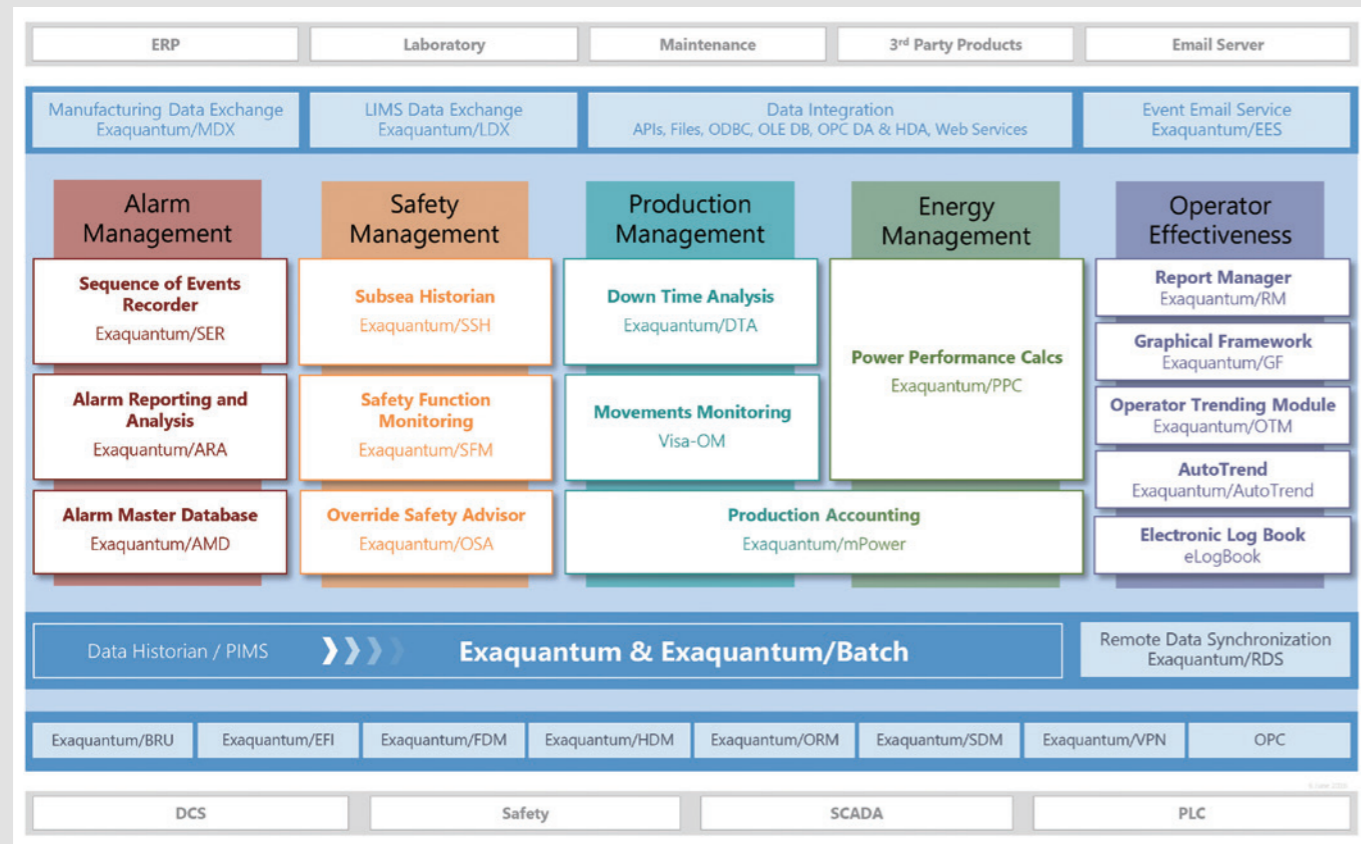- Operational Cost and Performance Visibility

Chemicals

- Batch Production Monitoring and Reporting
- Downtime Analysis
- Performance Based Maintenance Scheduling

Power & Energy

- Power Performance Monitoring
- Power Plant Performance and Cost Optimization
- Captive Power Operational Optimization
- Fuel and Utilities Management

The Exaquantum Family

Exaquantum is Yokogawa's platform for delivering operational value from the wealth of process information available from process automation systems. It is seamlessly integrated and aligned with Yokogawa and third party DCSs, Safety Systems, SCADA Systems and PLCs. Complimenting and enhancing the value of Exaquantum providing Alarm Management, Safety Management, Production Management, Energy Management, Operator Effectiveness and Data Connectivity. Exaquantum integrates with Yokogawa higher-level solutions to provide comprehensive manufacturing intelligence.

ERP	Laboratory	Maintenance	3rd Party Products	Email Server
Manufacturing Data Exchange Exaquantum/MDX	LIMS Data Exchange Exaquantum/LDX	Data Integration APIs, Files, ODBC, OLE DB, OPC DA & HDA, Web Services		Event Email Service Exaquantum/EES

Alarm Management
- Sequence of Events Recorder Exaquantum/SER
- Alarm Reporting and Analysis Exaquantum/ARA
- Alarm Master Database Exaquantum/AMD

Safety Management
- Subsea Historian Exaquantum/SSH
- Safety Function Monitoring Exaquantum/SFM
- Override Safety Advisor Exaquantum/OSA

Production Management
- Down Time Analysis Exaquantum/DTA
- Movements Monitoring Visa-OM
- Production Accounting Exaquantum/mPower

Energy Management
- Power Performance Calcs Exaquantum/PPC

Operator Effectiveness
- Report Manager Exaquantum/RM
- Graphical Framework Exaquantum/GF
- Operator Trending Module Exaquantum/OTM
- AutoTrend Exaquantum/AutoTrend
- Electronic Log Book eLogBook

Data Historian / PIMS ››› **Exaquantum & Exaquantum/Batch** Remote Data Synchronization Exaquantum/RDS

Exaquantum/BRU	Exaquantum/EFI	Exaquantum/FDM	Exaquantum/HDM	Exaquantum/ORM	Exaquantum/SDM	Exaquantum/VPN	OPC

DCS	Safety	SCADA	PLC

The Exaquantum solutions architecture provides the platform and building blocks to leverage the investment in the control systems and plant historian. The solutions can be installed on both existing and new facilities. Deployment can be achieved as part of a phased rollout, continually building upon the existing architecture in order to provide tangible benefits across the business. The Exaquantum solutions are constantly evolving through a continuous and agile development plan. Yokogawa has a strong track record in the development of both enhanced and new solutions through co-innovation with our customers with full lifecycle management.

Exaquantum

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals, Pharmaceuticals, Power Generation, Mining, Food and Beverage, Pulp and Paper, Environmental, Semiconductor.

Functionality: Standards-based Plant Information Management System incorporating a data historian for real-time and historical data, providing a centralized repository for users throughout the plant, providing KPIs, aggregations, role-based views, graphical interfaces, trending, reports and integration with different systems.

Benefits: Integration and enhancement of process data and alarms and events into timely accessible and actionable information available across the enterprise.

Exaquantum/Batch

Industry: Oil and Gas Midstream, Refining, Pharmaceuticals, Petrochemicals, Chemicals.

Functionality: Scalable ISA-88 based Batch Information Management System which collects and stores batch production, equipment and recipe information for analysis and reports.

Benefits: Improved production efficiency and plant utilization. Total visibility of all relevant information for key stakeholders. Key contributor to quality improvement programs. Supports FDA 21 CFR Part 11.

Alarm Management

Sequence of Events Recorder (Exaquantum/SER)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals, Pharmaceuticals, Power Generation.

Functionality: Integrated and unified sequence of event information stored in an open and portable database. Trip detection based upon specific plant conditions providing a full log of all relevant process information in the crucial period before and after a plant event.

Benefits: Plant wide integrated view of alarms and events. Root cause analysis and problem identification. Assists in the elimination or reduction in the number of unexpected incidents and trips.

Alarm Reporting and Analysis (Exaquantum/ARA)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals, Pharmaceuticals, Power Generation.

Functionality: Comprehensive set of statistical reports and KPIs based upon EEMUA 191, ISA-18.2 and IEC 62682. Alarm and events can be aggregated by hour, shift, day, week, month, quarter and year providing alarm rates, counts, peaks, floods, etc.

Benefits: Reduction in the number of unwanted and distracting alarms allowing operators to react faster to abnormal situations with the proper corrective action, resulting in a safer and more productive plant. Improved plant safety, reduced environmental risk and enhanced maintenance response. Reduction in the amount of equipment damage. Reduced operator stress. Information available to key stakeholders on demand and by emails facilitating efficient and timely decision making. Key component of an alarm rationalization program.

Alarm Master Database (Exaquantum/AMD)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals, Power Generation.

Functionality: Centralized database for all alarm settings and documentation with alarm metrics providing a comprehensive view of the overall alarm system configuration. Comprehensive management of change and auditing assists with the alarm definition, rationalization and approval processes. Alarm settings can be validated against permissible limits and enforced.

Benefits: Ensures that all changes to alarms are to specification with high integrity and consistency. Enforces the alarm definition, rationalization and approval processes. Provides full auditing for regulatory compliance.

Safety Management

Subsea Historian (Exaquantum/SSH)

Industry: Subsea Oil and Gas Production.

Functionality: Monitors the health of subsea wells though the collection and presentation of down hole temperatures and pressures, acoustic sand data and valve profiles. Valve profiles can be compared with ideal and previous profiles, and when combined with alarm information, will alert operators to any issues.

Benefits: Improved operator decision making through integrated and timely information presentation. Early indication of maintenance and potential failures preventing safety, environmental and production incidents.

Safety Function Monitoring (Exaquantum/SFM)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals, Power Generation.

Functionality: Plant wide monitoring, analysis and reporting of functional safety performance across Safety Instrumented System (SIS) and devices (sensors, actuators). Operational information from system and device activity is mapped against Hazard and Operational Analysis (HAZOP) or Layer of Protection Analysis (LOPA) risk analysis to report the effectiveness of actual safety performance against the design targets. Deviations from safety design expectations are highlighted, and supports maintenance test replacements following successful field safety activations.

Benefits: Improved operational safety. Visibility of safety performance at both system and device level. Identity and reduce spurious activations. Optimization of testing intervals, leading to reduced cost of functional safety improvement. Significant reduction in time and effort to produce regulatory reports. Provides comprehensive information for safety validation and improvement programs.

Override Safety Advisor (Exaquantum/OSA)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals, Pharmaceuticals, Power Generation.

Functionality: Provides a view of the safety integrity of the plant. Risk assessments provide the ability to assess the impact on the facility safety level before an instrument(s) is overridden. Authorization levels allow permission to be granted before an override is implemented.

Benefits: Continuous visibility of safety within the plant. Improves safety risk analysis before the override is implemented. Assists in the enforcement of operational procedures. Provides a full audit trail for accountability, post analysis and safety improvement processes.

Production Management

Movements Monitoring (Visa-OM)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals.

Functionality: Live tracking of material movements. Stock and movement accounting for continuous processes providing daily book-closing reports with mass balancing and data reconciliation.

Benefits: Effective management and supervision of tank farm facilities with little or no automation. Avoid contamination by tracking material and asset usage through early warning.

Production Accounting (Exaquantum/mPower)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals.

Functionality: Key production information for enterprise profitability and planning. A platform for scalable production reporting on material in/out, consumption, product yield and waste. The plant data model of the actual plant flow network provides reports for material and energy balances, consumptions, emissions and reactions.

Benefits: Optimized stock management. Early detection of missed production targets. Auditable methodology for the automated creation and management of production accounts reports.

Down Time Analysis (Exaquantum/DTA)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals, Pharmaceuticals, Mining, Power Generation.

Functionality: Automatically captures plant data to enable analysis to be carried out by recording times when plant equipment is not running ('Downtimes') and production figures which are less than the maximum Sustainable Production Rate ('Rate Losses'). Reasons can then be assigned to these events to add context. The provided statistics, including Overall Equipment Effectiveness (OEE), are integral to the operational decision making process by assisting with minimizing plant loss and maximizing future production.

Benefits: Continuous plant availability improvement through increased awareness of downtime and rate loss within the operating process and equipment dynamics. Prioritized maintenance by identifying the causes and effects of production loss. Inaccuracies removed through automated data collection. Improves maintenance by identifying the cause and effects of production loss.

Operator Effectiveness

Report Manager (Exaquantum/RM)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals, Pharmaceuticals, Power Generation, Mining, Food and Drink, Pulp and Paper, Environmental, Manufacturing, Semiconductors.

Functionality: Microsoft Excel reports containing Exaquantum Historian data can be emailed to one or more people, printed, stored and/or published for access from Exaquantum/Web users.

Benefits: Reduced manpower in the timely production of regular reports.

AutoTrend (Exaquantum/AutoTrend)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals, Pharmaceuticals, Power Generation.

Functionality: Exaquantum/AutoTrend provides operators and analysts with system wide and user defined advanced trending for the long term viewing and analysis of plant operations.

Benefits: Improves operator efficiency with quicker and accurate decision making. Provides process analysts with a clear historical view of plant performance.

Electronic Log Book (eLogBook)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals, Power Generation.

Functionality: Advanced computer-based replacement for traditional control room paper-based log books enabling the capture of observed and non-automated information and tracking.

Benefits: Consolidation of key automated and non-automated information that requires tracking until completion. Improved shift handovers through clear status and task assignments. Enhanced management reporting.

Graphical Framework (Exaquantum/GF)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals, Pharmaceuticals, Power Generation.

Functionality: Enhanced framework for the Exaquantum/Explorer Graphical User Interface providing graphic navigation control, history replay, integration of additional process information, user configurable trend groups and links to frequently used functions.

Benefits: Provides a framework for quick access to relevant information. Reduced configuration time for graphics and trend groups. Improved analysis using the history replay facility.

Operator Trending Module (Exaquantum/OTM)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals, Pharmaceuticals, Power Generation.

Functionality: Integrated within Yokogawa Distributed Control System (DCS) Human Interface Stations (HIS), Exaquantum/OTM provides operators with long-term trending of process values and alarm and events. System wide and user defined trend groups provide quick and easy access to important process information.

Benefits: Optimized plant performance and safety by providing operators with an extended window onto the operation of the plant.

Energy Management

Power Performance Calcs (Exaquantum/PPC)

Industry: Power Generation.

Functionality: Calculates the efficiencies of primary and auxiliary power plant equipment such as boilers, turbines and overall plant efficiency. Standard templates containing American Society of Mechanical Engineers (ASME) compliant performance calculations are provided which can be defined for specific plant configurations. 'What-if' analysis provides the ability to examine different plant operating scenarios and their impact.

Benefits: Performance KPIs are available in real-time to all relevant users. Bottlenecks and performance deficiencies in key plant assets can be quickly identified. Identification of optimal operating conditions.

Energy Balancing (Exaquantum/mPower)

Industry: Midstream Oil and Gas, Refining, Petrochemicals, Chemicals, Power Generation.

Functionality: A production model of the plant flow network provides material and energy balancing, fuel consumption, emissions and reaction enthalpies. The thermodynamic calculations provide material and mixture properties, including chemical reaction behavior in order to close material and energy balances, and estimates unmeasured flows or heat losses within the plant.

Benefits: Energy management and fuel cost improvement. Environmental and emissions visibility. Reporting and improved regulatory compliance. Data reconciliation highlights poor performing equipment. Supports predictive, condition based maintenance.

Data Integration

LIMS Data Exchange (Exaquantum/LDX)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refining, Petrochemicals, Chemicals, Pharmaceuticals, Power Generation.

Functionality: Integrates production and quality information within Exaquantum by collecting laboratory sample data from Laboratory Information Management Systems (LIMS) packages.

Benefits: Identify optional process conditions for ensuring quality products. Traceability of process conditions leading to 'off-spec' products and auditing.

Manufacturing Data Exchange (Exaquantum/MDX)

Industry: Refining, Petrochemicals, Chemicals.

Functionality: Provides the integration of Exaquantum with Enterprise Resource Planning (ERP) systems such as SAP using the ISA-95 standard. Configurable web services enables the business loop to be closed providing data transfer of production requests, production status, equipment status, KPIs and alerts between the Distributed Control System (DCS) and the ERP.

Benefits: ISA-95 standard results in a lower cost to implement and maintain ERP to Plant (E2P) integration. Enables quicker response to changing business requirements resulting in improved business agility.

Remote Data Synchronization (Exaquantum/RDS)

Industry: Oil and Gas Production, Oil and Gas Midstream, Refinery, Petrochemicals, Chemicals, Power Generation.

Functionality: Transfers process data and/or alarms and events between one or more Exaquantum servers via satellite, microwave, internet, etc.

Benefits: Secure low bandwidth transfer of process data (tags, and alarm and events) over unreliable or slow network links. Integration of information over a wide geographical area. Facilitates the centralization of key information for easy access to subject matter experts.

Batch Recipe Update (Exaquantum/BRU)

Works in conjunction with Exaquantum/Batch providing the capability to retrieve all or selected recipe parameters for a specified batch on demand then updates the Exaquantum/Batch database with the retrieved recipe values.

Event Email Service (Exaquantum/EES)

Email notifications are sent to one or more people when either important process data arrives or upon receipt of a specific alarm or event.

Event File Interface (Exaquantum/EFI)

CSV file interface for importing Honeywell Distributed Control System (DCS) alarm and events into Exaquantum.

File Data Manager (Exaquantum/FDM)

Read tag, quality and timestamp data from a CSV file into Exaquantum.

Historical Data Manager (Exaquantum/HDM)

Read tag, quality and timestamp data from an OPC Historical Data Access (HDA) Server(s) into Exaquantum.

OPC Redundancy Manager (Exaquantum/ORM)

Allows one or more redundant pairs of OPC Data Access (DA) servers to be connected to a single Exaquantum server.

Synchronous OPC Data Manager (Exaquantum/SDM)

Provides Exaquantum with a synchronous OPC DA client that will poll one or more OPC servers to reduce Distributed Control System (DCS) loading.

Virtual Private Network (Exaquantum/VPN)

Provides a secure and controlled Virtual Private Network (VPN) connection from an OPC server to Exaquantum.

Exaopc Connectors

Exaopc Cassettes connected to OPC servers are used to connect with different sub-systems to take advantage of Exaopc's OPC HAE (Historical Alarms and Events) interface with Exaquantum. The following cassettes are available:

- OPC A&E concentrator
- OPC DA to OPC A&E convertor
- Hathaway SER OPC A&E server connector
- Triconex OPC A&E server connector

Additional cassettes can be developed upon request.

OpreX™ Yokogawa achieves operational excellence by providing products, services, and solutions based on the OpreX comprehensive brand that cover everything from business management to operations.

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