General Specifications

NTPC002
Exaquantum
Alarm Reporting and Analysis

Exaquantum

GS 36J40A20-01EN

■ PROBLEM

Plant operators are often faced with large numbers of alarms and abnormal situations making them unable to respond quickly enough to prevent safety related incidents, environmental issues, shutdowns and equipment damage. A poorly applied alarm management policy resulting in excessive alarms and events can also make operators routinely ignore alarms due to the excessive amount of information being received.

■ SOLUTION

Exaquantum Alarm Reporting and Analysis (Exaquantum/ARA; hereafter referred to as 'ARA') is Yokogawa's solution. Exaquantum/ARA assists supervisors and managers in implementing effective alarm management by highlighting patterns in alarm and event occurrences making it easier to identify and correct areas of concern.

■ BENEFITS

- Reducing the number of distracting and nuisance alarms allows operators to focus on and react faster to abnormal situations with the proper corrective action.
- Reduced operator stress will improve reaction times for incident resolution.
- Improved plant safety and reduced risk of serious environmental incidents.
- Identification of improvement opportunities through focused KPIs.
- Consolidated alarm and process information can be supplied in custom reports to provide additional analysis information.
- Information available to key stakeholders on demand and by email, facilitating efficient and timely decision making.
- Microsoft Power BI Data Connector allows users to integrate alarm management information and KPIs to the corporate reporting environment.
- Microsoft Power BI Data Connector puts alarm report visualization capabilities into users own hands, to meet specific business needs and requirements.
- Microsoft Power BI Data Connector and reports are available to help users freely visualize and explore ARA Alarm Management KPIs and Metrics and support a typical alarm management workflow.

■ KEY FEATURES

- Up to 45 standard, plus 2 configurable reports, many based on EEMUA 191, ANSI/ISA-18.2-2009 and IEC-62682
- On demand access to Operator and Area KPIs.
- Drill down from summary reports to the individual alarms and events.
- Detailed filtering options to expose hidden problem areas.
- Automatic replication of CENTUM plant hierarchy.
- Reports can be scheduled for printing, storing and emailing.
- Integration with Yokogawa's CENTUM Distributed Control Systems (DCS), Consolidated Alarm Management System (CAMS), Unified Alarms and Conditions Server (UACS) and FAST/TOOLS SCADA.
- Interfaces available for non-Yokogawa systems via OPC A&E 1.1.
- API to access ARA KPIs, with access via an optional OPC DA 2.05a server also available.
- Connector available to make ARA alarm management data and KPIs accessible to Microsoft Power BI for reporting.
- Pre-built Microsoft Power BI alarm management data model, dashboards and reports.

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■ INTRODUCTION

ARA continuously collects alarm and event data to provide statistical reports based on EEUMA 191, ISA-18.2-2009 and IEC-62682. These reports aid supervisors and managers to identify which alarms and events are occurring most frequently and where the alarm management policy can be improved. Each report can be filtered and drilled down to desired levels, including individual alarm occurrences, and then exported to a number of file formats including PDF, Word and Excel.

ARA can be installed on a single server and provides access to multiple users via its intuitive web user interface, eliminating the need for any client software.

In addition to the web user interface, authorized access to the data is provided via Excel and SQL Server Report Builder, allowing custom reports to be created.

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■ CAPABILITIES

Alarm and Event Collection

Alarms and event data is continuously collected via OPC A&E 1.1. For those Yokogawa systems that use Exaopc, Yokogawa has extended Exaopc's OPC HDA server to include Historical Alarms and Events (HAE), which allows Exaopc to automatically buffer all alarms and events if the network connection to Exaquantum PIMS is lost. Once the connection is restored, all buffered Exaopc alarms and events will be available to be processed by ARA.

Interface with Yokogawa's 'CAMS for HIS'

ARA can retrieve the following information from Yokogawa's 'CAMS for HIS'.

- Shelving Correction – ARA regularly synchronizes with CAMS for HIS to get the correct shelving status of alarms (if an alarm is shelved or not). This is to maintain reporting accuracy when shelving status change events are missed, for example due to a network loss or system downtime. This is available for both One-shot and Continuous Shelving.
- Detection Disabled Alarms – This status is used in CAMS to annunciate important alarms and remove low-value alarm messages from DCS alarm displays within an operator station. Reports that are designed to reflect alarm loading from the operator's perspective exclude detection disabled alarms. Reports are provided that display information about the number and frequency of disabled alarms.
- Alarm Priority Overrides – CAMS for HIS operators can override alarm priority. ARA can be configured to read the CAMS configuration, where it is present, configuration for priority will override the DCS priority.
- Group Suppressions – CAMS group suppression allows a group of alarms to be suppressed from the operator's perspective. Reports that contain alarm loading from the operator's perspective can be filtered to include or exclude group suppressed alarms.
- Shelved Alarms – CAMS allows operators to shelve alarms, temporarily removing them from the operator's view, allowing them to concentrate on more important alarms and return to the shelved alarms when convenient. Reports that relate to actions by operators can be filtered to include or exclude shelved alarms.

Interface with Yokogawa's UACS

ARA can retrieve the following information from Yokogawa's UACS:

- Alarm Correction - ARA can synchronize with UACS to get the correct alarm status (active and long standing alarm state) by closing, or opening, active alarms based on their current state in the alarm system. This is to maintain reporting accuracy when alarm status events are missed, for example due to a network loss or system downtime.
- Suppression Correction – ARA can synchronize with UACS to get the correct suppression status (if an alarm is currently suppressed or not). This is to maintain reporting accuracy when alarm status events are missed, for example due to a network loss or system downtime. This is available for Group Suppression (manual and advanced) and both One-shot and Continuous shelving.
- UACS Offline Periods - offline periods are tracked and displayed in the Area Spline chart on the ARA dashboard page to quickly show any days where UACS systems were offline.
- Alarm Priority Overrides – UACS operators can override the alarm priority. ARA can be configured to read the UACS configuration, where it is present, configuration for priority will override the DCS priority.

- Group Suppressions – UACS Manual and Advanced group suppression allows a group of alarms to be suppressed from the operator's perspective. Reports that contain alarm loading from the operator's perspective can be filtered to include or exclude group suppressed alarms.
- Shelved Alarms – UACS allows operators to shelve alarms, temporarily removing them from the operator's view, allowing them to concentrate on more important alarms and return to the shelved alarms when convenient. Reports that relate to actions by operators can be filtered to include or exclude shelved alarms.

Automatic Plant Hierarchy Creation

If configured in the Process Control System, ARA can extract and store plant hierarchy information contained within received alarm and event messages. This plant hierarchy can then be used to filter information displayed in reports and supports remote alarm reporting and monitoring for multiple plants across various countries/regions.

Reports Overview

ARA provides up to 43, many based on EEMUA 191, ANSI/ISA-18.2-2009 and IEC-62682. Reports are grouped into the following four areas.

- Management – providing a high-level overview of plant KPIs
- Performance – covering specific EEMUA 191 performance guidelines to quickly highlight potential areas of concern
- Operations – day-to-day operator reports covering alarm rates and trends
- Maintenance – highlighting problem alarms and aiding in the alarm rationalization process

Report Compatibility

Data connectors are required for non-Yokogawa systems and FAST/TOOLS SCADA. Exaquantum/ARA reports may have restricted functionality due to the completeness of data provided through the connector.

The table below summarizes the number of reports supported by each data connector.

Data Connector	Full Support	Partial Support	Not Supported
Exaopc	43		
Exaopc CAMS	43		
Exaopc UACS	43		
Yokogawa FAST/TOOLS	16	13	14
Yokogawa FAST/TOOLS Tokuchu	20	15	8
ABB (800xA)	20	9	14
Azbil (Harmonas)	30	7	6
Emerson (Delta V)	35	3	5
Schneider (Foxboro)	17	16	10
GE (CIMPLICITY)	25	4	14
Honeywell (Experion)	25	4	14
Schneider (Citect)	25	4	14
Schneider (Citect with Kepware)	23	4	16
Siemens PCS7	24	5	14
Supcon ECS 700	27	7	9

Please refer to Chapter 8 Report Compatibility of the Exaquantum/ARA User Manual (IM 36J40A21-01EN) for full details of compatible reports.

Exaquantum/ARA Report Branding

Report styles are stored centrally in ARA, allowing style changes to be made easily and consistently across all reports. This ensures that company standards can be adhered to in the production of reports.

Report Filters

ARA report filters are used to refine and analyze the report information to expose hidden alarming problems. As the information on the report is already generated, filtering occurs on demand. Depending on the report, the filters may include:

- Time resolution and periods to determine when problems are occurring and the alarming patterns
- Plant area or units to isolate areas of particular concern
- Operator selection to help identify the alarms and events that the selected operator sees most frequently
- Alarm tag and conditions help to identify patterns in a particular alarms behavior, enabling effective corrective action to be taken
- Alarm priority to highlight the priority distribution and discover alarms that may have an inappropriate priority level assigned to them
- Suppression types to view statistics on the number of alarms that have been disabled, group suppressed and shelved
- Annunciator report filter allows the filtering of annunciator alarms in the reports

Report Scheduling and Exporting

Microsoft Reporting Services technology is used by ARA to schedule and distribute reports to various file locations and email addresses.

In addition, ARA provides key exporting options for ARA reports, such as:

- PDF – Standard for publishing, storing and distributing reports
- Excel – Allows further analysis and combining of disparate data for reporting
- Word – Creation of weekly/monthly reports that can be annotated and signed off

Custom Reports

In addition to the reports supplied with ARA, custom reports can be created in:

- Excel - ARA data can be further analyzed and charted with process data from Exaquantum PIMS also incorporated to produce a single report containing both alarm and process data
- SQL Server Report Builder - Created in SQL Report Builder and accessed via the ARA web browser menu of reports, these reports can be scheduled and distributed
- Microsoft Power BI – Visualize ARA reports in Power BI in the form of dashboards and reports that can be customized and shared.

Web User Interface

Client access to ARA is provided via an intuitive web user interface, eliminating the need for specific client software. A central navigation bar provides links to each of the reports, localization options and other Exaquantum products.

The web user interface is compatible with Edge and Chrome with security provided through Windows local and domain user groups.

Localization

The ARA user interface can be seamlessly switched between installed languages. ARA is provided with US English by default with support for additional languages available on request – please contact your local Yokogawa office for more information.

Centralized ARA server

ARA can be hosted on a central server with Yokogawa's Remote Data Synchronization solution 'Exaquantum/RDS' installed on remote Exaquantum servers worldwide to transfer Alarms & Events to the central server via the internet. This allows alarms to be analyzed from each connected remote site. Process data can also be transferred.

Alarm Rationalization using Exaquantum/ARA with Exaquantum/AMD (Alarm Master Database)

Alarm rationalization can be provided by using Exaquantum/ARA with Yokogawa's Master Alarm Database solution 'Exaquantum/AMD'.

Exaquantum/ARA provides a comprehensive set of reports in order to understand the performance of the system and to identify problem areas. Once such problem alarms have been identified, the alarm settings can then be modified using Exaquantum/AMD's comprehensive Management of Change (MOC) environment.

Microsoft Power BI Data Connectors Option and Reports (R3.40.10 or later)

A Microsoft Power BI Data Connectors Option and pre-built data model, hierarchical dashboards and reports are available as an option to visualize and explore the Alarm Management KPIs and Metrics from ARA. The following dashboards and reports are provided.

Dashboard Report
(Browse report in Power BI Server)

Drilldown Report
(Detailed Report in Exaquantum/ARA)
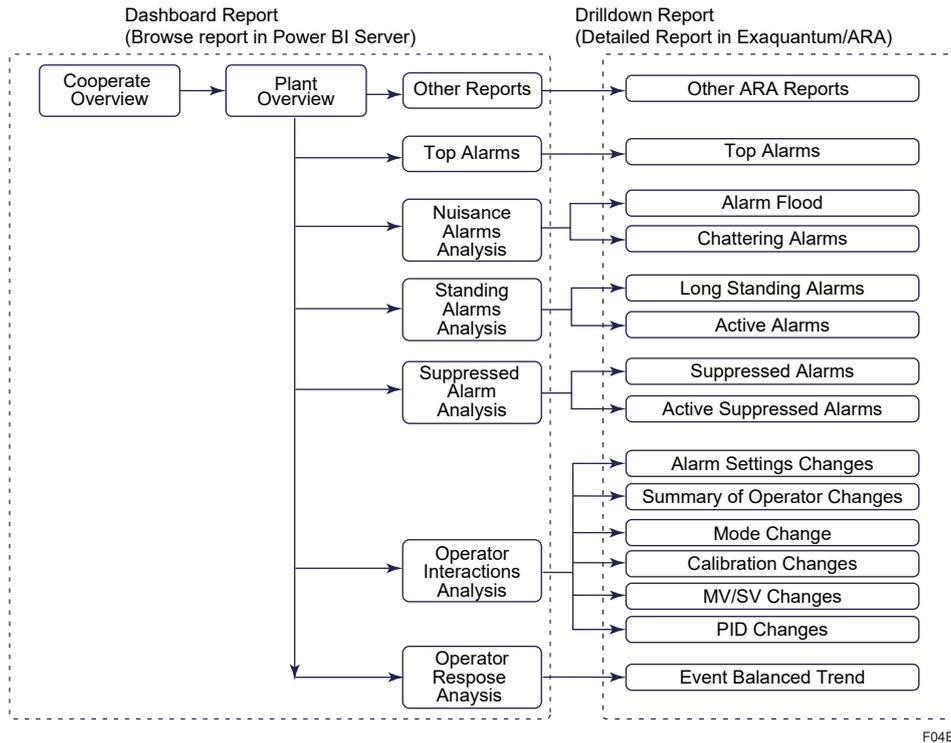
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■ DASHBOARD REPORT (Power BI)
• Corporate Overview Report
• Plant Overview Report
• Other Report
• Top Alarms Report
• Nuisance Alarms Analysis Report
• Standing Alarms Analysis Report
• Suppressed Alarms Analysis Report
• Operator Interaction Analysis Report
• Operator Response Analysis Report

■ DRILLDOWN REPORT (Power BI)
• Other ARA Reports
• Top Alarms
• Alarm Flood
• Chattering Alarms
• Long Standing Alarms
• Active Alarms
• Suppressed Alarms
• Active Suppression Events
• Alarm Settings Change
• Summary of Operator Changes
• Mode Change
• Calibration Changes
• MV/SV Changes
• PID Changes
• Event Balanced Trend

Additionally, a number of Drilldown reports are available in Microsoft Drildown as described in the User Manual.

■ REPORTS (OTHER THAN Power BI)

Management Reports
- Alarm Overview
- Alarm Rate KPIs
- Area KPIs
- KPIs by Operator
- Shift
- Summary

Operation Reports
- Alarm by Condition
- Alarm by Condition and Tag
- Alarm Flood
- Alarm Frequency
- Alarm Peak
- Alarm Rate
- Alarm Rationalization Progress
- Alarm Responsiveness
- Alarm Setting Change
- Area Alarm Counts
- Consequential Alarms
- Event Balanced Trend
- High Integrity Pressure Protection System (HIPPS) (*1)
- Shelved Events
- System Alarms
- Top Alarms
- Top Alarms by Operator
- Valve Travel Time (VTT) (*1)

  *1:   These reports need to be configured.

Performance Reports
- Area Alarm Average
- Area Alarm Peak
- Area Performance

Maintenance Reports
- Active Alarms
- Active Events
- Active Suppression Events
- Bad Actors
  - Alarm Messages Segregation (sub-report)
- Bad Actors by Condition
- Calibration Events
- Chattering Alarms
- Duplicate Alarm Analysis
- Force
- Long Standing Alarms
- Mode Change
- MV/SV Changes
- Override
- PID Changes
- Range Changes
- Summary of Operator Changes
- Suppressed Alarms
  - Suppressed Alarms by Tag (sub-report)
- Settings

The ARA User Manual, containing detailed information for each of the above reports, can be obtained from your local Yokogawa office.

■ HARDWARE AND SOFTWARE REQUIREMENTS

Minimum Hardware and Software Specifications

Component	Minimum Hardware and Software Specification
Exaquantum/ARA Server	For detailed specification information, refer to the following description in "Exaquantum GS (GS 36J04A10-01E)." Hardware: ● Hardware Operating Environment "Exaquantum Server" Software: ● Software Operating Environment "Exaquantum Server" For detailed supported revision, please refer to "GS 36J40W10-01EN."
Exaquantum/ARA Web Server	For detailed specification information, refer to the following description in "Exaquantum GS (GS 36J04A10-01E)." Hardware: ● Hardware Operating Environment "Web Server" Software: ● Software Operating Environment "Exaquantum Web Server" For detailed supported revision, please refer to "GS 36J40W10-01EN."
Exaquantum/ARA Web Clients	For detailed specification information, refer to the following description in "Exaquantum GS (GS 36J04A10-01E)." Hardware: ● Hardware Operating Environment "Exaquantum Use PCs" Software: ● Software Operating Environment "User PCs for Exaquantum/Explorer, Exaquantum/Web Client" For detailed supported revision, please refer to "GS 36J40W10-01EN."

The Exaquantum/ARA Release Notes provide exact details of the supported hardware and software.

If ARA will be installed on a different version (*1) of Exaquantum, please contact Yokogawa for assistance.

*1:   For details, please refer to "GS 36J40W10-01EN"

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■ MODELS AND SUFFIX CODES

Exaquantum/ARA Product

		Description
Model	NTPC002	Exaquantum/ARA Product
Suffix Codes	-S	Basic Software license
	1	Always 1
	1	English version
	-SV□□	Enter number of Exaquantum/ARA Server Licenses (01 - 99)
	-SD□□	Enter the number of discounted Exaquantum/ARA Server Licenses (01 - 99)
	-YYYY	Select an Option Code
Option Codes	/PBD□□	Enter the number of Power BI Data Connectors (01-10) (R3.40.10 or later) (*5) (*6) (*7) (*8) (*9)
	/DAA□□	Enter the number of Exaquantum/ARA OPC DA 2.05a Server Interface Licenses (01 - 99) (*4)
	/CYK□□	Enter the number of Configurable Interface connections to Yokogawa OPC servers (01-31) (*1) (*2)
	/CNY□□	Enter the number of Configurable Interface connections to Non-Yokogawa OPC servers (01-31) (*1) (*2)
	/CHX□□	Enter the number of Yokogawa CAMS for HIS Interface Licenses for 3rd Party Systems (01 - 99) (*3)
	/WC□□	Enter the number of New per-seat Exaquantum/ARA Web Client Licenses (01 - 99)
	/WD□□	Enter the number of 50% discounted Exaquantum/ARA Web Client Licenses (01 - 99)
	/PBC□□	Enter the number of Power BI Client to access Drilldown Reports (01-99) (R3.40.10 or later) (*8) (*9) (*10)

*1: Specify the license /CYK□□ /CNY□□ per ARA server.
*2: To collect alarm events from the control system and process them with ARA, Purchase one interface connection license for each OPC A&E or OPC UA A&C Gateway configured in ARA server to collect alarm and event from the alarm system.
  For example, order /CYK03 if an ARA server is configured to collect A&E from 2 Exaopc CAMS for HIS servers and 1 CI Server.
  One Exaquantum server supports a combined total of 31 connections to OPC Classic A&E and OPC UA A&C servers.
  Yokogawa OPC servers include Exaopc, FAST/TOOLS and CI Server.
  If your system is running R3.50 or an earlier revision and your plan to upgrade to R3.60 or later, particularly if you intend to increase the number of Configurable Interface connections, please contact your Yokogawa representative prior to placing your order.
*3: This a standalone installation to provide CAMS for HIS interface access to third party products only. Please note that this CAMS for HIS interface and Exaquantum/ARA cannot be installed on the same server.
*4: The Exaquantum/ARA OPC DA 2.05a server will provide Exaquantum/ARA KPIs. Purchase only one license per Exaquantum server. Must be installed on a server containing an approved Exaquantum/ARA software release.
*5: Includes Power BI ARA Data Model.
*6: Includes standard Microsoft Power BI Alarm Management Dashboard Reports.
*7: Up to ten Power BI Data Connectors can be purchased after which Power BI Data Connectors will be provided at no additional cost. Please consult Yokogawa if the total number of /PBD exceeds ten.
*8: Includes Power BI Client access to Drilldown Reports.
*9: Option Code : As for /PBD□□ and /PBC□□, please see below.
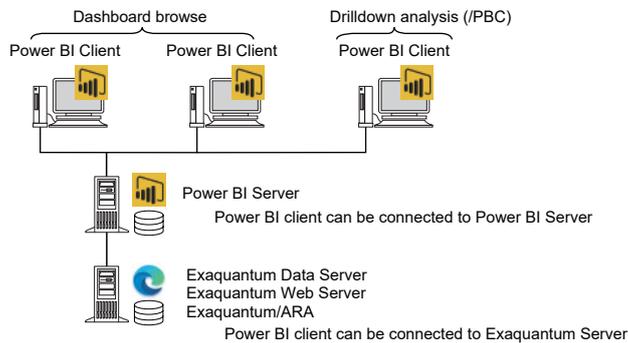
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/PBD□□
  The number of Power BI Server connection to Exaquantum/ARA.
  (The PBD option allows users to access Dashboard Reports.)
/PBC□□
  The number of drilldown analysis user by Power BI Client
  (The PBC option extends access to the additional Drilldown Reports.)

*10: Yokogawa does not supply Microsoft Power BI with Exaquantum/ARA. It must be licensed separately by the end user.

Maintenance Service for Exaquantum/ARA

		Description
Model	SV3NTMC002	Maintenance Service for Exaquantum/ARA
Suffix Codes	-S	Annual Contract
	1	Always 1
	1	Always 1
	-SV□□	Enter the number of Exaquantum/ARA Server Licenses (01 - 99)
	-YYYY	Select an Option Code
	-N	New
	-R	Renewal
Option Codes	/PBD□□	Enter the number of Power BI Data Connectors (01-10) (R3.40.10 or later)
	/DAA□□	Enter the number of Exaquantum/ARA OPC DA 2.05a Server Interface Licenses (01 - 99)
	/CFH□□	Enter the number of Yokogawa CAMS for HIS, UACS Interface Licenses (01 - 99) (up to R3.50) (*1)
	/FTA□□	Enter the number of Yokogawa FAST/TOOLS Interface Licenses (01 - 99) (up to R3.50) (*1)
	/CYK□□	Enter the number of Configurable Interface connections to Yokogawa OPC servers (01-31) (R3.60 or later) (*2)
	/EDA□□	Enter the number of Emerson DeltaV R10.3 Interface Licenses (01 - 99) (up to R3.50) (*1)
	/HEA□□	Enter the number of Honeywell Experion R300 Interface Licenses (01 - 99) (up to R3.50) (*1)
	/GEA□□	Enter the number of GE CIMPLICITY V9.0 Interface Licenses(01 - 99) (up to R3.50) (*1)
	/ABA□□	Enter the number of ABB 800xA DCS (with an Advant AC450 Controller) Interface Licenses (01 - 99) (up to R3.50) (*1)
	/CTA□□	Enter the number of Schneider Electric CitectSCADA V7.30 Interface Licenses (01 - 99) (up to R3.50) (*1)
	/CTB□□	Enter the number of Schneider Electric CitectSCADA (using Kepware's 'KEPServerEX' V5) Interface Licenses (01 - 99) (up to R3.50) (*1)
	/CNY□□	Enter the number of Configurable Interface connections to Non-Yokogawa OPC servers (01-31) (R3.60 or later) (*2)
	/CHX□□	Enter the number of Yokogawa CAMS for HIS Interface Licenses for 3rd Party Systems (01 - 99)
	/WC□□	Enter the number of New per-seat Exaquantum/ARA Web Client Licenses (01 - 99)
	/PBC□□	Enter the number of Power BI Client to access Drilldown Reports (01-99) (R3.40.10 or later)

*1:   When ARA up to R3.50 is used continuously / updated to R3.60 or later, please place this Option Code.
*2:   When new ARA is used R3.60 or later, please place this Option Code.

■ ORDERING INFORMATION

Specify the model, suffix code(s), and option code(s).

■ TRADEMARK ACKNOWLEDGMENT

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