General Specifications

Exarqe System Overview

GS 36J06D20-01E

GENERAL

The process control industry has been continuously shifting the focus away from controlling intermediate variables, namely Flow, Temperature, Level and Pressure to the final product qualities. The advances made in Advanced Process Control, especially Model Based Predictive control has overcome the problems in quality control loop such as process interactions, and large time delay. However, there are still many quality control loops not closed because of the lack of reliable product quality measurement.

The Robust Quality Estimator is a software package designed to provide product quality signal as feedback to Advanced Process Control applications. It has been widely applied in Refineries and Petrochemicals processes. For example, the package has been successfully applied to infer the following properties:

Polymer Melt Index,

4CBA in Terephthalic Acid (TA),

Kerosene Flash Point,

Total aromatics in Platformate,

Light Naphtha RVP,

Light Cycle Oil 90% distillation point, etc.

FUNCTION SPECIFICATION

The equation below shows the general form of a quality estimator model.

QE = f(T,F,P,,,)

f: linear or non-linear, static or dynamaic

For example,

iC5 = C1 x Top_Temp + C2 x Top_Press + C3

The Exarqe consists of two portions, off-line for data analysis and model design and on-line portion of real-time implementation.

Off-line

The off-line package provides tools for data analysis and building of the Exarqe models.

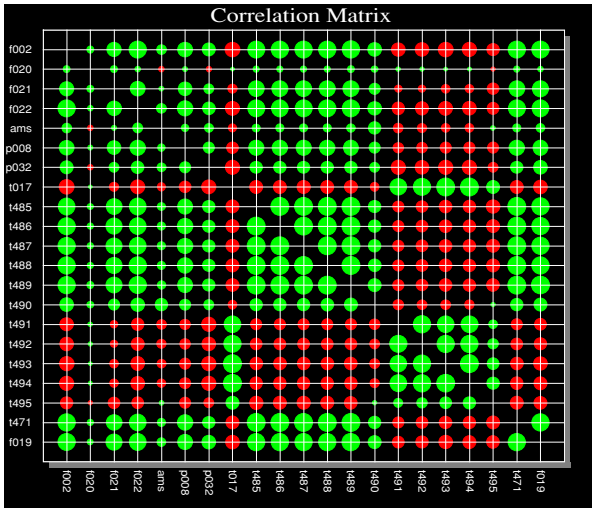

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Figure 1 Correlation Matrix

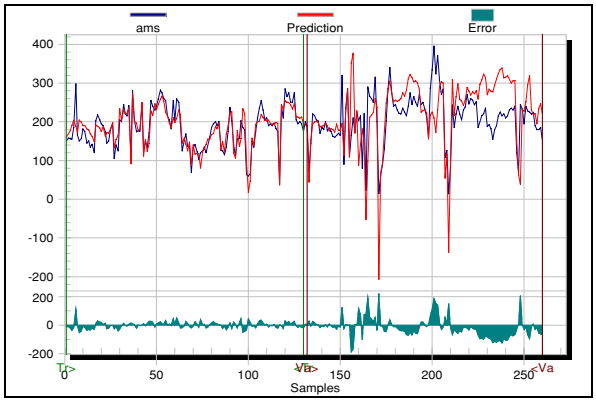

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Figure 2 Model Plo

On-Line

The function of Exarqe on-line is to periodically read process information from the DCS, estimate the quality with the model and download the results to the DCS or APC system. It also include the update mechanism using feedback from either on-line analyzer or laboratory results.

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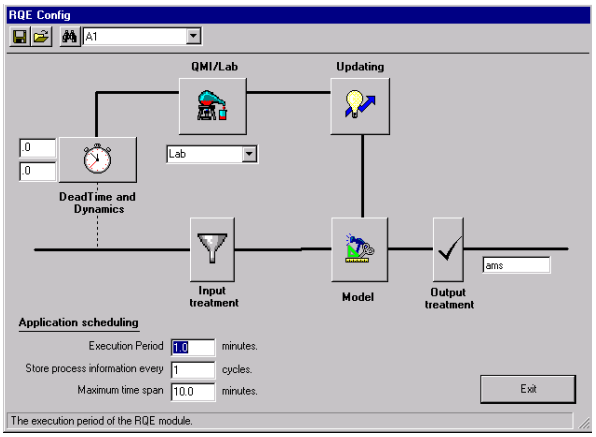

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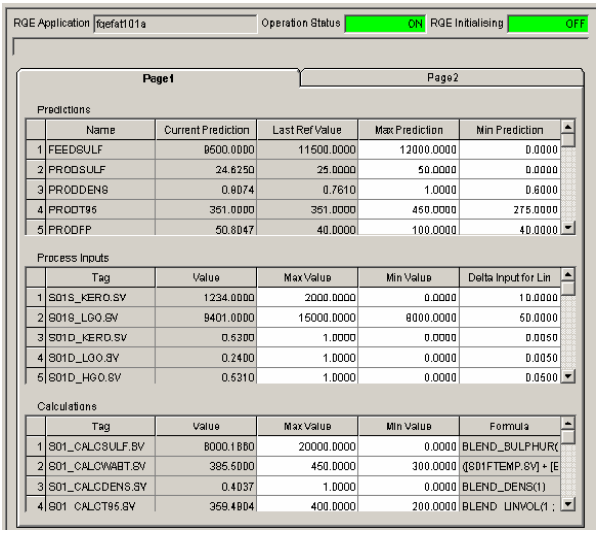
Figure 3 Exarqe on-line

Lab Data and on-line Analyzer input checking
Exarqe's model and its predictions need to be constantly updated based on feedback. This feedback is normally, from lab data or on-line analyzer. Before, Exarqe goes into the step of updating, the feedback data itself is verified.

Model Update
One way of making an estimator robust is to let the model learn from feedback. In case of quality estimator, the problem is peculiar since feedback comes with a delay. The way in which the estimator handles this delay will make it robust.

■ PANEL CONFIGURATION

- Overview
- Engineering
- Lab Entry
- Trend



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■ GENERAL CONFIGURATION

● Features

Extensive on-line analyzer signal checking, including out-of-range handling, frozen value detection and spike rejection.

Operator lab interface with entry consequence preview.

Prediction calculation and output processing (clamping, asymmetrical filtering)

Full model updating using Kalman filtering (either on basis of on-line analyzer or on basis of laboratory results)

Handling of non-linear qualities either via non-linear Neural Network type model, or via built-in configurable characterizer functions.

Input checking of reference laboratory result prior to model prediction update.

SPC techniques, including score card, CUSUM, and spike rejection.

Internal steady state detection.

Robust handling of uncertain and varying delay of the quality reference measurement.

Operator graphical interface and engineer graphical interface.

Messaging and alarming

● Application

Multiple models in a single model
Exarqe applications consist of multiple Exarqe predictions.

A multiple model performs many systematic estimations.

For example, it is effective in the following applications.

- Multiple oil blend models.
- Combination of online analysis model and lab analysis model.
- Outlet quality estimation which has intermediate quality model in input.
- Series reactor quality estimation which connected each reactor model.

Blending application
Exarqe makes multiple tank quality estimations in oil blending process.

It makes multivariable model predictive control using Exasmoc.

Tank Quality Estimation (TQE) makes many blending quality estimations by using blending process information, blending rule, tank quality values.

Tank Quality Control (TQC) makes tank quality estimation control of blending process by using Exasmoc multivaliable model predictive controller.

● Connected Systems

System	Connection Method	Connection Method	Support
CENTUM CS 3000	Directly connected to VF701 Control Bus Interface Card	VHF	X
CENTUM CS 1000			X
CENTUM CS			X
CENTUM-XL	Via ECGW3 gateway	Ethernet	X (*1)
		GP-IB	–
		BSC	–
		TTY Protocol	–
μXL	Via MOPS/MOPL getaway	Ethernet	X (*1)
		GP-IB	–
		BSC	–
		TTY Protocol	–
DCS from other vendors	Depends on each specification	Ethernet/OPC	X (*2)

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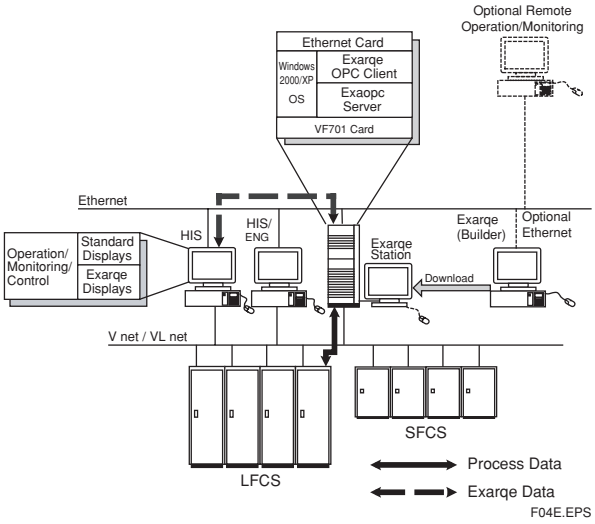
*1: Contact APC Center for support
*2: TOKUCHU

System Configuration

CENTUM CS 3000/1000 System Configuration

Exarqe station is connected to control stations via the VF701 Control Bus Interface Card, where it reads or writes process related data and receives process messages.

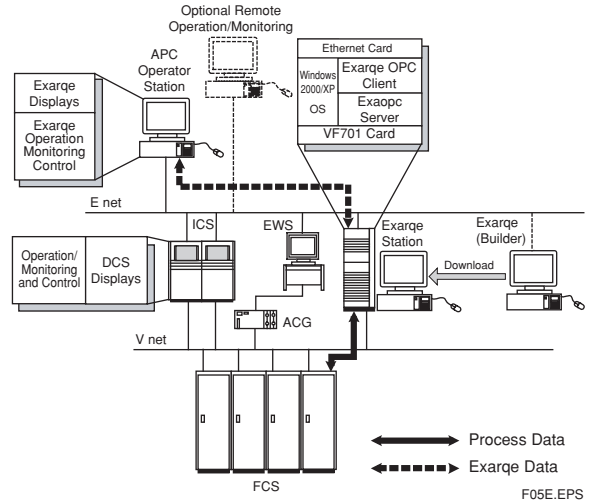
Exarqe station and HIS would equalize engineering data that is submitted from the ENG station of the CENTUM system.



CENTUM CS Configuration

The same as CENTUM CS 3000 configuration, Exarqe is also connected to control stations via the VF701 Control Bus Interface Card, where it reads or writes data and receives process messages.

Here, Exarqe also equalizes data from the ENG/EWS station of the CENTUM System.

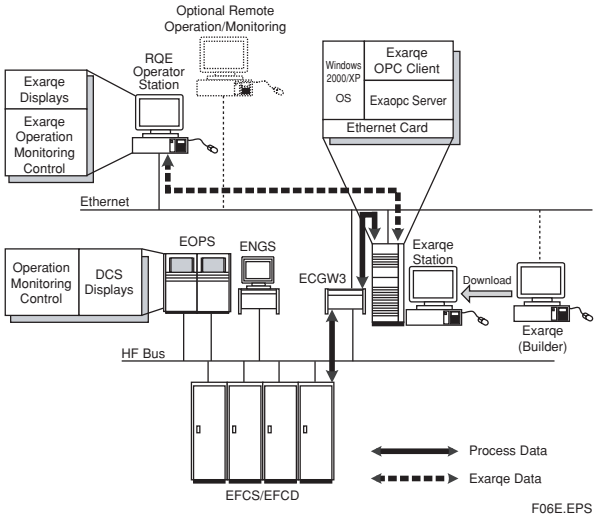


CENTUM-XL System Configuration

The Exarqe station is connected to control station via ECGW3 gateway. It reads/writes tag data and receives process messages.

The gateway equalizes engineering function data.

After equalizing, the process data is sent to APC operator station.

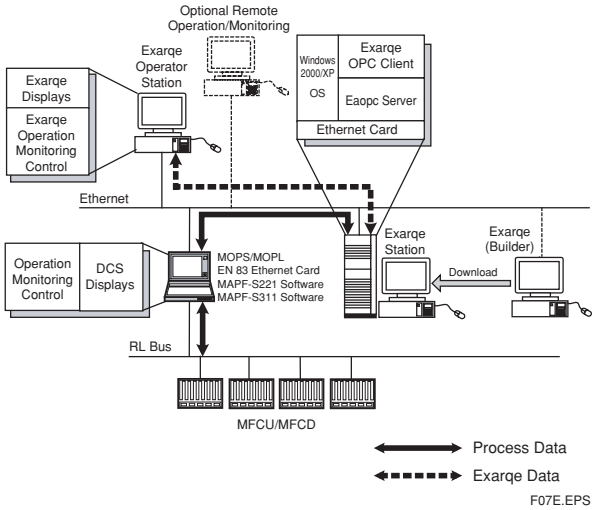


µXL System Configuration

The Exarqe station is connected to control station via MOPS/ MOPL gateway, which also reads and writes tag data and receives process messages.

The gateway also equalizes engineering function data.

APC operator station will receive process data after equalization.



■ APPLICATION CAPACITY

Max. number of Exarqe application: 20
Max. number of prediction: 20 per 1 application
The period of the Exarqe estimator: The value should be specified 60 seconds or more.
The state of the Exarqe estimator: ON or OFF.
The name of the Exarqe Estimator: Up to 16 characters.

■ OPERATING ENVIRONMENT

Hardware

Machine: IBM PC/AT (DOS/V)-compatible (where Windows 2000/XP runs)
CPU: Pentium 500 MHz or faster
Main memory: 256 MB or greater
Disk capacity: 10 GB or greater.
Communication device:
Ethernet-ready network card VF701 Control Bus Interface Card (YOKOGAWA) required when connecting to CENTUM CS 3000/ 1000, CENTUM CS.

Software

OS: Windows 2000/XP Professional/2003 Server
The Exaopc package and Windows must use the same language.

Other:
CENTUM CS 3000: R2.06.00 or later versions
CENTUM CS 1000: R2.06.00 or later versions
CENTUM CS: R2.09.00 or later versions
Optional software: To connect to the Micro XL system, the following optional software are required.
MAPF-S221 Ethernet Communication Package for EN83
MAPF-S311 Ethernet Computer Communication Package for EN83

Interface Package

Exaopc R2.10 or later is required.

When Exaopc is installed on the same pc as Exarqe, Exaopc R3.10 is required.

Note: The current version does not support DualCPU or Hypert Thread mode. Please use on the Single CPU and Hypert Thread = OFF.

OPC Interface

OPC interface connected to Exarqe should support the following specification. Connection test in advance is recommended.

- OPC revision: Compliant to OPC Foundation specification.
  OPC DA 1.0 a or later.
- OPC function: Synchronous read/write
- OPC performance : 100 data read and write per every second.

■ MODEL AND SUFFIX CODES

[Release: R1]

		Description
Model	NTPS420	Exarqe Robust Quality Estimator
Suffix Codes	-S1	Basic Software License (with Media) (*1)
	-S5	Site License for Small Site (with Media) (*2)
	-S6	Site License for Medium Site (with Media)
	-S7	Site License for Large Site (with Media)
	0	Without Exarqe online package (*3)
	1	With Exarqe online package
	1	Always 1
	1	English version
Option Code	/□-ADU	Software License for Additional Unit (1 to 7 units) (*4) □: 1 to 3 □: 4 to 7

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*1: Basic software license includes 1 copy of offline RQE.
*2: Site license includes 3 copies of offline RQE.
Suffix Code "-S5": Small Site; Less than 100,000 BPD
Suffix Code "-S6": Medium Site; 100,000 BPD to 199,999 BPD
Suffix Code "-S7": Large Site; 200,000 BPD or larger
*3: At least one Exarqe online package has to be quoted per PC.
Exaopc package is required for Exasmoc to interface with CENTUM CS 3000.
*4: The number of additional unit has to be entered in □.

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