CHAPTER 1

INTRODUCTION TO PROCESS CONTROL

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2. ***Process control functions***
3. ***Process Control Systems***
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INTRODUCTION TO PROCESS CONTROL SYSTEM

This chapter deals with the introduction to process control system, system concepts of distributed control system and the development history of process control system.

1. PROCESS CONTROL BY CONTROLLERS

A temperature control loop using a controller is shown in the figure below. The operator sets the temperature "Setpoint (SV)", and the controller automatically adjusts the "manipulated variable (MV)" i.e. output (opening of valve which controls steam flow) so as to minimize the deviation between measured (temperature) "process variable (PV)" and target value "Setpoint". The process of adjusting the manipulated variable to minimize the deviation between process variable and Setpoint is called "Feedback control".

The indicating (PID) controller displays the measured process variable (temperature of the liquid of the tank), and using a PID (P-Proportional, I-Integral and D-Derivative) control algorithm, computes the manipulated variable output (steam flow) that will minimize the deviation between process variable and Setpoint temperatures; i.e. it controls the tank temperature.

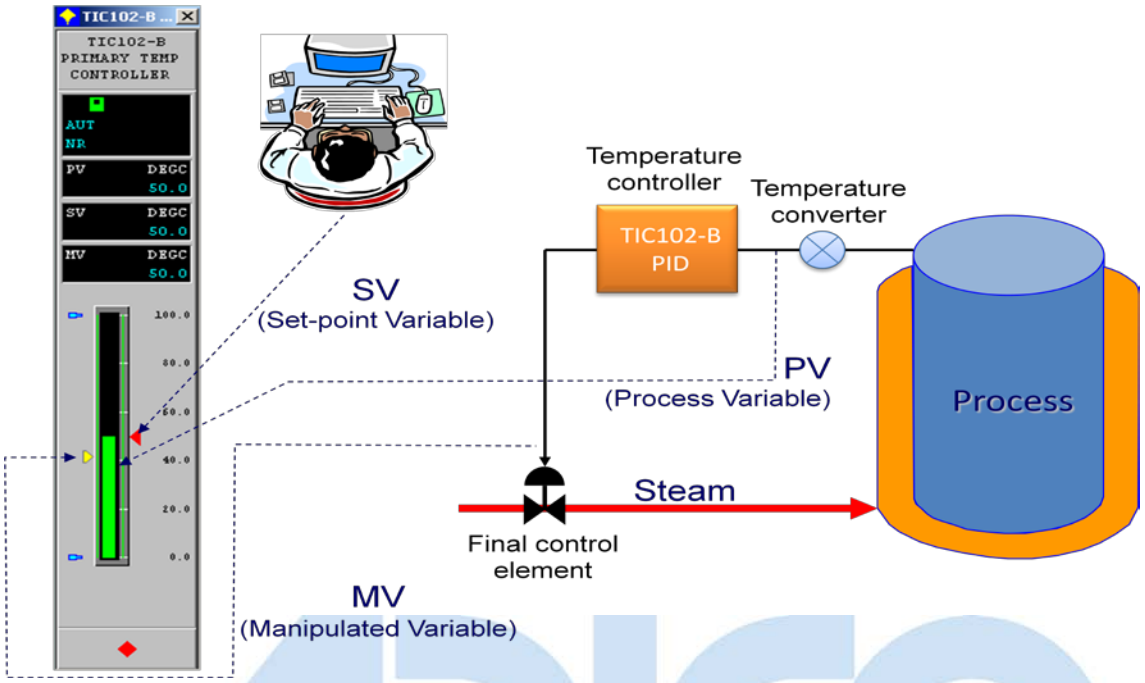

Figure: Process Control by Analog Controller

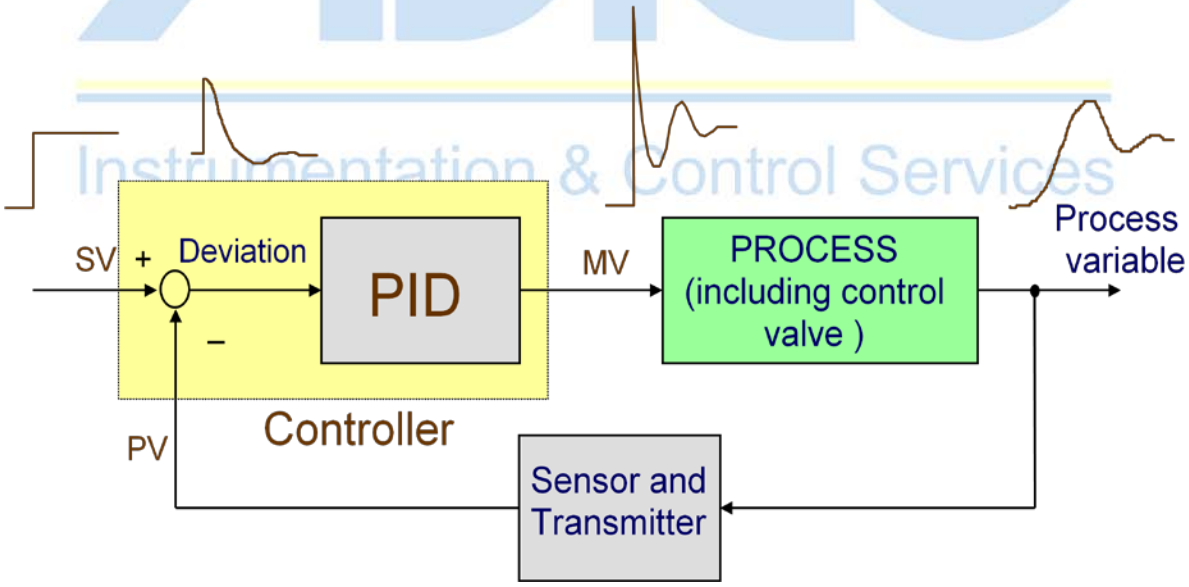

Figure: Basic Control Loop

2. PROCESS CONTROL FUNCTIONS

The method to directly control process is roughly divided into two categories: the loop control that inputs analog measured values (including feedback control and feed forward control) and the sequential control that inputs operating sequences and process status signals.

- ***Feedback Control***
  Control that acts to correct the process variable (e.g. Temperature in a tank) to agree with the target value (Setpoint) by comparing both.

- ***Feed forward Control***
  Control which takes a corrective action by measuring the disturbances (e.g. Ambient temperature) and directly driving the valve before it affects the process.

- ***Sequential Control***
  Control that successively advances each control step in accordance with the pre-determined sequence.

3. PROCESS CONTROL SYSTEMS

To perform temperature control as discussed before, a control system (a device to perform the control computation) is required. There are many control systems available, which are generally classified into analog, and digital control system.

Analog Control System
Control device that makes a control computation with analog signals (e.g. Voltage) using operational amplifiers etc. I this case sequence control is not available.

Digital Control System
Control device that makes control computation with digital values using a processor (processing unit). Not only the feedback and feed forward controls (called DDC-Direct digital controls collectively) but also sequential control is available.

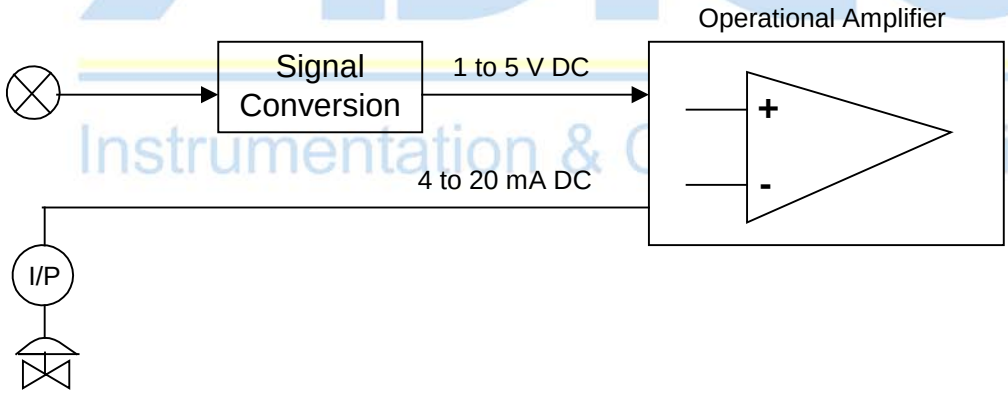

Figure: Overview of Analog Control System

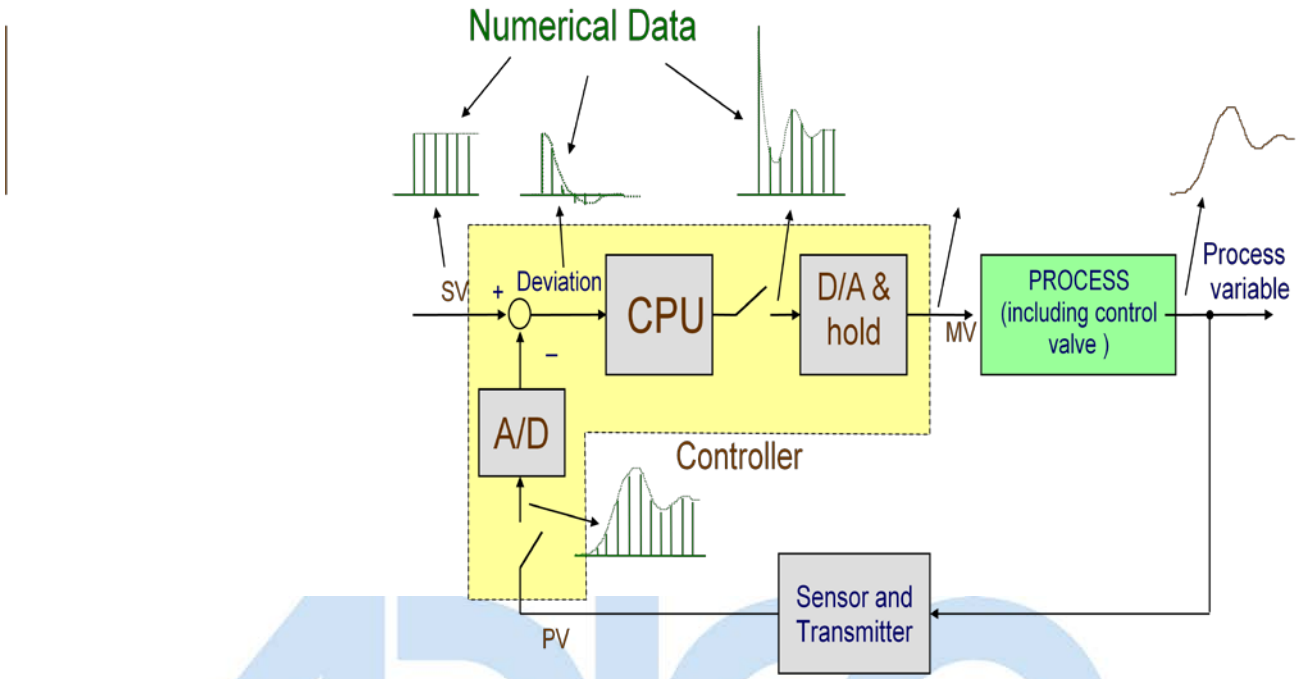

Figure: Overview of Digital Control System

DDC – Direct Digital Control

Generally referred to control in which the controller functions are implemented with digital equipment. Inputs and outputs of the controller may be analog signals. Also refers to a supervisory control scheme when a higher-level computer drives the output of a digital controller directly.

4. DEVELOPMENT HISTROY OF CONTROL SYSTEM

Electronic computers were first introduced into the process control filed in 1960's. Digital control technology developed widely in the following years.

The purpose of introducing computers was mainly (1) data logging and (2) set point control (SPC) at first.

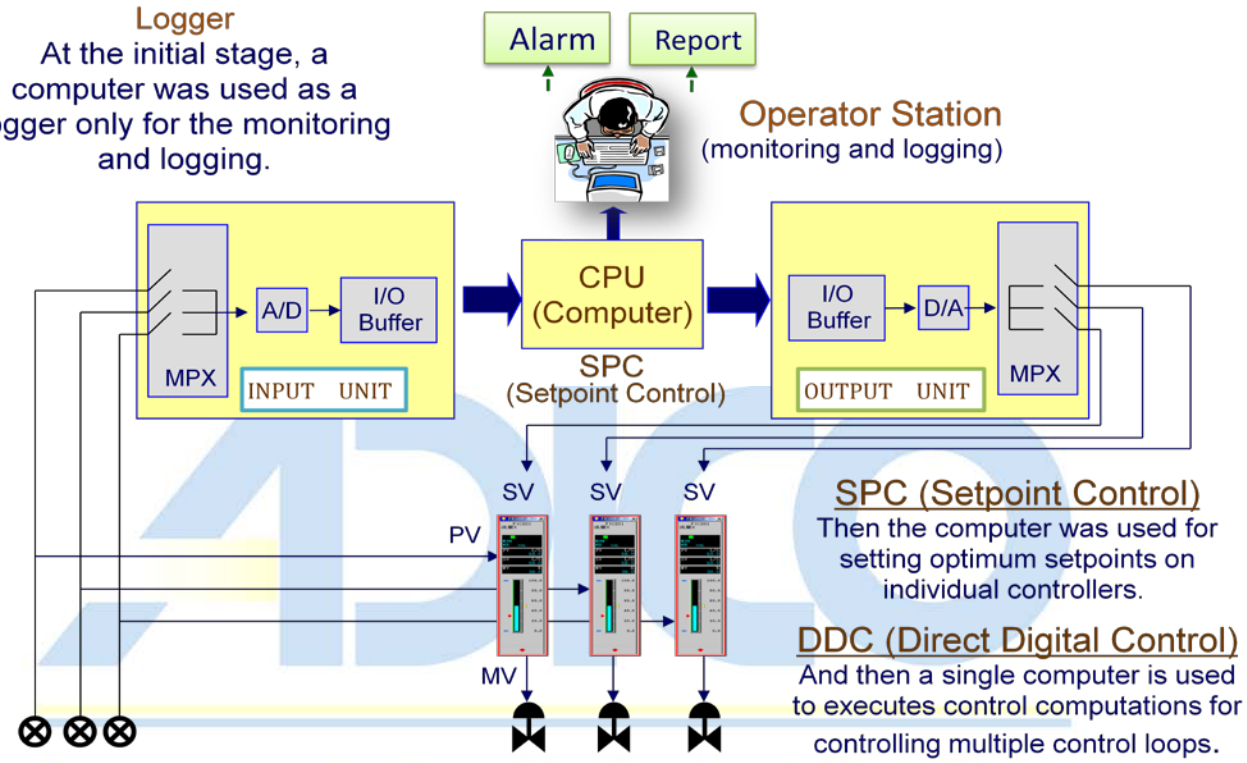

Figure: Data Logging *Figure: Set Point Control*

As the introduction of computers into process control advanced, controller functions were superseded by computers, and DDC in which computers directly controlled processes began to be employed.

In the early stages, the control system was centralized where a central computer executed not only monitoring and operation but also all process controls. The most important reason was cost effectiveness.

The advent of microprocessors greatly changed the above situation. The study theme moved to how diversification could be implemented (risk distribution, function distribution, etc) and how exclusiveness and versatility could be united.

The distributed control system (DCS) now has inputs points distributed for 1 loop, 8 loops, 16 loops and up to 80 loops to be able to apply approximately when seen from processes.

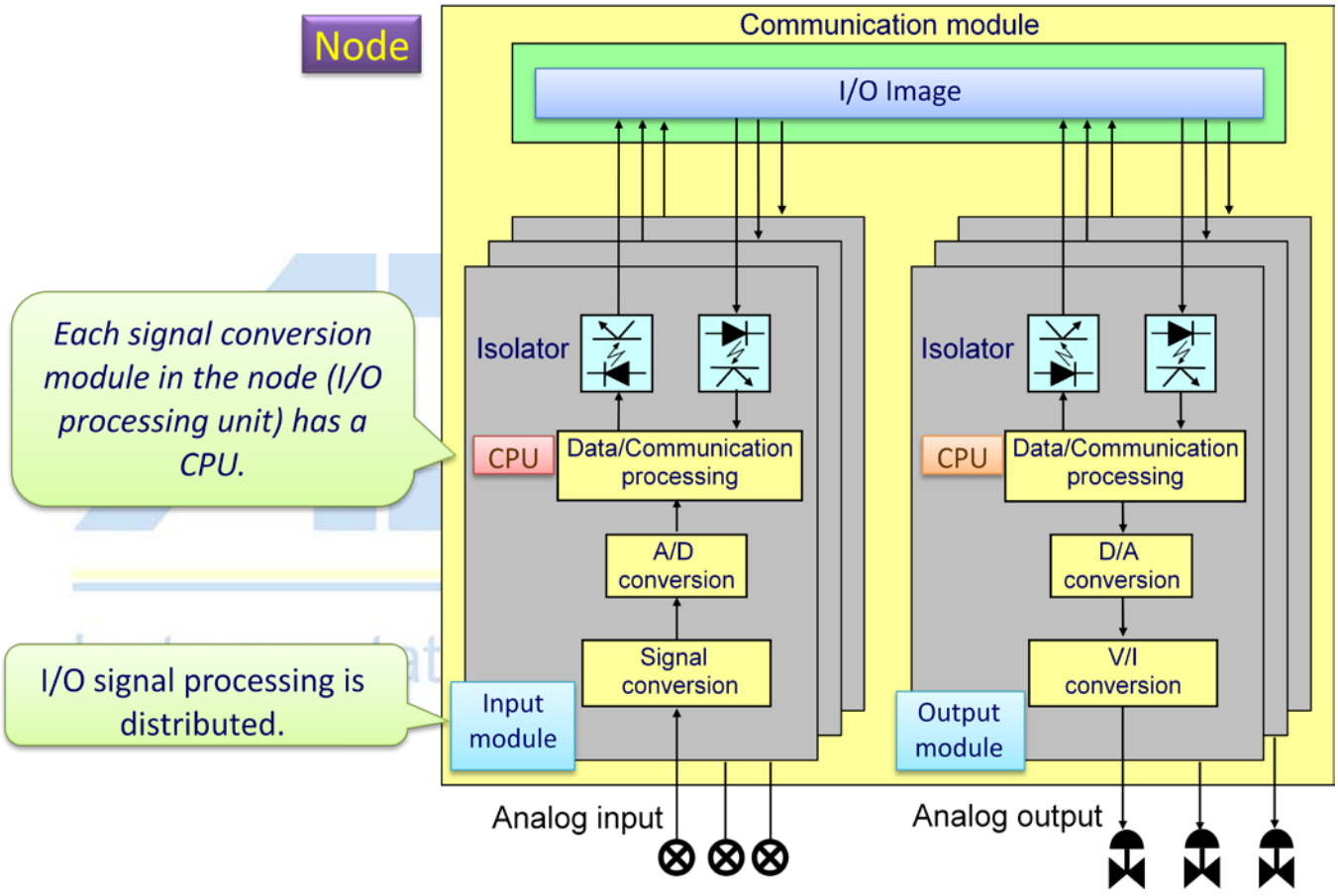

Figure: Distributed Control

Digital control systems have been subjected to technical innovation together with changes in component parts. Yokogawa process control system development history is as shown in the below figure.

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CHAPTER 2
SYSTEM OVERVIEW

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3. ***Human Interface Station (HIS)***
4. ***Field Control Station(FCS)***
5. ***Network***
6. ***System capacity***
7. ***Hardware configuration***

SYSTEM OVERVIEW

This chapter describes various system components of CS3000 system.

1. DCS MINIMUM SYSTEM COMPONENTS

For the Distributed Control system to function two major components are necessary.

a. *The Engineering / Operator Station – From which the operator controls the plant and the same component, can also be used to do configuration changes. The operator station or the Man Machine Interface (MMI) is called the Human Interface Station (HIS) in CS3000 R3 system while the component used for configuration is called the Engineering station (ENG). Both these components can reside in one hardware.*

b. *The Field Control Station – which is the interface between the Field instruments and the control room. This is the component where all the control functions are executed and hence is a very important and critical component in the overall system.*

c. *The above two components are connected via a real time control network which communicates all the parameters to and from the Field Control Station to the Human Interface station. This network is called the V-Net / Vnet-IP in CS3000 R3 system.*

The above three are the minimum required components for the Distributed Control System to function. The number of the HIS and the FCS for a particular plant is broadly decided on the following basis.

The number of Field Control Station to control a process plant is decided based on the Input/output count; Input/output segregation based on the different sections of the plant, Field Control station CPU load and the Field Control Station hardware capabilities.

The number of Human Interface Stations is decided based on the number of operators required to control the process plant considering number of screens required during startup and shutdown situation. The operation grouping / security to control the various sections of the plant is also a criteria in deciding the number of Human Interface Stations.

2. SYSTEM COMPONENTS OF CS3000 R3 SYSTEM

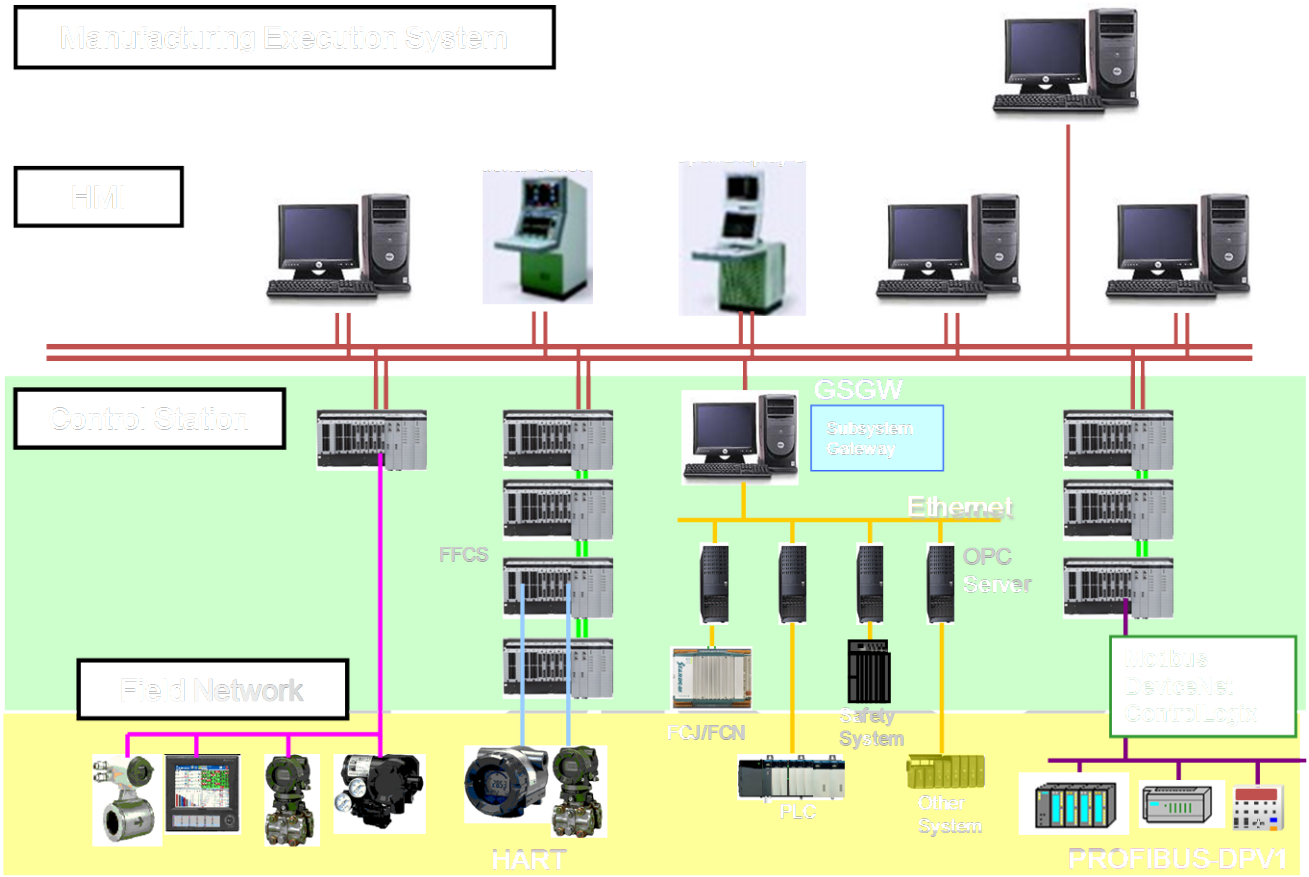


Figure: CS3000 R3 System configuration

The following are the various components that form the CS3000 R3 Control System. Each of the components on the real-time network is called as Station with a unique station address.

HARDWARE COMPONENTS

- ***Human Interface Station (HIS)***
  Human Interface Station is an operator station which is used for Operation and Monitoring of the process plant. It displays process variables, control parameters, alarms and events necessary for the process operator to quickly have a view and control the process plant.

- ***Engineering Station (ENG)***
  Engineering station is dedicated to configure/modify the distributed control system software. The complete database of the Distributed control system resides in the Engineering station.

- ***Field Control Station (FCS)***
  Field Control Station is the component, which performs all the control and calculation processing of the filed inputs/outputs.

- ***Safety Control Station (SCS)***
  Safety Control Station is the component that performs the processing and logical computation of Emergency Shutdown inputs and outputs. Yokogawa's Emergency shutdown system is called Prosafe-RS System.

- ***Communication Gateway Unit (CGW)***
  The Communication Gateway Unit is a gateway that connects the supervisory computer with the VL net or V net, which are the control communication networks for the CS 3000 system.

- ***Bus Converter (BCV)***
  The V net bus converter connects a V net on the CS 3000 system and a CS 3000 on another domain to enable system integration. A domain refers to stations that are connected to a single V net network.
  A CS 3000 system V net and HF Bus (in case of Centum-V and Centum-XL Systems) or RL-Bus (in case of Micro-XL Systems) can be connected using a bus converter.

- ***EXAOPC Server (EXAOPC)***
  Exaopc is an OPC (OLE for Process Control, OPC is a standard interface developed by the OPC Foundation) server, which can be connected to a variety of DCS (Distributed Control Systems) and provides an OPC client with process data via OPC interface. With the package, the OPC client can acquire and define process data from DCS and receive alarm events.

- ***Plant Resource Manager (PRM)***
  Field networks have been developed in recent years, and field devices have become more intelligent. These intelligent field devices communicate digitally to the Field Control Station. Plant Resource Manager handles field device management and maintenance work. Plant Resource Manager maintains a historical record of device parameters and maintenance records. Implements centralized management of device management information such as the device list, inspection record, schedule, and parts lists.

- ***EXAQUANTUM Server***
  A Distributed Control System typically produces large amounts of data that must be converted into information to facilitate management decisions and optimize the operation of the plant. Exaquantum is a Plant Information Management System (PIMS), which processes these data from the various to deliver high-value business information to all decision-makers throughout the organization.

- ***Fieldbus Devices***
  Field devices, which can communicate on the Fieldbus and are compliant to Foundation Fieldbus (FF) protocol.

COMMUNICATION COMPONENTS

- ***Fieldbus***
  Fieldbus is a digital, two-way, multi-drop communication link among intelligent fieldbus devices for measurement and control. It is one of field local area networks dedicated for industrial automation.

- ***Vnet / Vnet-IP***
  Vnet / Vnet-IP is a dual redundant real time control bus which connects all the components on the network such as the Human Interface Station (HIS), Engineering Station (ENG), Bus Convertor (BCV) and Communication Gateway Unit).

- ***Ethernet***
  Ethernet is the standard local area network used to connect the Human Interface Station (HIS), Engineering Station (ENG) and other Supervisory Computers. The Ethernet is used for downloading the database from the Engineering Station (ENG) to the Human Interface station (HIS) and additionally communicates trend information between the Human Interface stations (HIS).

3. HUMAN INTERFACE STATION (HIS)

HIS acquires process variables, events and alarms from the Field Control Station (FCS) and send set points and output to the FCS. This monitoring and control operation is done using user-defined Graphics panels.

There are three types of Human Interface Stations namely Desktop type, Enclosed Display Style Console Type and Open display type console kit.

- ***Desktop Type***
  An IBM PC/AT compatible machine is generally used. The specifications of the PC are as below.

CPU	*: Pentium 466 or better*
Main Memory	*: 128 Mb or more*
Hard Disk	*: 4 Gb or more (User space should be 500 Mb or more)*
Video Display	*: 1024 x 768 or more (256 colors)*
Video Memory	*: 2 Mb or more*
CRT Monitor	*: Multi-scan, 17 inch or larger. LCD display can also be used.*
Serial Port	*: RS232C or port or more (Dsub9pin)*
Parallel Port	*: One port or more*
Extension Slot	*: PCI, ISA (One slot for VL-Net interface card, 1 slot for Ethernet card)*
Power Supply	*: 110 VAC or 220 VAC*
Optional accessory	*: Yokogawa Operator Keyboard.*
Sec. Storage Media	*: Cartridge Drives, DAT Drive or CD Writer.*
Basic O/S Software	*: Microsoft Windows 2000 with Service Pack 1.*
CS3000 Software	*: CS3000 R3 Packages with necessary software Licenses.*

- ***Enclosed display style console type HIS.***

The desk of the enclosed display style console-type HIS contains a 21 inch CRT that is necessary for operation, an operation keyboard for performing operation and monitoring, and a mouse pad in an easy-to-operate layout. A tray is included for use of the engineering keyboard. A PC, a power distribution board and an auxiliary (AUX) board are mounted in the lower rear of the enclosed display style console-type HIS.

Figure: Enclosed display style console type HIS

- *The open display style console type of HIS*
  The open display style console type of HIS is configured with a general-purpose PC and a liquid crystal display (LCD). Two types of operation keyboards are available: one for eight-loop simultaneous operation and one for single-loop operation. A power distribution board is mounted in the lower-front section of the open display style console-type HIS. Yokogawa provides the above-mentioned kit while the general purpose PC is to be procured additionally to mount the same in the open display style console.

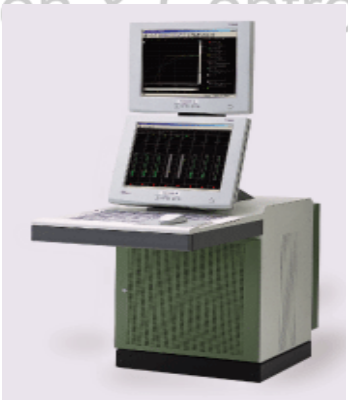


Figure: Open display style console type of HIS

4. FIELD CONTROL STATION (FCS)

There are generally three types of Field Control Station: KFCS - Standard Field Control Station with Field Input/output Modules (FIO), LFCS - Standard Field Control station with remote Input/output (RIO) Bus and PFCD - Compact Field Control Station.

- ***KFCS-Standard Field Control Station with Field Input/output Modules (FIO)***
  The following figures show the hardware components of the KFCS type of FCS.

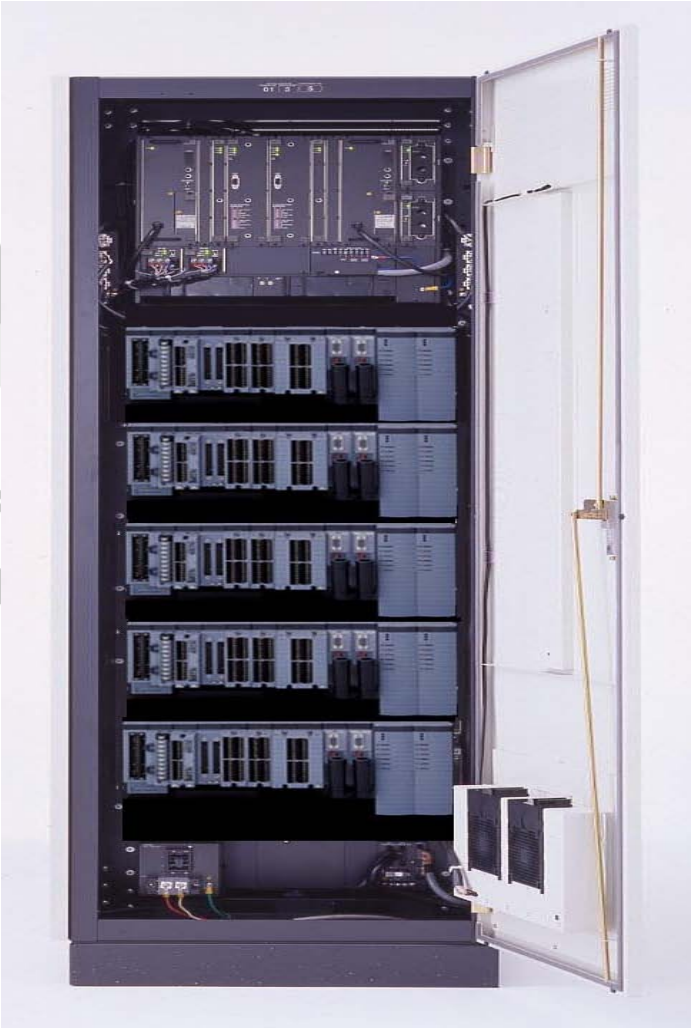


Figure: KFCS-Standard FCS with Field Input/output Modules (FIO)

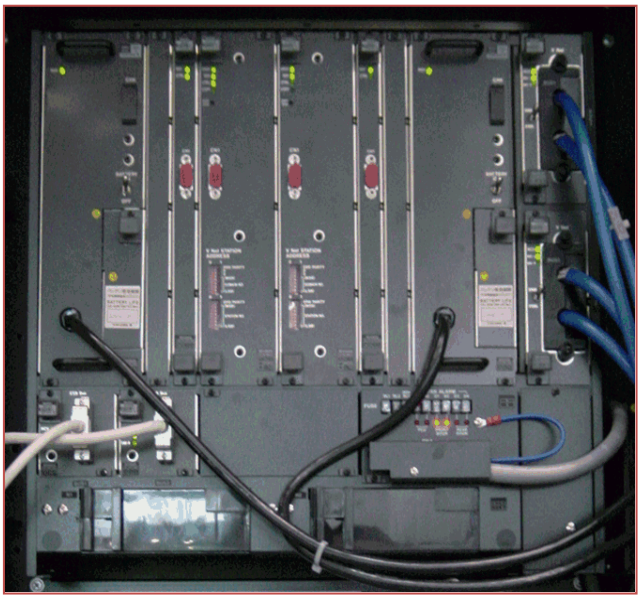


Figure: KFCS Field Control Unit (FCU)

Card/Unit \ Model	Field Control Unit		Duplexed Field Control Unit	
	AFS30S, AFS40S		AFS30D, AFS40D	
Power supply unit (100-120 V AC)	PW301	1ps	PW301	2ps
Power supply unit (220-240 V AC)	PW302	1ps	PW302	2ps
Power supply unit (24 V DC)	PW304	1ps	PW304	2ps
Processor card	CP333	1ps	CP333D	2ps
ESB bus interface card	SB301	1ps	SB301	2ps
V net coupler unit	AIP501	2ps	AIP502	2ps
ESB bus coupler unit	AIP532	1 or 2ps	AIP532	2ps

Figure: KFCS Field Control Unit (FCU) Cards

- ***LFCS - Standard Field Control station with remote Input/output (RIO) Bus***
  The following figures show the hardware components of the LFCS type of FCS.

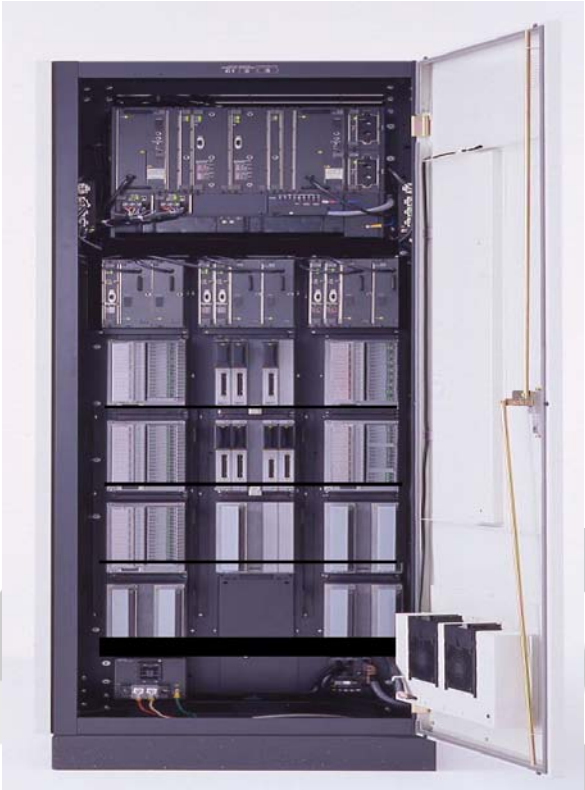


Figure: LFCS - Standard FCS with remote Input/output (RIO) Bus

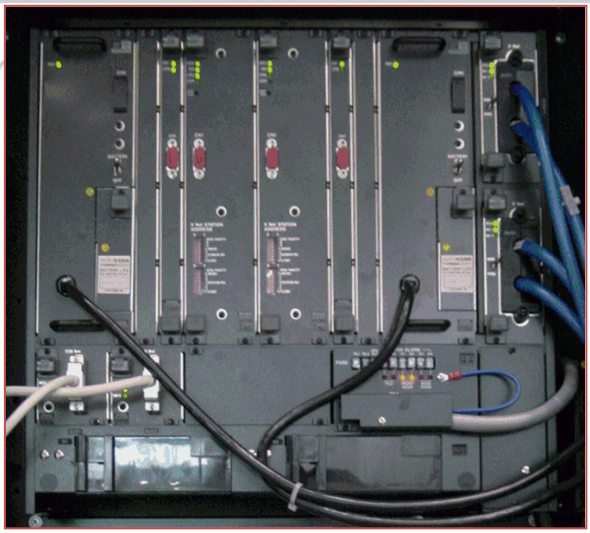


Figure: LFCS - Field Control Unit (FCU)

Model / Card/Unit	Field Control Unit		Duplexed Field Control Unit	
	AFS10S, AFS20S		AFS10D, AFS20D	
Power supply unit (100-120 V AC)	PW301	1	PW301	2ps
Power supply unit (220-240 V AC)	PW302	1	PW302	2ps
Power supply unit (24 V DC)	PW304	1	PW304	2ps
Processor card	CP333	1	CP333D	2ps
RIO bus interface card	RB301	1	RB301	2ps
Vnet coupler unit	AIP501	2ps	AIP502	2ps
RIO bus coupler unit	AIP511	1 or 2ps	AIP512	2ps

Figure: LFCS - Field Control Unit (FCU) cards

- ***FFCS – Compact Field Control station(FIO Bus)***
  The following figures show the hardware components of the FFCS type.

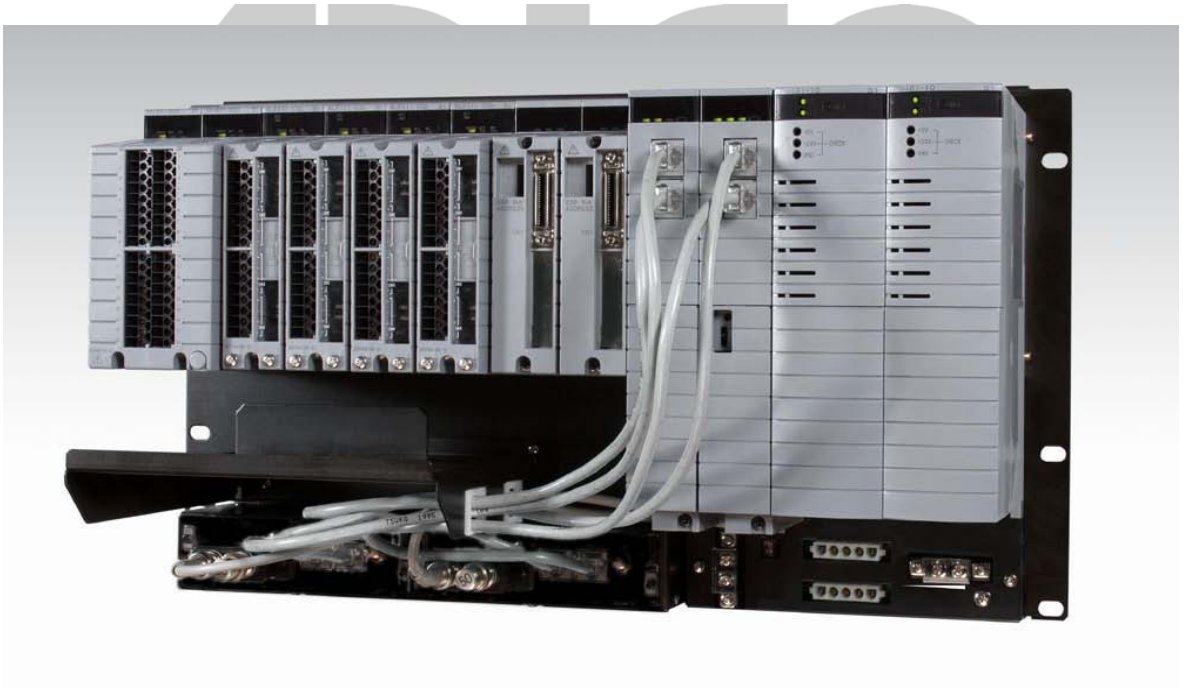


Figure: FFCS - Compact Field Control Station (FIO Bus)

- ***PFCS – Compact Field Control station(RIO Bus)***
  The following figures show the hardware components of the FFCS type.

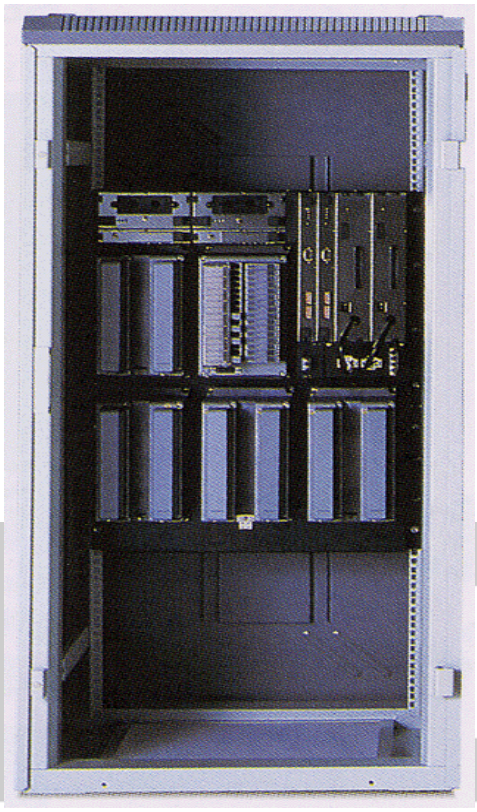


Figure: PFCD - Compact Field Control Station (RIO Bus)

Unit Name	PFCS (single)		PFCD (duplexed)	
Power supply unit (100-120 V AC)	PW701	1 or 2ps	PW701	2ps
Power supply unit (220-240 V AC)	PW702	1 or 2ps	PW702	2ps
Power supply unit (24 V DC)	PW704	1 or 2ps	PW704	2ps
Processor card (standard)	CP701	1	CP701	2ps
Processor card (enhanced, compact type)	CP703	1	CP703	2ps
Control bus coupler unit	AIP521	1 or 2ps	AIP521	2ps
Branch plug (for VL net or V net 10BASE cable)	S9764UK	1 or 2ps	S9764UK	2ps
Branch plug (for V net 10BASE cable)	S9628UK	2ps	S9628UK	2ps
Battery unit	S9766UK	1	S9766UK	2ps

Figure: PFCD - Compact Field Control Station Cards

FCS HARDWARE

The following is the brief description of hardware components of all types of FCS. Some of the hardware components are specific to that type of FCS.

- ***Field Control Unit (FCU)***
  The field Control station (FCS) basically consists of two parts – The Field Control Unit (FCU) and the Node. The FCU consists of the Station control cards.

- ***Control Bus Coupler Unit***
  The Coupler is where the V-Net or the VL-Net is installed into the FCS Station. It has provision for two-bus connection. The coupler unit couples the processor card installed in the Field Control Unit (FCU) to the V-Net or the VL-Net Cable by performing signal isolation and the signal level conversion.

- ***Power Supply Unit (PSU)***
  For Compact type of FCS (PFCD), this unit receives power directly from the main source while for the KFCS and LFCS this unit receives power from the distribution board. This unit converts the main AC voltage into an isolated DC voltage for distribution to cards and units mounted in the Filed Control Unit (FCU)

- ***Back Up Batteries***
  These are rechargeable battery units installed in the PSU, backs up the memory in the processor card during the main power failure. It can hold the memory for about 72 hours. If the power failure is more than this specified time, the FCS has to be loaded off-line, for it to function normally.

- ***Remote Input/output (RIO) Interface Card and RIO Bus.***
  The RIO Interface card is used in the LFCS. The interface card performs communication via the RIO coupler unit between multiple nodes connected on the RIO bus.

- ***Process Input Output Units(PIO) or Input/output Units (IOU)***
  These are Modules that perform the conversion processing and transmission of filed process signals to the CPU card.

- ***Node Interface Unit (NIU)***
  This component send the analog and the contact i/o signals from the field to the Field control Unit (FCU) for processing and it offers the function to supply power to the Input/Output Units (IOU)

- ***Node***
  Node consists of Node Interface Unit (NIU) and Input/output Units (IOU) incase of LFCS (for RIO) while the Node consists of Input/output Units in case of KFCS (For FIO).

- ***ESB Bus Coupler Unit***
  The ESB bus coupler unit couples the ESB bus interface card installed in the FCU to the ESB bus by modulating and demodulating the signals. This is applicable for Field Control station with FIO (KFCS)

- ***Processor Card***
  The Processor Card performs calculations and control computation. In case of redundant CPU models of the LFCS and KFCS, there are two processor cards. One of the cards is in control status and the other is in the standby status.

Each of these two processor unit have two processors or the CPU, which perform the same control computation. A collator compares the computation results during each computation cycle. If the computation results from the two CPUs match, the collator determines that the computation is normal and sends data to locations such as the main memory and bus interface unit. Because the main memory as an ECC, transient bit inversion errors occurring in the main memory can be rectified.

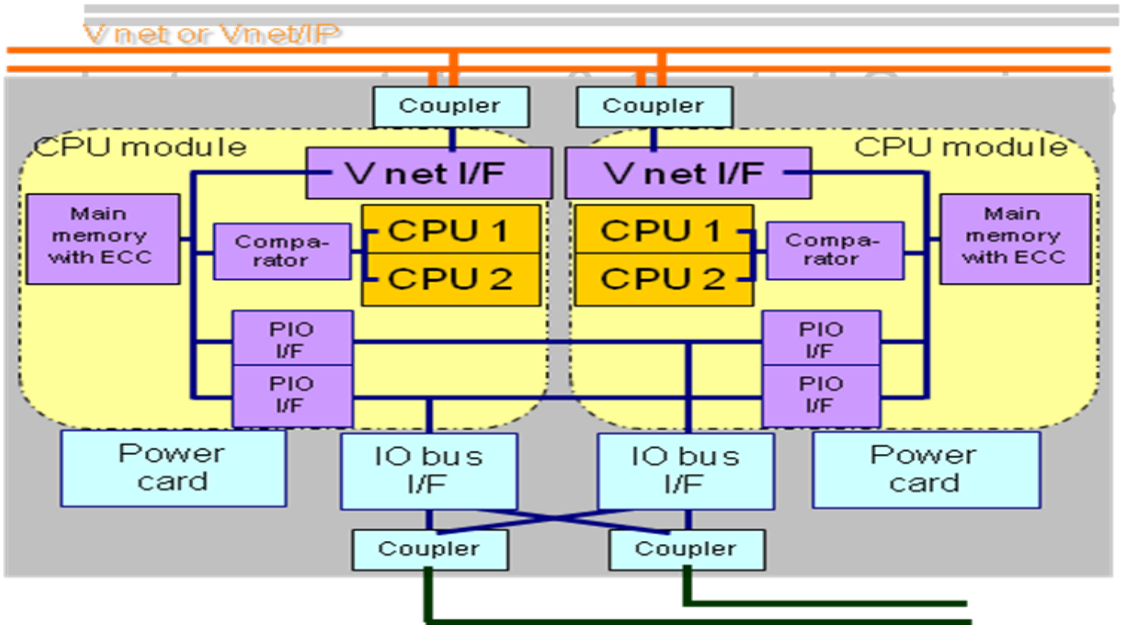


Figure: Pair and Spare function of the CPU Card for FFCS.

If the computation results from CPU1 and CPU2 do not match, the collator judges that a computation error has occurred, and the control will be transferred to the standby side. The standby processor unit performs the same computation as the control side, even though it is in the standby state. Therefore, it can immediately resume the output of control computation data to the bus interface when it takes over the control

Therefore, CPUs within the same unit collate each other's computation data, being sure to detect any computation errors. Because the unit on standby performs the same control computation concurrently with the control side (even though it is in standby status), it takes over the control computation at any point of time without interruption (bumplessly). This is called the pair and spare function of the CPU card.

5. NETWORK

CS3000 R3 uses Vnet/Vnet-IP and Ethernet for data communication. The specifications of the network are as below.

SPECIFICATION	V NET	Vnet-IP
Transmission Speed	10 Mbps	1000 Mbps
Cable	10base2 cable used between HIS stations 10base5 cable used between FCS, ACG, ABC etc	CAT5e or higher UTP cables, single-mode fiber optic cables
Transmission distance	500 m/segment (for 10base5) 185 m/segment (for 10base2)	No Limitation
Network Topology	Daisy Chain	Star(Tree Format)

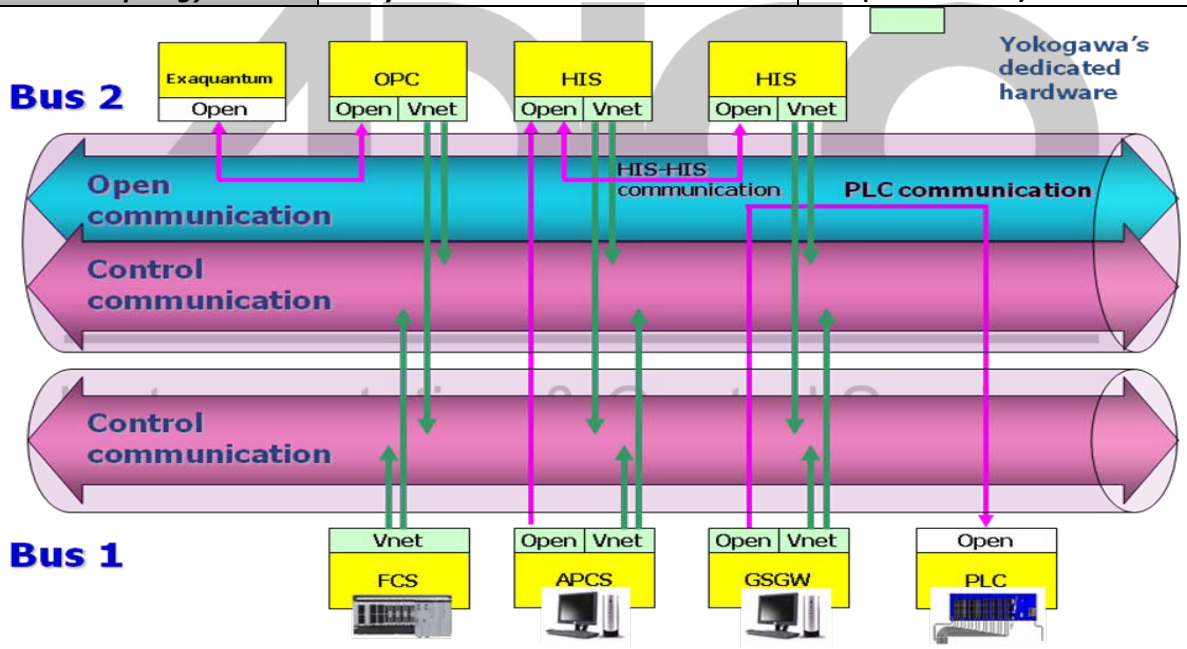


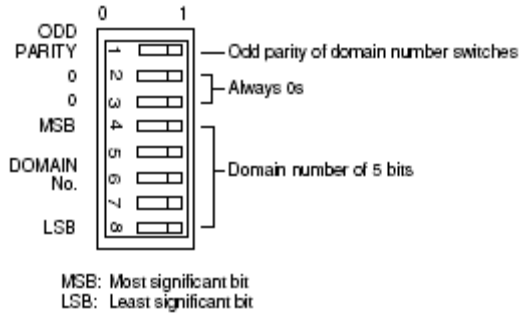
Figure: Vnet-IP Configuration

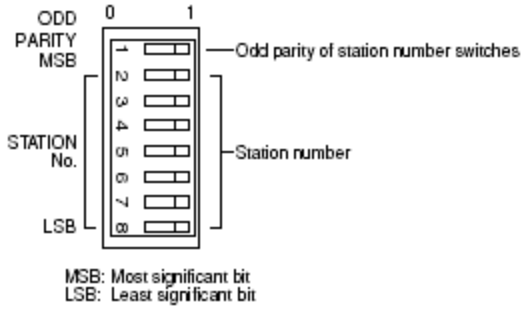
6. SYSTEM CAPACITY

SPECIFICATION	CS3000 R3
Max. no. of HIS monitored tags	100,000
Max. no. of stations	256
Max. no. of domains	16
Max. no. of stations per domain	64

7. HARDWARE CONFIGURATION

The dip switches for domain and station no. setting for the FCS is found in the CPU card and has to be set correctly for station address identification as per the configuration.



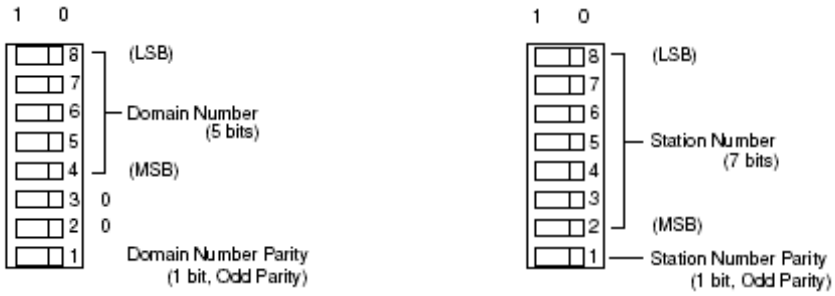


Domain no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Bit 1	0	0	1	0	1	1	0	0	1	1	0	1	0	0	1	0
Bit 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bit 5	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
Bit 6	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0
Bit 7	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0
Bit 8	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0

Station no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Bit 1	0	0	1	0	1	1	0	0	1	1	0	1	0	0	1	0
Bit 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bit 5	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
Bit 6	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0
Bit 7	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0
Bit 8	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0

Figure: Domain and Station number setting for FCS

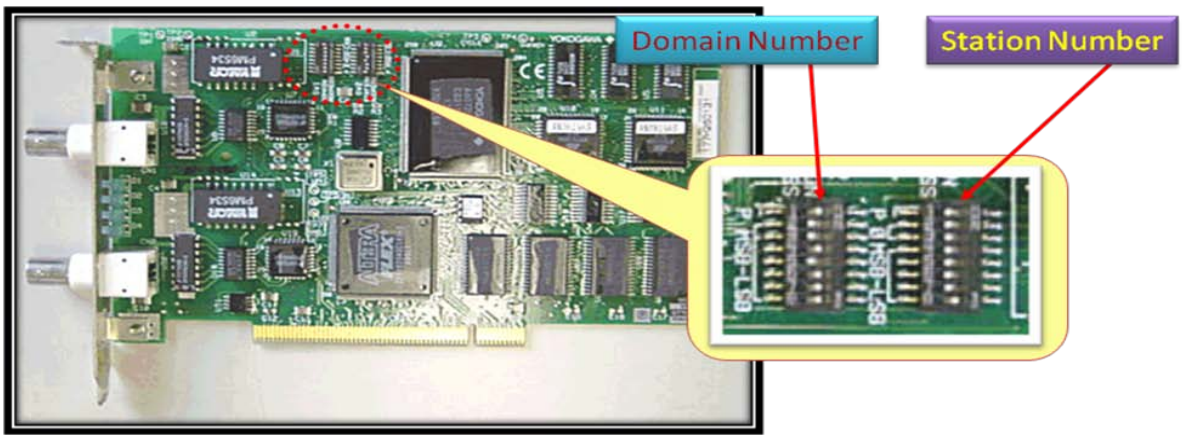
The dip switches for domain and station no. setting for the HIS is found in the Vnet control bus card, installed in the PC PCI slot and has to be set correctly for station address identification as per the configuration.



Domain no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Bit 8	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
Bit 7	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0
Bit 6	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0
Bit 6	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
Bit 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bit 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 1	0	0	1	0	1	1	0	0	1	1	0	1	0	0	1	0

Station no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Bit 8	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
Bit 7	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0
Bit 6	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0
Bit 5	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
Bit 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bit 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 1	0	0	1	0	1	1	0	0	1	1	0	1	0	0	1	0

Figure: Domain and Station number setting for HIS.



Instrumentation & Control Services

CHAPTER 3
HIS STARTUP

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Objectives
1. HIS Utility
2. Virtual Test Function

HIS STARTUP

This chapter explains the start up the HIS operation and Monitoring functions, which is necessary before commencing the plant operation and monitoring.

1. HIS UTILITY

When the CS3000 operation and monitoring package is loaded, an account with a user name "CENTUM" is created as part of the installation steps. Hence to login to the CS3000 operation and monitoring function on the HIS, the operator has to login as a "CENTUM" user. The HIS starts the operation and Monitoring package based on the selection done in the HIS utility.

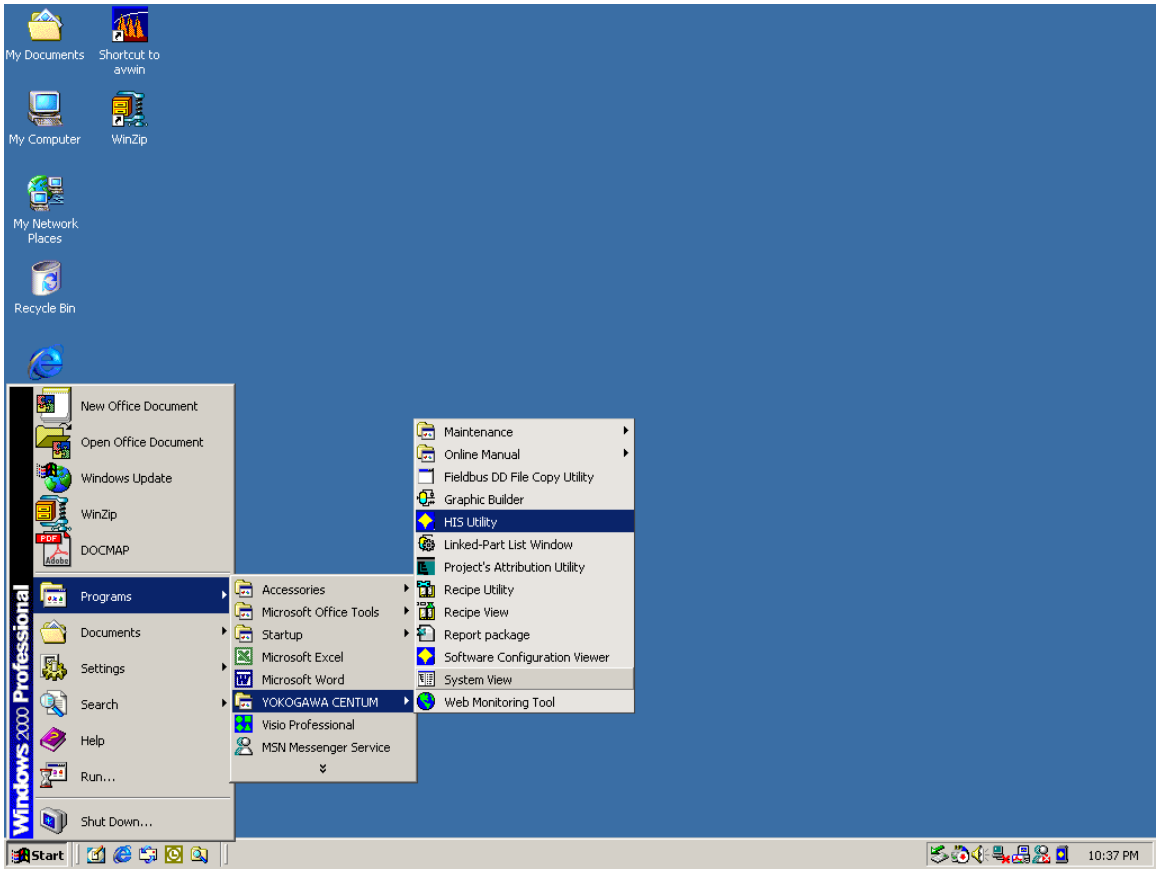

Figure: To start the HIS Utility from Windows 2000 environment.

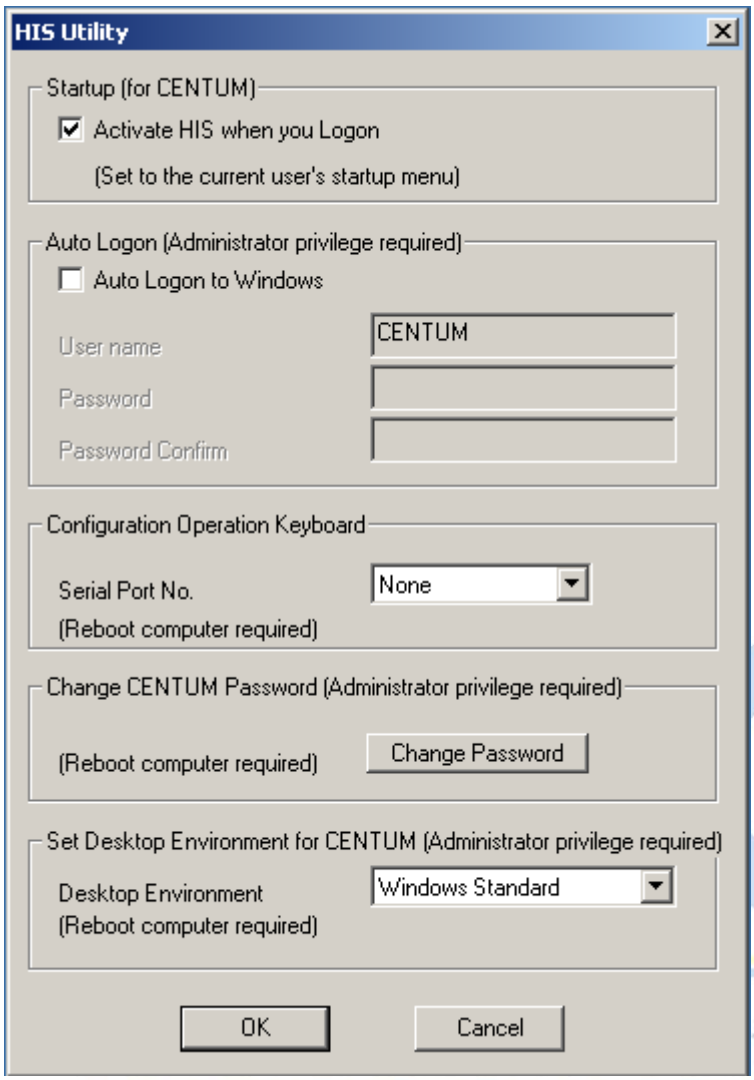

Figure: HIS Utility with Startup (for CENTUM) selected.

When setting up [Startup] Only (as shown in the above figure)

Turn the power on for the PC in which Windows is installed.

Log on using the [Ctrl] + [Alt] + [Del] keys.

Enter the user name (CENTUM) and the password.

The operation and monitoring window starts.

When setting up [Automatic Log On]

Turn the power on for the PC in which Windows is installed.

The following processing is performed automatically.

User is logged on with the [Ctrl] + [Alt] + [Del] keys.
The user name and password set up in the HIS Utility dialog box is entered.
The HIS starts if [Startup] is set.

When neither [Startup] nor [Automatic Log On] is Set up
Turn the power on for the PC in which Windows is installed.
Log on using the [Ctrl] + [Alt] + [Del] keys.
Enter the user name (CENTUM) and the password.
The CENTUM (Windows general user environment) starts. At this time, the HIS does not start up but System View can be used.

When setting up both [Startup] and [Automatic Log On]
Turn the power on for the PC.
The HIS starts.

2. VIRTUAL TEST FUNCTION

In the absence of actual FCS and the VL Net control bus card, using the virtual test function, the memory of the HIS can be used to generate the FCS simulator and emulate FCS control functions and HIS Operation and Monitoring functions based on the FCS and HIS chosen. The following procedure describes the steps to start the Virtual test function.

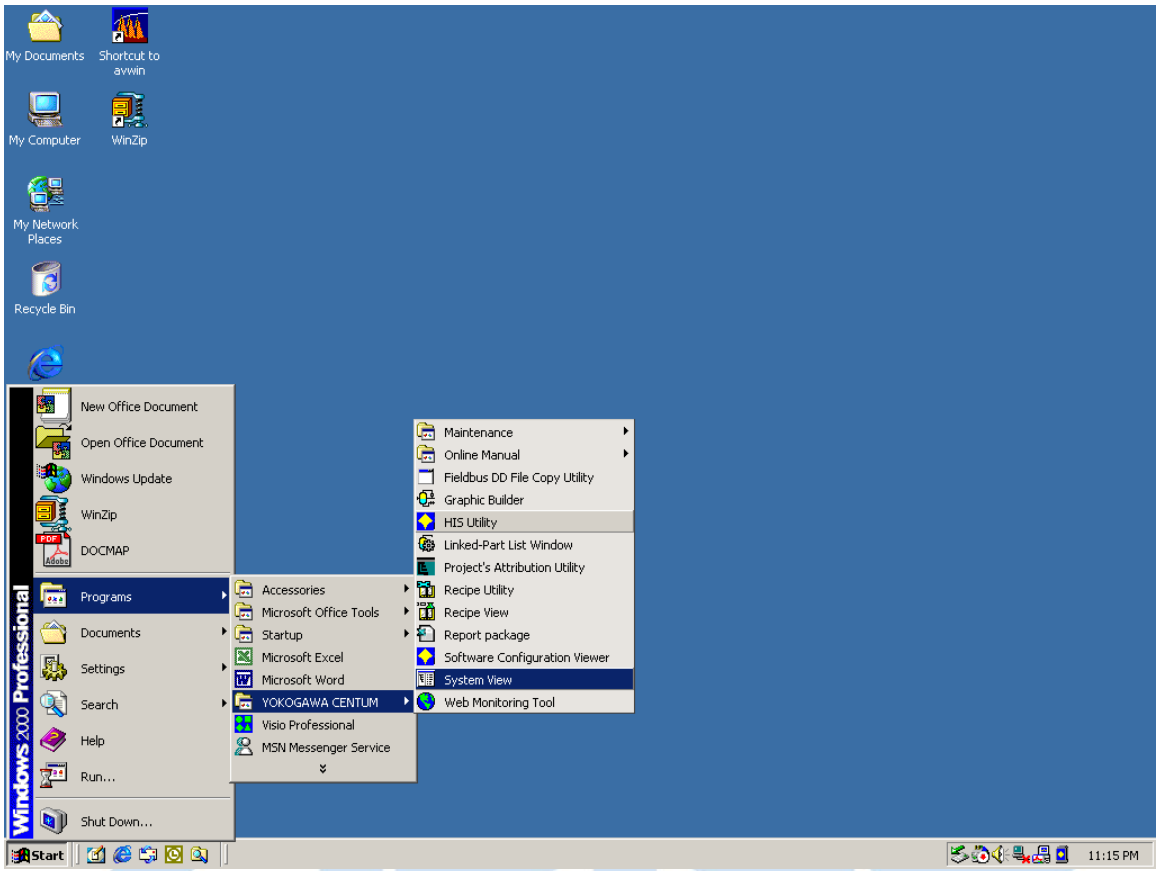

Figure: To start the System View from Windows 2000 environment.

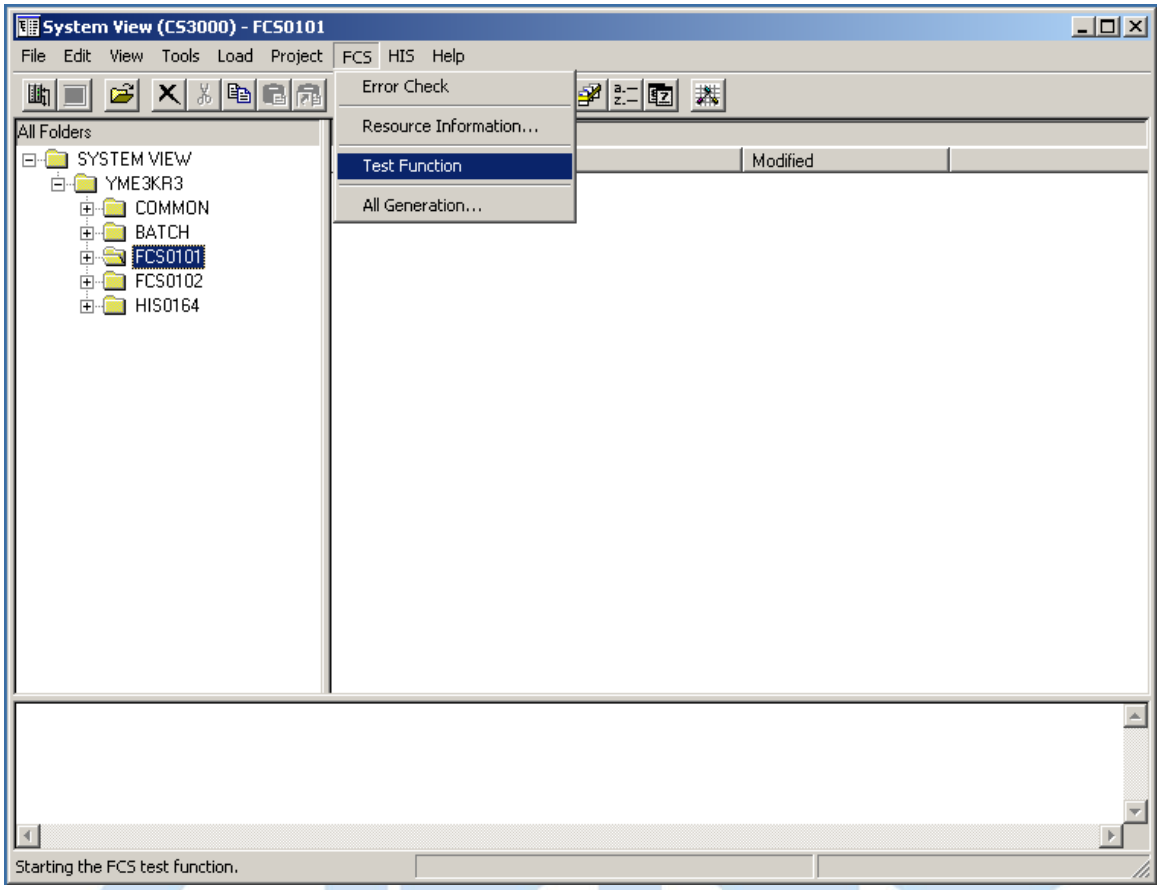

Figure: To start the Test function for FCS0101 from System.

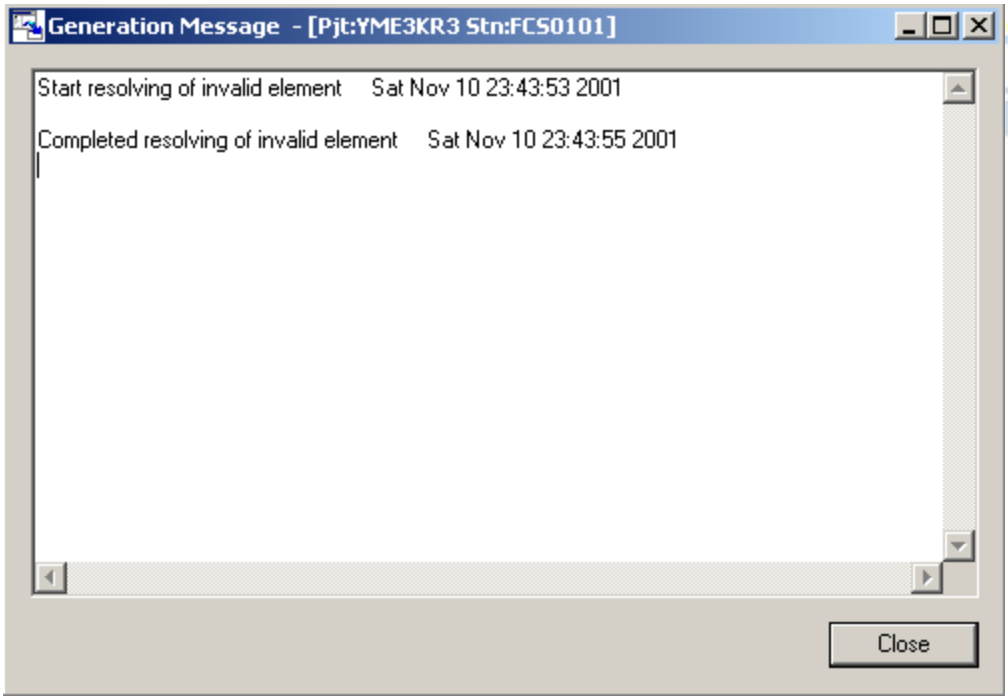

Figure: The Generation Message Dialog that appears after selecting the test function.

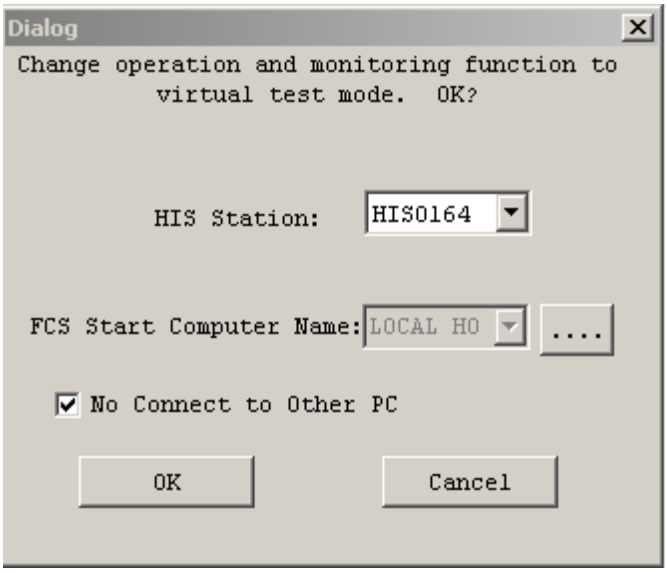

Figure: Dialog to select the HIS Station for Operation and Monitoring function.

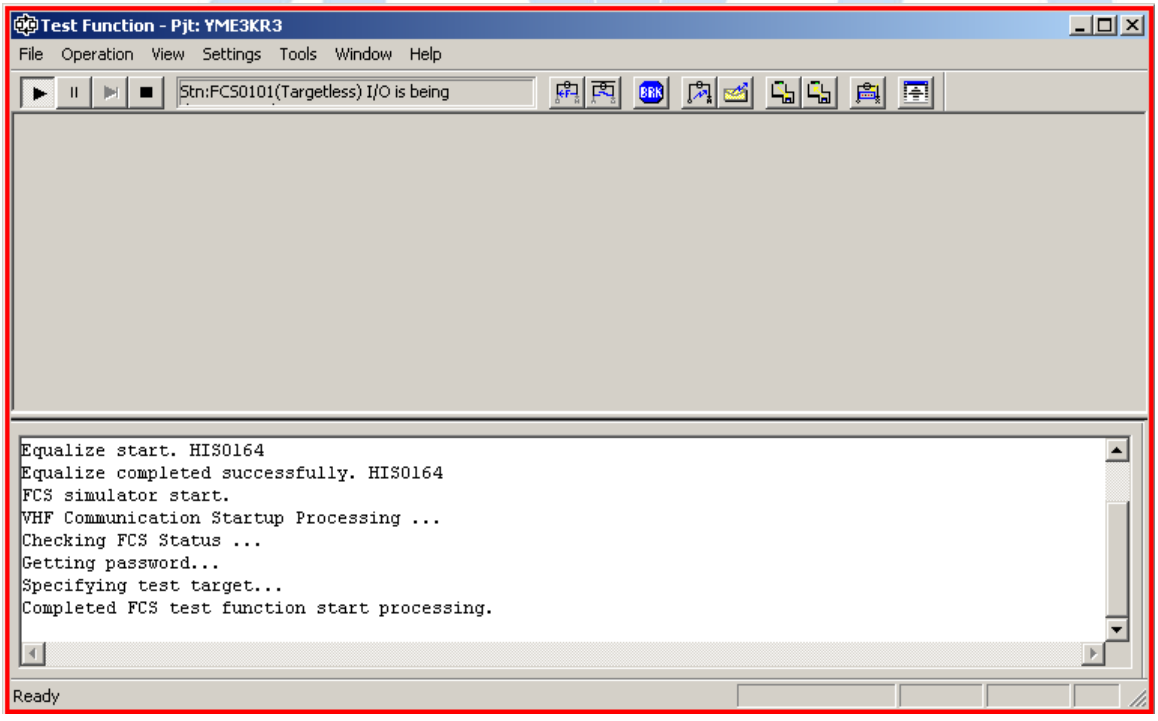

Figure: Window to indicate the completion of FCS test function processing.

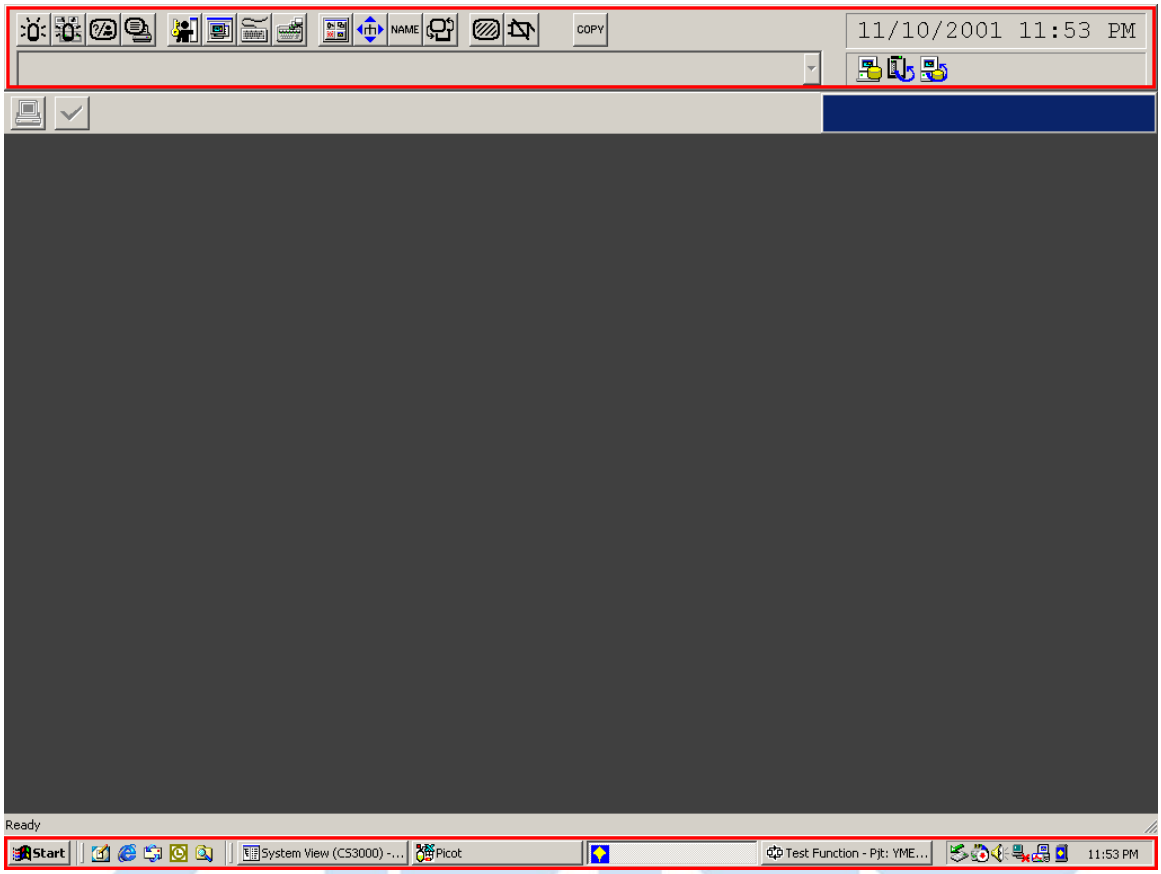

Figure: Virtual HIS Operation and Monitoring function in Full-Screen Mode.

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Objectives
1. Target system
2. Non-Target system
3. Concurrent engineering
4. Engineering flow

CHAPTER 4
ENGINEERING ENVIRONMENT

ENGINEERING ENVIRONMENT

The engineering work is done on the ENG (Engineering Station), which has the standard builder function or system generation function installed. There are potentially following two types of engineering environment.

- ***Target System***
- ***Non-Target system***

1. TARGET SYSTEM

In case of target system, the system generation is done on the ENG and loaded to the components connected on-line. In this case all the system hardware is connected in the network.

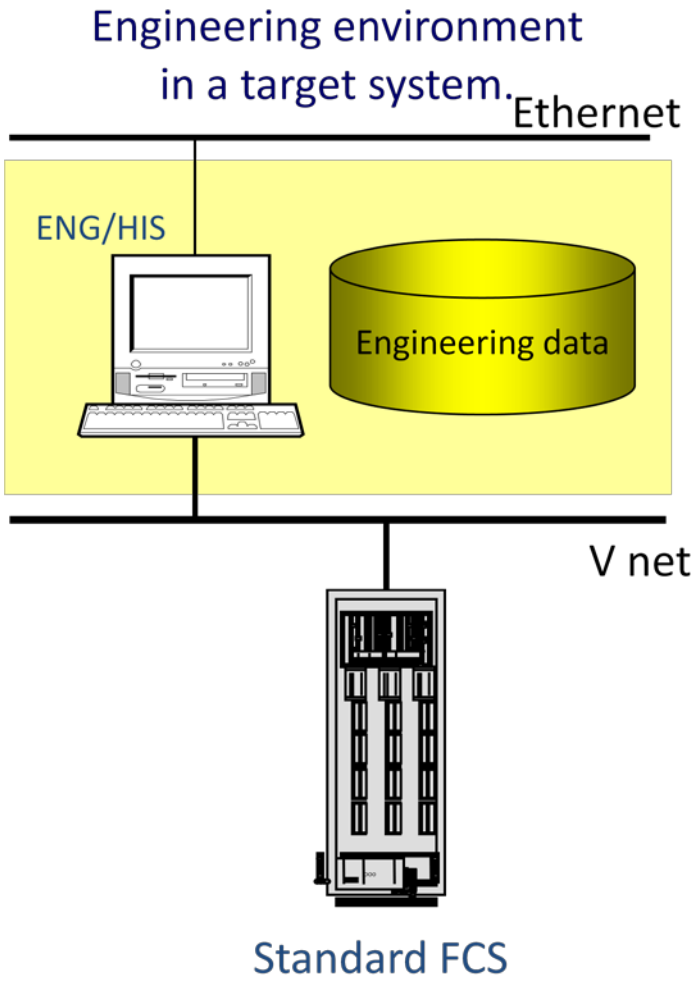

Figure: Target system.

2. NON-TARGET SYSTEM

In case of non-target system, the system generation is done on a non-target ENG without any of the CS3000 system components. Once all the generation is completed, the same is tested using the virtual test function. The project is then copied into a secondary media and loaded on to the target ENG and then off-line downloaded to all the components after the complete network is connected. This function allows the engineering work to start even before the actual CS3000 hardware components are procured.

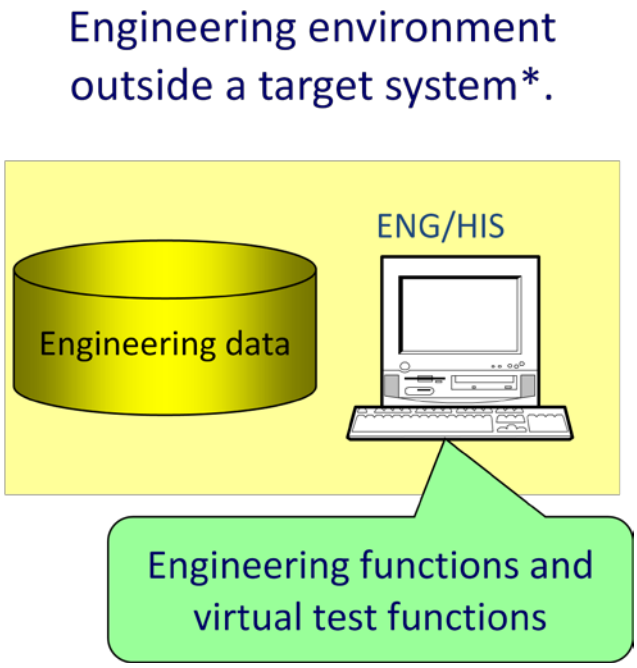

Figure: Non-Target system.

3. CONCURRENT ENGINEERING

Using the Windows 2000 networking features, one engineering database is shared among several users thus achieving concurrent engineering. With this feature, a team of systems engineers could generate different sections of the project like, I/O generation, sequence/logic generation, graphics etc., thus reducing the system engineering time.

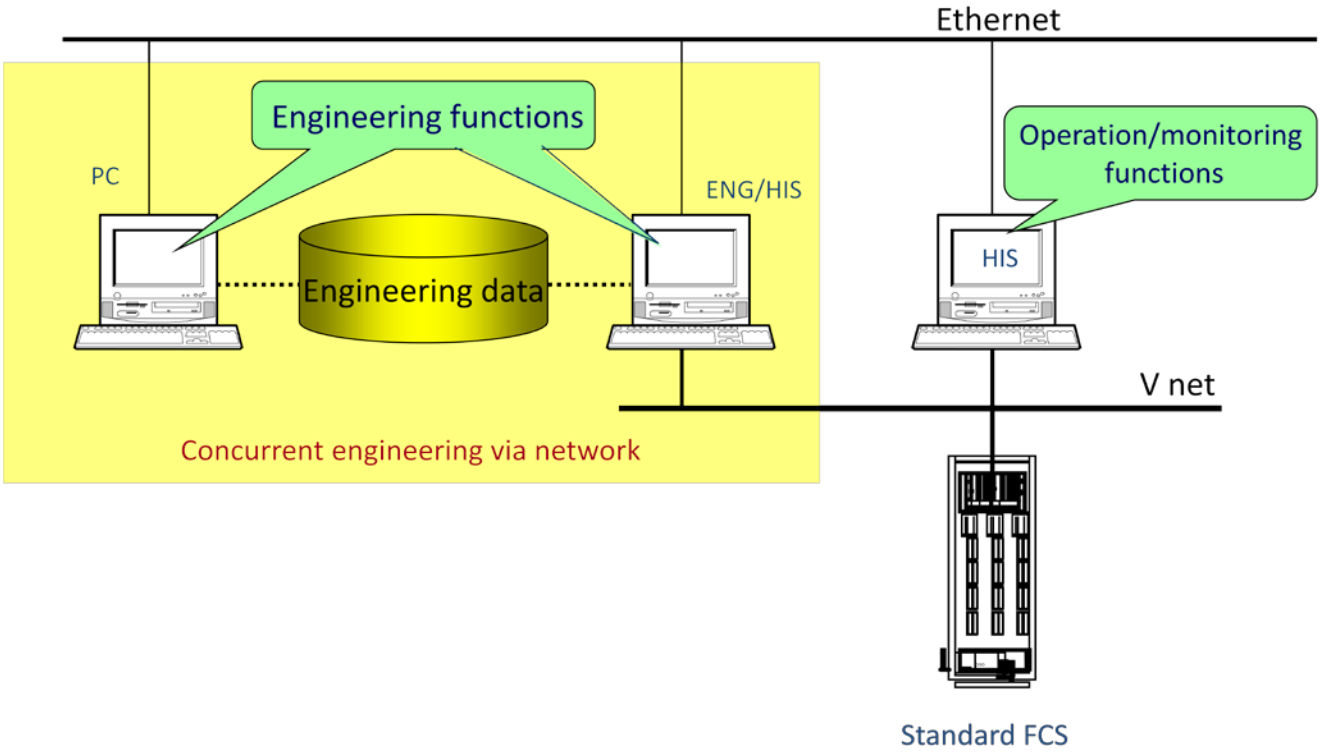

Figure: Concurrent Engineering.

4. ENGINEERING FLOW

The following engineering flow is followed in this course.

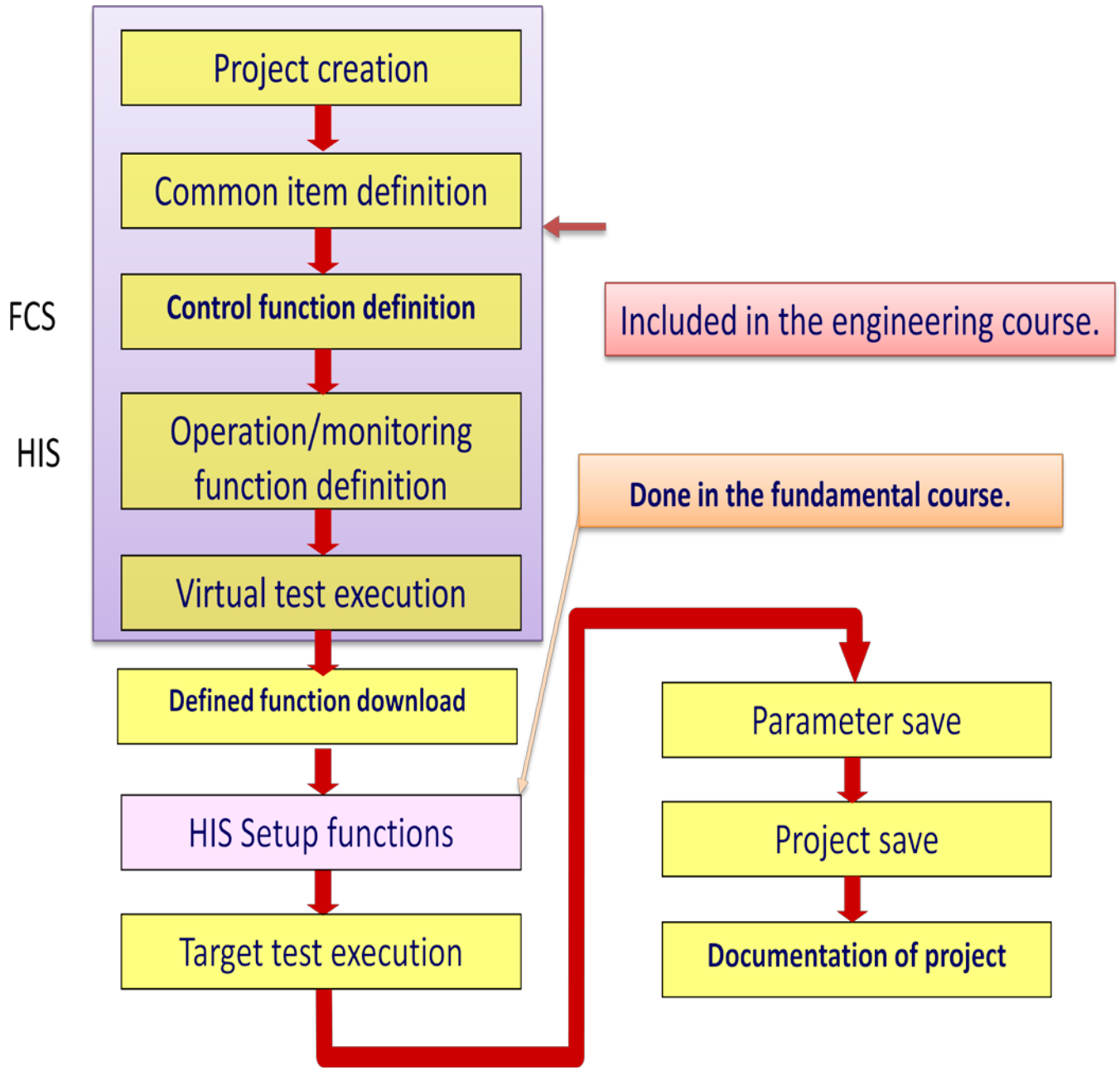

Figure: Engineering flow.

CHAPTER 5
PROJECT CREATION

Table of Contents

Objectives

1. Types of project

2. Creating a default project

3. Project attribution utility

PROJECT CREATION

This chapter explains the creation of a new project, different types of projects and project attributes.

1. TYPES OF PROJECT

A project is a folder that contains the project database i.e. all the system component folders and the files. All the builder files are modified and created under this project folder. There are three types of projects: the default project, the current project and the user defined project.

DEFAULT PROJECT

The default project is automatically created when the system view is started for the first time. Once all the system generation is carried out using the default project and the FCS is off-line loaded, this default project is converted to a current project automatically. If a project is defined as a default project, on-line functions cannot be performed unless it is converted into a current project. With a default project, virtual test function can be performed.

CURRENT PROJECT

When a FCS off-line loaded using a default project, the default project is automatically converted into a current project. This allows on-line functions to be performed. Both default and current project cannot co-exist. The image of the current project components is same as the actual components installed in the network. Hence only one current project can exist. A target test function can be performed if a project is a current one.

USER-DEFINED PROJECT

A project copied from a default or a current project is referred as a user-defined project. There could be as many user-defined project assigned in a system view. On-line functions cannot be performed from a user-defined project. A virtual test function can be performed from this type of project.

2. CREATING A DEFAULT PROJECT

- ***Start System view***

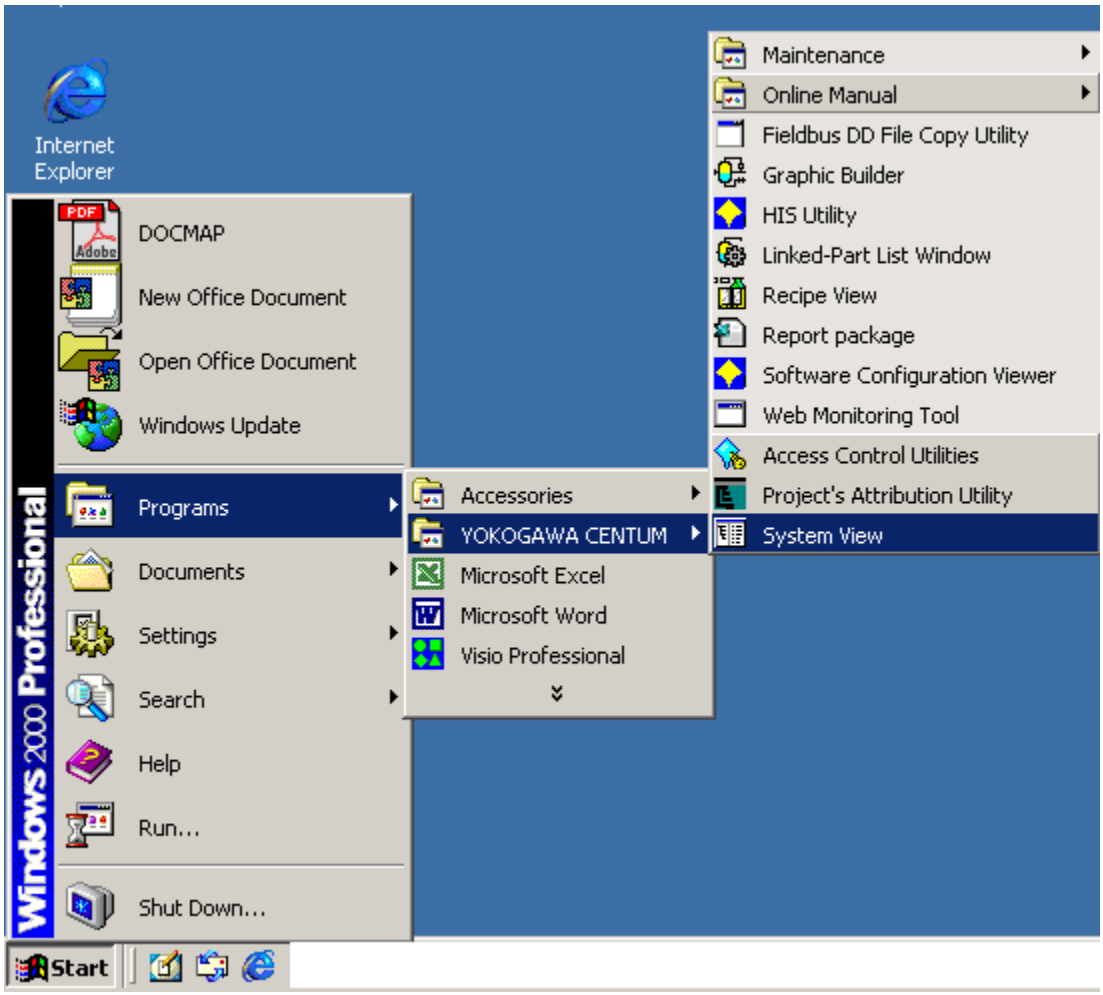

Figure: Start system view.

- ***Confirm default project creation***
  When the system does not find any project definition, it automatically prompts for a creation of a default project.

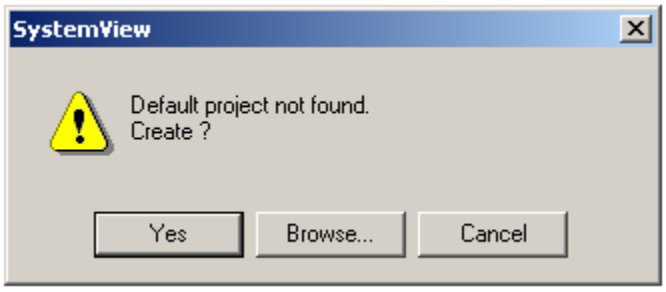

Figure: Confirmation of default project.

- ***Project out-line***
  Allows entering the user name and project information. It is mandatory to enter the project information details at least an arbitrary character.

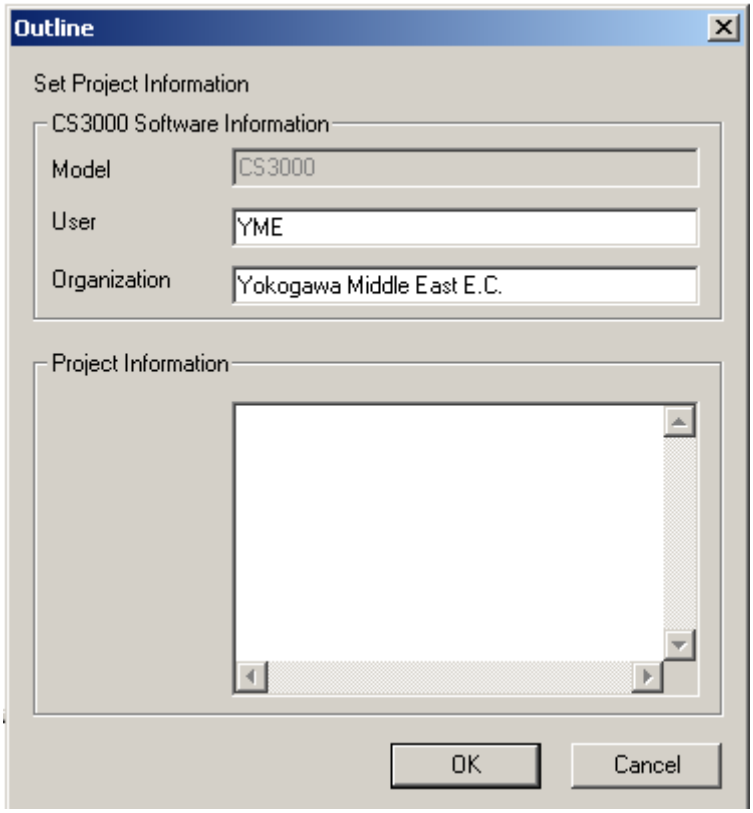

Figure: Project outline dialog.

- ***Project property***
  Allows entering the Project name (an alphanumeric characters less than 8 characters). This would be the main folder of the project under which all the sub-folders and files are created.
  Project location or position: Where the project directory resides. The default project path is Default drive\CS3000\eng\BkProject

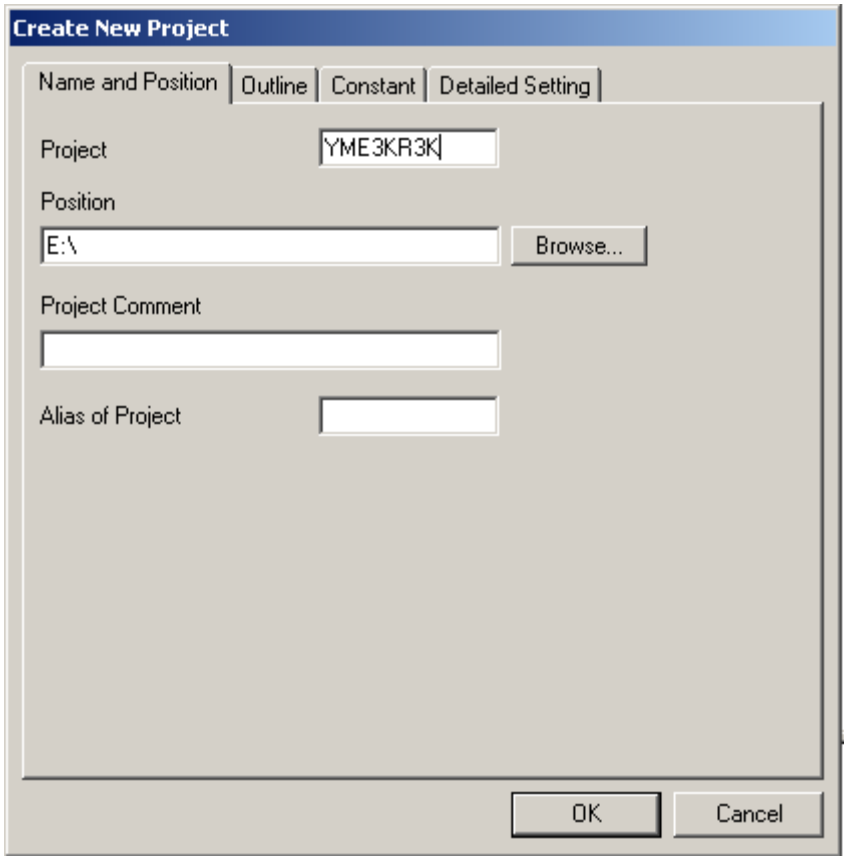

Figure: Create new project dialog.

- ***Creating FCS folder***
  For a CS3000 minimum system at least one FCS and one HIS are required. This prompts to create a FCS. The station number and address are assigned from this dialog. Once this is confirmed, the station number cannot be changed. Additional FCS stations can be created from the system view later.

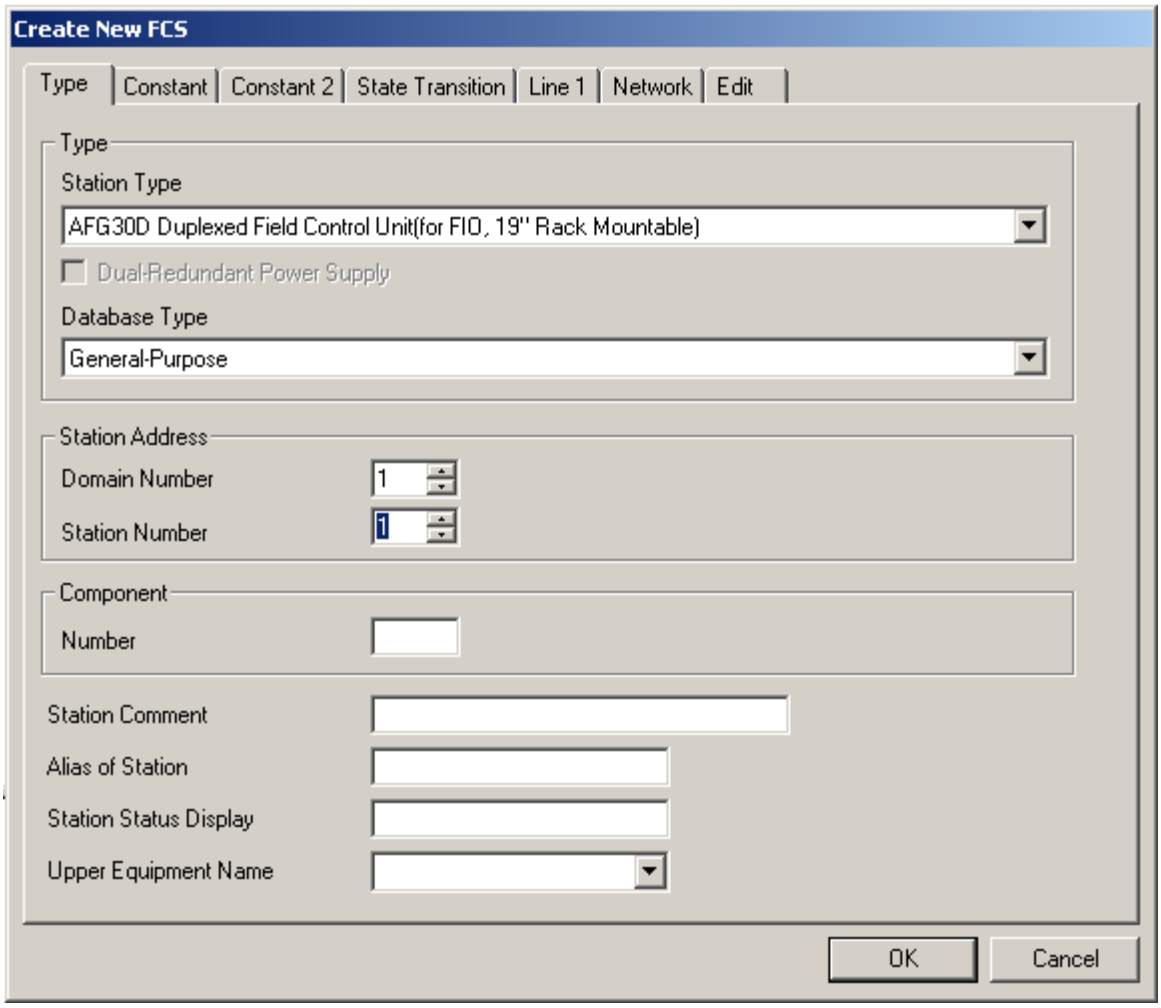

Figure: Create new FCS dialog.

- ***Creation of HIS***

  As mentioned above at least one FCS and one HIS are required for a minimum CS3000 system. The station number and address are assigned from this dialog. Once this is confirmed, the station number cannot be changed. Additional HIS stations can be created from the system view later.

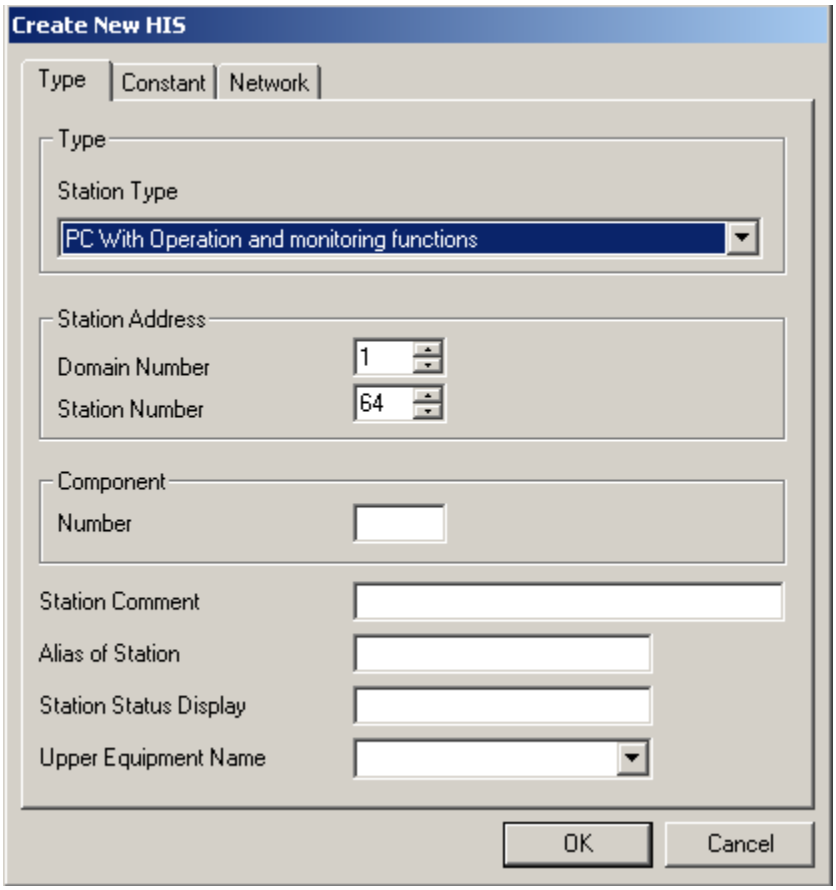

Figure: Create new HIS dialog.

- ***Project folder***

  Thus the project folder is created with one FCS and one HIS. Also a Common folder common to the entire project is created automatically. All the required sub-folders and files are created under each of the above mentioned three folders.

3. PROJECT ATTRIBUTION UTILITY

Project attribution utility is an engineering tool to register projects, modify the project type and delete project registration. Before the project attribution utility is started, the system view has to be closed.

START PROJECT ATTRIBUTION UTILITY

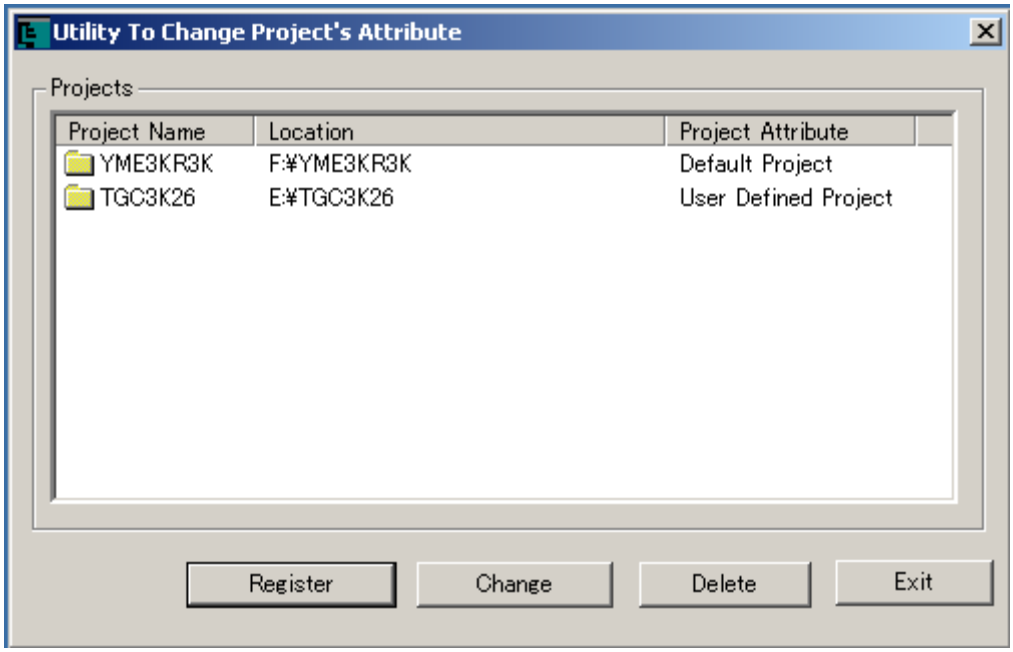

Figure: Project attribution utility.

REGISTERING A NEW PROJECT
This is used to register a new project in the system view. Even a network path for the project folder can be specified.

CHANGING PROJECT ATTRIBUTE
Using this a project attribute i.e. the property can be changed to one of the three types – Default project, Current project or User-defined project.

DELETING A PROJECT REGISTRATION
Using this a project registration can be deleted. This will not deleted the project folder from the hard disk.

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CHAPTER 6
DEFINING FCS CONFIGURATION

Objectives

1. ***FCS properties***
2. ***FCS station definition***
3. ***Scan transmission definition item***
4. ***Equipment***

DEFINING FCS CONFIGURATION

This chapter explains the detailed setting of the following items in the FCS folder.

- *FCS Properties*
- *FCS Station definition (FCS Constants) builder.*

1. FCS PROPERTIES

- ***FCS Station Type***
  There are five categories for FCS stations: SFCS, LFCS, APCS, KFCS and RFCS2. The required type of FCS is selected.

- ***Power Supply Unit in Dual-Redundant Configuration***
  Specify if the dual configuration is required for power supply unit. This is set as per the FCS hardware.

- ***Define Database Type***
  The database type for the FCS is decided according to the control system configured for the FCS. The different type of database handles different numbers of function blocks. Once a database type is defined, the database type cannot be changed. The number and types of function blocks vary based on the database selected. This is selected based on the project requirement.

- ***Station Address***
  Station addresses are used to identify the stations on the V net. The station address is composed of a domain number and a station number. Set a domain number for a new FCS to be created. Set a domain number in the range of 1 to 16. The domain number cannot be changed once it is set. Station numbers are used to identify the devices in the same domain of the system. With FCSs, the station number is generally set from 1 in ascending order. The station number may be set for each domain in the range of 1 to 64. The station number cannot be changed once it is set.

- ***Component Numbers***
  Component numbers are used for devices that are configured in the project. For example, assigning a component number to a FCS cabinet will be convenient for wiring the cables by labeling the connection origin or connection destination component numbers. Component number settings can be omitted.

- ***Station Comments***
  If more information about each station is required, the station comment may be input for each station. The station comment can be omitted.

The station comment is displayed on the FCS property tab.

- ***Alias of Station***
  An alias can be used as an alternative of station name. After setting aliases, the stations displayed on the HIS will be indicated by their aliases. An alias of a station can be defined with up to 8 alphanumeric characters.

- ***Station Status Display***
  A window can be designated to display the station status on HIS instead of using the HIS station status display panel. The name of this window can be designated using up to 16 alphanumeric characters.

- ***Upper Equipment Name***
  The name of the higher-level process equipment group in plant hierarchy can be designated using up to 16 alphanumeric characters.

- ***High-Speed Scan Period***
  High-speed Scan period may be applied when the fast response is required for the process control. 200 ms or 500 ms may be specified as the High-speed Scan period. 50 ms or 100 ms may be specified with keystrokes.

- ***Medium-Speed Scan Period - LFCS***
  Medium-speed scan period may be applied when the relatively faster response is required for the process control. Either 200 ms or 500 ms may be specified as the medium-speed scan period.

- ***Pulse Width***
  When the MC-2 or MC-3 blocks output signal conversion type is either [2-position Pulsive Output] or [3-position Pulsive Output], the time span of the contact output signal's ON (pulse width) may be set. The range for setting the pulse width is from 1 to 100 seconds. The default setting is 1 second.

- ***Serial Start Interval***
  The serial start function puts the motor control blocks (MC-2, MC-3) of the same control station into groups and starts multiple motor control blocks (MC-2, MC-3) in the same group sequentially at a specified interval when start requests are issued to these blocks simultaneously. Serial start is executed only when the manipulated output value (MV) is changed to a greater value. The serial start interval may be set between 0 and 9999 seconds. The default setting is 0 second.

- ***MLD-SW Block AUT/CAS***

Manual Loader Block with Auto/Man SW (MLD-SW) is a function block to switch the output between the signal from the connected function block such as a regulatory control block and the manual output signal of itself. The mode of the block other than MAN is AUT or CAS is selected from this setting. The default setting is [AUT].

- ***Action Type of SEBOL "drive" Statement***
  There are 3 action types of SEBOL "drive" statement that can be specified. In accordance with the block mode of the function block, which is running SEBOL and the action type specified here, the permission to output the operation commands to function blocks may be checked.

- ***Setting Options***
  When using option programs, the programs need to be registered on the FCS properties setting box. After installing the option programs, the programs may be listed on the properties setting box for registration.

- ***Blocks with User-Defined Data Items***
  The user-defined blocks should not be specified in the area that may duplicate with others in whole FCS. When using the blocks with user-defined data items (SFC block, unit instrument), a specific area for the user-defined blocks needs to be specified. [Number of Block Type] displays the allowed number of block types for the current type of FCS database. [Block-type start number] may be set with reference of the [Number of Block Type]. For example, if the allowed number of block types is 20 for both FCS0101 and FCS0102, and the [Block-type start number] for FCS0101 is set to 0, the areas from 0 to 19 is reserved for FCS0101. Thus the [Block-type start number] for FCS0102 may be set to 20 or greater.

- ***Action when Downloading to IOM***
  When downloading to an I/O module, the behavior of function blocks connected to the module may be specified as IOP (input open) or not.

- ***SS-DUAL PV Update during Deviation Alarm***
  When SS-DUAL block signal selector switch is at the position 3, both input1 and input2 will be monitored. If one of them is not normal, the switch will select the normal side input. If a deviation alarm occurs, to update PV or to hold the current PV can be set by checking this option. When checking the option box for [SS-DUAL PV Update During Deviation Alarm], if a deviation alarm occurs when the switch position is 3, the data status of PV will become BAD but the PV itself will continue to update vary with the selected input signal. The default setting does not check this option, so that when a deviation alarm occurs, the SS-DUAL will hold its current PV. This setting covers all SS-DUAL blocks for the whole FCS.

- ***Alarm Notify Action when All AOF Released***
  When alarm inhibition (AOF) of all function blocks are released, if the existing alarm gives an output or not can be specified by checking this option box. When checking [Alarm Notify Action When All AOF Released] option box, all the existing alarms will output when their inhibitions (AOF) are released all together. By default setting, this option box is not checked, so that the existing alarms will not output when AOF released. This setting covers the whole FCS; it can only be changed via offline maintenance.

- ***Specify Reference Station for Tag List***
  Enable to Designate Station for Referencing Tag List. The tag list of a designated station can be referenced when checking this option box. When this option is not checked, the stations start from smallest domain number and the smallest station number will be listed in ascending order and set as the default stations for referencing tag list.

- ***Annunciator Message Head Number***
  The annunciator message head number can be designated. When an annunciator is initiated, the data assigned for the annunciator can be referenced for the printing message. The annunciators from the designated annunciator head number will correspond one by one to the printing messages from the designated printing message head number.

- ***Printing Message Head Number***
  The printing message head number corresponds to the annunciator message head number can be designated. When the setting for annunciator message head number or for printing message head number is not correct, an error will be displayed in the dialog box and the setting will become invalid.

- ***State Transition Matrix***
  When the FCS database is a type of database for unit configuration, state transition matrix can be defined. Maximum specification number indicates the total number of state transition matrixes. This is only an indication and cannot be edited. A state transition matrix to be applied in this FCS can be selected from the state transition matrix list of this project.

- ***Making IO Bus Dual-Redundant: KFCS***
  Specify whether or not the ESB bus is made dual-redundant in an FCS in which only one CPU card is used. When this checkbox is checked to make the ESB bus dual-redundant. Also the interface card type is specified.

- ***Control Bus TCP/IP Settings***

Normally there is no need to change the TCP/IP protocol setting for the control bus. The IP addresses on the control bus are used to logically identify the HIS for communication among HISs on the control bus. In normal situation, the automatically determined setting should be used.

172. 16. dd. ss
172: System fixed
16: Identifier showing that the bus type is control bus (fixed)
dd: Domain number
ss: Station number

- ***Control Bus Subnet Mask***
  The control bus subnet mask is set to "255.255.0.0" as the default setting. In normal situations, this default setting should be used.

2. FCS STATION DEFINITION

The following explains the setting details of FCS station definition.

DEFINITION ITEM

- ***Start condition***
  The start condition determines which method to be used, initial cold start or restart, to initiate the FCU, upon turning on the power to FCU, which was in the power shutoff status. Select one from "MAN (Initial Cold Start)," "TIME (Restart in case of momentary power failure)" or "AUTO (Restart)." The default is "MAN (Initial Cold Start)."

Start Condition		*Start Operation*
MAN (Initial cold start)	-	*Initial cold start*
TIME (Restart at the time of momentary power failure)	*Prolonged power failure (Momentary power failure tolerant time-FCS power failure time)*	
	Momentary power failure (Momentary power failure tolerant time>FCS power failure time)	*Restart*
AUTO (Restart)	-	

Table: FCS Start condition

Initial Cold start:
Initial cold start is to reset all FCS's internal states and initiates the control operations from initial status.

Auto (Restart):
FCS Restart is a start operation that attempts to maintain the status before the operation stop status as long as possible in order to restart the operation. The start operation is executed after restarting the suspended function block processing where it was suspended and completing it.

Time:
When "TIME" is selected as the start condition, "Momentary Power Failure Tolerant Time" should be specified. "Momentary Power Failure Tolerant Time" is a definition item used to determine the type of start operation based on the power failure time. The length of power failure time is categorized into either "Prolonged power failure" or "Momentary power failure" by comparing the power failure time with the momentary power failure tolerant time. Tolerant Time: Set 0.0 to 4.0 (sec). The default is 2.0 sec.

- ***Digital Filter***
  The digital filter is a function in which the input signal is processed by the first-order lag filter in order to reduce input signal noise.

  The following is the computational expression for the digital filter:
  $Yn=(1-\alpha) \bullet X+\alpha \bullet Yn-1$

  α: Filter coefficient
  X: Input value
  Yn: Current filtering data
  Yn-1: Previous filtering data

  There are three kinds of digital filter coefficients.
  Digital Filter Coefficient 1: 0 to 1.00 (0.01 unit) – Default: 0.5
  Digital Filter Coefficient 2: 0 to 1.00 (0.01 unit) – Default: 0.75
  Digital Filter Coefficient 3: 0 to 1.00 (0.001 unit) – Default: 0.875

3. SCAN TRANSMISSION DEFINITION ITEM

To transfer/receive the values of global switches between stations, define the following scan transmission definitions on the FCS Constants Builder.

- ***Self station buffer size***
  Define the communication buffer size to transfer the values of global switches assigned to the present station to other stations.
  - ***Present station buffer size:***
    Define 32 or 1024 (bytes) to transfer the values, or 0 not to transfer them. The default is 0.

- ***Station definition type***
  Define whether to receive the values of global switches under the control of other stations if transferred.
  - ***Station definition type:***
    Choose "0: Not communicate," or "1: Individual Station Communication." The default is 0. When you choose "Individual Station Communication," define the communication buffer size to receive data.
  - ***Individual Station Definition (stations 1 to 64):***
    Define 32 (bytes) (same value as the buffer size of the present station defined at the sending station) to receive data, or 0 not to receive data.

DETAILED SETTING ITEMS

- ***Wind up Time***
  Windup operation is a preparatory processing for organizing time-series data that are required for control operations. The function block's input processing, control processing, calculation processing and alarm processing executed during windup operation are executed in the same manner as in normal operation. All output signal processing, except for the one that outputs control output signals to the process output terminal, are executed in the same manner as in normal operation. Sequence table blocks and logic chart blocks don't operate while windup operation is running.

  The windup operation time can be set on the FCS Constant Builder.
  - ***Wind Up Time: Set 0 to 100 (sec.).***
    The default is 60 sec.

- ***SEBOL / User C Ratio***
  The setting of the processing executed in the idle time in FCS's CPU is defined in "SEBOL/User C time ratio" on the FCS Constants Builder. This time ratio is set as "100 %" as default, means the total idle time of FCS's CPU is used by SEBOL.

- ***Interval for repeat warning alarms***
  The repeated warning alarm is a function that retransmits a process alarm message after a specified time has elapsed during the period between the alarm occurrence and recovery from the alarm, regardless of whether the alarm is acknowledged. The purpose of the repeated warning alarm is to notify the operator that a critical alarming state is continuing. The setting value is between 0 to 3600 seconds. When 0 is set, repeated warning alarm function is disabled. Default is 600 seconds

- ***Alarm mask for initial cold start***
  The repeated warning alarm has a function in which at initial cold start (include recovery from a long period of power failure) of the FCS, only the high-priority alarms are picked up from all the alarms and issued to the operation and monitoring consoles. When the initial cold start for the FCS is executed, as a rule, only the alarms that were newly activated after start are transmitted to the operation and monitoring console by the alarm mask function. However, for the alarms that are set as repeated warning, if alarm is in process, the process alarm message is transmitted even though it was not newly activated. However, if it is set as "alarm mask disabled" in the FCS Constants Builder, every alarm that is in progress will be classified as newly activated, and the process alarm messages will be issued at initial cold start.

- ***Inter-station data link communication period***
  The inter-station communication period is a time required to complete all inter-station data link processing within a FCS. It is specified in the FCS Constants Builder as a FCS-specific constant. The default is one second. During inter-station data link processing, inter-station data link processing at all points is completed within the time in seconds corresponding to the "inter-station communication period." The number of inter-station communications points executed in one second is shown below. Points obtained by rounding up the result of the following equation to the nearest multiple of 8.

  (Effective inter-station data link points) = (round up by every 8 points)
  (Inter-station communication period)

- ***Retransmission skip when Inter-station data link error***
  When a communication error is detected during inter-station data link processing, inter-station communication transmission skips for a period of time then retry the transmission in the interval of this skip period. This re-transmission skip period is expressed as follows:

  Re-transmission skip period = (Inter-station communication period) * (re-transmission skip times)

The default is 60. If the inter-station communication period extends, the re-transmission skip period extends accordingly.

4. EQUIPMENT

- ***Equipment name***
  The equipment name is assigned for each equipment object registered in the plant hierarchy. The name is specified using up to 16 alphanumeric characters. Make sure no equipment name conflicts with another within the same project. However, when registering the custom unit equipment, specify an identical equipment name for both the default and custom unit equipment.

- ***Upper Equipment name***
  The upper equipment name refers to the name of the equipment object located in the next upper layer of an equipment object in a plant hierarchy. Specifying an upper equipment name via the Plant Hierarchy Builder determines the location of an equipment object in the plant hierarchy. Only custom equipment names can be specified as the upper equipment name.

- ***Equipment comment***
  A comment may be attached to an equipment object as a note when generating a system. The comment can be entered using 12 double-byte characters or 24 single-byte characters. This comment is not displayed in the operation and monitoring window. For a default equipment, the comment for corresponding equipment is attached as the equipment comment. For example, the station comment is attached as the station equipment comment, and the control drawing comment is attached as the control drawing equipment comment. For custom equipment, the user can freely define a desired comment.

Instrumentation & Control Services

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Objectives

1. Creation of a new node

2. IOM builder

CHAPTER 7
PROCESS INPUT/OUTPUT

PROCESS INPUT/OUTPUTS

This chapter explains the definition of Nodes and Input/Output modules for KFCS. Process inputs/outputs are used to exchange signals between field equipment and an FCS. There are three types of process inputs/outputs:

- ***Analog input/output***
- ***Contact input/output***
- ***Communication input/output***

Process input/output signals are used as input/output signals for the regulatory control, arithmetic calculation and sequence control.

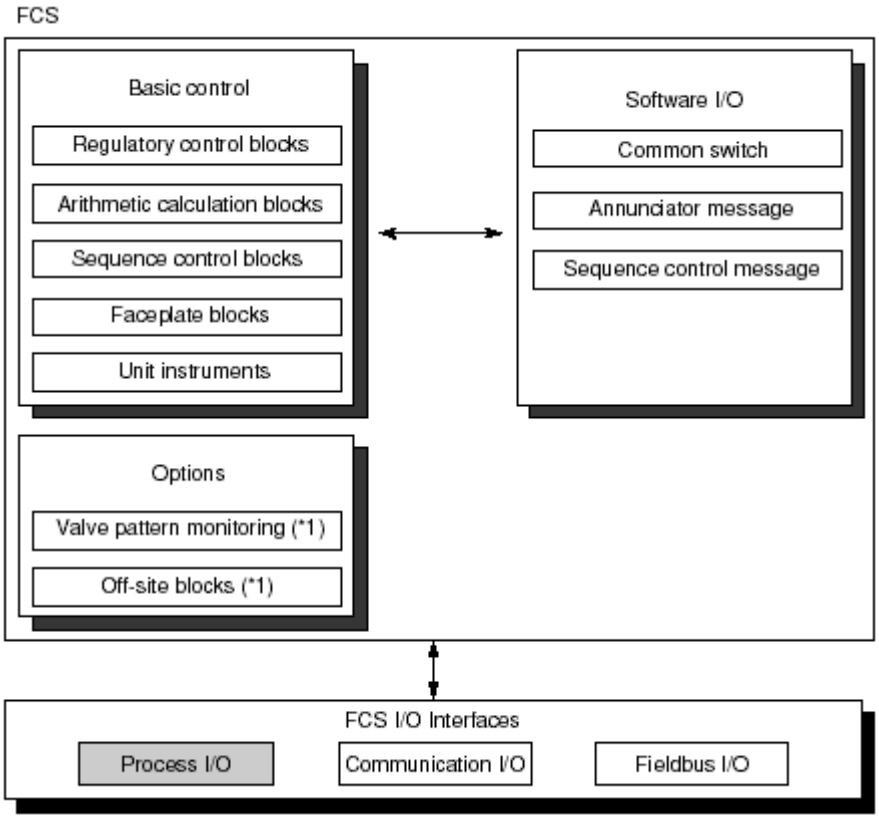


Figure: Relationship of Process I/O with basic control

1. CREATION OF A NEW NODE

Create a new node for installing an I/O module. While selecting the [IOM] folder, select [Create New] [Node] from the [File] menu. The following new FIO node dialog box for creating a new node will be displayed:

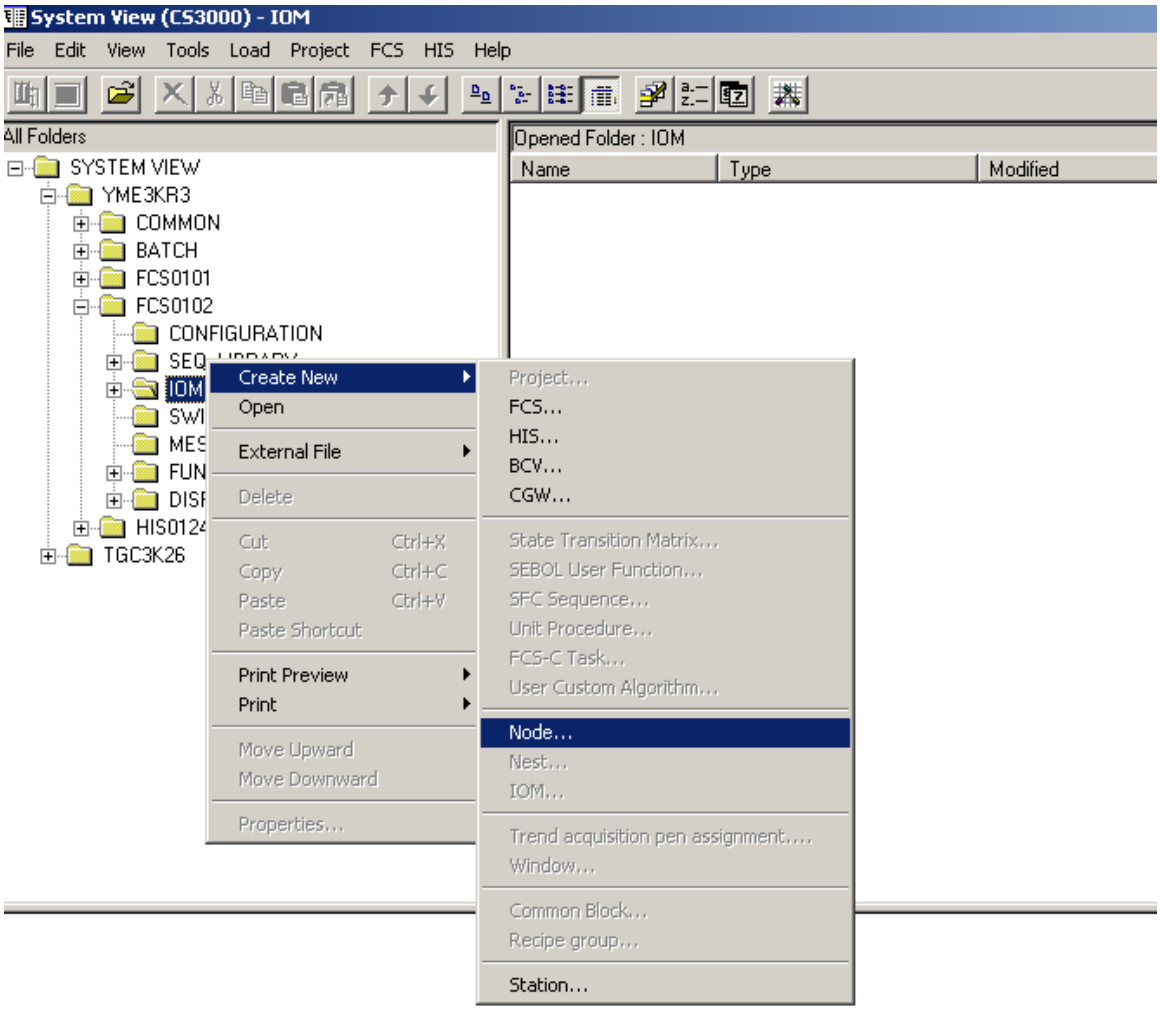


Figure: Creation of a new node.

The following dialog appears to set the details of the node.

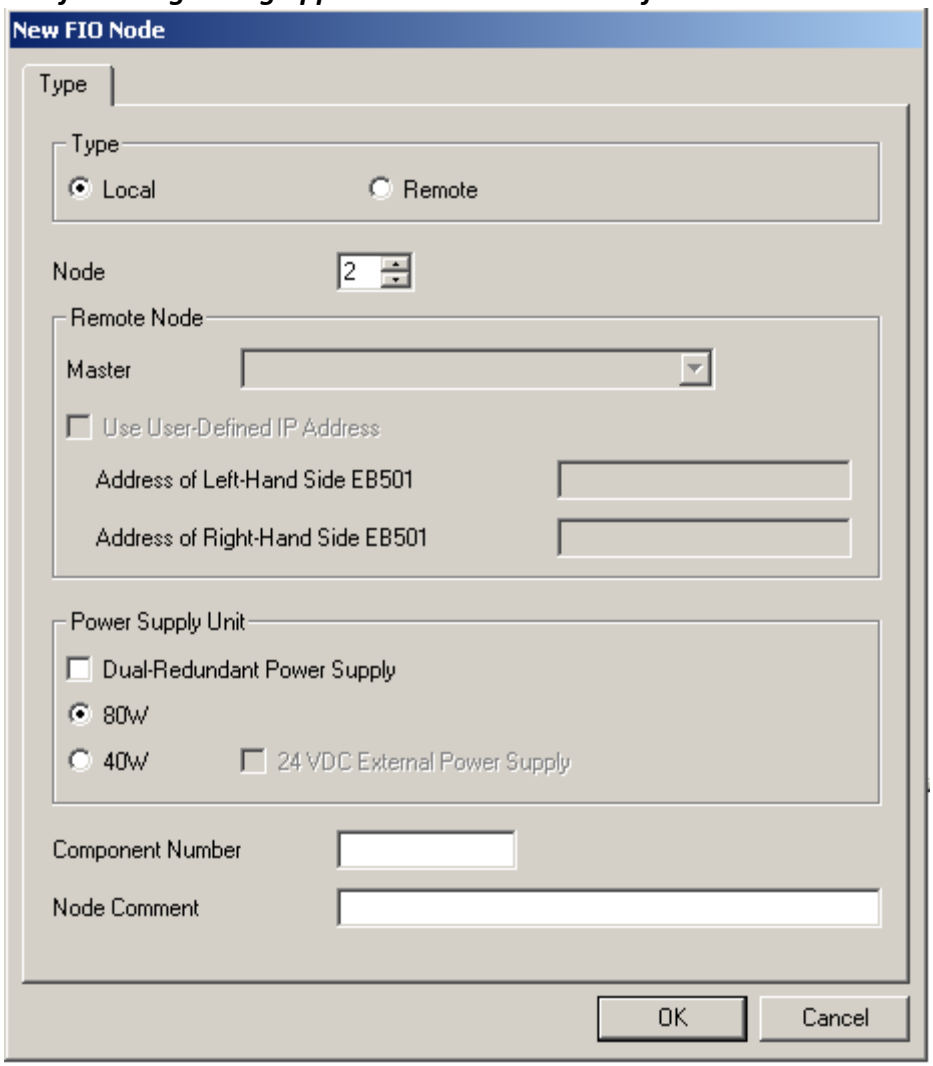


Figure: New FIO node dialog box

- ***Type***
  Two selections, Local and Remote, are available for Type. Specify the type of a node to be created. To create a remote node, it is necessary to define an EB401 (ER bus interface master module) for a local node to which that remote node is to be connected in advance.

- ***Node Number***
  The node number is used to identify a node unit. Specify a node number between 1 and 10. The default node number is 1. A maximum of 10 local nodes, a maximum of eight remote nodes, and a total of 10 local and remote notes when they are mixed can be connected. Also, a maximum of four ER buses can be connected to each KFCS2/KFCS.

Remote Master specification

Select the installation position of the EB401 (ER bus interface master module) to which a remote node is to be connected. Specify this item only when the node type is remote. The installation position is expressed in the following format:

NODEn\sEB401
n: Node number
s: Slot number

- ***Power supply redundancy***
  Specify whether or not to make the power supply unit dual-redundant. To make the power supply unit dual-redundant, check this check box. This check box is unchecked by default.

- ***Power supply capacity***
  The power supply unit has two options, 80W or 40W. When using 80W power supply unit, up to six modules(*1) which can supply power to field transmitter can be installed in one node unit. If 40 W power supply unit is used, the external power supply is required when the I/O modules providing power to the field transmitters. in this case, check the check box of [24VDC from External Power Unit]. If the installed I/O modules do not supply power to the field transmitters, do not check the check box of [24VDC from External Power Unit]. Thus the 24VDC will not be supplied to the field transmitters.

- ***Component Number***
  Enter the component number within eight single-byte characters. This field is blank by default. The component number is a number assigned to a cabinet that houses an FCS. This number is used to indicate the connecting source and destination of each cable when cables are wired. The specification of the component number may be omitted.

- ***Node Comment***
  Enter a comment on the node within 24 single-byte or 12 double-byte characters. This field is blank by default. The specification of the node comment may be omitted.

CREATION OF NEW IOM

Once the node is created. The IOM that are installed in the node are defined. On the created node, right click and select create new, IOM

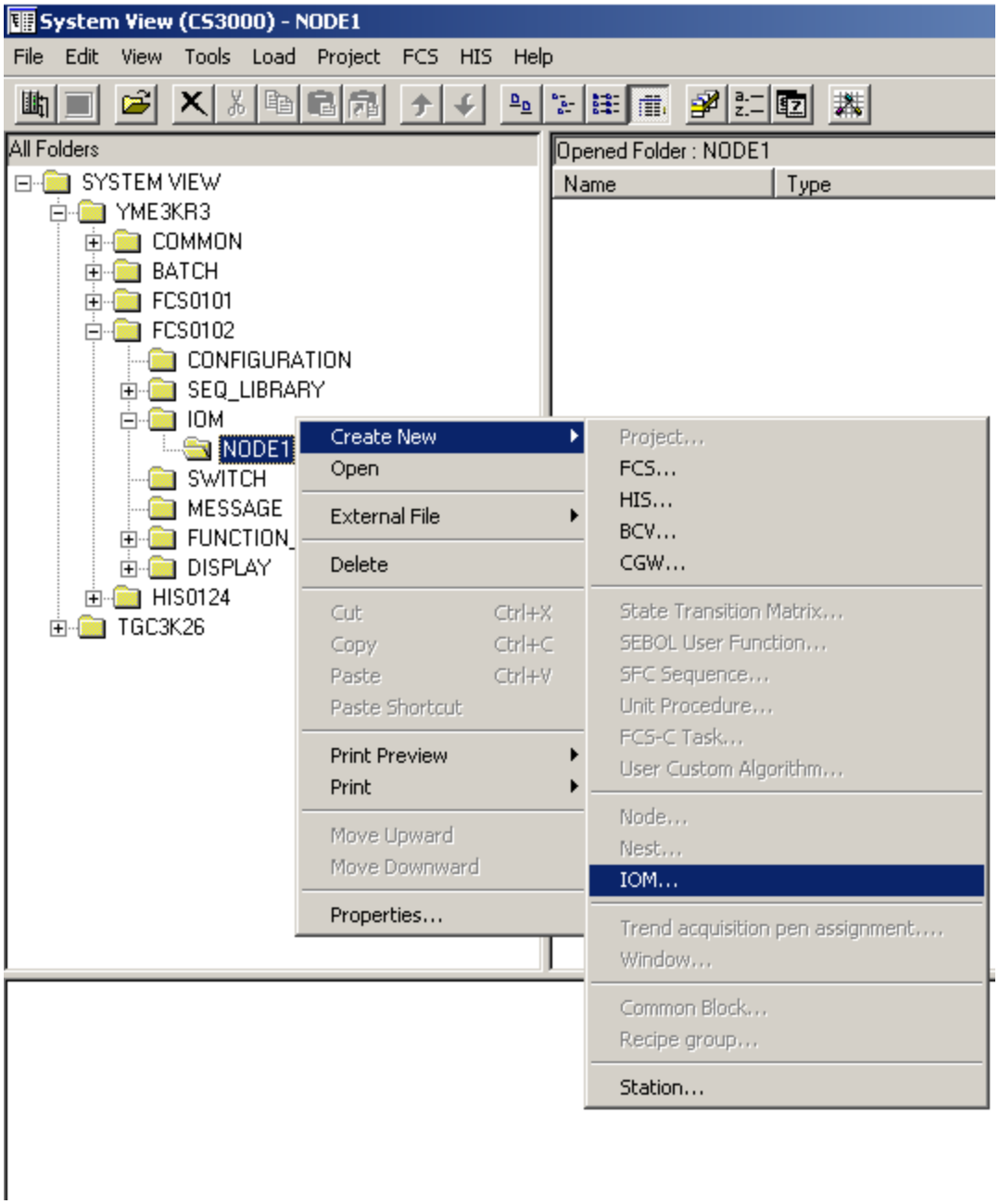


Figure: Creation of new IOM

The following example illustrates the definition of analog input/output module (IOM)

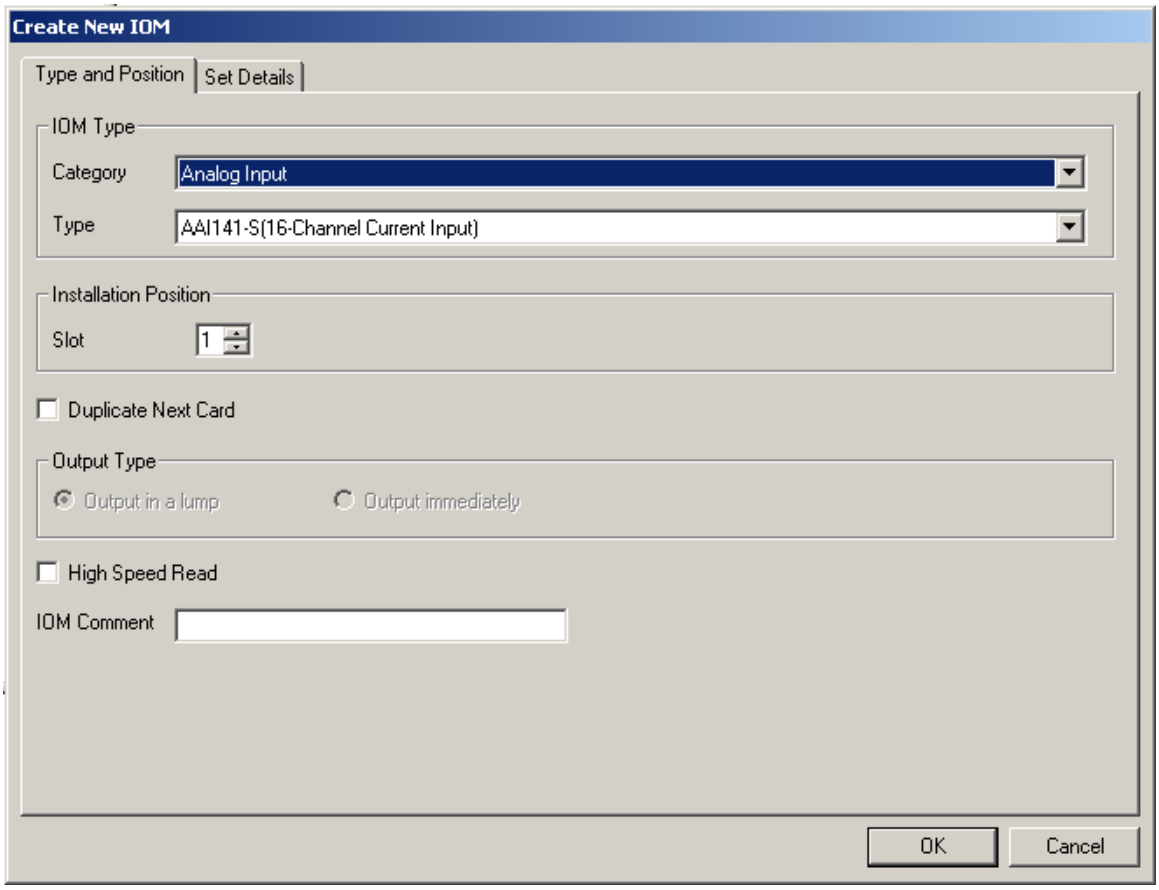


Figure: Create new IOM dialog

FIO (Field Network) Analog I/O modules are connected via ESB bus. The following table lists the category and types of FIO Analog I/O modules:

Analog I/O Modules

Model	I/O Types	Specifications
AAI141-S	16ch Input	4~20mA, Non-isolated
AAI141-H	16ch Input	4~20mA, Non-isolated, HART protocol
AAV141	16ch Input	1~5V DC, Non-isolated
AAV142	16ch input	-10~10V DC, Non-isolated
AAI841-S	8ch Input/8ch Output	4~20mA Input & Output, Non-isolated
AAI841-H	8ch Input/8ch Output	4~20mA, Non-isolated, HART Protocol
AAB841	8ch Input/8ch Output	1~5V DC Input, 4~20mA Output, Non-isolated
AAV542	16ch Output	-10~10V DC, Non-isolated
AAI143	16ch Input	4~20mA, Isolated
AAI543	16ch Output	4~20mA, Isolated
AAV144	16ch Input	-10~10V DC, Isolated
AAV544	16ch Output	-10~10V DC, Isolated
AAT141	16ch TC/mV Input	TC: JIS R, K, E, T, B, S, N/mV: -100~150mV, Isolated
AAR181	12ch RTD Input	RTD: JIS Pt100 ohm, Isolated
AAI135-S	8ch Input	4~20mA, Isolated channels
AAI135-H	8ch Input	4~20mA, Isolated channels, HART protocol
AAI835-S	4ch Input/4ch Output	4~20mA, Isolated Channels
AAI835-H	4ch Input/4ch Output	4~20mA, Isolated Channels, HART protocol
AAT145	16ch TC/mV Input	TC: JIS R, J, K, E, T, B, S, N/mV; -100~150mV, Isolated Channels
AAR145	16ch RTD/POT Input	RTD: JIS Pt100 ohm, POT: 0~10 kohm, Isolated Channels
AAP135	8ch Pulse Input	Pulse Count, 0~10 KHz, Non-isolated
AAP149	16ch Pulse Input	Pulse Count, 0~6 KHz, Non-isolated
AAP849	8ch Input/8ch Output	Pulse Count Input, 4~20mA Output, Non-isolated

Figure: Types of FIO analog I/O modules

Digital I/O Modules

Model	I/O Types	Specifications
ADV151	32ch Input	24V DC
ADV551	32ch Output	24V DC
ADV141	16ch Input	100~120V AC
ADV142	16ch Input	220~240V AC
ADV157	32ch Input	24V DC, Pressure Clamp Terminal Support Only
ADV557	32ch Output	24V DC, Pressure Clamp, Terminal Support Only
ADV161	64ch Input	24V DC
ADV561	64ch Output	24V DC
ADR541	16ch Relay Output	24~110V DC/100~240V AC
ADV859	16ch Input/16ch Output	Compatible with ST2 (Isolated Channels)
ADV159	32ch Input	Compatible with ST3 (Isolated Channels)
ADV559	32ch Output	Compatible with ST4 (Isolated Channels)
ADV869	32ch Input/32ch Output	Compatible with ST5 (Common Minus Side every 16-channel)
ADV169	64ch Input	Compatible with ST6 (Common Minus Side every 16-channel)
ADV569	64ch output	Compatible with ST7 (Common Minus Side Every 16-channel)

Communication Modules

Model	I/O Types	Specifications
ALR111	2 port	RS-232C (1200 bps ~ 115.2 Kbps)
ALR121	2 port	RS-422/RS-485 (1200 bps ~ 115.2 Kbps)
ALE111	1 port	Ethernet (10 Mbps)
ALF111	4 port	FOUNDATION Fieldbus H1 (31.25 Kbps)
ALP111	1 port	PROFIBUS-DPV1

Figure: Types of FIO contact and communication I/O modules

- ***Installation position - Slot***
  The slot number where the card is installed (1 to 8) is defined.

- ***Duplicate Next Card***
  The two I/O modules installed next to each other (odd numbered slot and the odd number + 1 slot) can be configured as dual-redundant. After checking the option "Duplicate Next Card," a duplicated IOM (sIOM name Dup) is created. If this option is unchecked, the duplicated IOM (sIOM name Dup) will be removed. The properties of the duplicated IOM (sIOM name Dup) cannot be modified. The property sheet and the contents in the property sheet cannot be accessed. When the original IOM is modified, the same modification will be automatically duplicated to the duplicated IOM (sIOM name Dup).

- ***Output Type***
  Output type can be specified to the analog input/output modules and analog output modules. Different output type makes the output to the modules or to the EB401 at different timings.
  Output in a lump: Output when all highest scan function blocks in the FCS complete their processing.
  Output immediately: Output when the connected function block is performing output process.

- ***High Speed Read***
  When check the option box [High Speed Read], CPU reads the data at high speed from the I/O module. However, the I/O modules for communication with remote nodes, and the I/O modules for Fieldbus communication, High Speed read option are not available.

- ***IOM Comment***
  Up to 24 alphanumeric characters or up to 12 double-byte characters can be put as IOM comment text. The IOM comment can be omitted. There is not comment text by default.

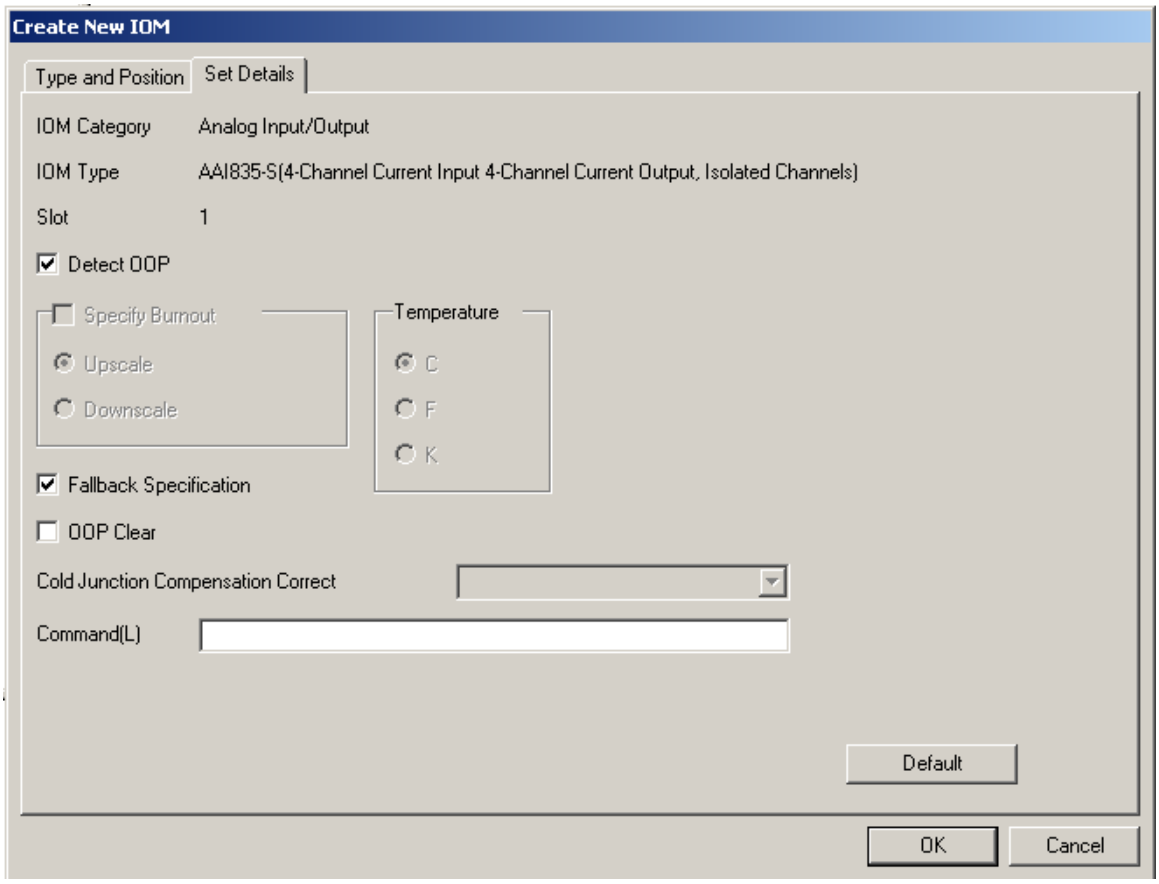


Figure: Detail setting of a Analog input/output IOM

- ***Detect OOP***
  Whether or not to detect the disconnection of the output signal (OOP: output open) is set in the I/O module properties. By default, this check box is checked.

- ***Fallback specification***
  Whether or not the operation of the fallback function is performed is set in the I/O module properties. By default, this check box is checked. If the modules are in dual-redundant configuration, [Fallback] cannot be unchecked.
  - ***If "Set Fallback" has been set, either "Maintain Current Value" or "Output" can be specified for each terminal with IOM Builder.***
  - ***If "Not performed" has been set, the current value is retained when an abnormality occurs in the processor unit or in the interface with the processor unit. However, even if the processor unit or the interface with the processor unit recovers to the normal state, the occurrence of that error will not be notified.***

- ***OOP Clear***

  The OOP clear function automatically sets the output to the tight-shut value when the output open (OOP) state has continued for more than the specified time (fixed at 4 seconds). Whether or not the OOP clear function is available is set on the I/O module properties. By default, this check box is not checked.

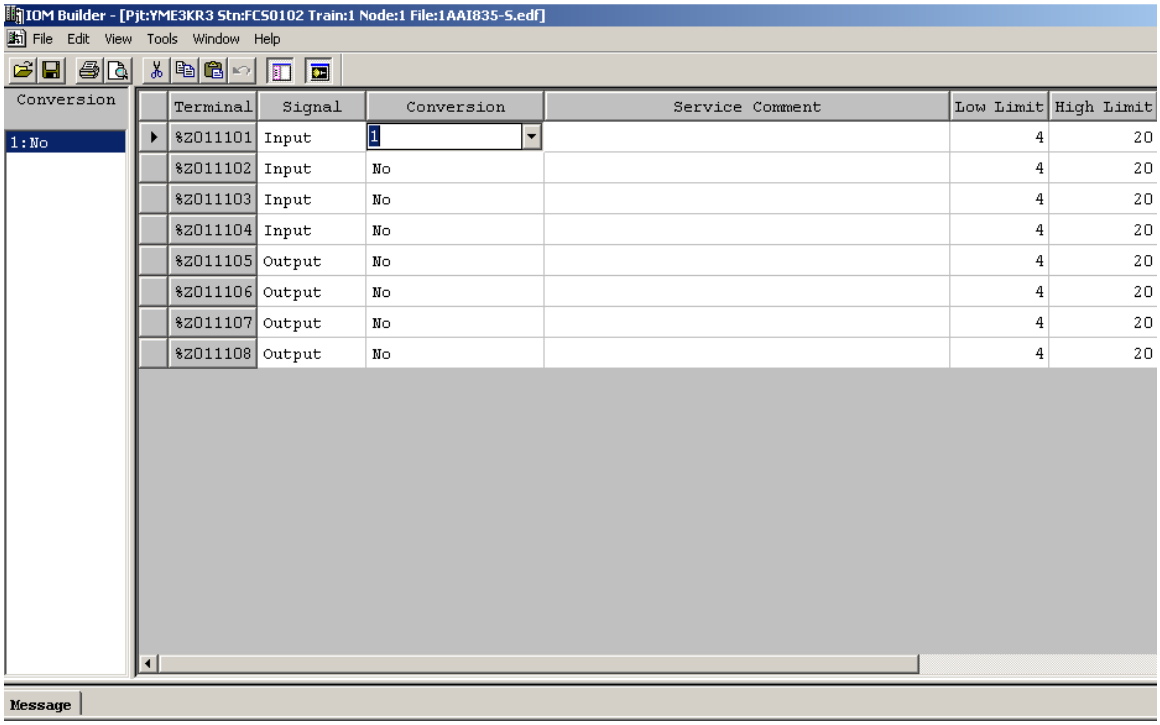
- ***Command***
  Specify a special setting for each I/O module in a command line. The following shows the commands that can input command lines for the analog I/O module:

Command	Description	Default	Specification method
SOOP	OOP detection level specification	0.00085 mA	0 to 0.023 A
ORBE	Output readback function specification	Yes for current output. In case of the voltage output, Yes when the I/O module is set as dual-redundant, and No when the I/O module is set as single.	Yes or No
CNCTCHK	Front connector disconnection check	Yes when the I/O module is set as dual-redundant, and No when the I/O module is set as single.	Yes or No

Table: Input command line for analog I/O module.

2. IOM BUILDER

IOM builder definition for AAI835 IOM is discussed in detail below.



- ***Terminal***
  A terminal of a process I/O or a Fieldbus I/O can be numbered in accordance with its physical position and the I/O module location. The format of a terminal number is as follows.
  %Znnusmm
  %Z: Identifier of process I/O (Fixed)
  nn: Node Number (01 - 10)
  u : Unit Number (1 - 8)
  s : For a Fieldbus communication module, s stands for segment number (1 -4). When using modules compatible to HART communication, for measured analog data s=1, while for the data via HART communication s=2. For other I/O modules s is fixed as 1.
  mm: Terminal Number (01 - 64)

- ***Conversion***
  No conversion is applicable for this type of card.

- ***Service Comment***
  The service comment is set with IOM Builder. Nothing is set by default. A string of up to 40 alphanumeric characters or 20 double-byte characters can be entered. The setting of the service comment may be omitted.

- ***High/Low range and Unit***
  The lower and upper limit values of the measurement range of the terminal is set with IOM Builder. The values that can be selected as the lower and upper limits of the range vary depending on the I/O module type, signal conversion type, and terminal position. For AAI835 type the low and high limits are fixed at 4 and 20 mA respectively.

- ***Set details***
  The details setting of the I/O module are carried out in IOM Builder. The items that can be selected vary depending on the I/O module type. For AAI835, the output points can have either direct or reverse setting. If direct is set, when the output reads 0% the current output to the valve would be 4mA and 100% implies 20mA. If reverse is set, when the output reads 0% the current output to the valve is 20mA and 100% implies 4mA.

- ***P&ID tag name***
  Nothing is set by default. A string of up to 16 alphanumeric characters or 8 double-byte characters can be entered. The setting of the P&ID tag name may be omitted.

- ***Label***
  The user-defined label can be set for terminals. Nothing is set by default. This can be used in the control drawings instead of system defined terminal names, which would difficult to remember. Up to 16 byte alphanumeric characters can be entered. The setting of the user-defined label may be omitted and in such case the terminal name should be used in the control drawing.

  The following shows the specification format of the user-defined label:
  %%Mnnnn

  %%: Unique to the system
  M: The third character must be an uppercase character (A through Z).
  nnnn: The forth and subsequent characters must be within 13 characters in a combination of uppercase and lowercase alphanumeric characters (A through Z, a through z, and 0 though 9).

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CHAPTER 8
CONTROL DRAWING BUILDER

Objectives

1. Control drawing
2. Control drawing environment
3. Tool bar definition
4. Registering the function block
5. Control drawing wiring

CONTROL DRAWING BUILDER

The Control Drawing Builder is used to configure the basic control functions of the FCS. With the Control Drawing Builder, operations such as registering function blocks in the drawing file and determining the flow of data between function blocks can be performed graphically. CS3000 R3 system contains 200 control drawings per FCS.

1. CONTROL DRAWING

CS3000 R3 system contains 200 control drawings per FCS. To access control drawing select FUNCTION_BLOCK folder under FCS folder. 200 control drawing files are displayed on the right. Double-click to open the desired drawing file.

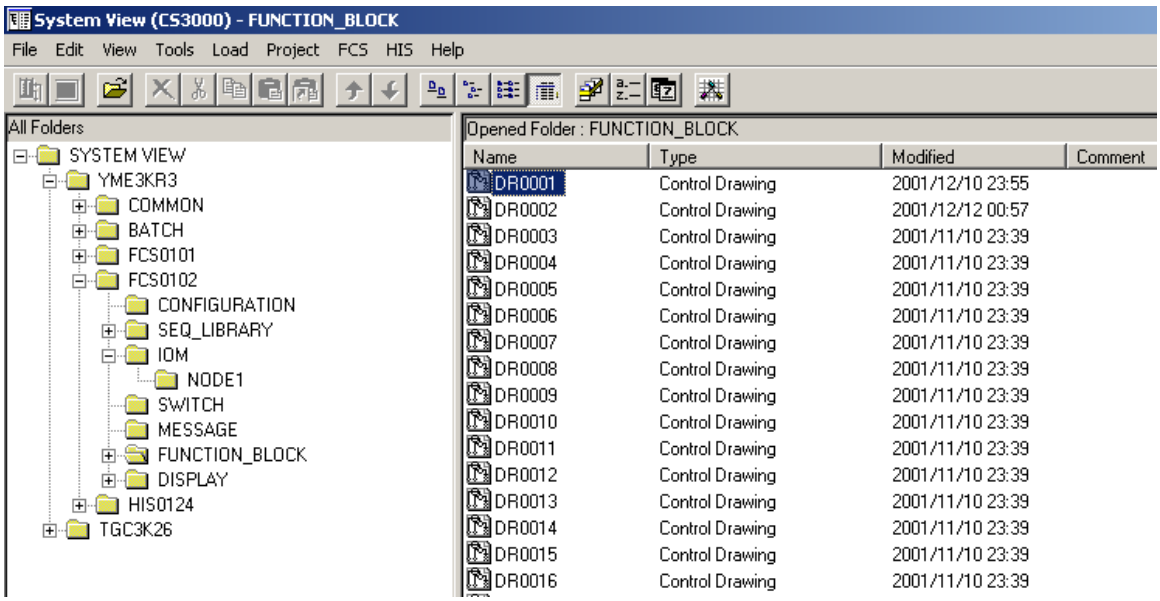

Figure: To open the control drawing file DR0001

2. CONTROL DRAWING ENVIRONMENT

The figure below shows the features of control drawing environment,

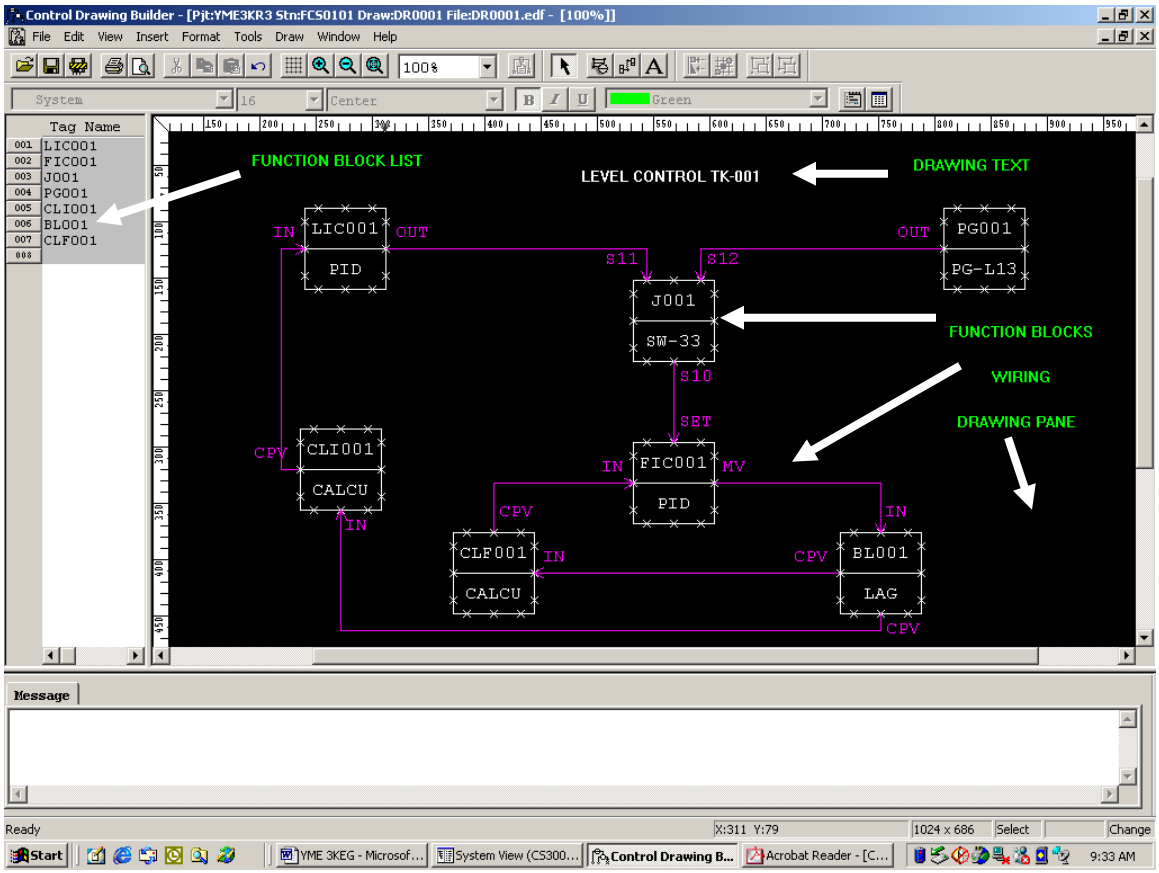

Figure: Control drawing environment

3. TOOL BAR DEFINITION

Icon buttons displayed in the upper area of the window provide the same functions as the menu. This series of icon buttons is called toolbar. Whether the icon buttons comprising the toolbar are displayed or not displayed can be set in the dialog box that appears when [Toolbar] is selected from the [View] menu. The four toolbars available are "Standard," "Draw," "Format" and "Edit object."

Figure: Draw tool bar

The icons in the above figure represent – Select Mode, Insert Function Block, Insert Wiring and Insert Text

4. REGISTERING THE FUNCTION BLOCK

To register a function block from the function block overview pane, select the line number, and then perform the following operation:

- ***Select [Insert] - [Function Block] from the pop-up menu displayed when the right mouse button is clicked.***

The Select Function Block dialog box appears, displaying a list of function blocks that can be registered.

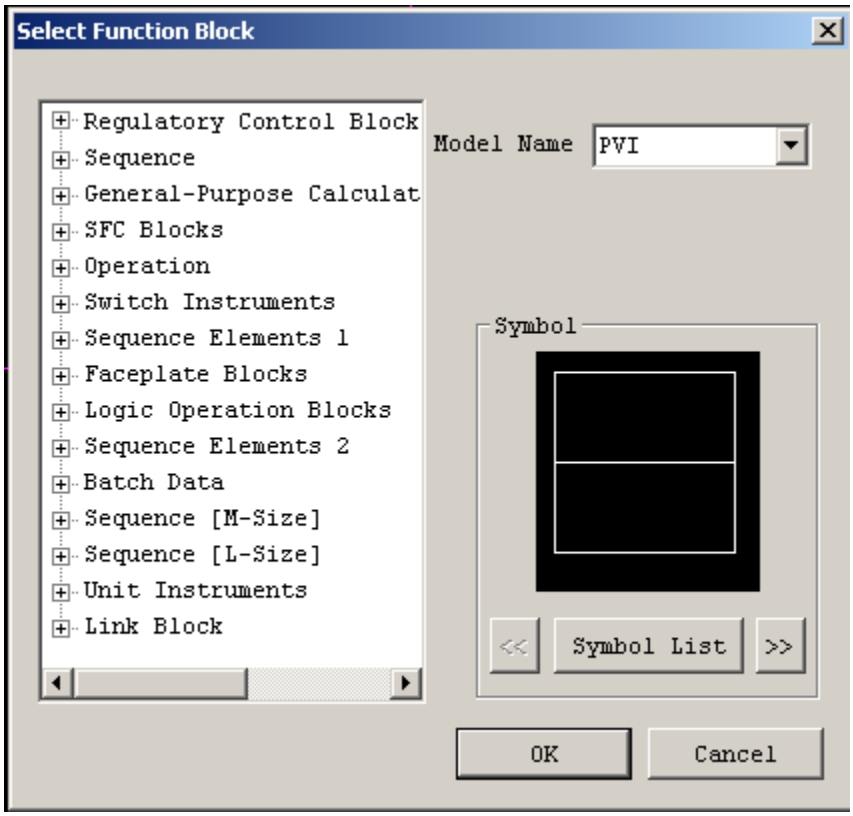

Figure: Function block dialog

5. CONTROL DRAWING WIRING

Wiring can be drawn by specifying an output connection terminal and an input connection terminal of block symbols in the drawing pane.

WIRING METHOD

Wiring is displayed with an arrow to indicate the flow of data between two function blocks or between a function block and a data link block. The three methods for drawing wiring are shown below:

- ***Automatic wiring***
- ***Manual wiring***
- ***All wiring***

With automatic wiring and group wiring, the property of the wiring drawn is set as "automatic." With manual wiring, the property is set as "manual." Whether the wiring can be edited or not is determined by its property. Also, there are forward wiring and backward wiring; these two types of wiring are displayed differently in the drawing pane. Forward wiring the means wiring follows the control sequence in the control drawing. Backward wiring means the wiring runs in the reverse direction from the control sequence.

[All wiring] may be used to convert the wiring information when changing the builder for editing the control drawing created on the function block overview builder, from the function block overview builder to the control drawing builder.

AUTOMATIC WIRING

To connect blocks with auto wiring, perform one of the following operations.

- ***Select [Wiring] on the [Insert] menu.***
- ***Click [Wiring] button at the toolbar.***

 ***Wiring icon***

Specify two points representing an output connection terminal and an input connection terminal of block symbols in the drawing pane. The wiring route is automatically determined and the wiring is drawn. The color of the wiring is purple.

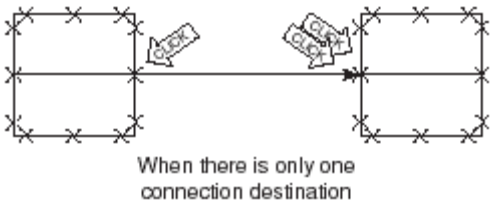

Figure: Automatic wiring when there is one connection destination

With automatic wiring, the wiring route is determined in accordance with the following rules:

- ***Two wiring lines both in the horizontal direction or in the vertical direction do not overlap with each other.***
- ***With the exception of block comments, no object cuts across the block area.***

Automatic wiring method has the following restrictions.

- ***Terminals that already have wiring connected or terminals that are used for block comments cannot be specified as an input connection terminal.***
- ***Wiring cannot be moved, or endpoint nodes cannot be inserted in wiring.***
- ***Up to 32 input connection terminals can be specified as wiring destinations for a single output connection terminal.***

Branching of wiring
Multiple destinations can be specified for a function block or data link block. In this case, the wiring will automatically branch when it is drawn.

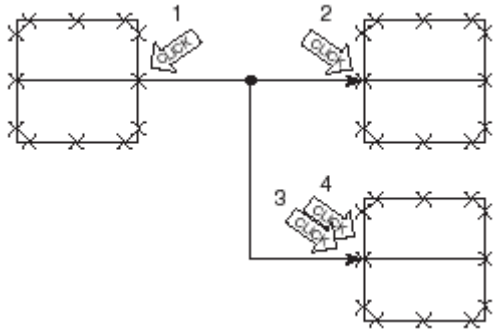

Figure: Branching of wiring in Automatic wiring.

Wiring that has already been drawn can also be modified to branch off. In the wiring already drawn, specify the point where branching should occur and specify the wiring destination.

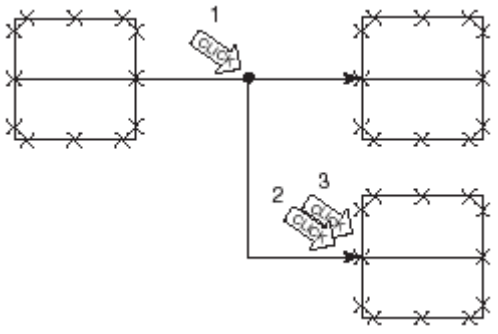

Figure: Branching of wiring already drawn.

Rewiring

All of the wiring already drawn in the drawing pane can be redrawn in accordance with the automatic wiring rules.

Select [Re-wiring] from the [Draw] menu.

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CHAPTER 9
DEFINING HIS FUNCTION

Objectives

1. HIS PROPERTY

2. HIS CONSTANTS BUILDER

DEFINING HIS FUNCTION

In this chapter the following items within the HIS folder is discussed.

- ***HIS Property***
- ***HIS Constants definition***

1. HIS PROPERTY

Select the HIS and right click and choose properties.

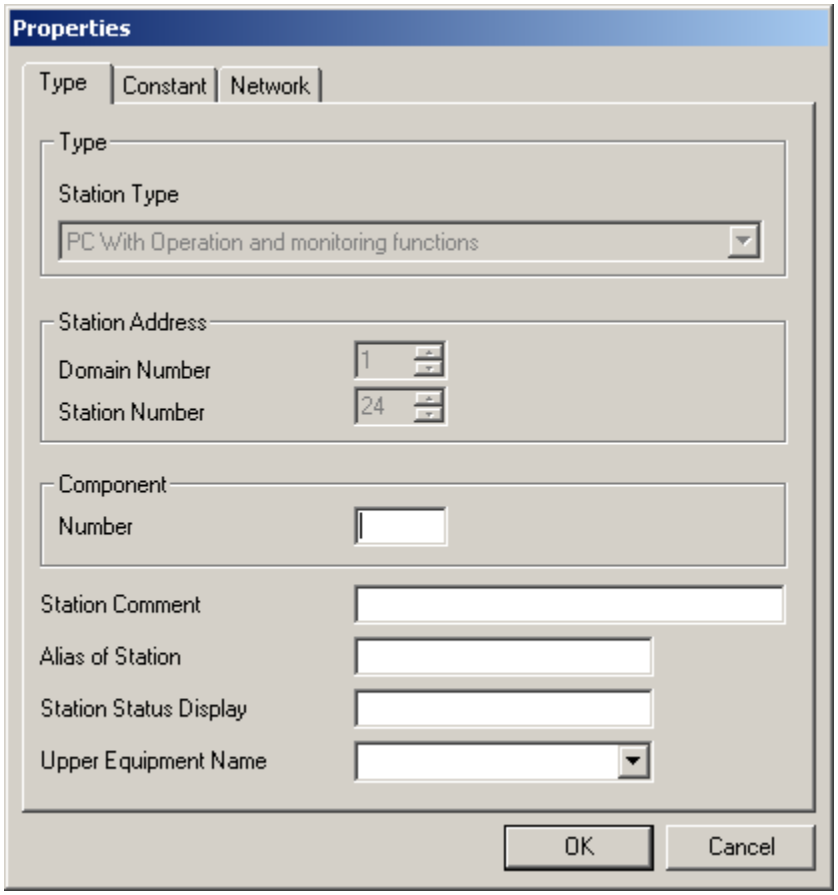

Figure: HIS Properties dialog

TYPE

- ***STATION TYPE***
  The following HIS station types may be specified. There are four station types for the HIS as shown below:
  - ***PC with Operation and Monitoring Functions***

- ***LPCKIT Enclosed Display Style Console Type HIS***
- ***YPCKIT Open Display Style Console Type HIS***

- ***STATION NUMBER, DOMAIN NUMBER***
  Set a domain number for a new HIS to be created. Set a domain number in the range of 1 to 16. The domain number cannot be changed once it is set. Station numbers are used to identify the devices in the same domain of the system. With HISs, the station number is generally set from the maximum number in descending order. The station number may be set for each domain in the range of 1 to 64. The station number cannot be changed once it is set.

- ***COMPONENT NUMBER***
  Component numbers are used for devices that are configured in the project. These numbers are used to indicate the connection origin or connection destination component numbers when wiring the devices. Component number settings may be omitted.

- ***STATION COMMENTS***
  If more information about each station is required, the station comment may be input for each station. The station comment may be omitted. The station comment is displayed on the HIS property tab.

- ***ALIAS OF STATION***
  An alias can be used as an alternative of station name. After setting aliases, the stations displayed on the HIS will be indicated by their aliases. An alias of a station can be defined with up to 8 alphanumeric characters.

- ***STATION STATUS DISPLAY***
  A window can be designated to display the station status on HIS instead of using the HIS station status display panel. The name of this window can be designated using up to 16 alphanumeric characters.

- ***UPPER EQUIPMENT NAME***
  The name of the higher-level process equipment group in plant hierarchy can be designated.

CONSTANT

- ***BUZZER ACK ID***
  The buzzer ACK ID is an ID that allows buzzers on other HISs with the same buzzer ACK ID to be reset when a buzzer is acknowledged on one HIS. The buzzer ACK ID can be set with up to eight single-byte characters.

- ***OPERATION GROUP IDENTIFIER***
  The operation group identifier is used for the identification if different operation groups exist. Up to eight single-byte characters may be used for an identifier. The first two characters are identifier characters, the rest are comment text.
  The default setting is [A1]. A wild card [*] may be used as the operation group identifier.

NETWORK

- ***CONTROL BUS HOST NAME***
  The control bus host name is automatically determined according to the bus type, domain number and station number. In normal situations, the automatically determined host name should be used.
  Mddss
  M: Identifier indicating that the bus type is control bus (fixed)
  dd: Domain number specified during project creation
  Domain number specified during HIS creation
  ss: Station number specified during HIS creation

- ***CONTROL BUS IP ADDRESS***
  The IP addresses on the control bus are used to logically identify the HIS for communication among HISs on the control bus. The IP address on the control bus is automatically determined according to the bus type, domain number and station number. In normal situations, the automatically determined setting should be used.
  172.16.dd. ss
  172: System fixed
  16: Identifier showing that the bus type is control bus (fixed)
  dd: Domain number specified during HIS creation
  ss: Station number specified during HIS creation

- ***CONTROL BUS SUBNET MASK***
  The control bus subnet mask is set to "255.255.0.0" by default. In normal situations, this default setting should be used.

- ***ETHERNET TCP/IP SETTINGS***
  Make sure that the names of HIS computer and HIS station match. Normally, there is no need to specify the Ethernet TCP/IP. Make sure to use the initial settings.

- ***ETHERNET HOSTNAME***
  The Ethernet Hostname will be automatically determined according to the bus type, domain number and station number. In normal situations, the automatically determined hostname should be used.
  Eddss

E: Identifier indicating that the bus type is Ethernet (fixed)
dd: Domain number specified when HIS was created
ss: Station number specified when HIS was created

- ***ETHERNET IP ADDRESS***
  Ethernet IP addresses are used to logically identify the HIS connected to the Ethernet. The Ethernet IP addresses are automatically determined according to the bus type, domain number and station number. In normal situations, the automatically determined setting should be used.
  172.17.dd. ss : Ethernet IP address
  172: System fixed
  17: Identifier showing that the bus type is Ethernet (fixed)
  dd: Domain number specified during HIS creation (*2)
  ss: Station number specified during the HIS creation

- ***ETHERNET SUBNET MASK***
  The Ethernet subnet mask is set to "255.255.0.0" by default. Normally, this default setting should be used.

2. HIS CONSTANTS BUILDER

Double click on the OpeconDef in the HIS configuration folder

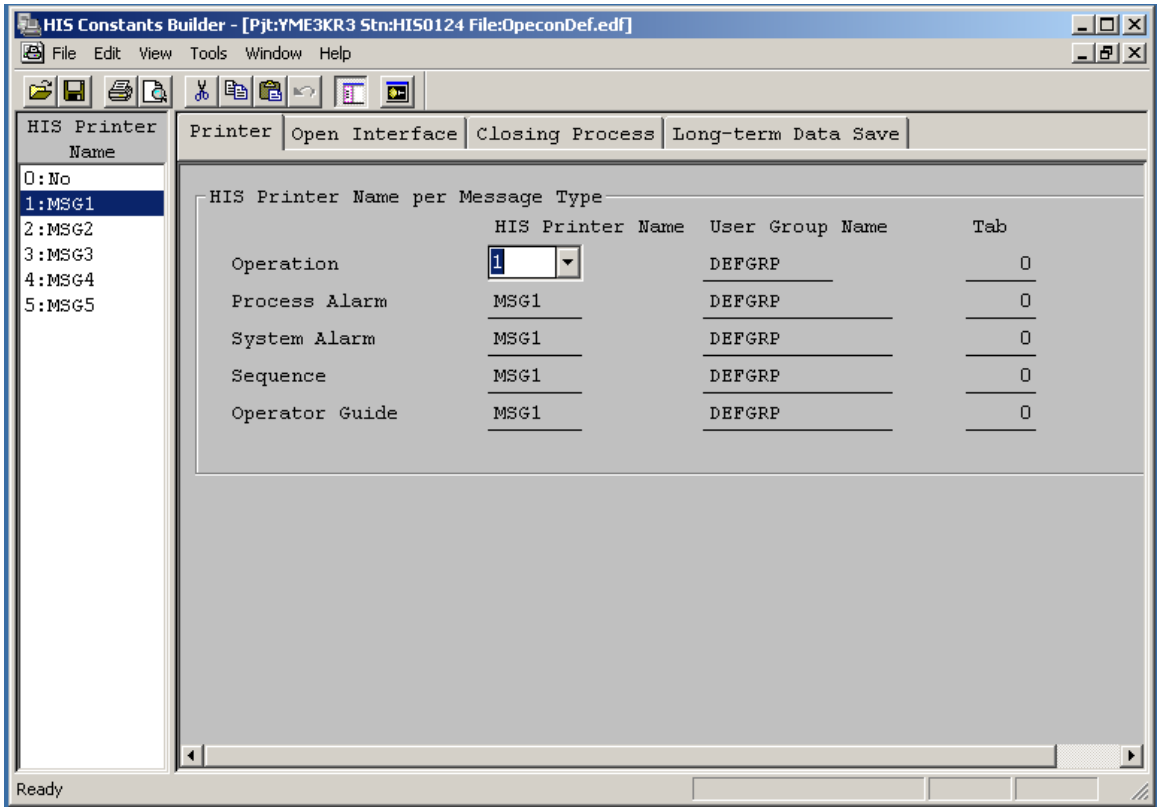

Figure: HIS Constants builder dialog.

PRINTER

- ***HIS Printer Name***
  Message output may be assigned to different printers, according to the message type. The assignment is defined in the printer definition tab of the HIS Constant Builder. The messages output to printer may be assigned, similar to the example showing below, as [None], [MSG1], [MSG2], [MSG3], [MSG4], [MSG5] according to the message type. The default setting is all types of message are assigned to MSG1.

Message type	HIS printer name
System message	MSG1
Process alarm message	MSG2
Sequence message request	MSG2
Operator guide message	None
Operation message	MSG3

Table: An example of Printer output definition

As the above example, since the process alarm message, and messages in response to the sequence message request are assigned to the same printer MSG2, both types of message are printed out from the same printer in the order of their arising. The HIS printer name here requires to be assigned a real printer, and this may be defined on HIS Setup window.

- ***User Group***
  When printing, the scope of operation and monitoring of the designated user group decides the scope of the message to print out. The message outside of the operation and monitoring scope cannot be printed. The default user group is DEFGRP (all), messages of all stations may be printed out.

- ***Tab***
  To define the start position for different types of message, the message printout may be in easy-to-read format. The print start position may be defined on the printer definition tab of the HIS Constant Builder.

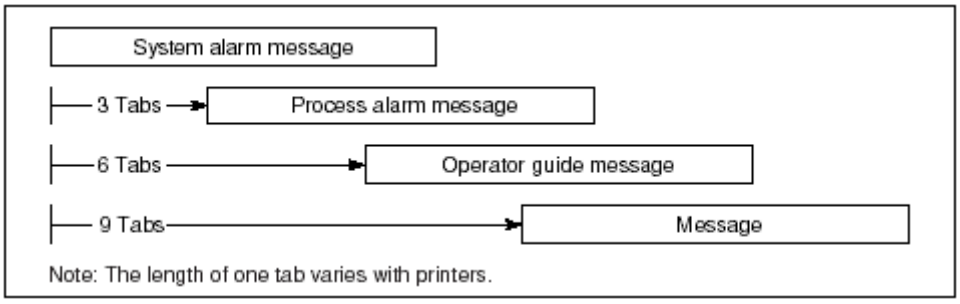

Figure Message Print Start Position

USER GROUP

When printing, the scope of operation and monitoring of the designated user group decides the scope of the message to print out. The message outside of the operation and monitoring scope cannot be printed. The default user group is DEFGRP (all), messages of all stations may be printed

CLOSING PROCESS

- ***Hourly Closing***
  In the hourly closing data process, the trend data of the previous one hour are gathered from the saved trend data file, in which the trend gathering pens specified for closing processing are also saved. The hourly closing data such as the average, total, maximum and minimum values are calculated for this one hour based on the gathered valid data. The calculated hourly closing data are stored into the hourly closing data files created for each trend gathering pen. Hourly closing data process is performed at the closing time of every hour. The number of data points used for the hourly closing processing vary depending on the trend sampling period.
  - ***Trend of 1-minute sampling period***
    Trend of 1-minute sampling period creates the hourly data using 60 points of data.
  - ***Trend of 2-minute sampling period***
    Trend of 2-minute sampling period creates the hourly data using 30 points of data.
  - ***Trend of 5-minute sampling period***
    Trend of 5-minute sampling period creates the hourly data using 12 points of data.
  - ***Trend of 10-minute sampling period***
    Trend of 10-minute sampling period creates the hourly data using 6 points of data.

- ***Daily Closing, Closing Time***
  In the daily closing data process, the hourly closing data of the previous 24 hours are gathered and the daily closing data are calculated for the day, including the average, total, maximum and minimum values. The calculated daily closing data are stored into the daily closing data files created for each trend gathering pen. Daily closing processing is performed after the hourly closing process at the daily closing time every day. The default daily closing time is 0:00 am. The daily closing time may be changed using the closing processing tab of the HIS constants builder to meet the requirement of the plant operation. Unlike the hourly and monthly closing times which are fixed by the system, whether data acquired until the daily closing time is the data of the closing day or that of the previous day may be specified, and the daily closing time may be adjusted within the range of 0:00 to 23:00 (in hour units).

- ***Monthly Closing***
  In the monthly closing process, the daily closing data of the previous one month are gathered, and the monthly closing data are calculated for the month, including the average, total, maximum and minimum values. The calculated monthly data are stored into the monthly data files created for each trend gathering pen. Monthly closing processing is performed after the daily closing processing on the last day of each month.

- ***Disk Space Used***
  Each type of closing data may be saved for the following period:

Closing data	Save period	Number of records
Hourly closing data	48 hours	9600
Daily closing data	62 days	12400
Monthly closing data	24 months	4800

Table: Save Period of Closing Processed Data

LONG-TERM DATA SAVE

- ***Historical Message, Hourly Closing, Daily Closing, Monthly Closing.***
  After trend data, closing data and historical messages are saved using the HIS standard function, they are automatically stored via the long-term data archive. The storage period in the long-term archive depends on the data type and data storage unit defined on the Trend Acquisition Pen Assignment Builder or on the HIS Constants Builder. When the storage period is defined, the required total hard disk space is calculated automatically. So long the 5 % free space is reserved in the hard disk, the data storage may take as much space as desired.

Data type	Storage unit for long-term data	Storage period set by the builder
Trend data	Trend block unit	Number of days
Closing data	All hourly closing data	Number of years
	All daily closing data	Number of years
	All monthly closing data	Number of years
Historical messages	All messages	Number of days

Table: Storage Units for Long-Term Data and Setting Units for Store Time

- ***Long-Term Data Save - Disk Space Used***
  The disk space required for long-term data storage can be calculated from the number of data points, data-sampling period and the number of days for storage.

Type and number of data	Sampling period	Formula for calculating disk capacity	Data per File
For 128 trend data	1 second	10.8 MB×(Number of days of data storage×8+1)	3 Hours
	10 seconds	10.8 MB×(Number of days of data storage+1)	1 day
	1 minute	10.8 MB×(Number of days of data storage+13)/7 (*1)	7 days
	2 minutes	10.8 MB×(Number of days of data storage+27)/14 (*1)	14 days
	5 minutes	10.8 MB×(Number of days of data storage+69)/35 (*1)	35 days
	10 minutes	10.8 MB×(Number of days of data storage+139)/70 (*1)	70 days
For 1 point of closing data	Hourly closing	(Number of years of data storage+1)×0.56 MB	
	Daily closing	(Number of years of data storage+3)/2×0.56 MB	
	Monthly closing	(Number of years of data storage+19)/10×0.56 MB	
Historical message	-	Number of days of data storage×0.5 MB	

****1: The required minimum disk free space is a multiple of 10.8 MB. After the division, the later part of the formula, trunk out the decimals then times 10.8.***

Table: Formula for Calculating Disk Capacity

- ***Calculation of Disk Space Required***
  For an example, a datum with 1 minute sampling period and 256 samples (2 blocks), when the datum is required to be archived for 30 days. The first, (30+13)/7 = 6.14, after trunk out, it becomes 6. Thus, the space for holding one block is 6x10.8 = 64.8 MB. For two blocks, the space required is 64.8 x 2 =129.6 MB.

PRINT WAIT TIME

The messages are not printed out until they are piled up to fit one page for print. With definition of the queuing time, the message may be sent to printer when the defined queuing time elapsed. When Queuing time is specified as 0, the auto print does not function. Auto print queuing time may be defined on the HIS Message Print Wait Time definition tab of the HIS Constant Builder. Printer queuing time: Define in minutes per HIS printer. The default is 5 minutes.

INSTRUMENT DIAGRAM OPERATION

- ***Operation Message Print Specification***
  The operation message output for the faceplate blocks may be specified.
  There are check boxes on the tab, check the corresponding items may be specify enable or disable the operation message output.

- ***Switch Instrument Operation***
  Twice-pressed operation or two-step operation may be specified. For faceplate blocks, only two-step operation may be specified.
  - ***Two-step Operation***
    The following items may be defined:
    • Operation guard frame in solid line
    • Flashing to prompt for acknowledgment
    • Color change to prompt for acknowledgment
    • Guard frame color change to prompt for acknowledgment

HIS SECURITY

The functional security level regarding operation and monitoring as well as the operation and monitoring scope can be set for the HIS itself. The HIS security check has a precedence over the user security check. On HIS Constant Builder, set the HIS security.

- ***Security Targets***
  Among the operation and monitoring scope for an HIS, operations that are performed directly on the HIS by an operator are checked. However, remote access using an OPC or DDE interface and message printing are not checked.

- ***HIS Attribute***
  Select the function security level of the HIS from the following two types:
  - ***Dedicated monitoring machine***
  - ***Operation and monitoring machine (default)***

  If the HIS is set as a dedicated monitoring machine, a user can only perform monitoring on the HIS regardless of privilege levels. Operations allowed on the HIS set as an operation and monitoring machine vary depending on the user privilege level and the access level of the operation target.

- ***Range of Operation and Monitoring***
  The operation and monitoring scope of the HIS can be set for each HIS.
  The operation and monitoring scope of the HIS is unrelated with the operation and monitoring scope set for each user group. In the operation and monitoring scope check, both the operation and monitoring scope of the HIS and that of the user group are checked. Any operation or monitoring that is not included in both scopes cannot be performed.

  - ***Monitoring Range (Default: ALL)***
  - ***Operation and Monitoring Range (Default: ALL)***
  - ***Window Range (Default: ALL)***
  - ***Acknowledgment (Default: ALL)***
  - ***Process Message Receiving (Default: ALL)***

- ***System Alarm Receiving (Default: ALL)***
- ***Exclude Operation (Default: NONE)***
- ***Exclude Operation and Monitoring (Default: NONE)***
- ***Exclude Acknowledgment (Default: NONE)***
- ***Exclude Process Message (Default: NONE)***
- ***Exclude System Alarm (Default: NONE)***

The default setting is "ALL" for INCLUDE and "NONE" for EXCLUDE.

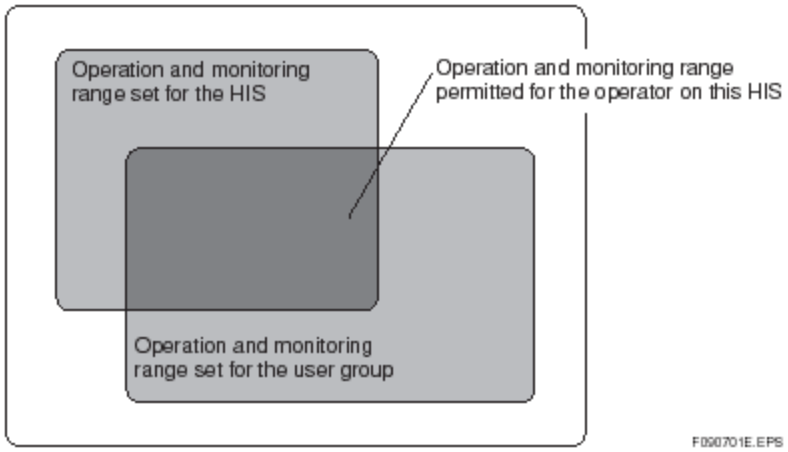

Figure: Operation and Monitoring Range Permitted for Operator

DEFINING PROJECTS

Projects for operation and monitoring are defined in the "Multiple Projects" tab. The "Multiple Projects" tab can be displayed by selecting [Detailed Setting Items] from the [View] menu of the HIS Constants Builder. A list of projects to be connected will be displayed on the "Multiple Projects" tab.

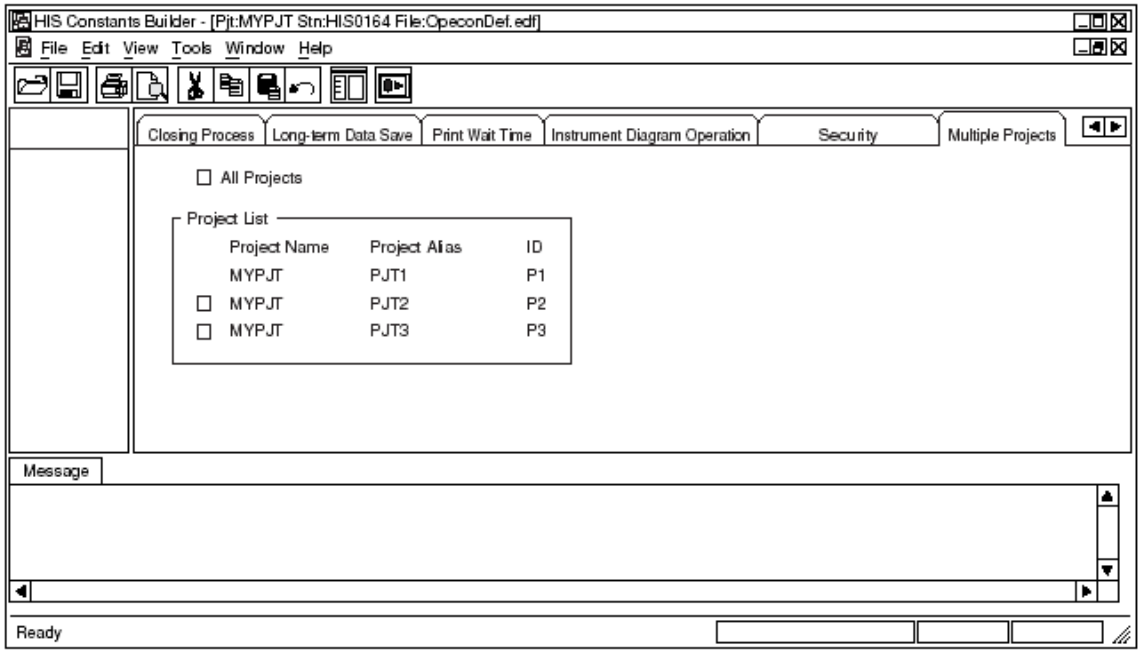

Figure Multiple Projects Tab

When operating and monitoring all projects, place a check in the [All Projects] checkbox. When this checkbox is left empty, you can select individual projects from the Project List.

Instrumentation & Control Services

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1. ITEMS ASSIGNABLE TO THE FUNCTION KEYS

2. LED FLASHING CONDITIONS

CHAPTER 10
FUNCTION KEYS

FUNCTION KEYS

The function keys provided on the operation keyboard allow the users to define functions freely. Accompanying each key are LEDs that indicate alarms and to the operator by flashing of the lamp and a label that describes the function assigned to the key. The assignment of functions to the function keys is performed by the Function Key Assignment Builder and the HIS Setup window.

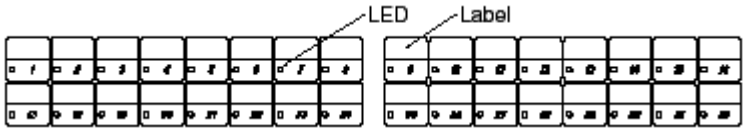

Figure: Function Keys

1. ITEMS ASSIGNABLE TO THE FUNCTION KEYS

The types of functions assignable to the function keys include the following:

- ***Calling up of windows***
  Calls up the operation and monitoring windows.
- ***Execution of the system function keys***
  Executes the functions provided by the system function keys.
- ***Starting, stopping or restarting of trend data***
  Controls the starting, stopping or restarting of trend data acquisition targeted at the specified trend groups.
- ***Flashing or turning ON/OFF of LED's***
  Controls the flashing or turning ON/OFF of LED's.
- ***Execution of programs by their file names***
  Executes programs by specifying their file names.
- ***Execution of the Multimedia***
  Plays the specified voice message files.
- ***Panel set display***
  The pre-defined panel set may be called up.
- ***Calling up of a window to another station***
  Calls up the currently displayed active window to the specified HIS.
- ***Calling up of remote windows by window name***
  Calls up remote windows to the specified HIS. This function can be used on the console type HIS.
- ***Copying of a currently displayed window set***
  Calls up to the specified HIS windows currently displayed on the CRT. This function can be used on the console type HIS.

2. LED FLASHING CONDITIONS

The following function blocks or windows can be set to the LED of the function keys as LED flashing conditions.

- ***Alarm display by the tag name or an annunciator message.***
- ***Alarm display by the window name. (Graphic window, Process Alarm window, Operator Guide Message window, System Alarm window)***

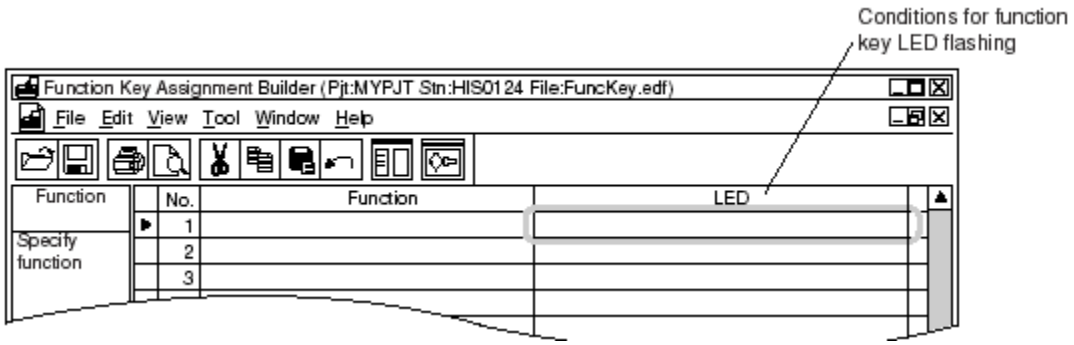

Figure: Setting LED Flashing Conditions in the Function Key Assignment Builder

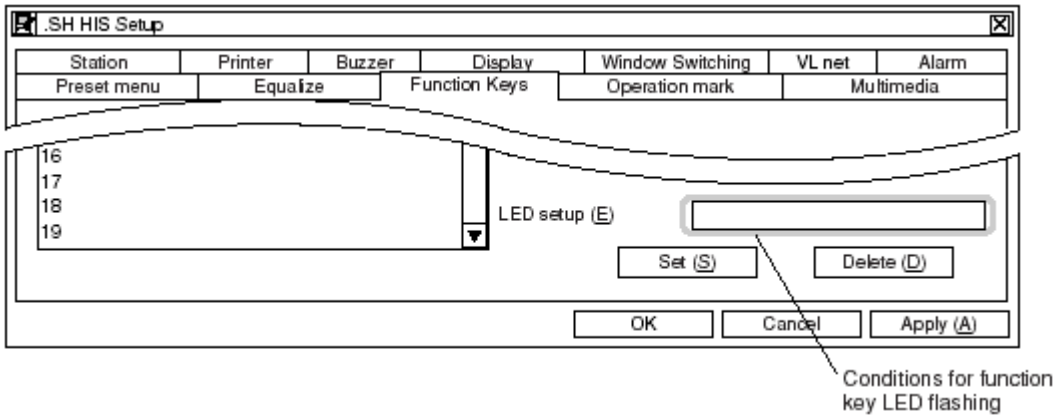

Figure: Setting LED Flashing Conditions in the HIS Setup Window

When the function block or window set as conditions for flashing changes to an alarm state, the LED flashes. When the acknowledgment operation is performed, the LED changes from a flashing display to a lit display. When the alarm returns to normal, the LED turns off. When the window name is set as the condition, an argument can be specified. Arguments can be specified for windows (Process Alarm window, System Alarm window, etc.) that accept arguments when called up.

CHANGE PRIVILEGE

Specify whether or not the function key assignment can be temporarily changed in the HIS Setup window, by using the following changing authorities provided by the security.

- ***Ordinary***
- ***Important***
- ***System operation***

The function key assignment may or may not be changed depending upon the above change authorization specification and the privilege level of the logged-in user.

- ***The user of the privilege level S1 can temporarily change the functions that are assigned to the function keys for which "ordinary" has been set.***
- ***The user of the privilege level S2 can temporarily change the functions that are assigned to the function keys for which both "ordinary" and "important" have been set.***
- ***The user of the privilege level S3 can temporarily change the functions assigned to any function keys.***

However, operation and monitoring authority for the function keys are restricted as follows:

- ***Monitoring: None***
- ***Operation: Function assignment change***

EXAMPLE OF ASSIGNING THE WINDOW CALL TO A FUNCTION KEY

The window call is assigned using the format below.

OΔWindow name {ΔFunction type} {Δ-Window size} {Δ=Display position} {ΔGeneric parameter} (*1)
{ }: Can be omitted
Δ: Space
****1: Generic parameter is used to call up a Graphic window with data bind.***

(Example) OΔFIC101ΔTUNΔ-SLΔ=+200+100

In the above example, the Tuning window for displaying the tag name "FIC101" is called as a large-size window located at X coordinate 200 and Y coordinate 100 from the upper left edge of the screen.

OΔ.ALΔFCS0101Δ-SM

In the above example, the Process Alarm window displaying the process alarm generated at station 01 is called up as a medium-size window.

SYSTEM FUNCTION NAME - FUNCTION KEYS

Set one of the system function key types shown below. The names of the system function keys are enclosed by the parentheses (). The names of the system function keys are used when their functions are assigned using the Function Key Assignment Builder.

- ***Hard Copy (HDCP)***
  Outputs hard copy of the images of all windows displayed including Windows general application windows.
- ***Print (PRNT)***
  Prints the active window. This is valid only when there is a print button in the operation and monitoring window to be printed.
- ***Message Printout (MSPR)***
  Forces all printers assigned to MSG1 to MSG5 to print messages currently generated.
- ***Buzzer Reset (BUZZ)***
  Executes buzzer reset operation. Stops all the buzzer output.
- ***Stop Voice Play (VOIC)***
  Pauses the voice play for checking.
- ***Panel set (PSET)***
  Calls up the panel set related to the active window. The panel set in which the active window is listed first of the group in the Panel Set Builder is called up.
- ***Isolate (ISOL)***
  Turn on/off "isolate" status. The "isolate" function, as described below, prevents window calls from other HIS. Changes only the "isolate" status of its own HIS, not other HIS.
  - ***Request from another HIS to execute the panel set function.***
  - ***Request from another HIS to call up a window.***
  - ***Request to display a window automatically due to notification of process alarm occurrence from a field control station.***
  - ***Request to display a window automatically due to occurrence of operator guide message.***
  - ***Request to display a window due to sequence message request.***
  - ***When HIS is turned to "isolate" status, the icon to indicate that HIS in "isolate" status is displayed in the icon display area of the System Message window. Simultaneously, the LED of the function key to which "isolate" function is assigned is turned on. It is impossible to assign the LED to the function key to which "isolate" function is assigned.***
- ***Window Set Store (WSSV)***
  Stores the Dynamic Window Set.
- ***Window Set Delete (WSCL)***
  Deletes the Dynamic Window Set.
- ***Window down (CRDN)***

Moves the front window of the stack to the back. However, the primary window is not affected.

- ***Window up (CRUP)***
  Moves the back window of the stack to the front. However, the primary window is not affected.
- ***Focus (FOCS)***
  Switches the active window sequentially between the primary window and the top most auxiliary window. This key becomes effective only in full-screen mode.
- ***Primary Window Focus (FCSF)***
  Makes the primary window the active window. This key becomes effective only in full screen mode.
- ***Circulate (CIRC)***
  Transposes the front to back relationship between the operation and monitoring window group and Windows-based application window group.
- ***Acknowledgment (ACKN)***
  Acknowledges alarms for the active window.
- ***Clear Windows (ERAS)***
  Closes all currently displayed windows.
- ***Primary Window Hide (CLFS)***
  Clears and hides the primary window to allow access to the Windows desktop. This function is valid only in the full screen mode.
- ***Primary Window Close (CLFS)***
  Closes only the primary window. This key becomes effective only in full-screen mode.
- ***Primary Window Clear (ERFS)***
  Clears the display contents of the primary window and displays it as an empty window. This key becomes effective only in full-screen mode.
- ***Active Window Erase (ERAW)***
  Closes the active window.
- ***History File Calling forward (RECF)***
  Sequentially calls up the operation windows displayed in the past, starting with the oldest one. Up to 30 windows can be called up.
- ***History File Calling backward (RECB)***
  Sequentially calls up the operation windows displayed in the past, starting with the latest one. Up to 30 windows can be called up.
- ***Navigator (NAVI)***
  Calls up the Navigator window.
- ***User-In (USIN)***
  Calls up the User-In dialog box.
- ***Clear (CLER)***
  Cancels the selection mode and input data.
- ***Message Monitor Window (MSDW)***
  Calls up the Message Monitor window. When a message occurs, the LED in a function key that has been assigned the function of calling up the Message Monitor window

turns on. The LED turns off after the message is acknowledged. The LED cannot be assigned to a function key that has been assigned the function of calling up the Message Monitor window.

- ***Window Shift (SHFT)***
  Shifts the windows displayed in main monitor to sub monitor. When using this function, the display in the sub monitor is replaced by the display in the main monitor. The display in main monitor becomes empty after Window Shift operation. After running this function, the windows shifted from main monitor to sub monitor may not be displayed in the same cascade sequence. This Window Shift function is valid only when the package for multiple monitors is installed. If the package for multiple monitors is not installed, an error beep can be heard when operating this function.
- ***Window Exchange (ECHG)***
  Exchanges the displays of main monitor and sub monitor.
  After running this function, the windows shifted from main monitor to sub monitor or vice versa may not be displayed in the same cascade sequence. This Window Exchange function is valid only when the package for multiple monitors is installed. If the package for multiple monitors is not installed, an error beep can be heard when operating this function.

EXAMPLE OF ASSIGNING THE SYSTEM FUNCTION KEY

A system function key is assigned using the format given below:

K⊿system function key name
⊿: Space

Example : K⊿USIN
In the above example, the User-In dialog box is called.

DEFINITIONS FOR ASSIGNING LED TO A FUNCTION KEY

When assigning a function to control the flashing and turning ON/OFF of LED's to the function keys, define the following items using the Function Key Assignment Builder:

- ***LED number***
- ***Parameter***

- ***LED Number***
  This is the number for the LED to be controlled. Select between 1 and 32.

- ***LED Parameter***
  Select one of the three LED display statuses: "flashing," "ON" or "OFF."

EXAMPLE OF ASSIGNING THE LED TO A FUNCTION KEY

Assign the LED to the function keys in the following manner.

E⊿LED Number⊿F
E⊿LED Number⊿ON
E⊿LED Number⊿OFF
⊿: Space

Example: E⊿1⊿ON
In the example above, the LED of LED number 1 is turned on.

Instrumentation & Control Services

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1. FLOW OF THE TREND RECORDING

2. STRUCTURE OF TREND

3. DEFINING TREND BLOCK

4. TREND GROUP DEFINITION

CHAPTER 11
TREND DEFINITION

TREND DEFINITION

The Trend Recording acquires process data such as temperature, pressure and flow rate gathered by an HIS, as the function block's tuning parameter and displays changes in the acquired data in a graph (trend graph).

1. FLOW OF THE TREND RECORDING

The Trend Recording consists of:

- ***Trend Data Acquisition***
- ***Trend Data Display***
- ***Closing Processing***

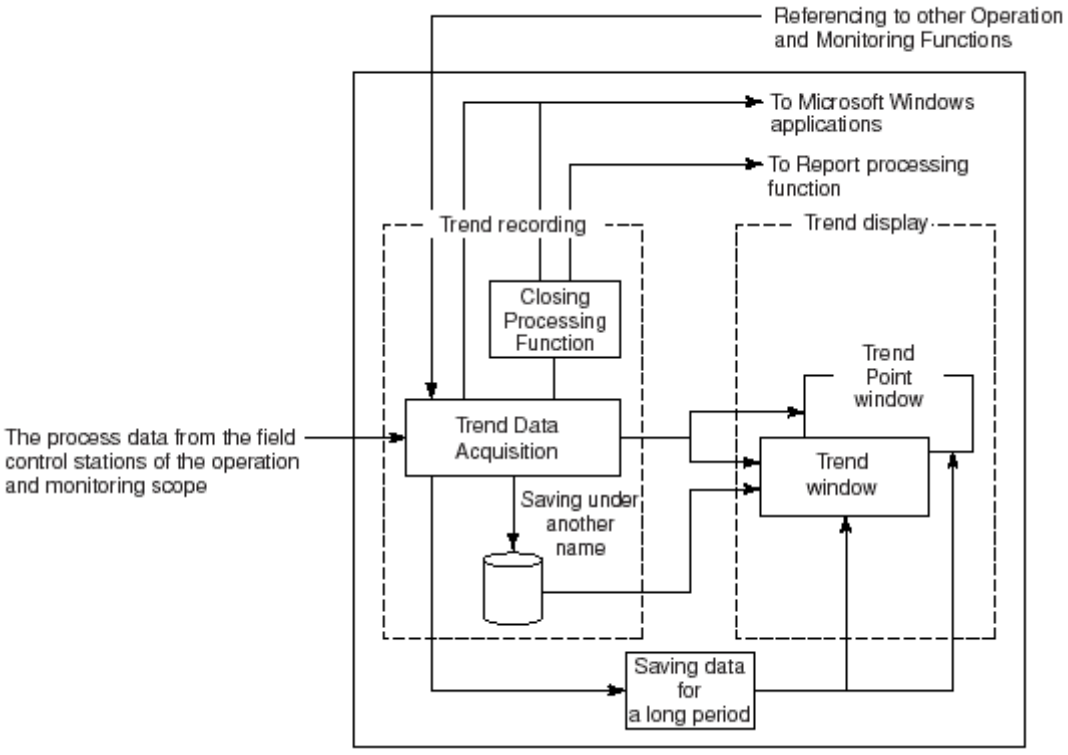

Figure: Flow of the Trend Recording

2. STRUCTURE OF TREND

The Trend Recording has a three-layer structure: a trend block, Trend window and Trend Point window.

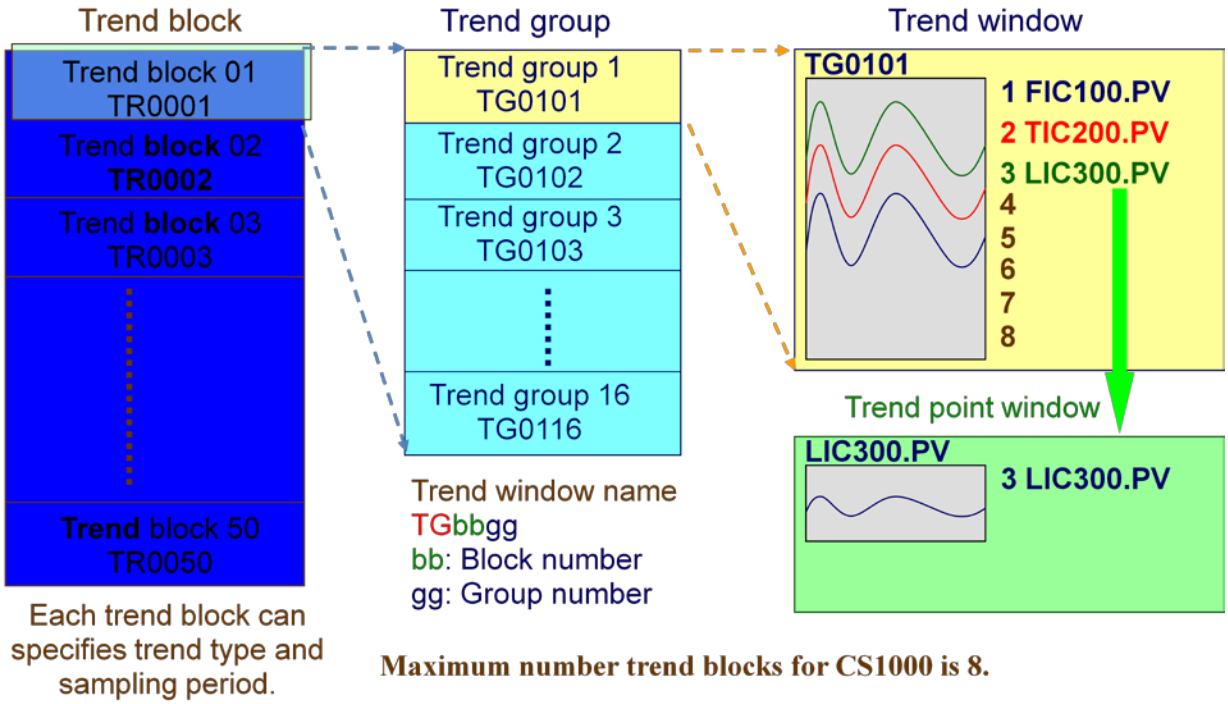

Figure: Structure of Trend Recording

TREND BLOCK

A trend block is comprised of 16 units of Trend windows. There are 50 trend blocks per HIS. Up to 20 of the 50 trend blocks can be defined in the rotary trend or batch trend format. The remaining 30 trend blocks are defined as trend of other stations. The trend format and sampling period are defined for each trend block.

TREND WINDOW

Eight-pen trend data can be assigned to a Trend window. There are 800 Trend windows per HIS.

TREND POINT WINDOW

The Trend Point window is called up from the Trend window. One trend pen is displayed in each Trend Point window. There are 6,400 Trend Point windows per HIS.

3. DEFINING TREND BLOCK

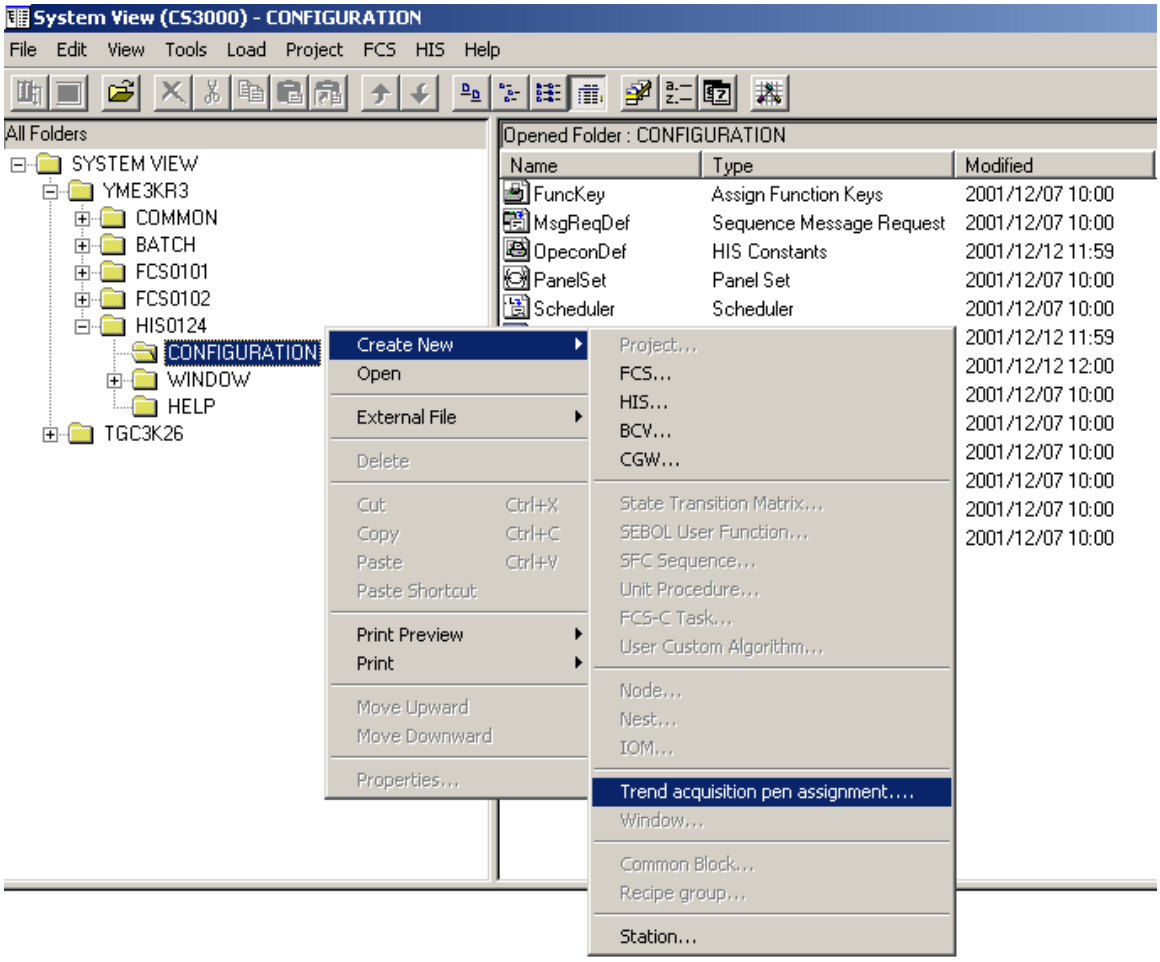

Figure: To assign a new trend block

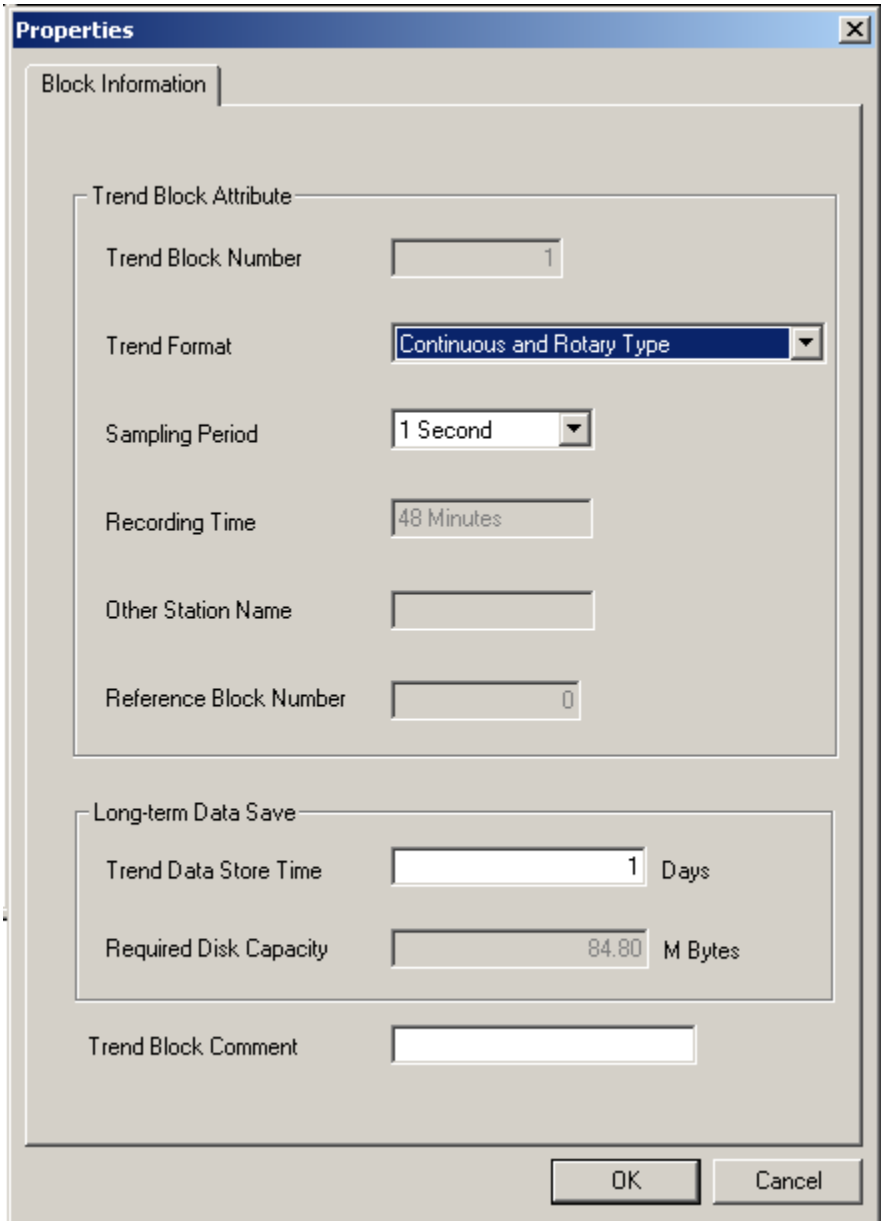

Figure: Trend block properties

TREND FORMAT

The acquisition type of process data are defined for each trend block. The data acquisition include the following 4 types:

- ***Continuous-Rotary Type***
- ***Batch-Stop Type***
- ***Batch-Rotary Type***
- ***Trend Acquired by other HIS***

SAMPLING PERIOD, RECORDING TIME

The sampling period of process data are specified for each trend block. The sampling period can be selected from 1 second, 10 seconds, 1 minute, 2 minutes, 5 minutes or 10 minutes. No more than 18 blocks can be specified with the sampling periods of 1 minute, 2 minutes, 5 minutes and 10 minutes. No more than 2 trend blocks can be specified with the sampling period of 1 second or 10 seconds. The trend data that may be used as closing data can have sampling periods of 1 minute, 2 minutes, 5 minutes and 10 minutes, 4 types. The recording span indicates the time to acquire 2,880 samples for each trend graph (maximum number of samples) in the specified sampling period.

Sampling period	1 second	10 seconds	1 minute	2 minutes	5 minutes	10 minutes
Recording Span	48 minutes	8 hours	2 days	4 days	10 days	20 days

Table: Trend Sampling Periods and Maximum Recording Span

For example, if the trend sampling period is 1 minute,
1 (minute)*2,880 samples = 2,880 minutes = 48 hours = 2 days
2 days of process data may be recorded.

LONG-TERM DATA SAVE - REQUIRED DISK CAPACITY

The disk space required for long-term data storage can be calculated from the number of data points, data-sampling period and the number of days for storage.

Type and number of data	Sampling period	Formula for calculating disk capacity	Data per File
For 128 trend data	1 second	10.8 MB×(Number of days of data storage×8+1)	3 Hours
	10 seconds	10.8 MB×(Number of days of data storage+1)	1 day
	1 minute	10.8 MB×(Number of days of data storage+13)/7 (*1)	7 days
	2 minutes	10.8 MB×(Number of days of data storage+27)/14 (*1)	14 days
	5 minutes	10.8 MB×(Number of days of data storage+69)/35 (*1)	35 days
	10 minutes	10.8 MB×(Number of days of data storage+139)/70 (*1)	70 days
For 1 point of closing data	Hourly closing	(Number of years of data storage+1)×0.56 MB	
	Daily closing	(Number of years of data storage+3)/2×0.56 MB	
	Monthly closing	(Number of years of data storage+19)/10×0.56 MB	
Historical message	-	Number of days of data storage×0.5 MB	

****1: The required minimum disk free space is a multiple of 10.8 MB. After the division, the later part of the formula, trunk out the decimals then times 10.8.***

Table: Formula for Calculating Disk Capacity

4. TREND GROUP DEFINITION

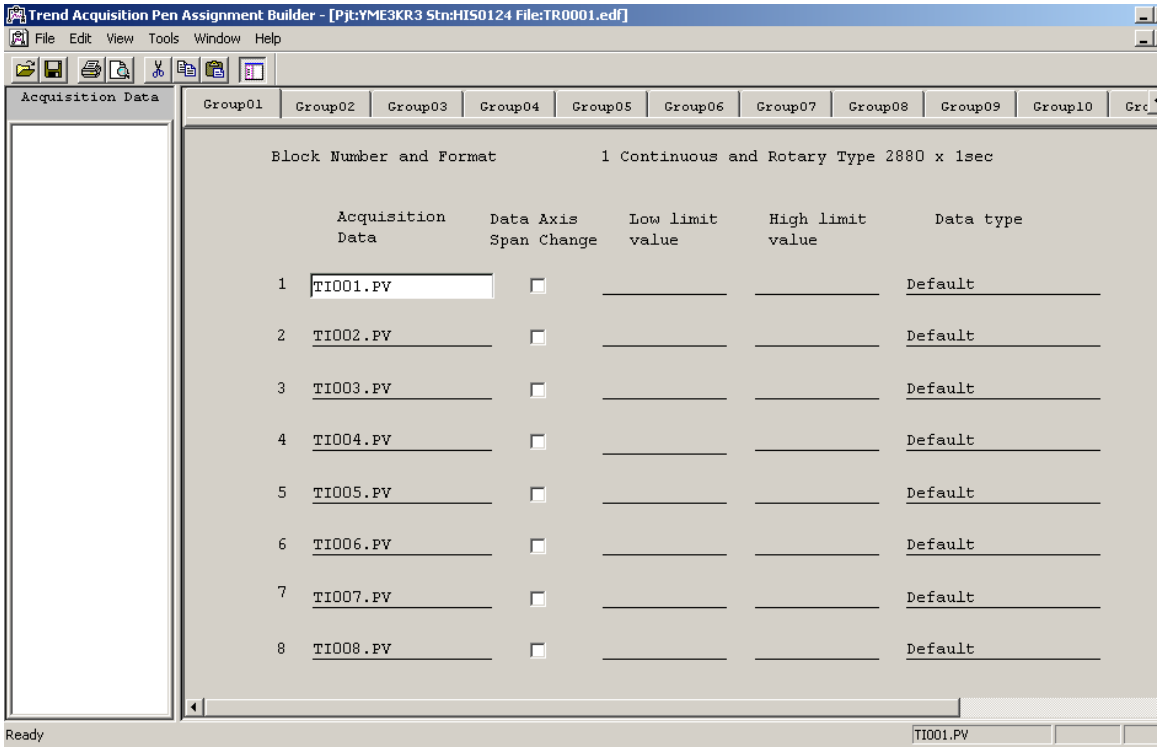

Figure: Trend group definition window

To display trend data in a Trend window or a Trend Point window, trend data must be assigned to each recording point (trend gathering pen) in trend groups. Up to eight trend data, eight trend gathering pens, can be assigned to each trend group. On the Trend Acquisition Pen Assignment Builder, the following four items may be defined.

TAG NAME AND DATA ITEM NAME
Define the tag name and data item of process data in the following format.
Tag Name. Data Item

DATA AXIS SPAN CHANGE
The data axis span refers to the display width along the data axis in the Trend window. For each pen, user can specify whether or not to change data axis span.
When "data axis span change" is not specified, the range of the data item of the function block, which is assigned to the pen, is applied. The default of the data axis span change is "no check."

LOW LIMIT VALUE, HIGH LIMIT VALUE

Define the high limit value and low limit value each trend data displayed in Trend window when data axis span changes. However, the trend data acquired from other consoles are displayed in accordance with that defined in the original console.

DATA TYPE

The display data type of each trend gathering pen is defined to display data in the Trend window. The data display for the trend gathering pen include the following types:

- ***Default***
  Acquired data are displayed in the default data type in the instrument faceplate showing the function block of the acquisition source.
- ***Analog type***
  Acquired process data are displayed in the data axis range 0 to 100 % of the trend graph.
- ***Discrete type***
  Acquired ON/OFF data are displayed in the fixed data axis range 6 % of the trend graph.
- ***Totalizer value (analog type)***
  Acquired process data are displayed in the data axis range 0 to 100 % of the trend graph. Process data acquired are not single-precision data but double-precision data.

CLOSING DATA

To define the closing data, in the trend acquisition pen assignment builder, click on view and select closing definition

- ***Hourly Closing***
  In the hourly closing data process, the trend data of the previous one hour are gathered from the saved trend data file, in which the trend gathering pens specified for closing processing are also saved. The hourly closing data such as the average, total, maximum and minimum values are calculated for this one-hour based on the gathered valid data. The calculated hourly closing data are stored into the hourly closing data files created for each trend gathering pen. Hourly closing data process is performed at the closing time of every hour. The number of data points used for the hourly closing processing varies depending on the trend sampling period.
  - ***Trend of 1-minute sampling period***
    Trend of 1-minute sampling period creates the hourly data using 60 points of data.
  - ***Trend of 2-minute sampling period***
    Trend of 2-minute sampling period creates the hourly data using 30 points of data.
  - ***Trend of 5-minute sampling period***

Trend of 5-minute sampling period creates the hourly data using 12 points of data.

- ***Trend of 10-minute sampling period***
  Trend of 10-minute sampling period creates the hourly data using 6 points of data.

♦ ***Daily Closing***
In the daily closing data process, the hourly closing data of the previous 24 hours are gathered and the daily closing data are calculated for the day, including the average, total, maximum and minimum values. The calculated daily closing data are stored into the daily closing data files created for each trend gathering pen. Daily closing processing is performed after the hourly closing process at the daily closing time every day. The default daily closing time is 0:00 am. The daily closing time may be changed using the closing processing tab of the HIS constants builder to meet the requirement of the plant operation. Unlike the hourly and monthly closing times which are fixed by the system, whether data acquired until the daily closing time is the data of the closing day or that of the previous day may be specified, and the daily closing time may be adjusted within the range of 0:00 to 23:00 (in hour units).

♦ ***Monthly Closing***
In the monthly closing process, the daily closing data of the previous one month are gathered, and the monthly closing data are calculated for the month, including the average, total, maximum and minimum values. The calculated monthly data are stored into the monthly data files created for each trend gathering pen. Monthly closing processing is performed after the daily closing processing on the last day of each month.

Instrumentation & Control Services

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2. SET DETALS

3. CONTROL GROUP WINDOW DEFINITION

4. OVERVIEIW WINDOW DEFINITION

CHAPTER 12
HIS WINDOW CONFIGURATION

HIS WINDOW CONFIGURATION

The creation of new user-defined windows is discussed in this chapter.

Click [Window] → Right click [Create New window]

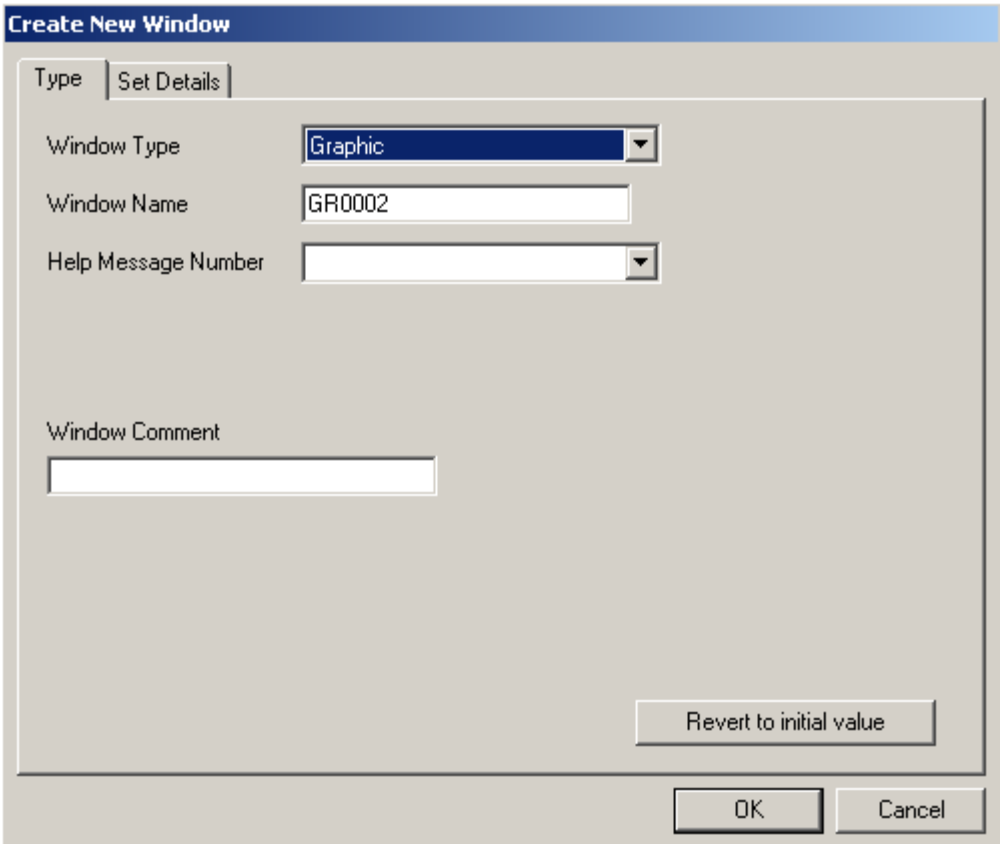


Figure: Create new window dialog

1. WINDOW TYPE

The operation and monitoring windows whose display content can be defined as desired by the user at system generation are called "user-defined window."

- ***Graphic Window with Graphic Attribute***
  The Graphic window with graphic attribute is used to display process data along with a process flow chart or to call various windows that are targets of operation and monitoring. The Graphic window with graphic attribute is the target of calling operation via the graphic button in the System Message window or graphic key on the operation keyboard
  .
- ***Graphic Window with Overview Attribute***
  The Graphic window with overview attribute is used to display the status of the function blocks and to call various operation and monitoring windows can be assigned to the Graphic window with overview attribute. The overall status of the plant can be grasped at a glance. Control group with 8 loops or 16 loops or 8 loops for console type can be assigned.

- ***Graphic Window with Control Attribute***
  The Graphic window with control attribute is used to assign the instrument faceplate in the Graphic window with control attribute. So user can operate the plant while viewing the graphic image of it.

- ***Trend Window***
  The Trend window displays acquired trend data. The trend data to be displayed in the Trend window is defined in the System View and Trend Acquisition Pen Assignment Builder. The assignment of the trend acquisition pen defined in the Trend Acquisition Pen Assignment Builder can be changed in the Trend window. From the Trend window, user can call up a Trend Point window that displays one of the eight process data assigned to the Trend window. A Trend Point window is automatically created when process data is assigned to the Trend window. There is no need to specify the window type for the Trend window since there are files available for them.

- ***Help Dialog Name***
  In the Help dialog box, system-fixed help message and user-defined message can be displayed. When user defines a help message, the definition is made in the Help Message Builder. The maximum length of the definable message is 21 lines 70 single-byte alphanumeric characters or 35 double-byte characters. The Help dialog box may be used in combination with a Graphic window, a Trend window or a Tuning window. For instance, user can define a help message for operation procedure and outline of a Graphic window. This message can be called up by pushing the help button when the Graphic window is being displayed.

- ***Shortcut Window***

  HIS can create a shortcut window in the window hierarchy of the user-defined window in itself. When the shortcut linked window is modified, all the shortcut windows are automatically modified (the modification becomes valid when the window is called up again). If there is shared equipment, it is useful for creating the same window in the multiple hierarchy. However, the shortcut window can be created in only one hierarchy. The shortcut of the shortcut window cannot be created. Shortcut window is a kind of user-defined windows. Its window type is dependent on the window type of the shortcut linked window. The maximum number of the windows is dependent on that of each window-type. When calling up the shortcut window, the content of the shortcut linked window is displayed. Use the window name and window comment of the shortcut linked window. Therefore the shortcut window and the shortcut linked window can be called up simultaneously. However, if the shortcut linked window is deleted, the shortcut window cannot be called up. The shortcut window can be called up in the same way as other user-defined windows.

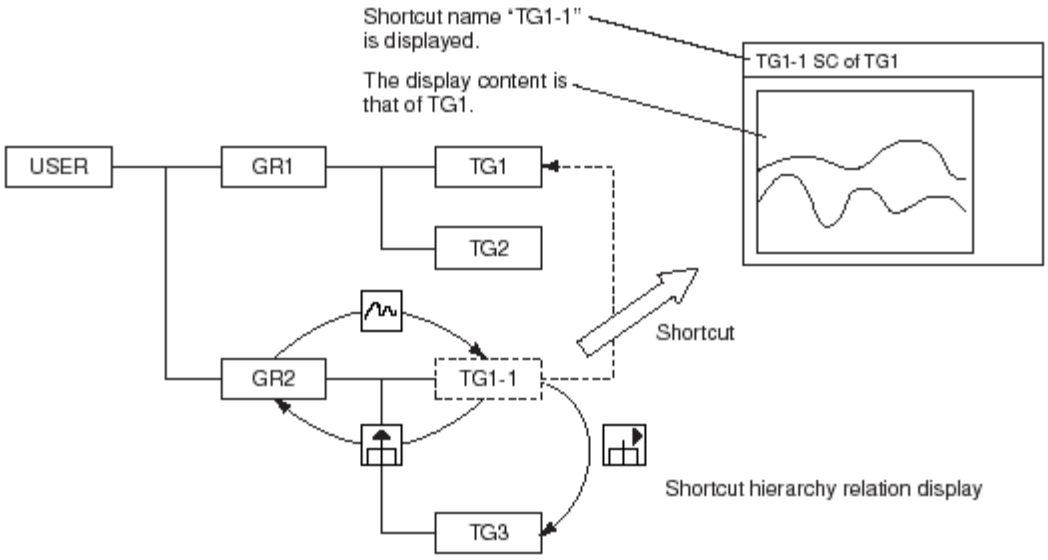


Figure: Displaying Shortcut

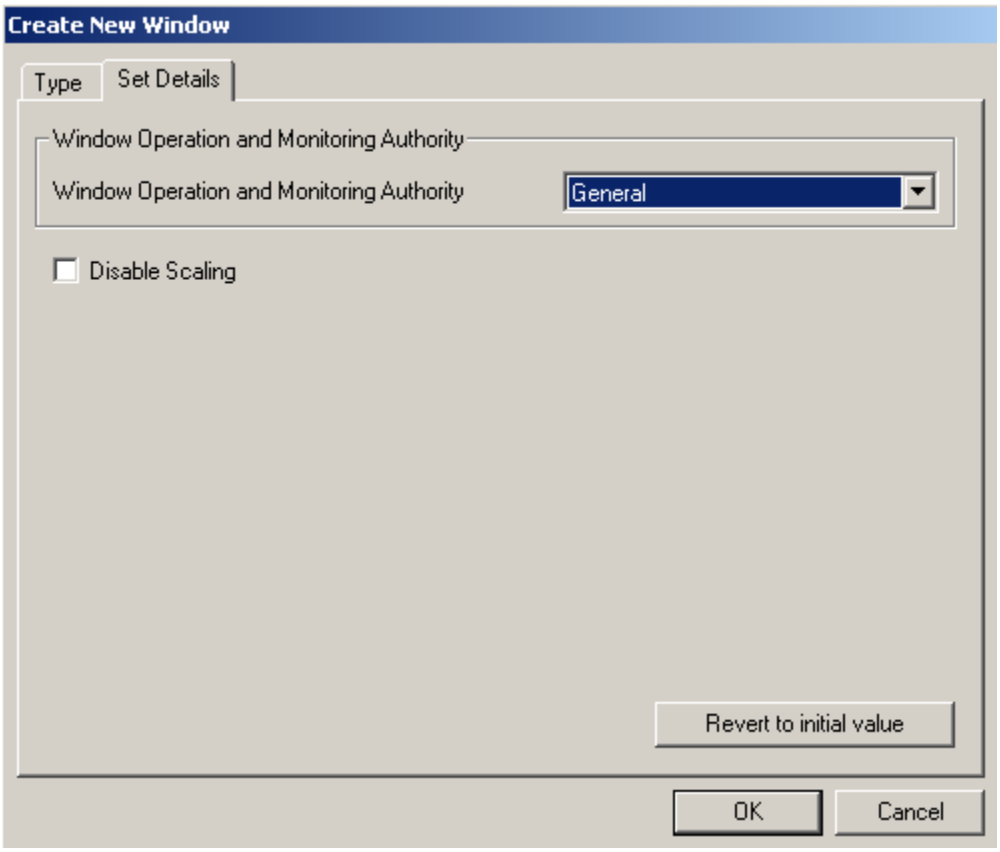
Also, when the shortcut window is grouped in the Dynamic Window Set, its function is the same as other user-defined windows.

- ***Window Comment***

  An explanatory description for each user-defined window can be defined with up to 24 single-byte characters or 12 double-byte characters. The window comment is defined on the property sheet for the window. The comment may be added to the following types of user-defined windows:

  - ***Graphic windows***
  - ***Help dialog box***

2. SET DETALS



- ***Window Operation and Monitoring Authorities***
  The table below shows operation and monitoring authorities on windows, indicating which user can perform operation and monitoring using which types of windows:

Operation/monitoring authority	Access level	Privilege level		
		S1	S2	S3
General window	1	R/W	R/W	R/W
Important window	2	R	R/W	R/W
System operation window	3	R	R	R/W
4	4	R	R	R
5	5	-	R/W	R/W
6	6	-	R	R/W
7	7	-	-	R
8	8	-	-	-

R/W: Both operation and monitoring are permitted.
R: Only monitoring is permitted.
-: Both operation and monitoring are not permitted.

Table: Window Operation and Monitoring Authorities

- ***Users of privilege level S1 or S2 cannot start System View from the system message window, but can start and operate System View from [Start Menu].***
- ***Users of privilege level S1 can operate and monitor general windows. However, they can only monitor important windows and system operation windows excluding System View.***
- ***Users of privilege level S2 can operate and monitor general and important windows. However, they can only monitor system operation windows excluding System View.***
- ***Users of privilege level S3 can operate and monitor all windows.***

♦ ***Disable Scaling***

When the scaling attribute is set to "none," the contents of the window display are shown at the size when it was created, regardless of the size of the display window. When a new user-defined window is created, the new window will have the scaling attribute by default.

Whether to add the scaling attribute can be set in the Property tab called from the System View. The content of the window display where the scaling attribute is set to "None," is shown at the size when it was created regardless of the display size. If the display is smaller than the window size, it is shown as is with blank margins, and if the display is larger it is shown with scroll bars. For a window with the scaling attribute, the display contents are adjusted to fit the window display size. Since scaling is automatically performed by the system, the line width may vary depending on the position, and small images may change their shapes. To minimize these scaling effects, designate an appropriate window size in the Graphic Builder.

3. CONTROL GROUP WINDOW DEFINITION

The following types are the types of Control group

- ***Control (8 loops)***
- ***Control (16 loops)***
- ***Console Control (8 loops)***

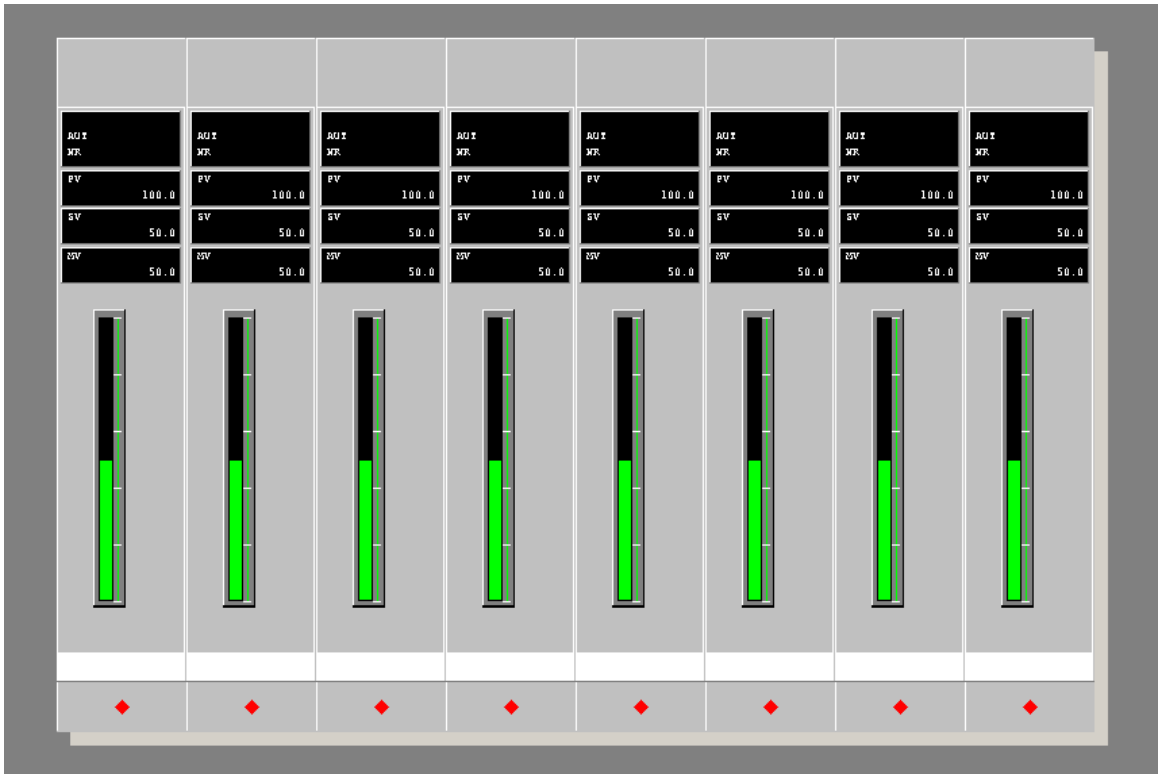


Figure: Control (8 loop) creation

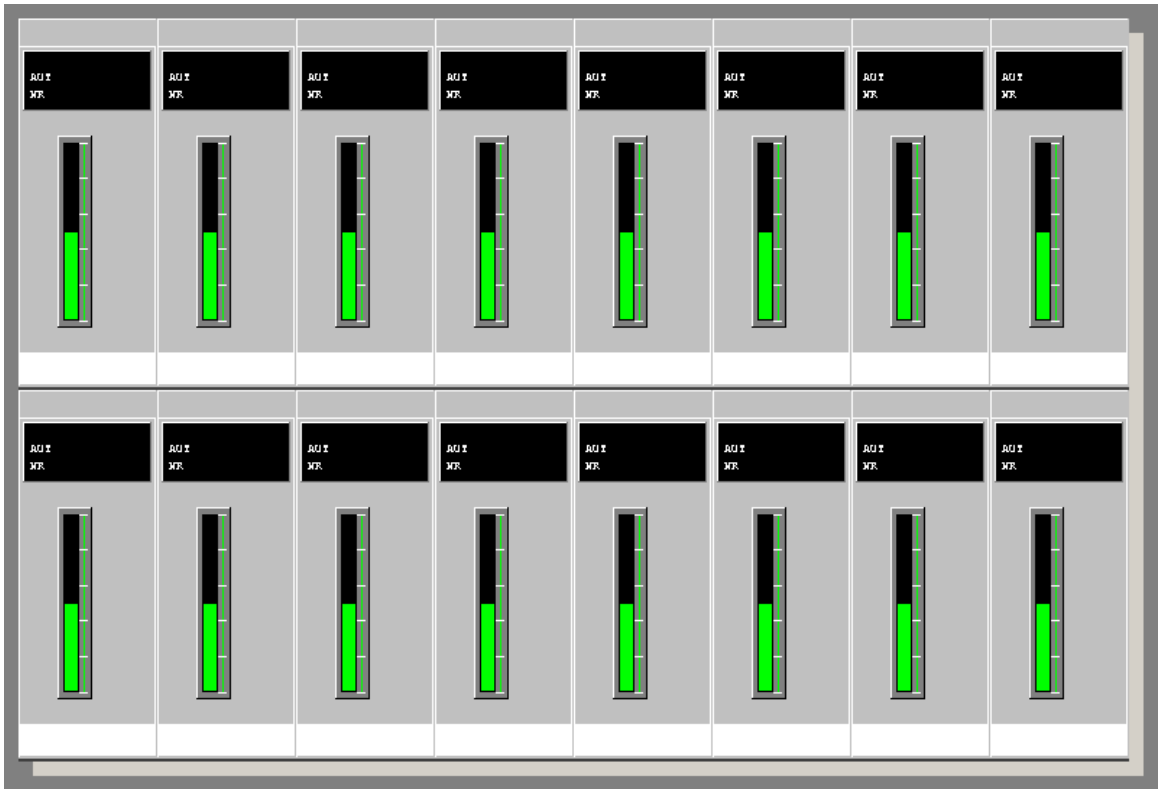


Figure: Control (16 loop) creation

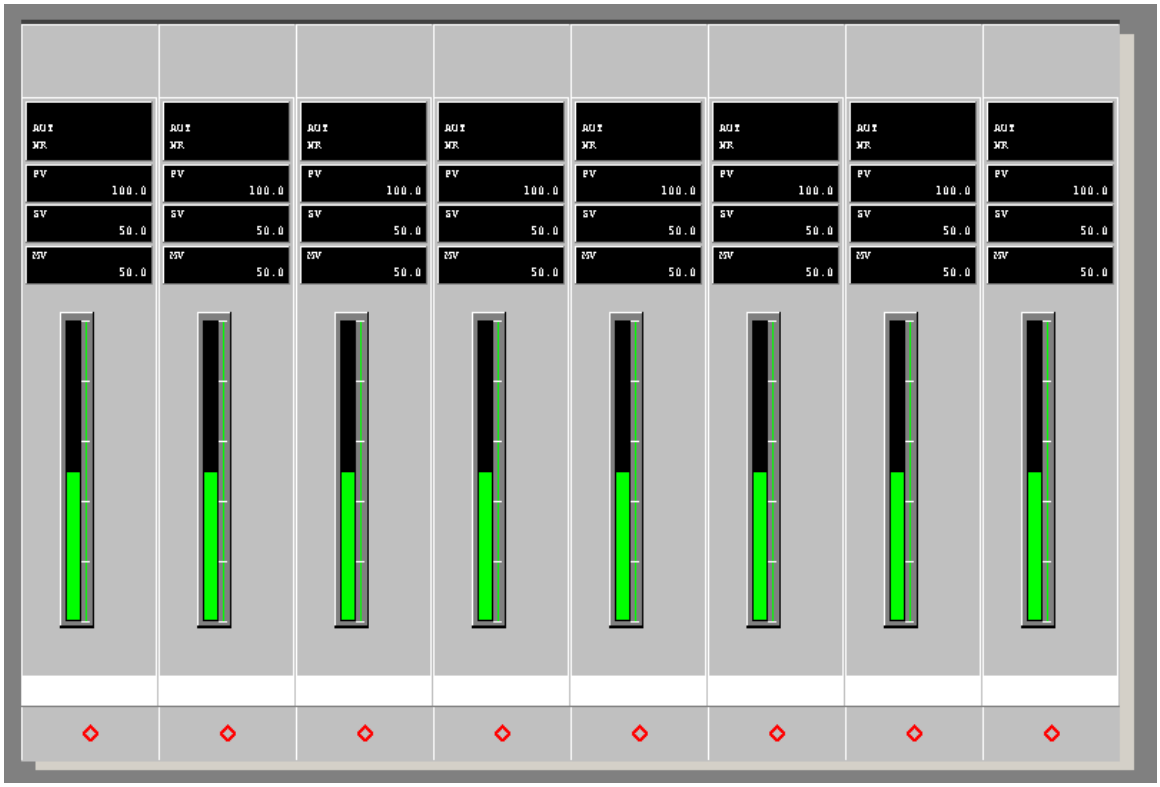
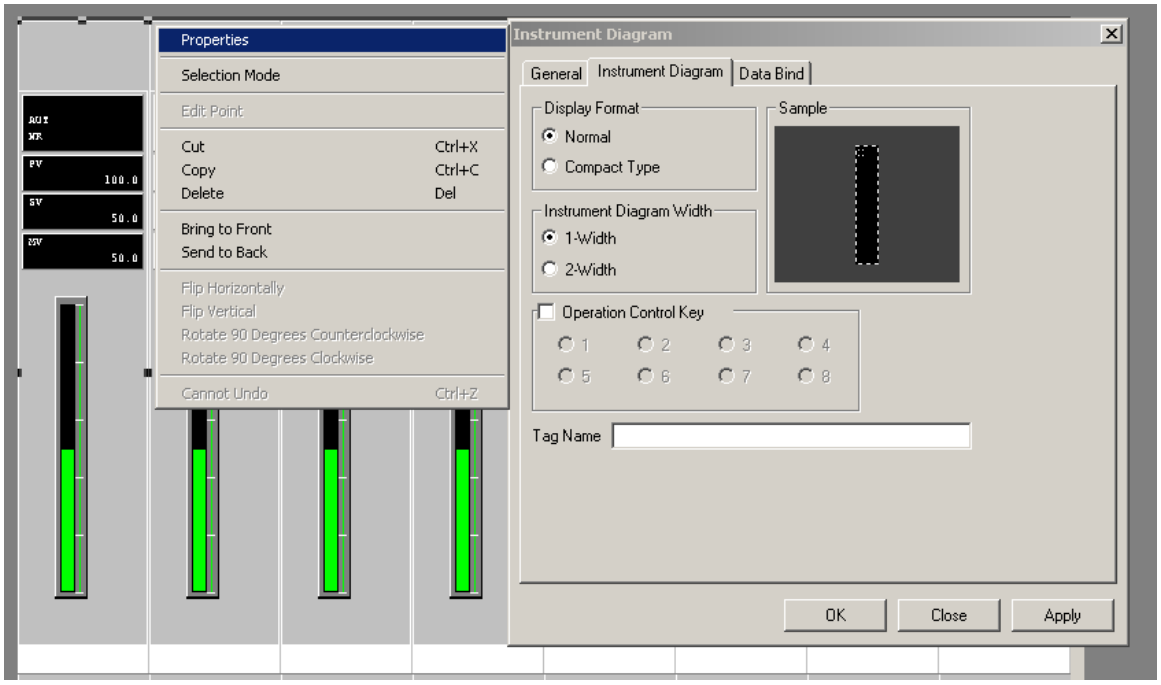


Figure: Console Control (8 loop) creation

INSTRUMENT DIAGRAM DISPLAY PROPERTIES



- ***Instrument Diagram Display Type***
  The display content of an instrument diagram differs by the type of a faceplate. Select either normal type or compact type.
  - ***Normal***
    The entire display contents of the instrument diagram are displayed in full.
  - ***Compact***
    The display contents of the instrument diagram are simplified. In compact type, the digital display of data is no longer available. The size of both full and compact types can be changed. However, the vertical to horizontal ratio is fixed in both types.
- ***Width of the Instrument Diagram***
  This sets whether the instrument diagram is displayed in default width (single-width) or in double width. However, even if the double width is specified, the actual HIS display may only be in single-width (default size) depending on the type of an instrument faceplate.
- ***Operation Key***
  The operation key (INC/DEC key) on the console type HIS may be specified for the corresponding instrument faceplate s on the display position 1 to 8. For the double-width instrument faceplate, it may be specified to the adjacent two positions. Thus, on position 8, the double-width instrument faceplate cannot be assigned. For example, if position 3 and 4 are available, it may be specified on position 3.

- ***Instrument Diagram Tag Name***
  Enter text for the tag name of an instrument diagram to be displayed.

4. OVERVIEIW WINDOW DEFINITION

The Overview tab is used to set the monitoring target to be assigned to an overview object. It also sets the properties of the display data and the presence/absence of an alarm notification according to the selected monitoring target.

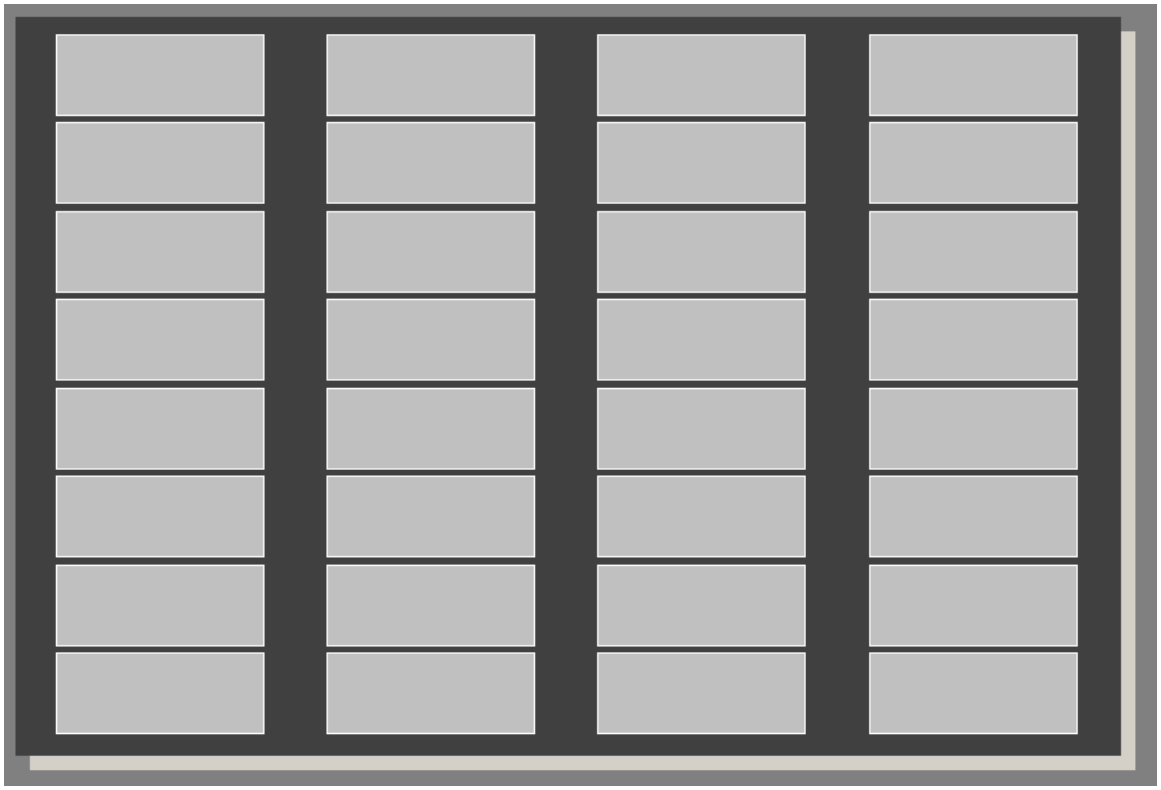


Figure: Overview window creation

OVERVIEW TAB

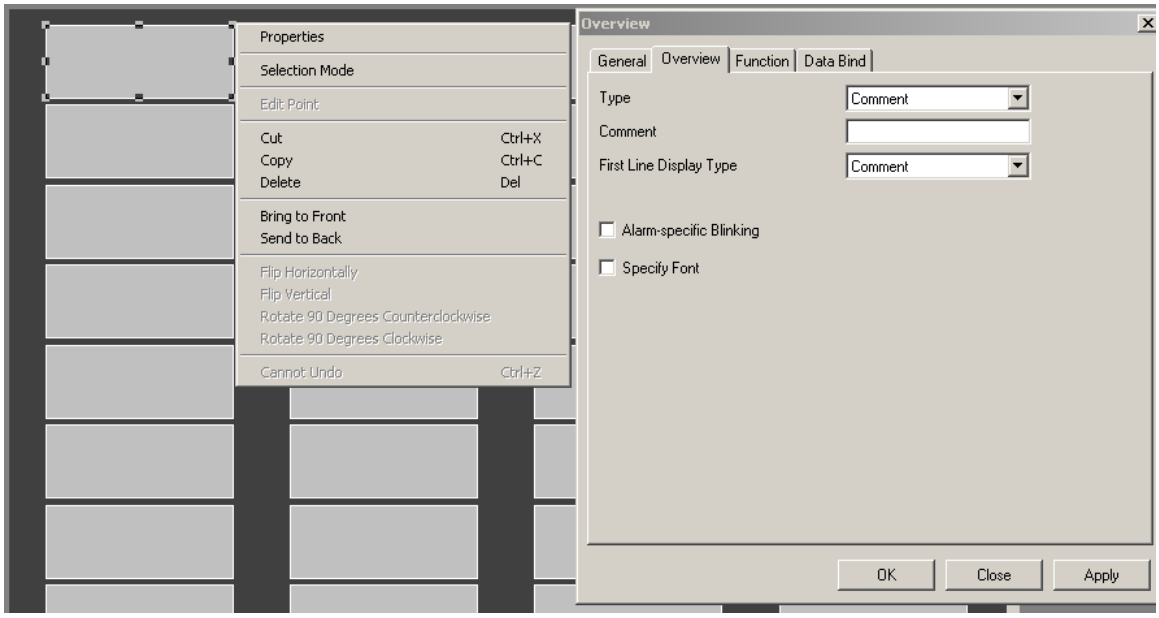


Figure: Overview Tab of Overview window

Type

This sets the type of a monitoring target to be assigned to an overview object. [Tag name], [Tag name (with tag mark)], [Window name], [Annunciator] and [Comment] can be selected as a monitoring target. The table below lists the types of monitoring targets and the setting items for each target.

Monitoring target type	1st line display type	Assigned data	2nd line display data	Window to be displayed
Tag name	Tag name Tag comment	Tag name	-	Mandatory
Tag name (with tag mark)	Tag mark and tag name Tag mark and tag comment	Tag name	-	Mandatory
Window name	Window name Window comment	Window name	Optional	-
Annunciator	Annunciator Message	Annunciator name	Optional	Mandatory
Comment	Comment	Comment character string	-	Mandatory

Table: Types of Monitoring Targets and Corresponding Setting Items

- ***Alarm Blinking***
  Checking the [Alarm-specific Blinking] check box will enable the overview objects to indicate the blinking status of the tag name or the window name, allowing the alarm to be acknowledged.
- ***Specify a Font***
  Checking [Specify font] check box enables to specify font displayed on overview object. The following three items need to be defined.
  - ***Font type***
  - ***Font size***
  - ***Font style***

FUNCTION TAB

The Function tab consists of the area used for assigning functions and that for setting the cursor movement sequence. The setting contents of the area vary with the functions to be assigned. The Function tab is used to set functions to be assigned to touch targets, push buttons, and soft keys.

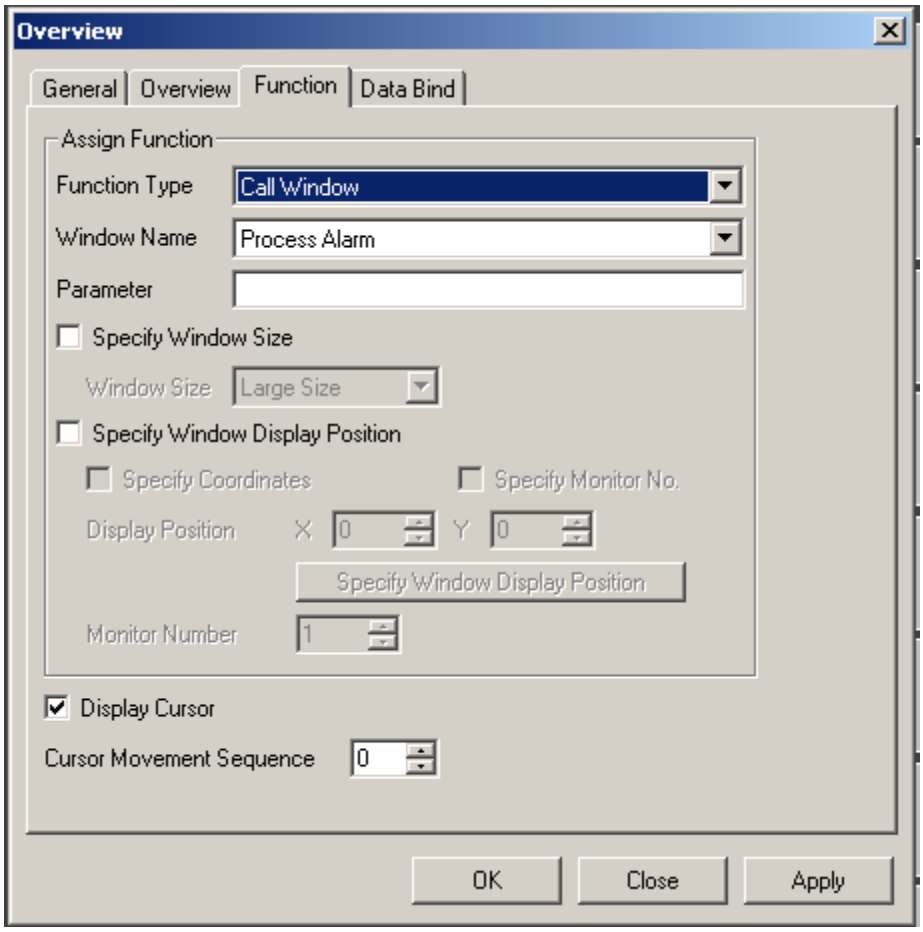


Figure: Function Tab of Overview window

- ***Types of Assigning Functions***
  This sets the type of functions to be assigned to an object. Functions such as system function key function and Graphic window specific function can be assigned. Some functions require setting on the menu page. The available function types are shown below.
  - ***Call window***
  - ***Execute the system function key***
  - ***Start/Stop/Restart Trend***
  - ***Flash/Light/Turn OFF the LED***
  - ***Execute the Program by File Name***

- *Instrument Command Operation*
- *Call Data Input Dialog*
- *Call Menu Dialog*
- *Data-Item Dependent Menu Dialog*
- *Execute the Multimedia Function*
- *Report Printout*
- *Call Panel set*
- *Others*

♦ *Window Size*
This sets whether or not to specify a window size. When specifying a window size, select a window size from [Large Size], [Medium Size], or [Special Size]. This item may be disabled depending on the type of the window selected. If a window display size is not specified, with the some exceptions, the window displays in the same size of the window where it is called up. The display size saved by the window set function is valid only when the window display size specification is omitted.

♦ *Window Display Position (Specify Coordinate)*
This sets the display position of a window to be called. Check the [Specify Coordinate] check box. The following two types of methods are used to set the display position.

- *Using the spin box*
  This sets the display position, using X- and Y-coordinates. The setting range is between -5000 and 3686400.
- *Using the mouse*
  Press the [Specify window display position] button to enable setting by the mouse. The cursor shape changes as shown below during the setting, and the button changes to [Exit Specification].

Figure: Cursor Displayed when Specifying a Window Display Position

The display position reference point is located at the top left corner of the drawing area. The "setting window display position" is optional. If it is not selected, the window display position cannot be specified.

♦ *Window Display Position (Monitor Number)*
Windows display position can be specified with a monitor number instead of the coordinates. If the HIS is installed with multiple monitoring packages, this setting is required. Check [Specify Monitor No.] check box, and then spin the spin box for setting the monitor number. 1 or 2 can be selected.

- ***Displaying the Cursor***
  Set whether or not to display the cursor movement sequence.
- ***Cursor Movement Order***
  The cursor moves between created touch targets every time the arrow key is pressed on the Graphic window. The cursor normally moves from one touch target to the nearest target in order of the target placement on the window, starting from the upper left corner. However, a desired movement order can also be specified, canceling the order of target placement. The cursor movement order is specified by assigning priority numbers to the objects. The movement order number can be set for the objects using an integer within the range from 1 to 5-digit value. The maximum number that can be set for the cursor movement order may be set on the Graphic Builder, as well.

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1. Create New Help Window

CHAPTER 13
USER DEFINED HELP WINDOW DEFINITION

USER DEFINED HELP WINDOW DEFINITION

1. Create New Help Window

This is a help message that the user can freely define. The user can define help messages to explain the function and operating procedure for user defined windows or help messages to explain the function block. These user defined help windows can be associated to other windows like graphic window, tuning window etc. When these windows are displayed and the Help key is pressed, the associated help window appears.

The user can search for user-defined help by entering the window name, tag name or help number as the keyword. The user-definable help message is defined in the Help Message Builder. Define a number between HW0001 to HW9999 as help number. The maximum size of one help message is 21 lines, each line can contain 70 single-byte characters.

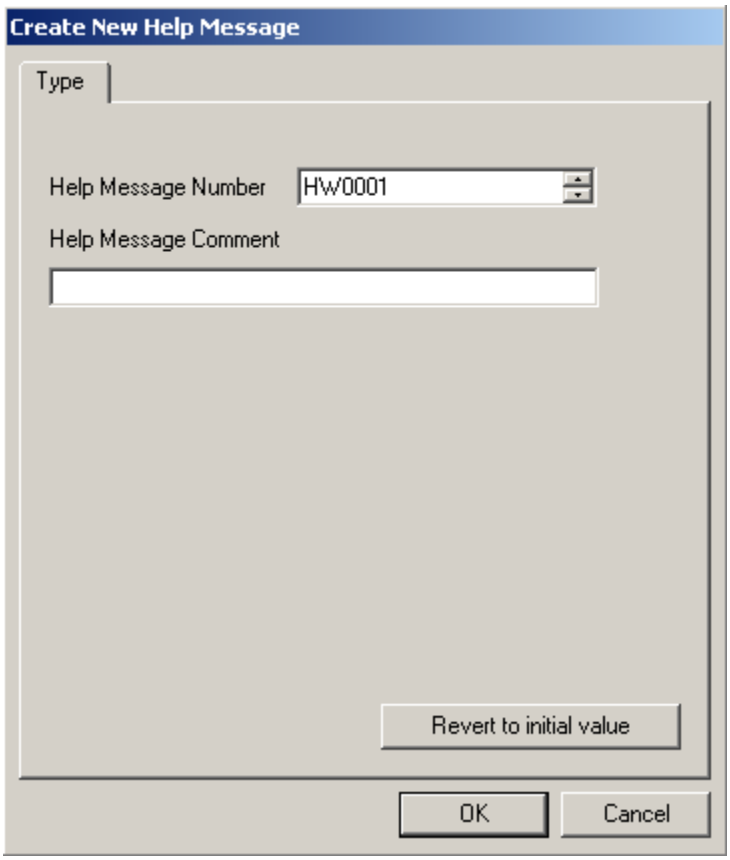

Figure: Create new help window dialog

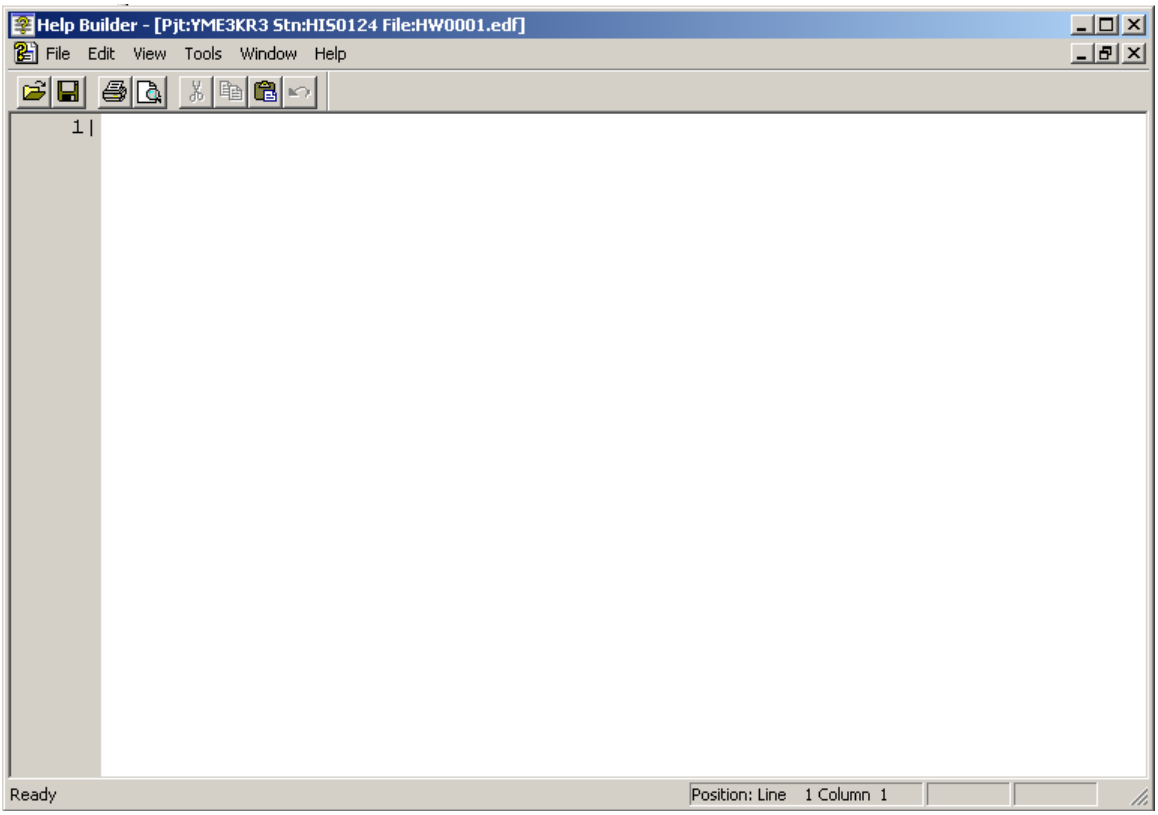

Figure: Help window builder

Instrumentation & Control Services

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2. GRAPHIC WINDOW CAPACITY

3 RECOMMENDED GRAPHIC WINDOW SIZE

4. CREATING A NEW GRAPHIC WINDOW

CHAPTER 14
GRAPHIC BUILDER

GRAPHIC BUILDER

The Graphic Builder is used to create and edit graphic windows for operation and monitoring. This chapter explains the functions specific to the graphic builder, including the use of tools to create/edit Graphic windows and to set properties for graphic objects.

1. GRAPHIC BUILDER OPERATION MODE

The Graphic Builder is divided into the following two types of operating modes, depending on the start up method.

- ***Engineering mode***
  The Graphic Builder becomes engineering mode when started directly from the System View or via other builders from the System View.
- ***Windows mode***
  The Graphic Builder becomes Windows mode when started individually as a Windows application. The following table shows the differences between Graphic Builder functions in different modes.

Function	Engineering mode	Windows mode
Editing files	Builder file (.edf) Working file (.sva)	Working file (.sva) only
Creating new files	Disabled	Enabled (select from menu)
Downloading files	Enabled (select from menu)	Disabled
Checking presence/absence of tags or windows at file write	User can specify whether performing a check or not.	Performs no check.
Create Working File	Applicable	Not applicable

Table: Differences between Engineering Mode and Windows Mode

2. GRAPHIC WINDOW CAPACITY

The capacity of one Graphic window is explained as follows. A Graphic window should not be configured beyond the limit of the capacity shown below. For some items, builder does not set restriction for the settings beyond the limit but the performance of the created Graphic window will be lowered.

- ***Number of Data Links***
  This is a total data number for linking display objects to the process data, function block data used in the modifier condition formulas as well as the data communicated from other stations.
  - ***Maximum 400/Window***

- ***Number of Modifier Conditions***
  - ***Maximum 8/Object***
  - ***Maximum 200/Window***

- ***Number of Graphs***
  This is a total number of Line-Segment graph, User-Defined Line-Segment graph, Bar graph, Step graph, Radar chart and Two-dimensional graph.
  - ***Maximum 4/Window***

- ***Graphic Arithmetic Expression***
  This is a total number of arithmetic expressions used for data displayed for the Process Data-Character and the Process Data-Bar, and arithmetic expressions used for Modify Coordinates along the X and Y axes.
  - ***Maximum 50/Window***

- ***Number of Touch Targets***
  This is a total number of Line-Segment graph, User-Defined Line-Segment graph, Bar graph, Step graph, Radar chart and Two-dimensional graph.
  - ***Maximum 400/Window***

- ***Overview Object, Graphic Modifier Color Change and Blinking***
  This is a total number of overview object, graphic modifier overview color change and overview blocking.
  - ***Maximum 60/Window***

- ***Number of Instrument Faceplate***
  - ***Maximum 16/Window***

- ***Number of Generic Names***
  - ***Maximum 400/Window***

- ***Number of Generic Name Sets***
  - ***Maximum 200/Window***

3. RECOMMENDED GRAPHIC WINDOW SIZE

The recommended graphic window sizes for each type of HIS are shown in the following table.

Type of HIS	HIS setup		Settings on graphic builder		
	Operation panel mode	Tool-button size	Graphic window size		Scaling
			With softkeys	Without softkeys	
Console Type HIS	Full-screen mode	32×32	1276×864	1276×778	Yes
Non-Console Type	Full-screen mode	24×24	1276×880	1276×792	
Non-Console Type	Windows mode	24×24	1024×686	1276×618	

Table: Recommended Graphic Window Size on HIS

4. CREATING A NEW GRAPHIC WINDOW

System View allows the creation of a Graphic window for a selected HIS in the data tree. To create a new Graphic window, set in the Create New Window dialog box the type and name of a window, a window operation and monitoring message, and scaling.

- ***Create New Window Dialog Box***
  With a WINDOW folder under any HIS folder selected, select [Create New...] - [Window] from the [File] menu to display the Create New Window dialog box used to create a new Graphic window. The Create New Window dialog box consists of the Type tab and the Set Details tab. The Type and Set details tab settings are same as discussed in Chapter Q – HIS Window configuration.

GRAPHIC BUILDER FILE MENU

Menu		Function
Create New		Opens a new document window.
Open ...		Opens an editor file.
Close		Closes an active document window.
Save		Writes the edited contents to a file.
Save As ...		Saves the contents under a different file name.
Create Working File		Creates a work file.
External File	Default ...	Reads a default file.
	Import ...	Imports an external file.
	Export ...	Export graphic builder configuration to an external file.
	Import CS source file ...	Imports a CS source file.
Properties		Displays the property sheet of a file.
Print Preview	Screen Image	Displays a print preview of printout.
	Setting Data	Displays a print preview of data set in objects.
Print ...		Executes printing.
Download		Downloads to HIS.
Exit Graphic Definition Builder		Exits the graphic builder.

Table: Function Overview of [File] Menu

GRAPHIC BUILDER EDIT MENU

Menu	Function
Undo	Cancels the previous edit operation.
Cut	Deletes the selected objects and stores them on clipboard.
Copy	Stores the selected objects on clipboard.
Paste	Extracts the data stored on dipboard.
Delete	Deletes the selected objects.
Selection Mode	Sets the mode in which objects can be selected.
Edit Point	Sets the mode in which a point of an object can be modified.
Select All	Selects all objects.
Deselect All	Deselects all the selected objects.
Find ... (*1)	Searches for an object by a given string or object number.
Find Next (*1)	Continue to search for the same item.

1: The objects and functions that cannot be selected are searched. The objects of soft-keys, functions linked to windows and elements of linked parts will be searched.

GRAPHIC BUILDER VIEW MENU

Menu	Function
Zoom In	Enlarges display area.
Zoom Out	Reduces display area.
Zoom Area	Enlarges specific area.
Whole Page	Enlarges or reduces the display area automatically so that the entire drawing area is displayed.
Display Foreground Image	Displays/hides the foreground image.
Display Background Screen	Displays/hides the background image.
Display Object Number	Displays the object number.
Redraw	Performs redrawing.
Toolbar ...	Opens a dialog for customizing display methods of toolbars.
Status Bar	Switches the status bar display.
Ruler	Switches the ruler display.
Message Display Area	Switches message area display between on and off.

Table: Function Overview of [View] Menu

GRAPHIC BUILDER INSERT MENU

Menu			Function
Diagram (P) ...			Imports diagrams such as bitmap from an external source.
Parts ...			Starts the parts window.
Linked Part ...			Starts the linked part window.
Pen			Selects the pen tool.
Line	Straight Line		Draws a straight line.
	Polyline		Draws a polyline.
	Arc		Draws an arc.
Graphic	Rectangle		Draws a rectangle.
	Circle		Draws a circle with a specified radius.
	Ellipse		Draws an ellipse.
	Sector		Draws a sector.
	Fill Area		Draws a fill area
Marker			Draws a marker.
Text			Draws text.
Data Display	Process Data-Character		Draws a process data character display object.
	Data Bar Display	Rectangular Bar	Draws a rectangular bar object.
		Arrow Bar	Draws an arrow bar object.
		Circular Bar	Draws a circular bar object.
	Display Data Graph	Line-segment Graph	Draws a line segment graph object.
		User-defined line-segment graph	Draws a user-defined line-segment graph object.
		Bar Graph	Draws a bar graph object.
		Step Graph	Draws a step graph object.
		Radar Chart	Draws a radar chart object.
		Two-dimensional Graph (X)	Draws a two-dimensional graph object.
Button	Touch Target		Draws a touch target object.
	Push Button		Draws a push button object.
	Faceplate Block Button		Draws a faceplate block button.
Instrument Diagram			Draws an instrument diagram.
Window			Draws a window object.
Message			Draws a message object.
Dialog Name			Draws a dialog name object.
Trend			Draws a trend object.
Control			Inserts a control object.
Overview			Draws an overview object.
Soft Key ...			Sets up a soft key.
Background Screen Bitmap	Import ...		Imports a bitmap file.
	Delete		Deletes an imported file.
	Properties ...		Sets properties for the imported file.

Table:

Function Overview of [Insert] Menu

GRAPHIC BUILDER FORMAT MENU

Menu	Function
General ...	Starts the object's general tab.
Line ...	Starts the tab that specifies lines in the object.
Fill ...	Starts the tab that specifies fill in the object.
Text ...	Starts the tab that specifies text in the object.
Modify ...	Starts the tab that specifies modifier in the object.
Default ...	Starts the tab that specifies defaults for the object.
Copy Modify	Copies the graphic modifier setting of the selected object.
Paste Modify Condition	Pastes the graphic modifier setting that is copied onto the selected object.

Table: Function Overview of [Format] Menu

GRAPHIC BUILDER TOOL MENU

Menu	Function
Debug ...	Executes debugging.
Tag/Window Name List ...	Displays the tag/window selection dialog.
Create Default File ...	Creates a user-defined default file.
Delete Default File ...	Deletes a user-defined default file.
Options ...	Displays the option property sheet that sets operating environment of the graphic builder.

Table: Function Overview of [Tool] Menu

GRAPHIC BUILDER DRAW MENU

Menu		Function
Grid Option...		Specifies grid option.
Object Order	Bring to Front	Moves the selected object to the very top.
	Send to Back	Moves the selected object to the very bottom.
	Bring Forward	Moves up the selected object by one layer.
	Bring Backward	Moves down the selected object by one layer.
Arrange Objects ...		Opens a dialog for aligning selected objects.
Rearrange Objects ...		Opens a dialog for arranging the selected objects evenly.
Group		Groups the selected objects.
Ungroup		Ungroups the selected objects.
Invert	Horizontal	Displays the selected object horizontally in reverse.
	Vertical	Displays the selected object vertically in reverse.
Rotate	Rotate 90 Degrees Counterclockwise	Rotates the selected object 90 degrees to the left.
	Rotate 90 Degrees Clockwise	Rotates the selected object 90 degrees to the right.

GRAPHIC BUILDER WINDOW MENU

Menu	Function
New Window	Opens the currently open file as a new document window.
Cascade	Displays all currently open windows stacked and offset.
Tile Vertically	Adjusts each document window size so that all open document windows are displayed side by side.
Tile Horizontally	Adjusts each document window size so that all open document windows are displayed one above the other.
Arrange Icons	Displays document window icons aligned.
Document Window Title	Displays a title list of the currently open document windows.

Table: Function Overview of [Window] Menu

GRAPHIC BUILDER HELP MENU

Menu	Function
Using On-line Manual ...	Starts the on-line manual.
Engineering Operation Manual ...	Displays the engineering operation manual. (*1)
Builder Definition Items ...	Displays a list of builder definition items.
Reference Index ...	Displays the reference information.
Version Information ...	Displays the version information.

***1: Not activate on product control builder.**

Table: Function Overview of [Help] Menu

GRAPHIC BUILDER STANDARD TOOLBAR

Button	Tool	Function
	Save	Writes the edited contents to a file.
	Create Working File	Creates a work file.
	Print	Starts printing.
	Screen Image Print Preview	Displays the print preview of printout.
	Setting Data Print Preview	Displays the print preview of data set for objects.
	Debug	Executes debugging.
	Cut	Deletes the selected objects and stores them on clipboard.
	Copy	Stores the selected objects on clipboard.
	Paste	Extracts the data stored on clipboard.
	Copy Modify	Copies the graphic modifier setting of the selected object.
	Paste Modify	Pastes the graphic modifier setting that is copied onto the selected object.

Table: Standard Toolbar Tool List (1/2)

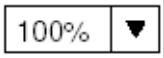
Button	Tool	Function
	Undo	Cancels the previous edit operation.
	Grid	Switches the grid display between on and off.
	Snap to grid	Switches the snap to grid setting between on and off.
	Zoom In	Enlarges the display area.
	Zoom Out	Reduces the display area.
	Area Zoom	Enlarges a specific area.
	Specify Zoom Size	Specifies the size of display area.

Table: Standard Toolbar Tool List (2/2)

GRAPHIC BUILDER DRAW TOOLBAR

Button	Tool	Function
	Select Mode	Sets the mode in which objects can be selected.
	Point Correction	Enters the point correction mode.
	Pen	Selects the pen tool.
	Straight Line	Draws a straight line.
	Polyline	Draws a polyline.
	Arc	Draws an arc.
	Rectangle	Draws a rectangle.
	Fill Area	Draws a fill area.
	Circle	Draws a circle with a specified radius.
	Ellipse	Draws an ellipse.
	Sector	Draws a sector.
	Marker	Draws a marker.
	Text	Draws text.

Table: Draw Toolbar Tool List

GRAPHIC BUILDER HIS FUNCTIONS TOOLBAR

Button	Tool	Function
	Process Data-Character	Draws a data character display object.
	Process Data-Bar	Draws a rectangle data bar object.
	Process Data-Arrow	Draws an arrow data bar object.
	Process Data-Circle	Draws a circle data bar object.
	Line-segment Graph	Draws a line-segment object.
	User-defined Line-segment Graph Object	Draws a user-defined line-segment graph object.
	Bar Graph	Draws a bar graph object.
	Step Graph	Draws a step graph object.
	Radar Chart	Draws a radar chart object.
	Two-dimensional Graph	Draws a two-dimensional graph object.
	Touch Target	Draws a touch target object.

Table: HIS Functions Toolbar Tool List (1/2)

Button	Tool	Function
	Push button	Draws a push button object.
	Faceplate	Draws a faceplate block button.
	Instrument Diagram	Draws an instrument diagram.
	Window	Draws a window display object.
	Message	Draws a message object.
	Dialog Name	Draws a dialog object.
	Trend	Draws a trend object.
	Overview	Draws an overview object.
	Control	Inserts an ActiveX control object.

Table: HIS Functions Toolbar Tool List (2/2)

GRAPHIC BUILDER FORMAT TOOLBAR

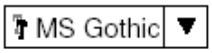
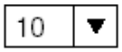
Button	Tool	Function
	Font Type	Selects font type of text.
	Font Size	Selects font size of text.
	Bold	Displays text in boldface.
	Italic	Displays text in italics.
	Underline	Underlines text.
	Text Color	Displays the menu from which a text color is selected.
	Fill Color	Displays the menu from which a fill color is selected.
	Line Color	Displays the menu from which a line color is selected.
	Line Type	Displays the menu from which a line type is selected.
	Line Thickness	Displays the menu from which thickness of a line is selected.
	Line End	Displays the menu from which items such as directions of arrows are selected.
	Properties	Displays the property sheet of the selected object.

Table: Format Toolbar Tool List

GRAPHIC BUILDER EDIT OBJECT TOOLBAR

Button	Tool	Function
	Align	Opens a dialog for aligning the selected objects.
	Distribute	Opens a dialog for arranging the selected objects evenly.
	Group	Groups the selected objects.
	Ungroup	Ungroups the selected group objects.
	Bring to Front	Moves the selected object to the very top.
	Send to Back	Moves the selected object to the very bottom.
	Bring Forward	Moves up the selected object by one layer.
	Send Backward	Moves down the selected object by one layer.
	Flip Horizontally	Flips the currently selected object horizontally.
	Flip Vertically	Flips the currently selected object vertically.
	Rotate 90 degrees counterclockwise	Rotates the selected object 90 degrees to the left.
	Rotate 90 degrees clockwise	Rotates the selected object 90 degrees to the right.

Table: Edit Object Toolbar Tool List

PARTS TOOLBAR ON GRAPHIC BUILDER

Button	Tool	Function
	Parts	Starts the parts windows
	Linked Part	Starts the linked part windows

Table: Parts Toolbar Tool List