CHAPTER 1
SYSTEM OVERVIEW

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Objectives

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

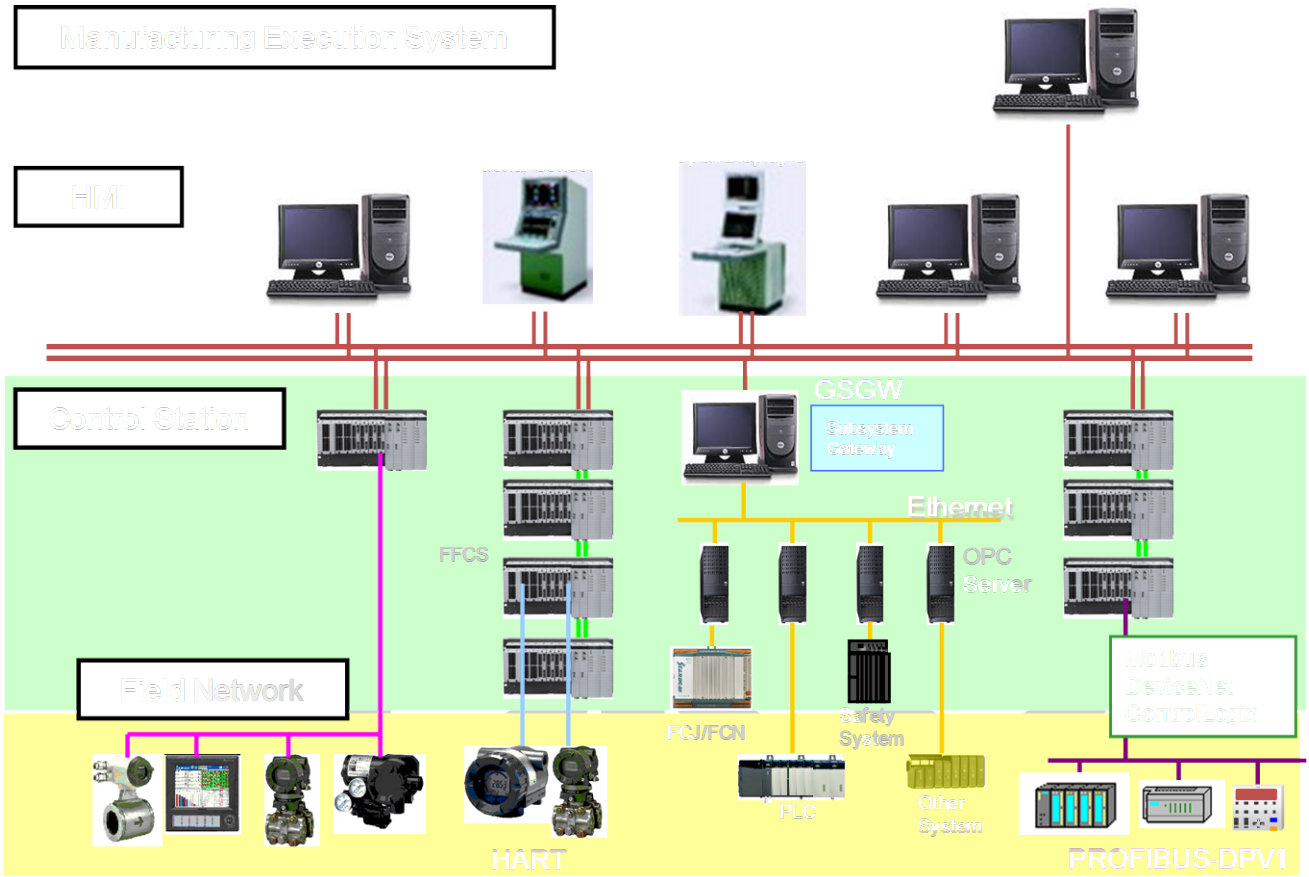


Figure: CS3000 R3 System configuration

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.

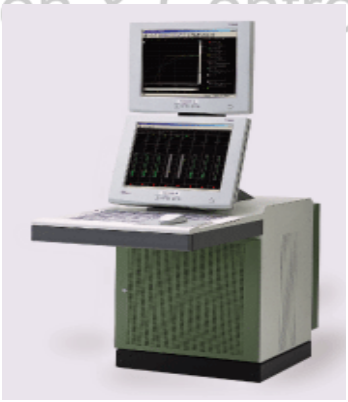


Figure: Open display style console type of HIS

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.

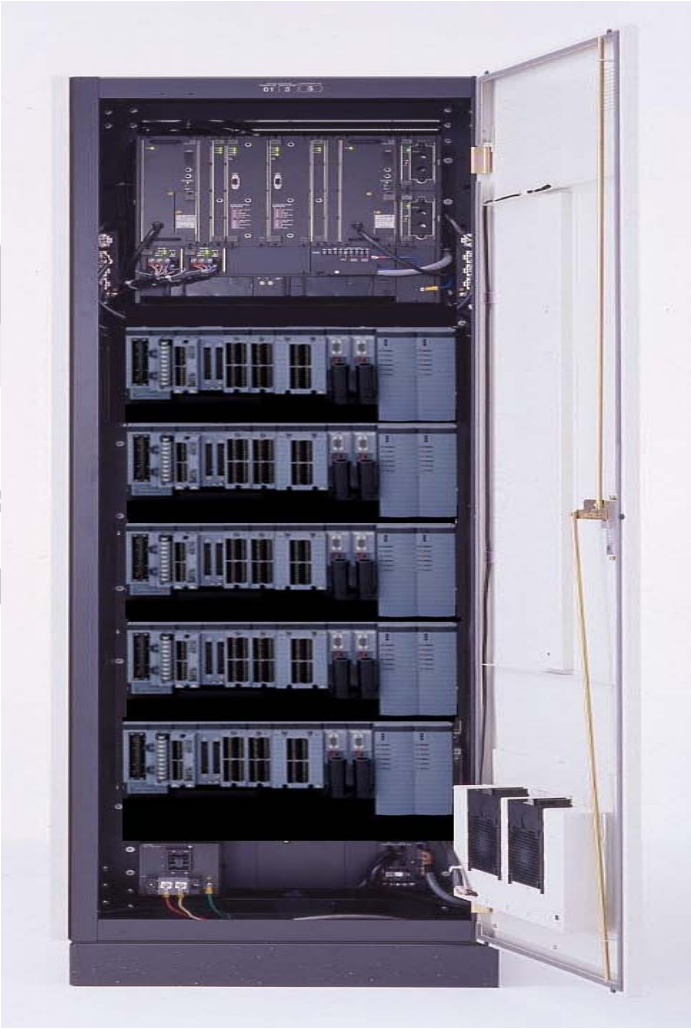


Figure: KFCS-Standard FCS with Field Input/output Modules (FIO)

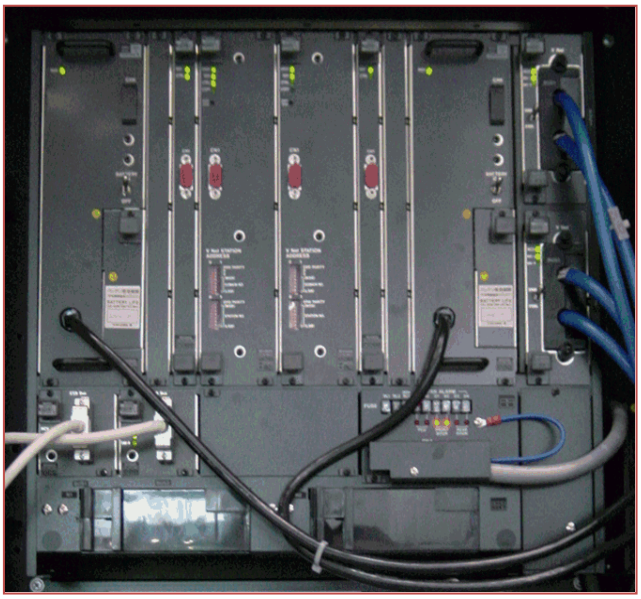


Figure: KFCS Field Control Unit (FCU)

Model / Card/Unit	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.

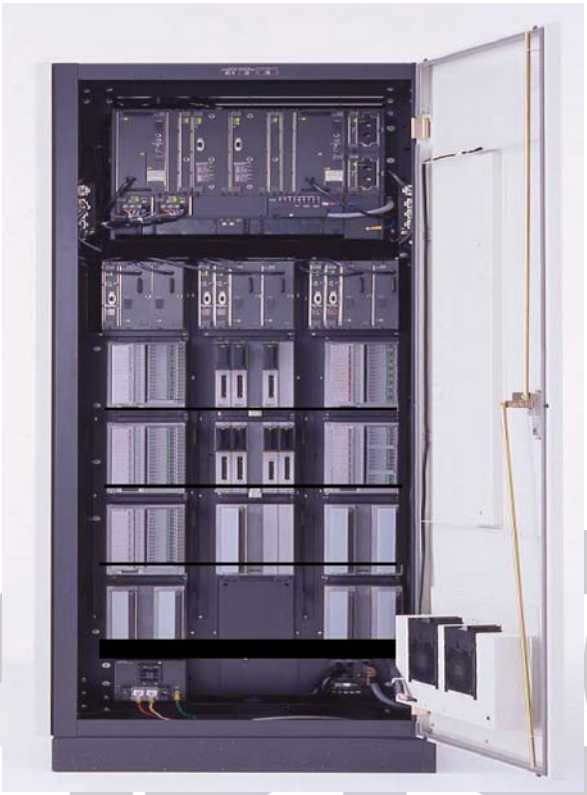


Figure: LFCS - Standard FCS with remote Input/output (RIO) Bus

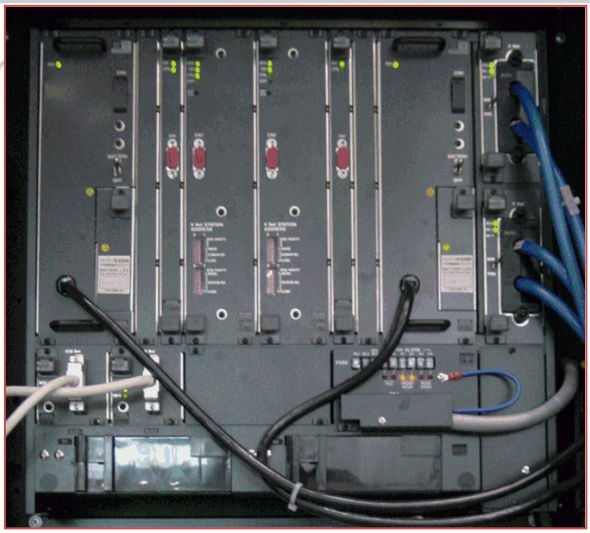


Figure: LFCS - Field Control Unit (FCU)

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.

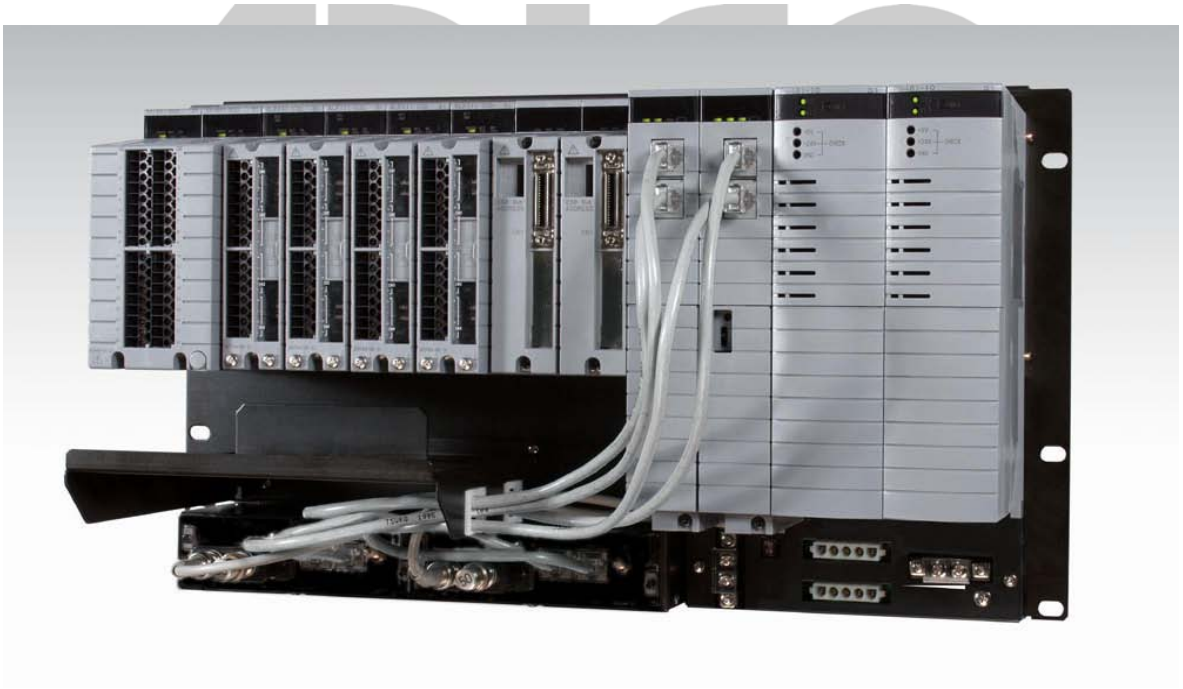


Figure: FFCS - Compact Field Control Station (FIO Bus)

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

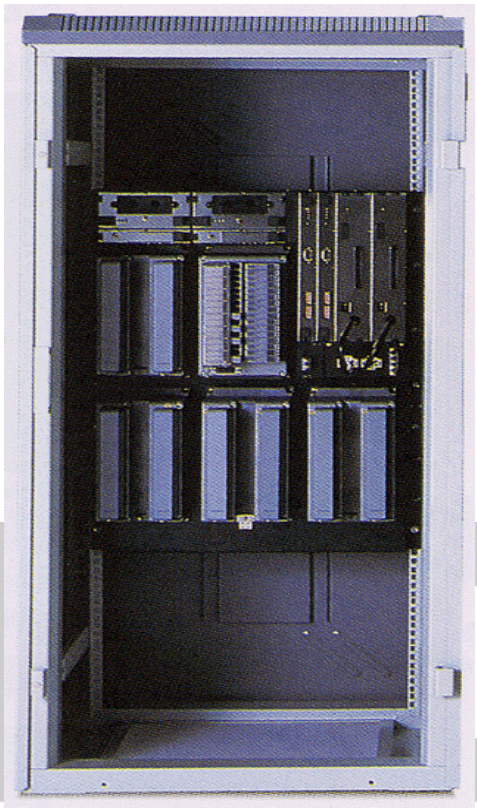


Figure: PFCD - Compact Field Control Station (RIO Bus)

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.

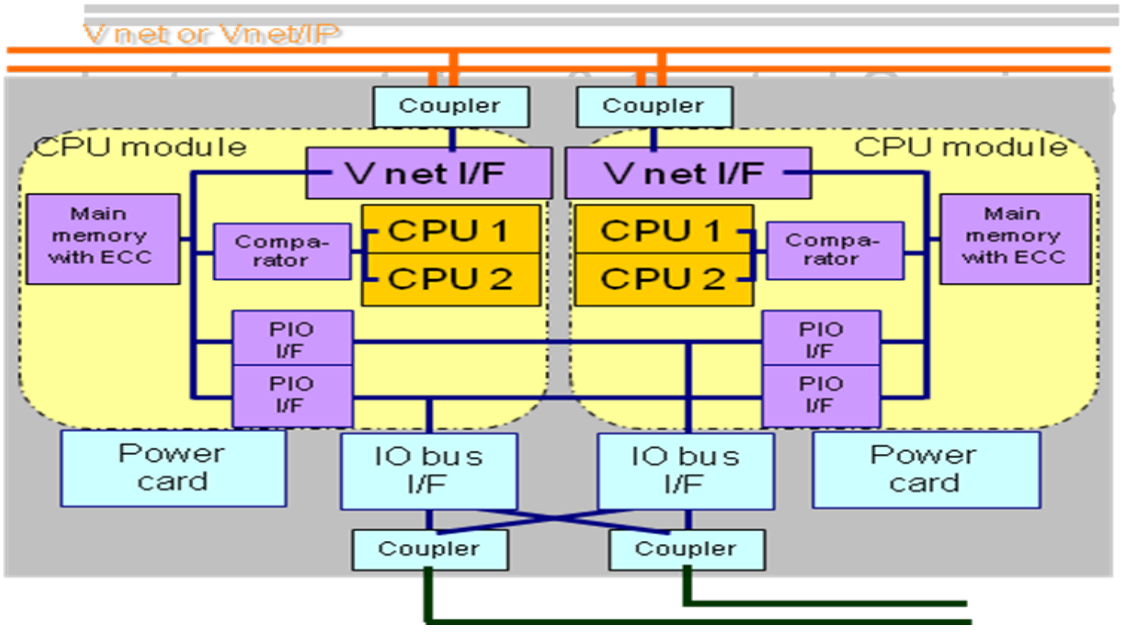


Figure: Pair and Spare function of the CPU Card for FFCS.

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)

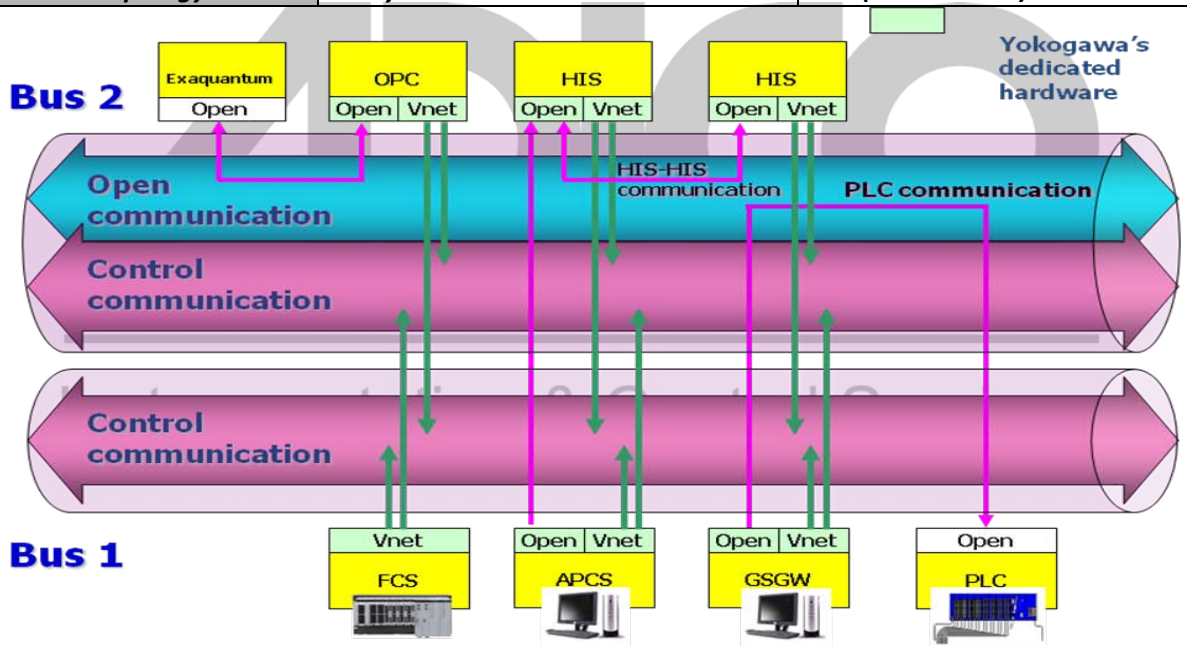


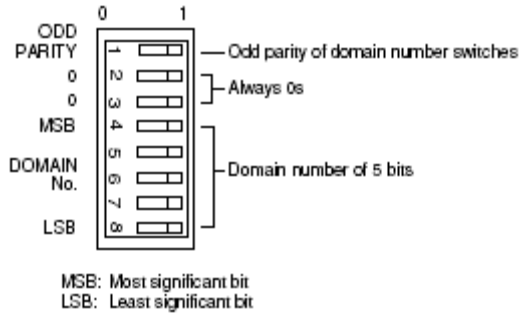
Figure: Vnet-IP Configuration

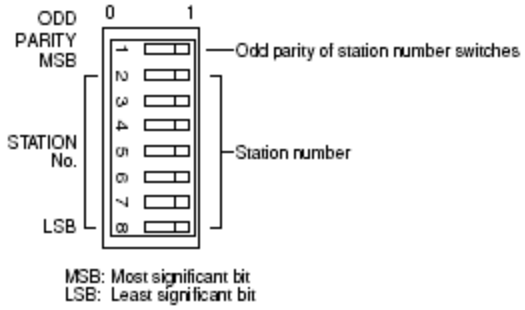
6. SYSTEM CAPACITY

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.



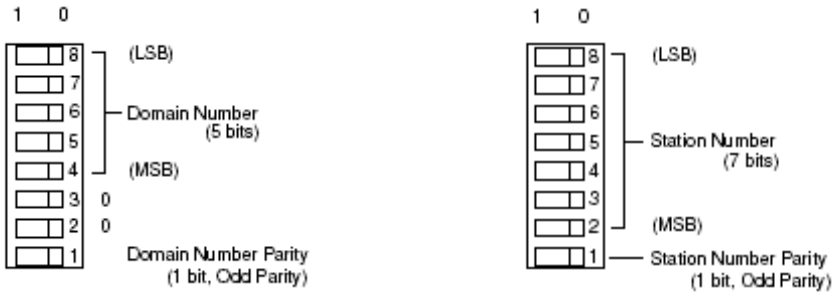


Domain no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Bit 1	0	0	1	0	1	1	0	0	1	1	0	1	0	0	1	0
Bit 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bit 5	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
Bit 6	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0
Bit 7	0	1	1	0	0	1	1	0	0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

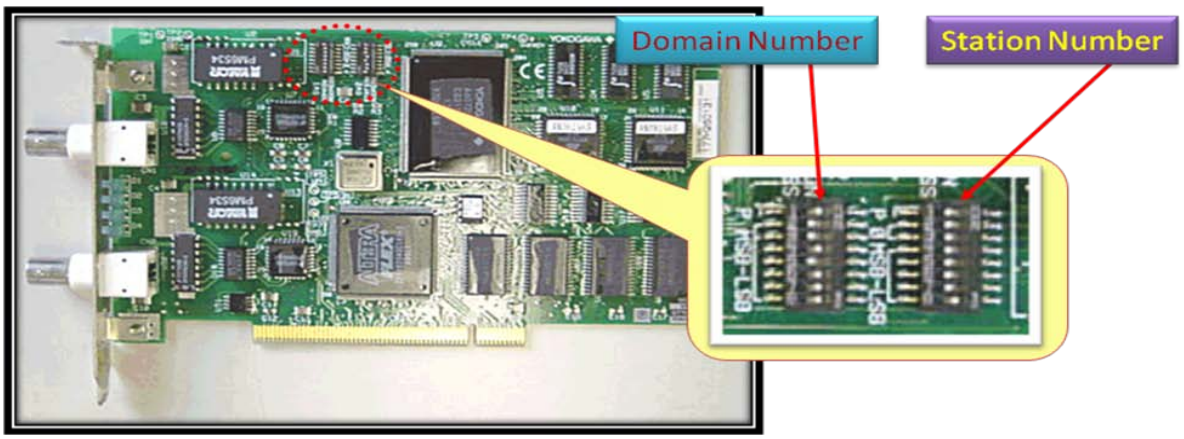
The dip switches for domain and station no. setting for the HIS is found in the Vnet control bus card, installed in the PC PCI slot and has to be set correctly for station address identification as per the configuration.



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.



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CHAPTER 2
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.

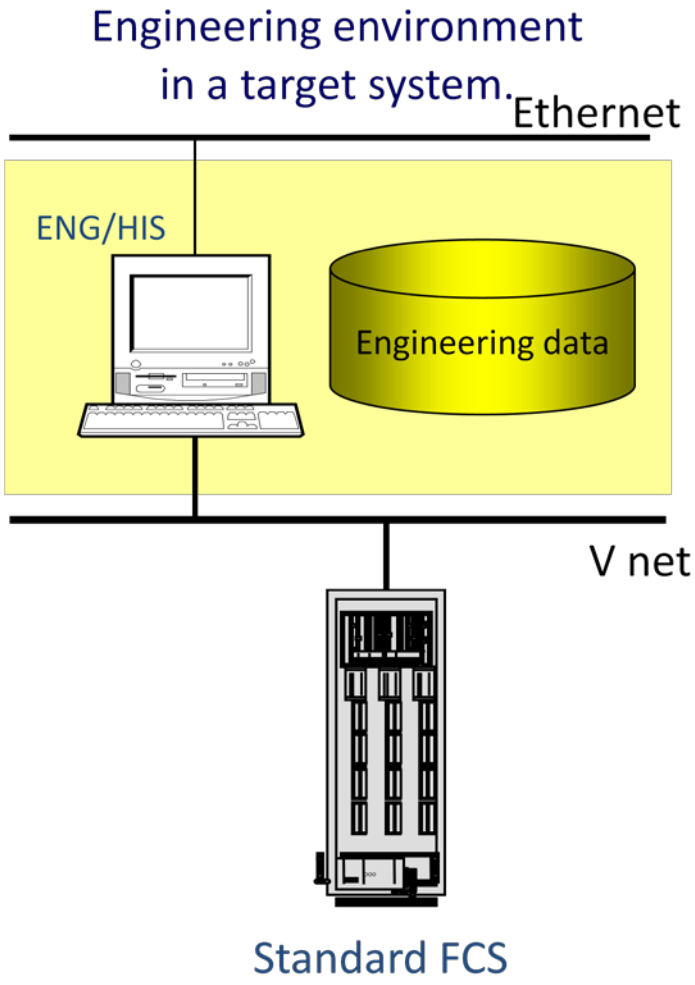

Figure: Target system.

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.

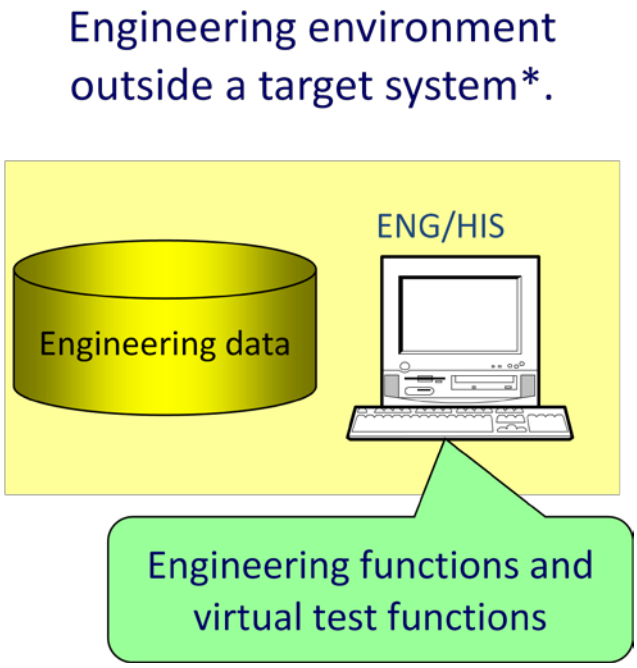

Figure: Non-Target system.

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.

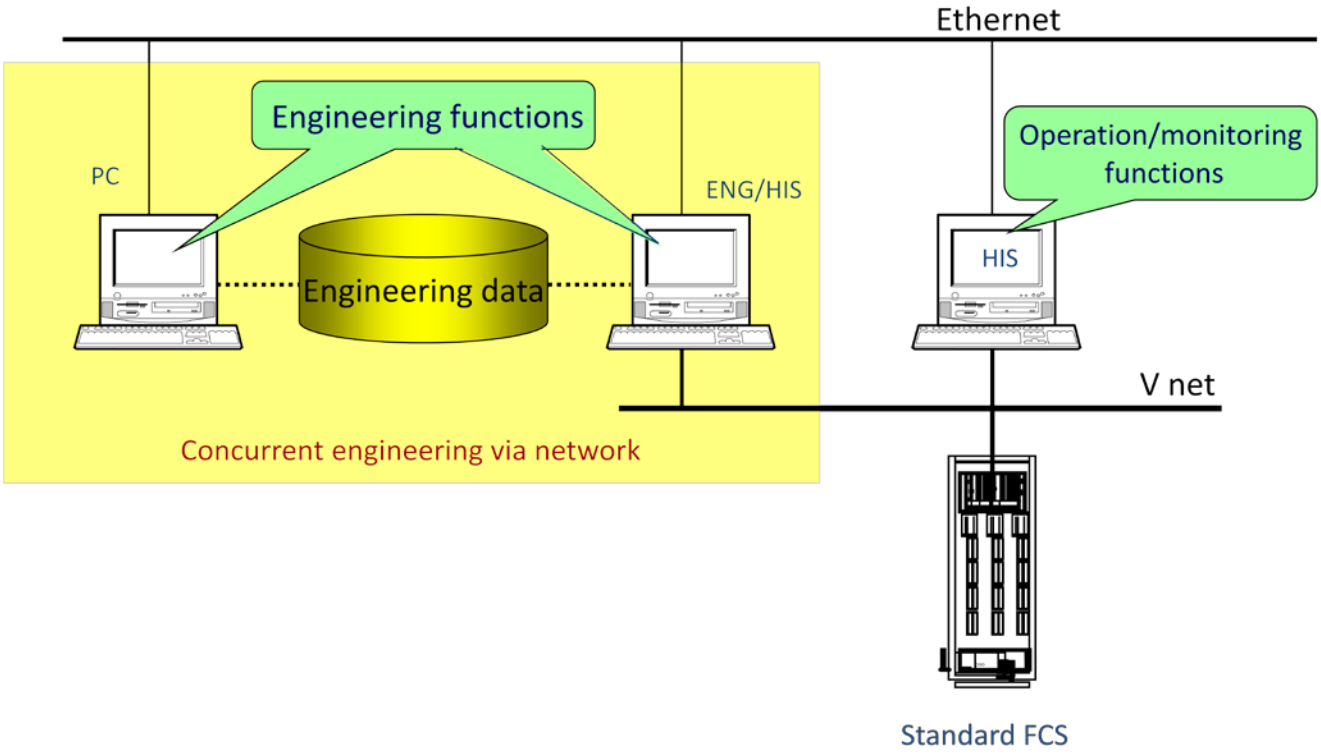

Figure: Concurrent Engineering.

4. ENGINEERING FLOW

The following engineering flow is followed in this course.

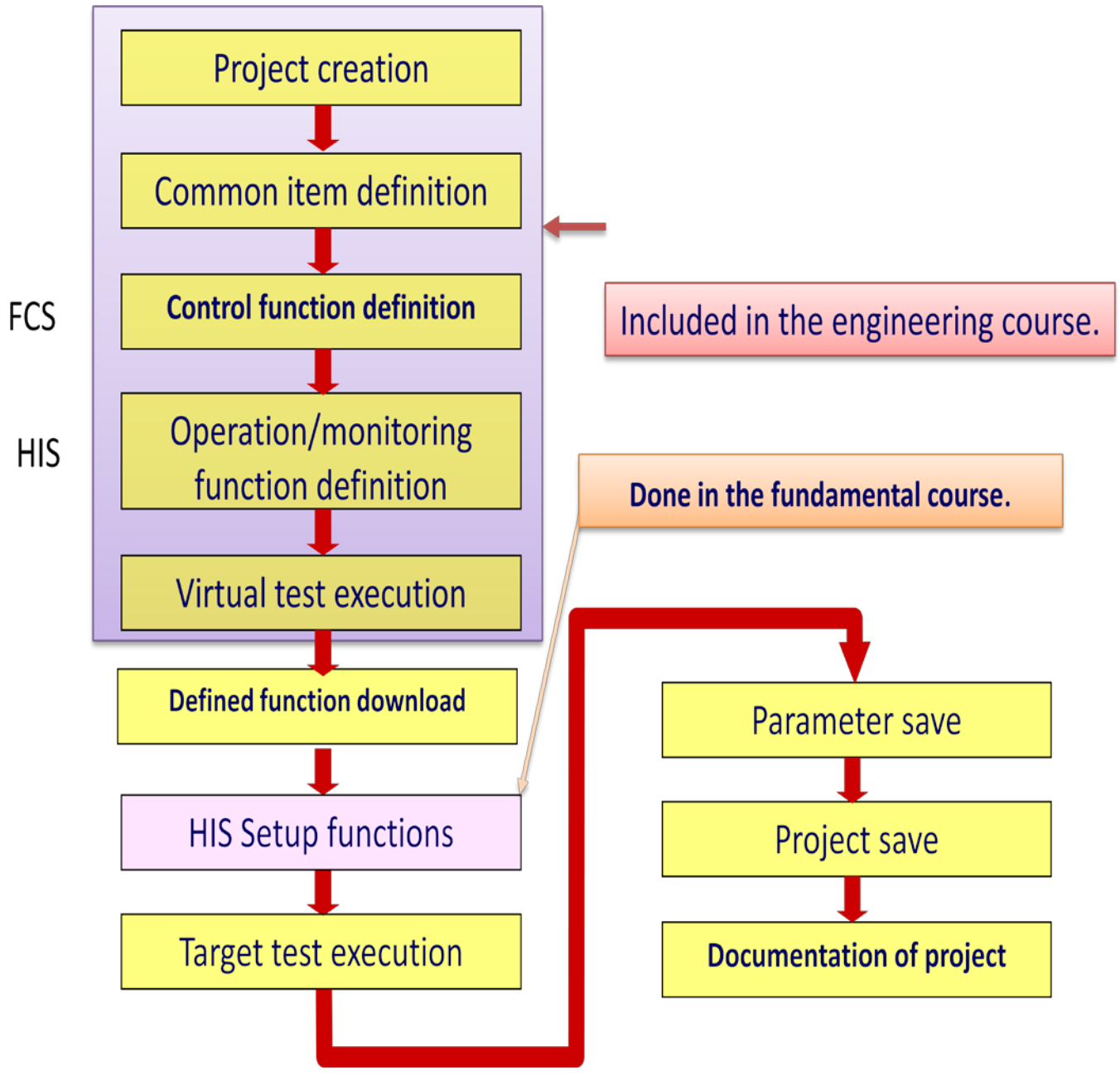

Figure: Engineering flow.

CHAPTER 3
PROJECT CREATION

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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***

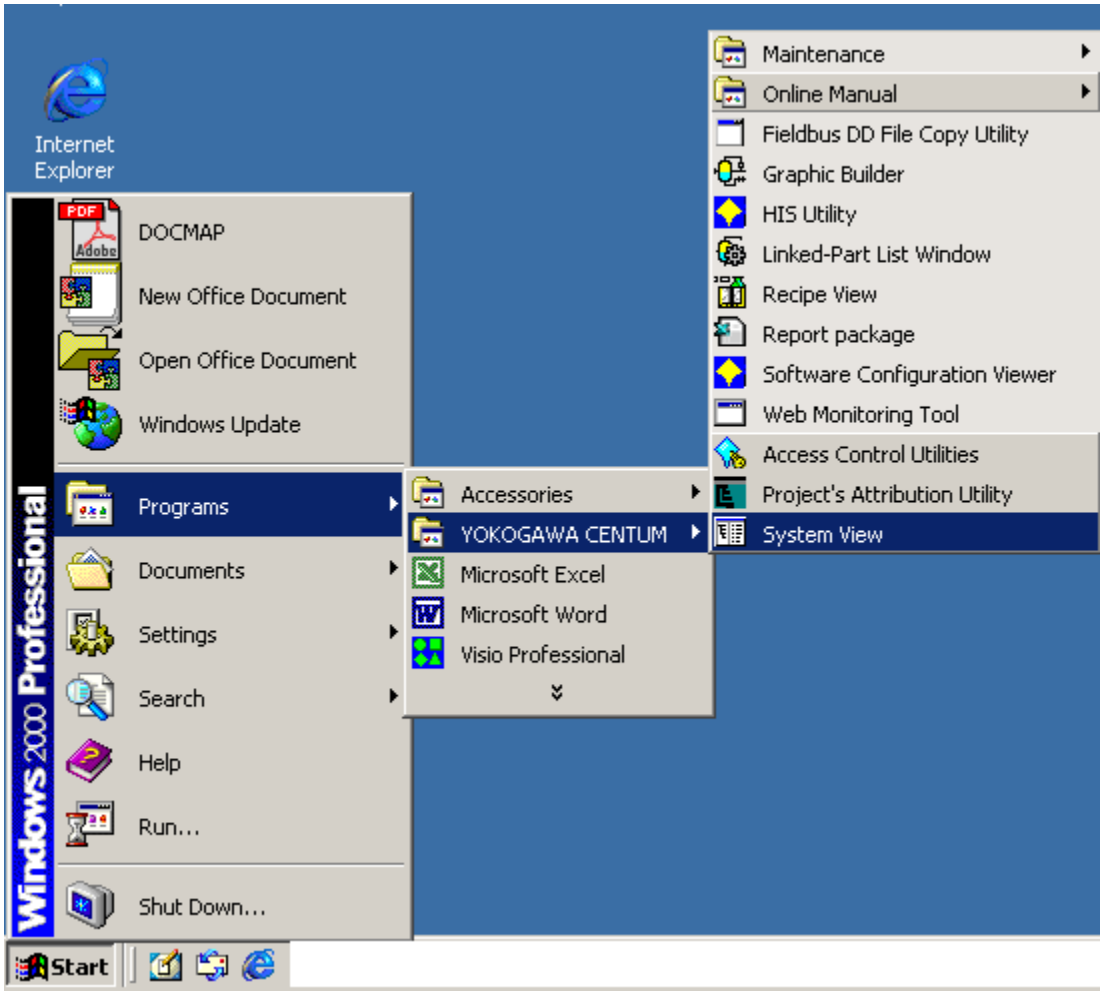

Figure: Start system view.

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

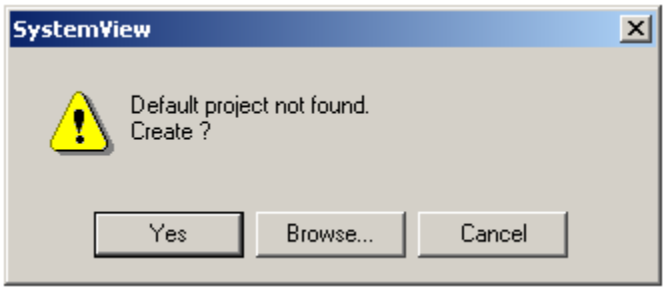

Figure: Confirmation of default project.

- ***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.

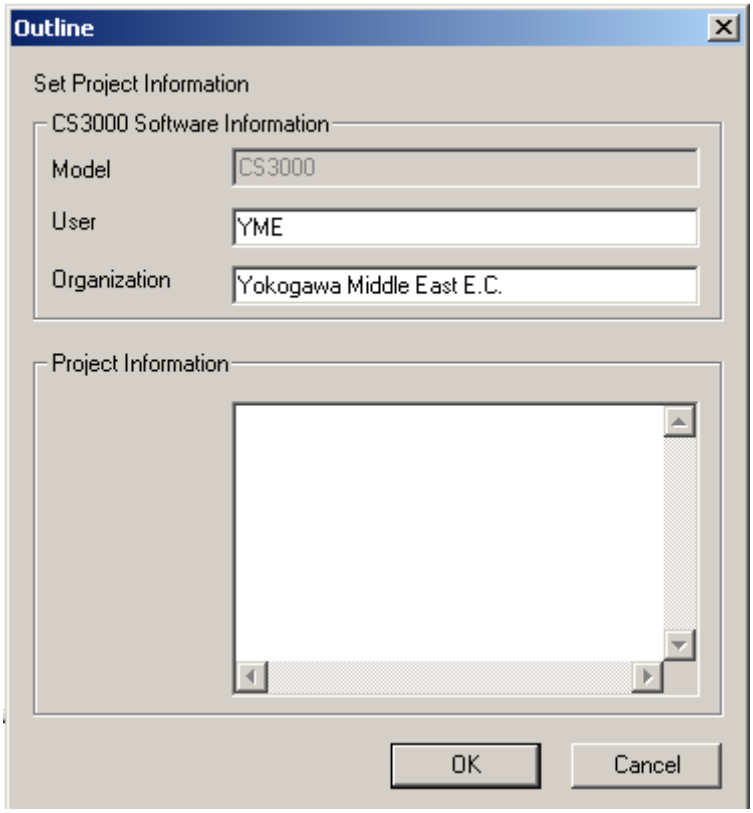

Figure: Project outline dialog.

- ***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

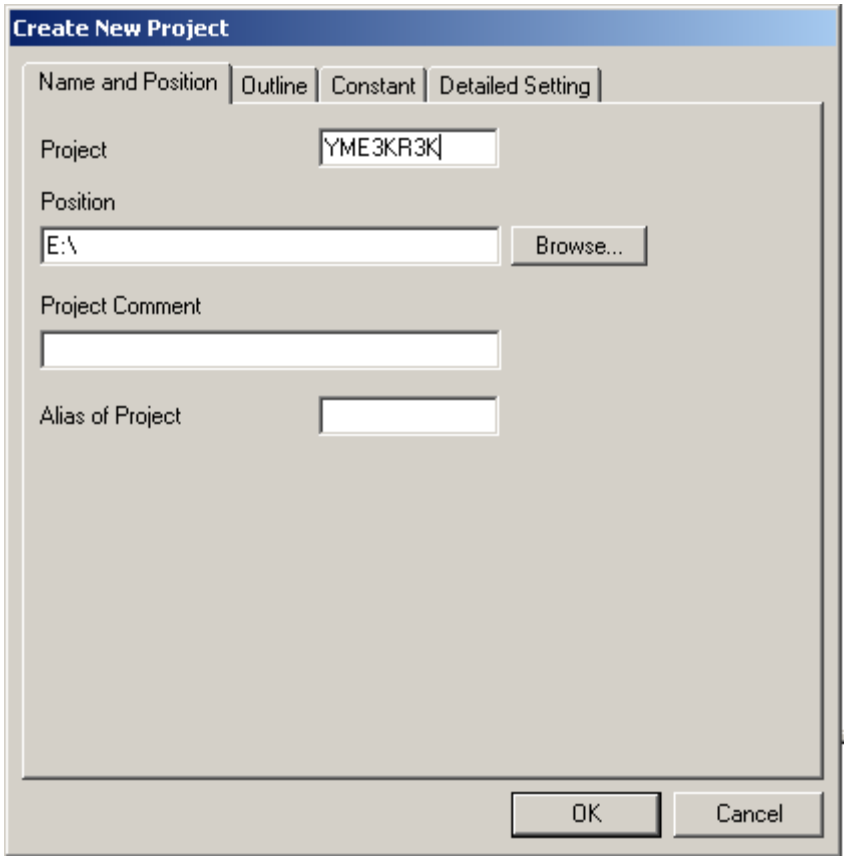

Figure: Create new project dialog.

- ***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.

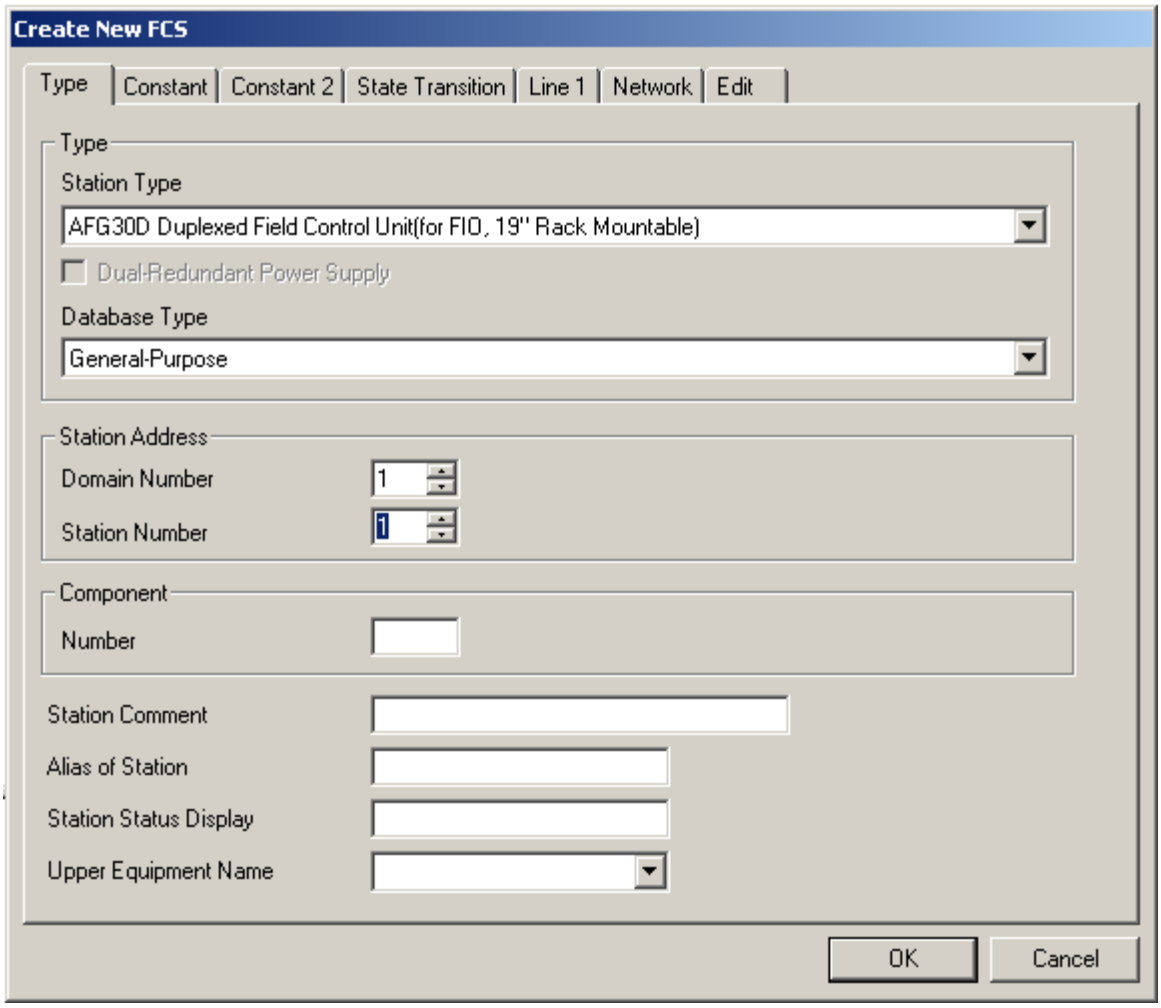

Figure: Create new FCS dialog.

- ***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.

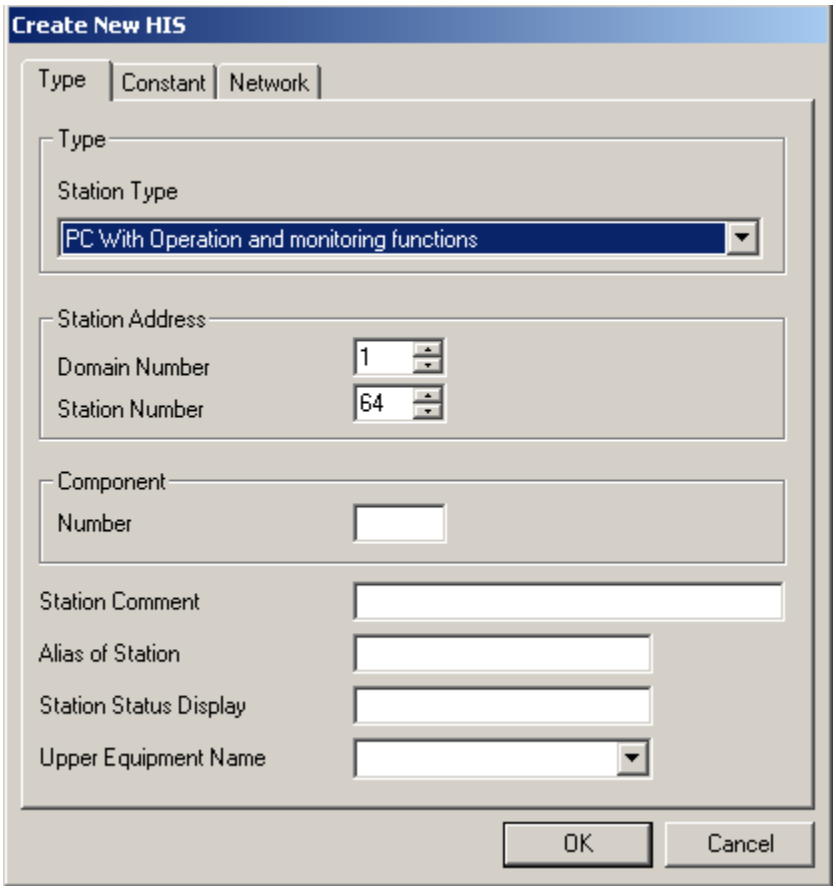

Figure: Create new HIS dialog.

- ***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

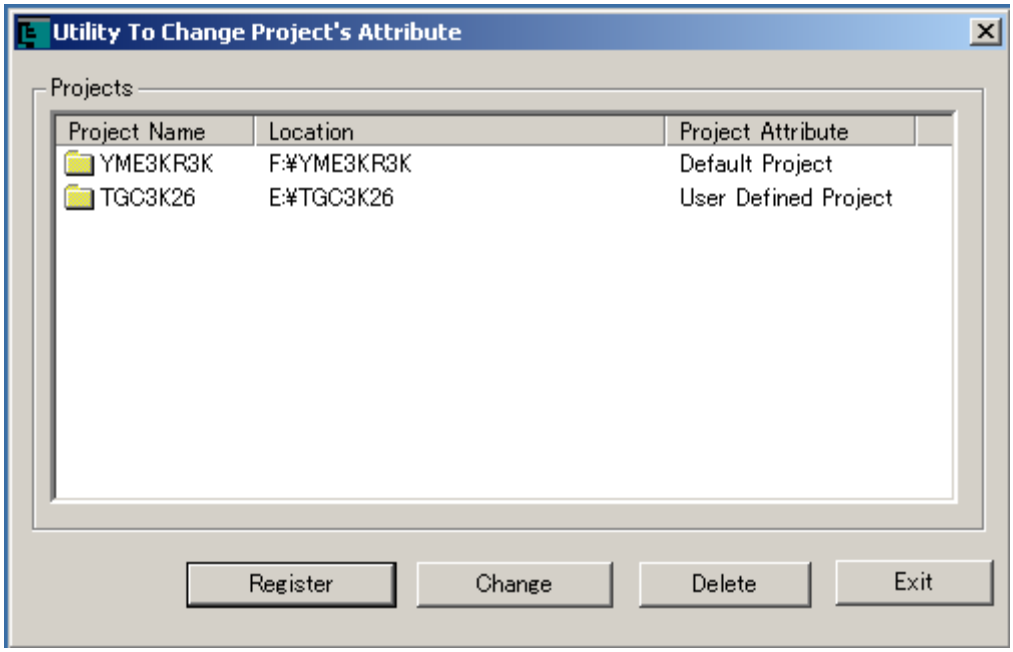

Figure: Project attribution utility.

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.

Instrumentation & Control Services

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CHAPTER 4
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 5

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.

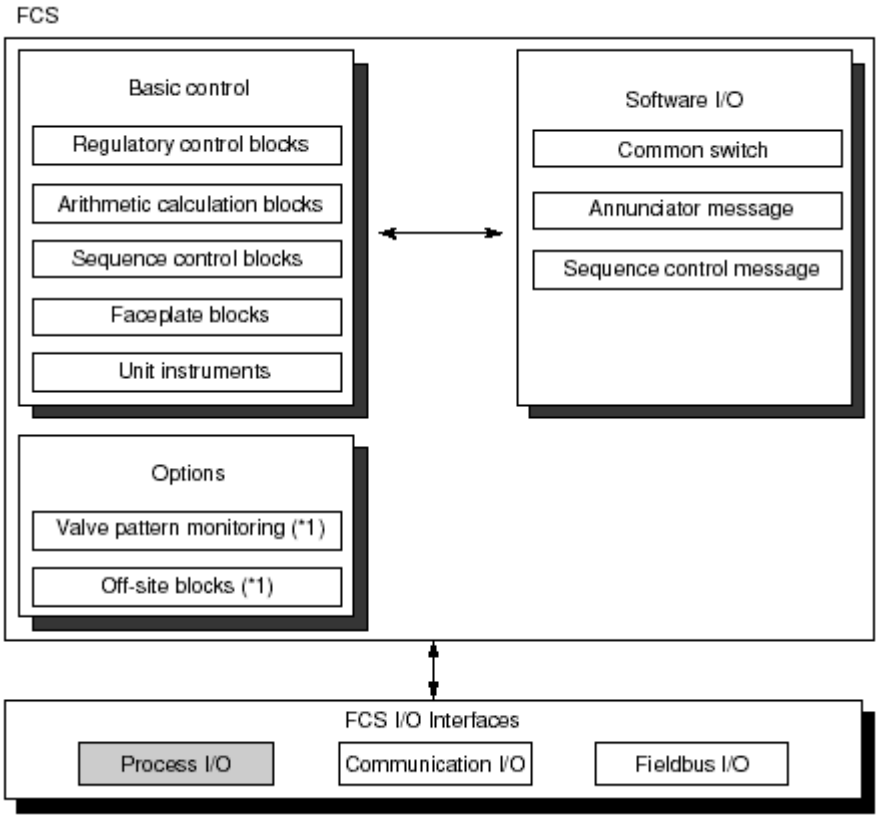


Figure: Relationship of Process I/O with basic control

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:

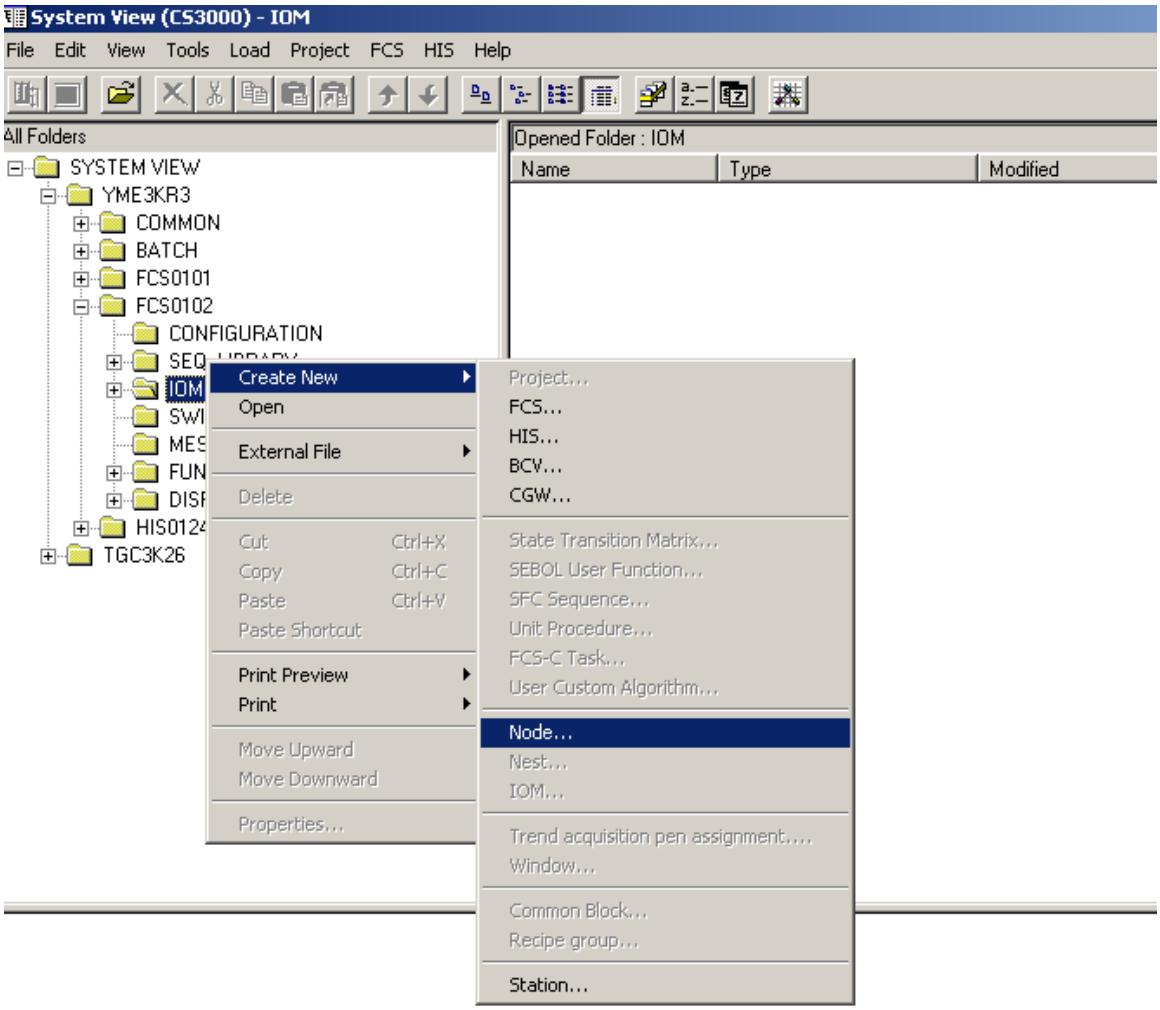


Figure: Creation of a new node.

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

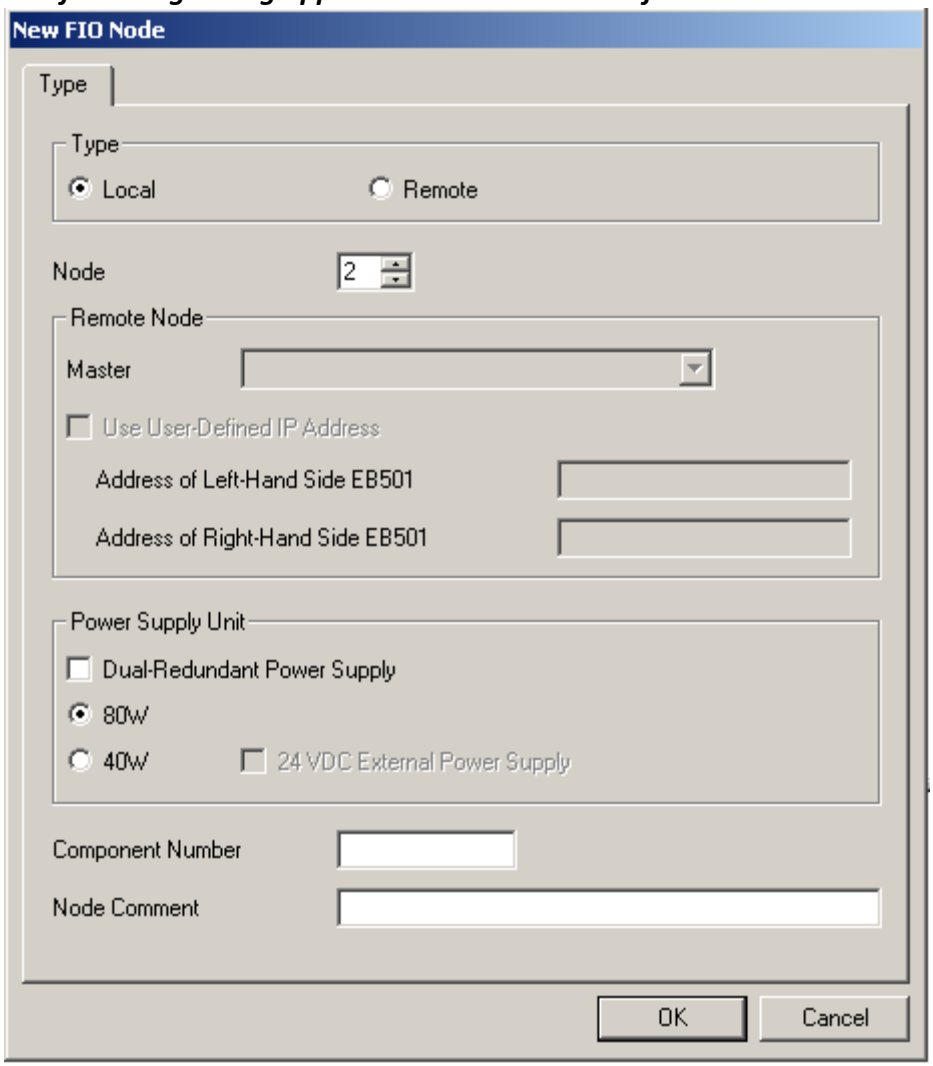


Figure: New FIO node dialog box

- ***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

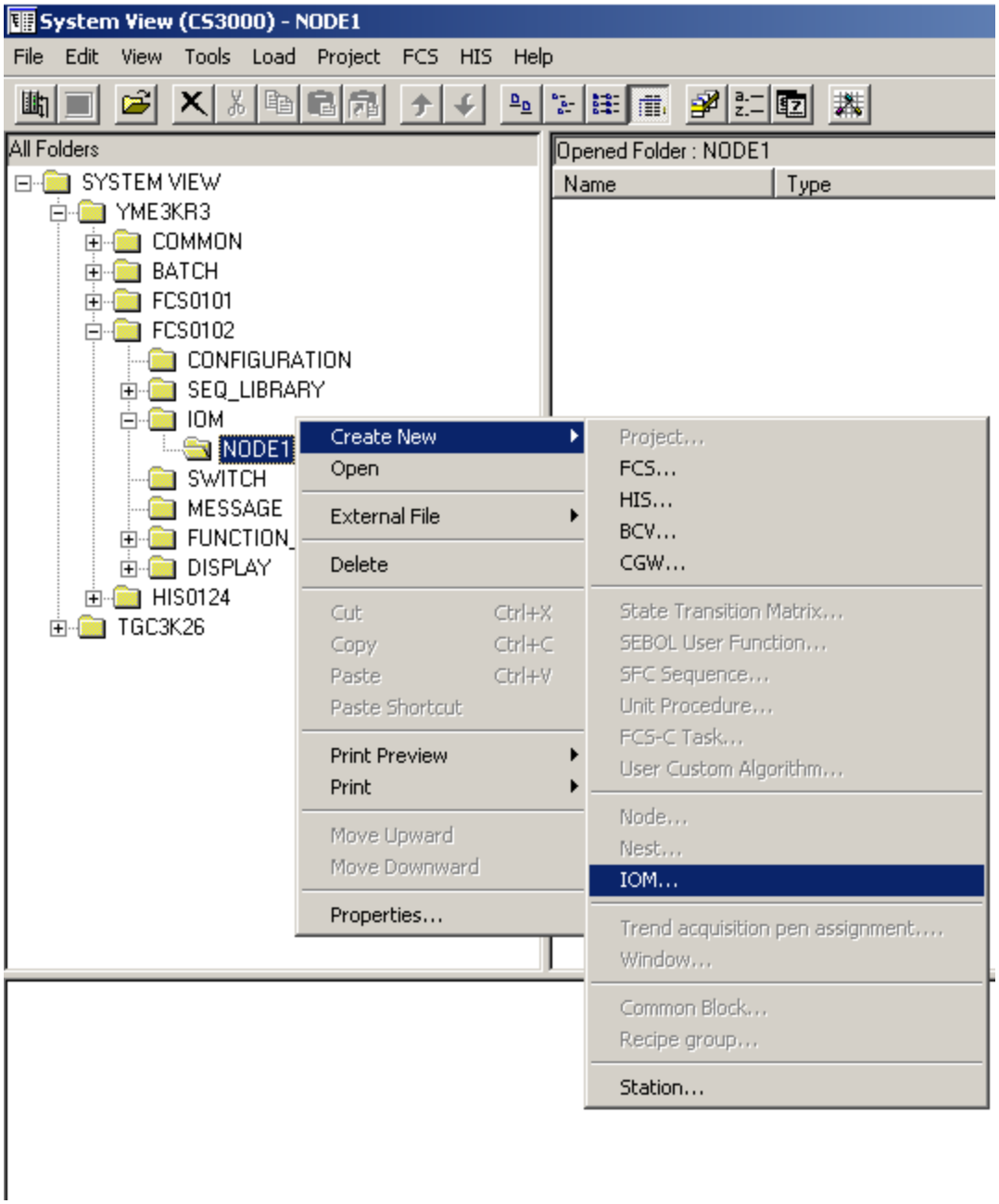


Figure: Creation of new IOM

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

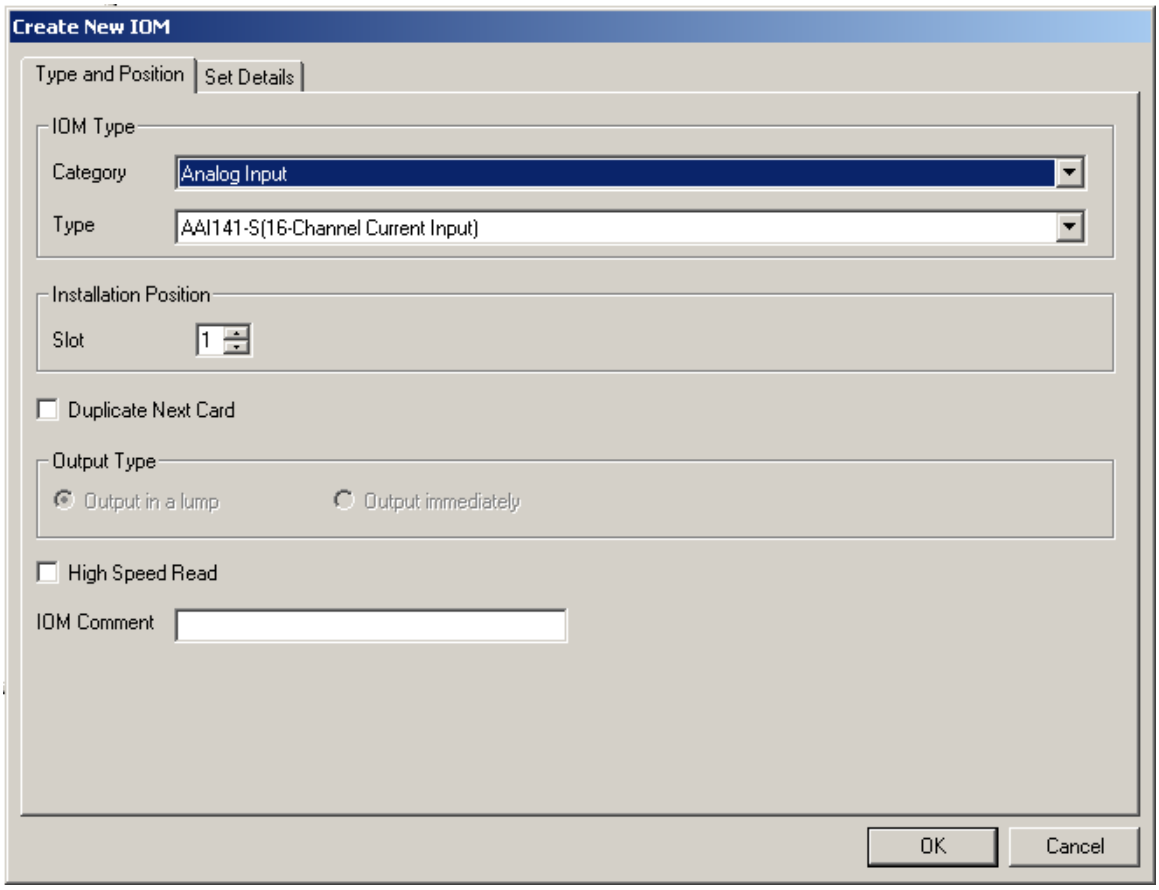


Figure: Create new IOM dialog

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.

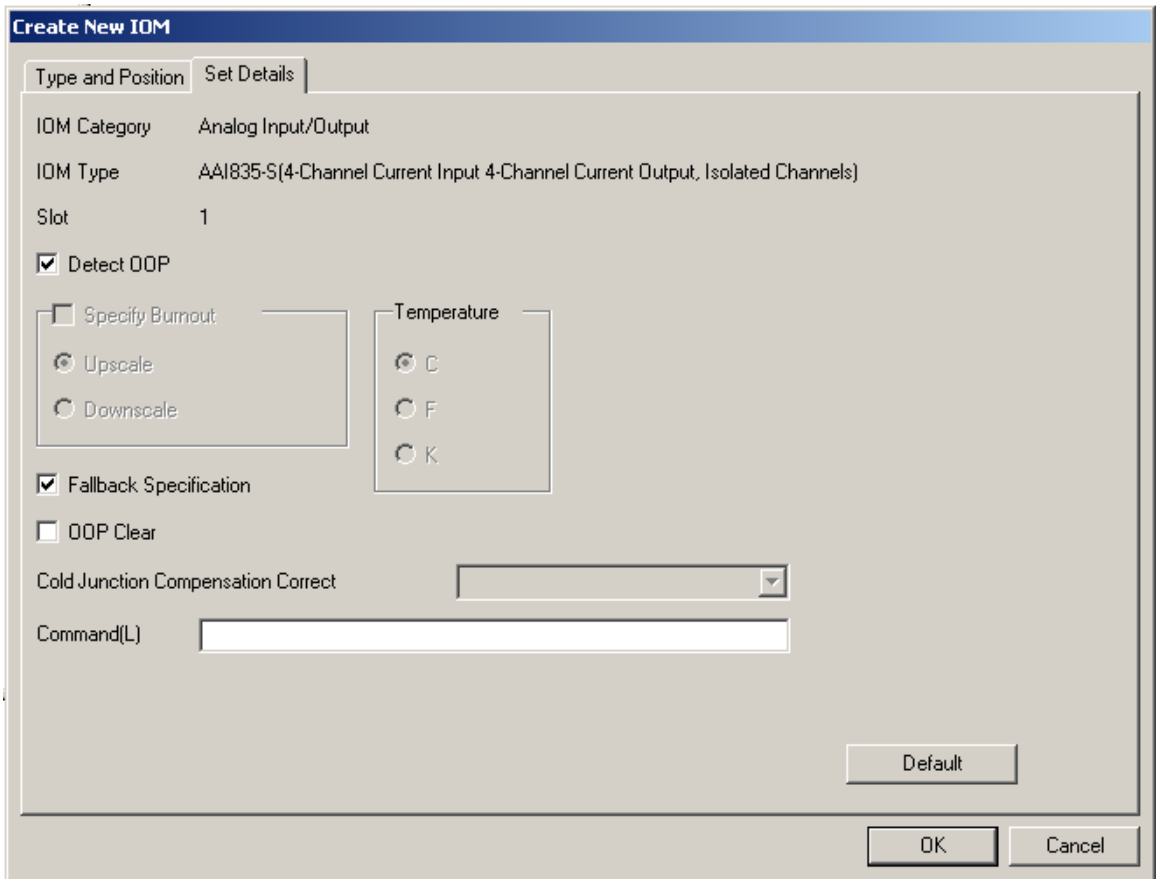


Figure: Detail setting of a Analog input/output IOM

- ***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.

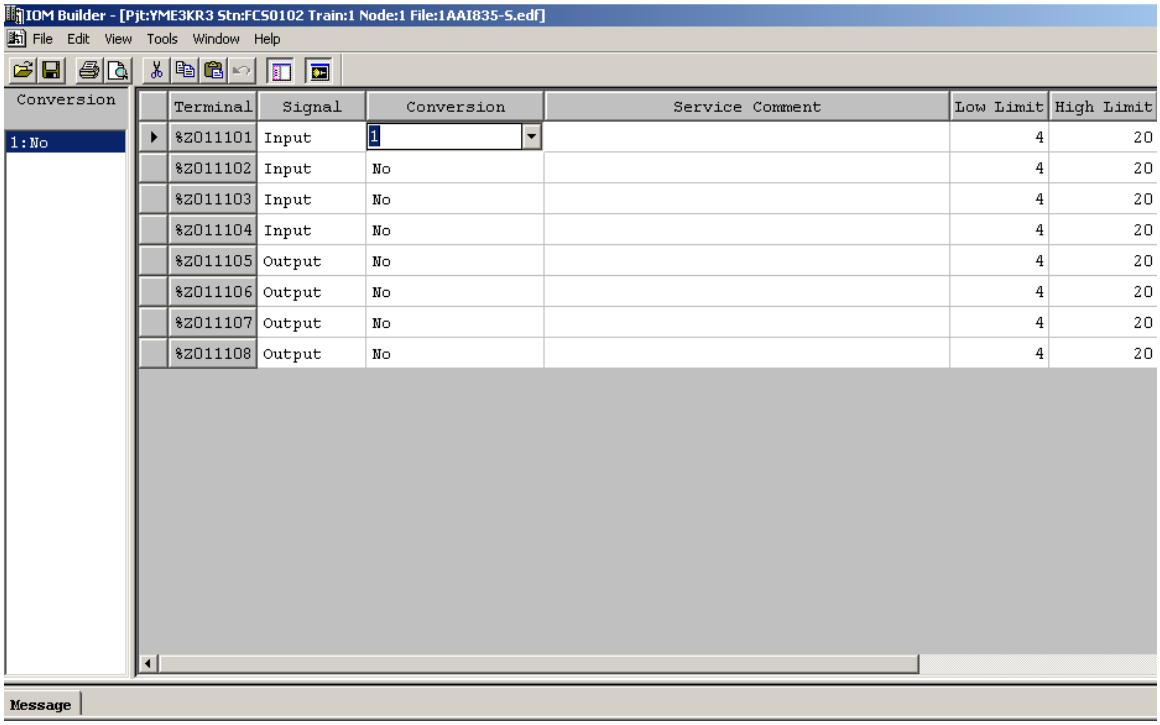
- ***Command***
  Specify a special setting for each I/O module in a command line. The following shows the commands that can input command lines for the analog I/O module:

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 6
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.

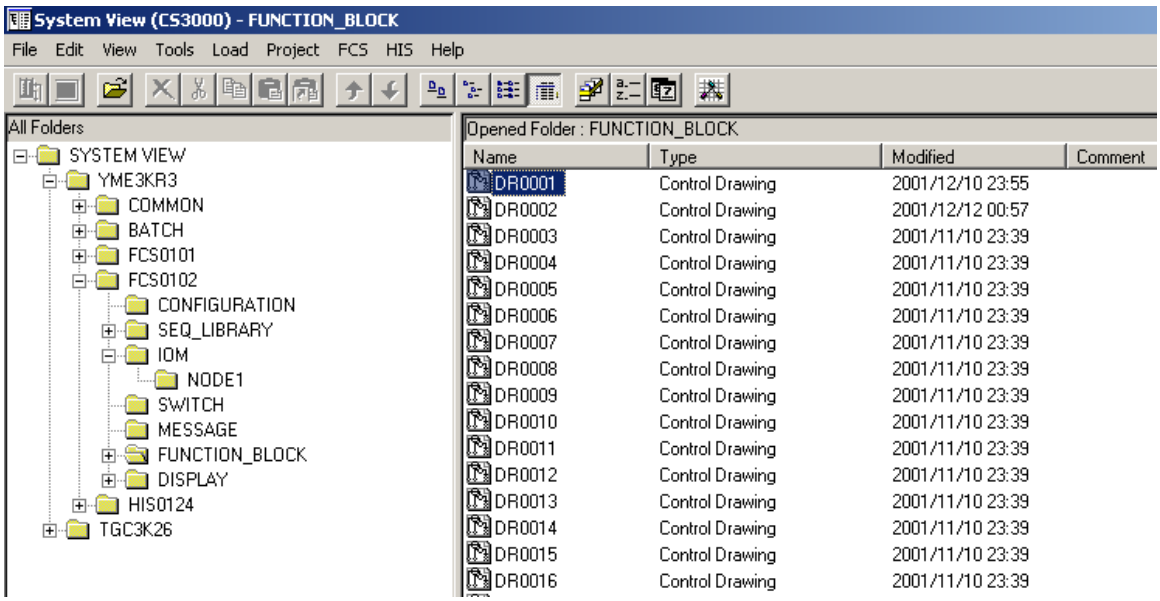

Figure: To open the control drawing file DR0001

2. CONTROL DRAWING ENVIRONMENT

The figure below shows the features of control drawing environment,

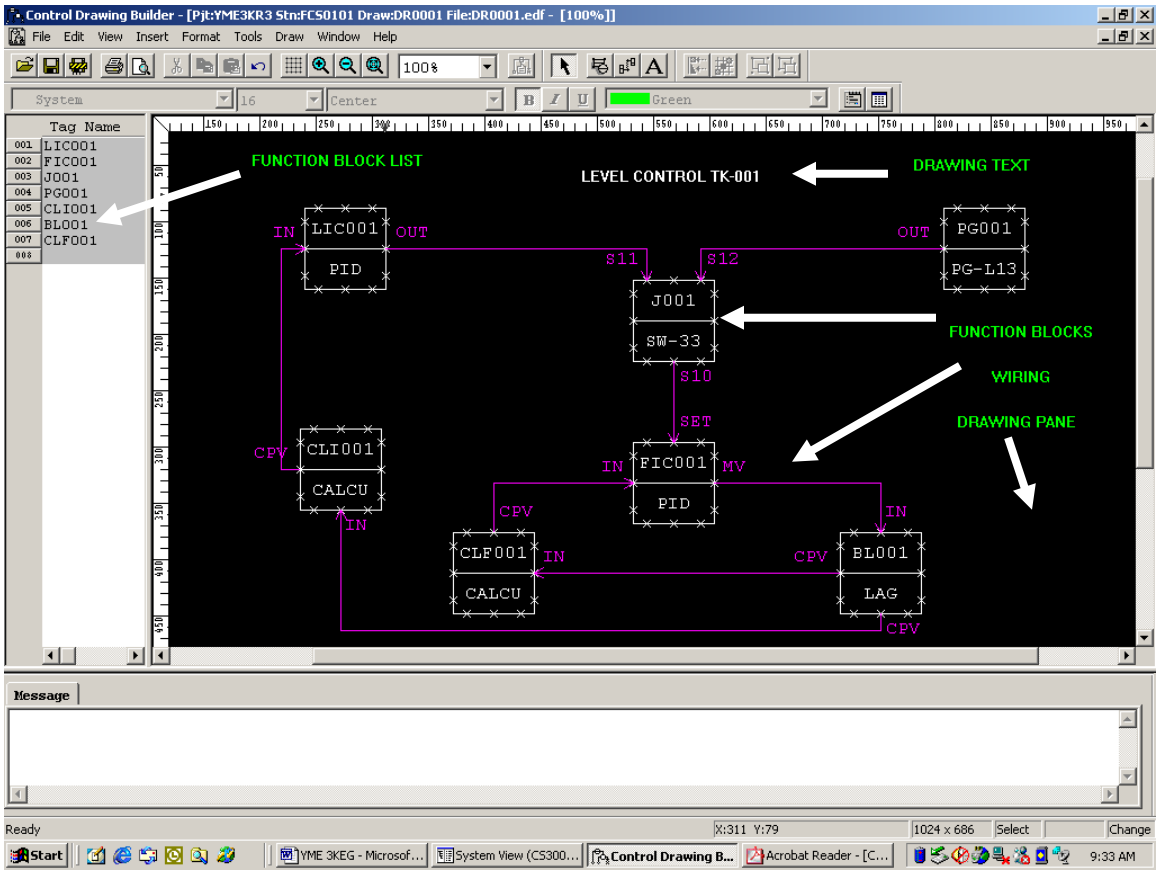

Figure: Control drawing environment

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.

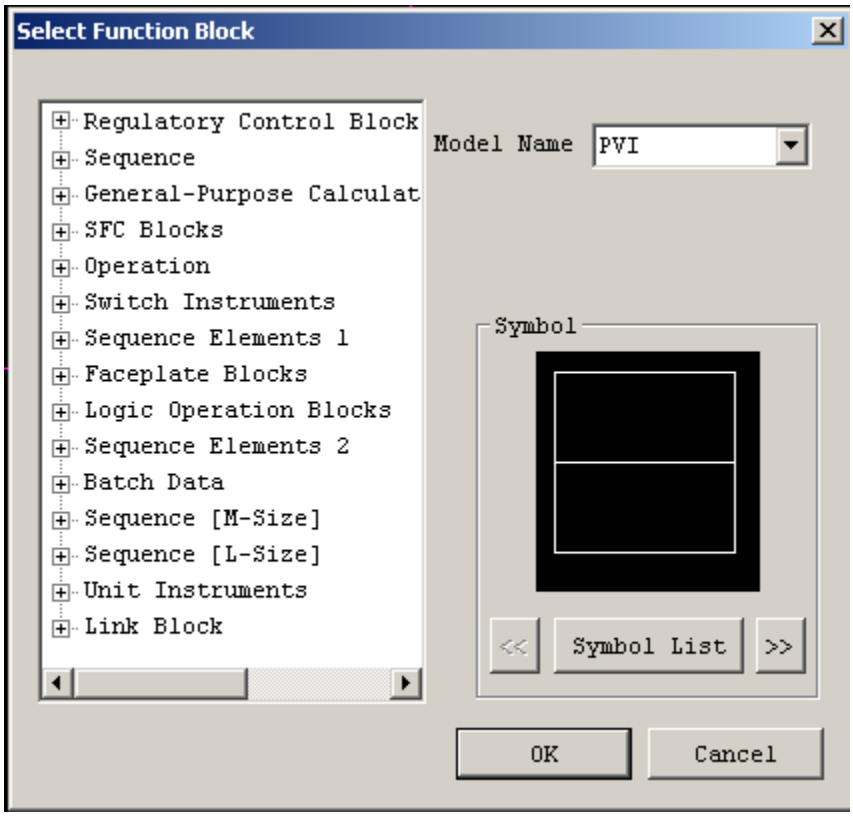

Figure: Function block dialog

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.

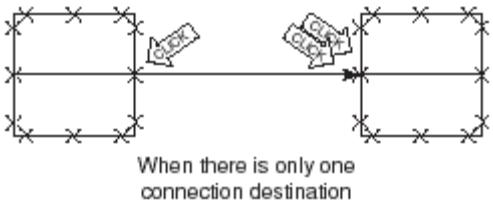

Figure: Automatic wiring when there is one connection destination

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.

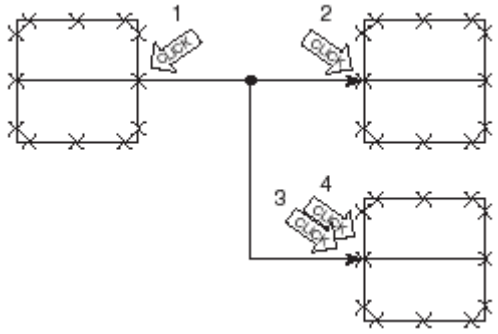

Figure: Branching of wiring in Automatic wiring.

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.

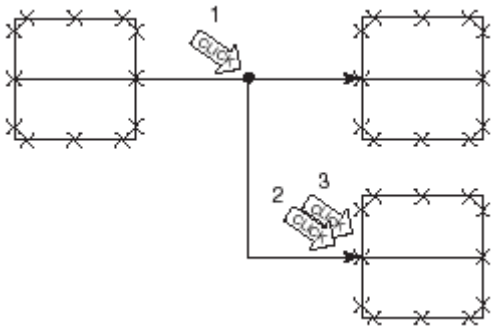

Figure: Branching of wiring already drawn.

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 7
REGULATORY CONTROL FUNCTION BLOCKS

Objectives

1. ***Functions of the regulatory control blocks***
2. ***Types of the regulatory control blocks***
3. ***Function block detail specification of PID Block***
4. ***Other regulatory control function blocks***

REGULATORY CONTROL FUNCTION BLOCKS

The regulatory control blocks are the function blocks that perform control computation processing mainly on the analog input as input signals. The calculated results are used for process monitor and process control. The regulatory control blocks support the following types of processing: input processing, control computation processing, output processing and alarm processing.

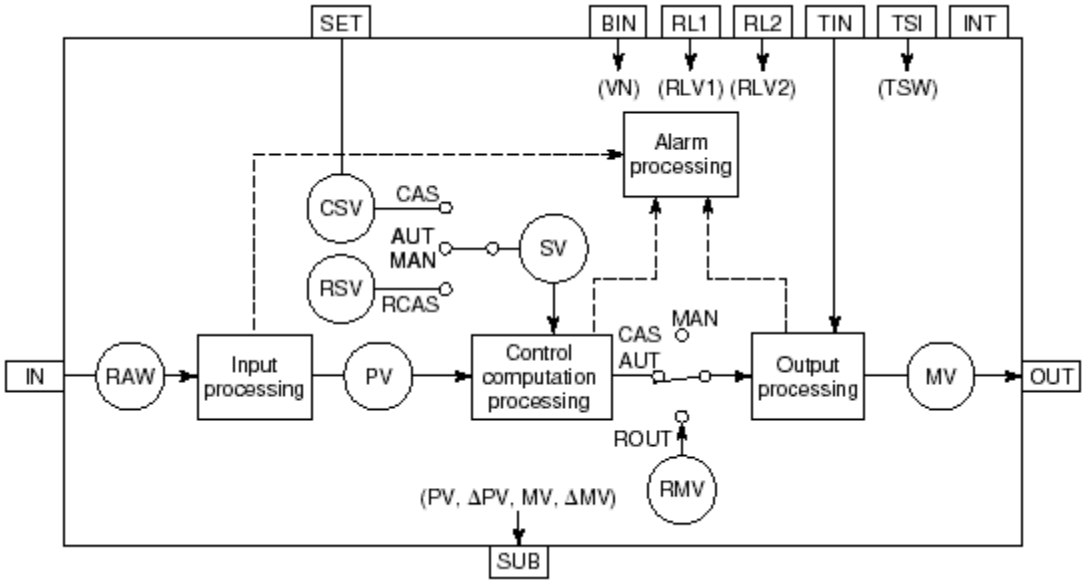


Figure: Function block diagram of a regulatory control function block.

IN:	Input terminal	RAW:	Raw data input signal
SET:	Setpoint value input terminal	PV:	Process variable
BIN:	Compensation input terminal	SV:	Setpoint value
RLn:	Reset signal input terminal	CSV:	Cascade setpoint value
TIN:	Tracking signal input terminal	RSV:	Remote setpoint value
TSI:	Tracking switch input terminal	VN:	Compensated value Input
INT:	Interlock switch input terminal	RMV:	Remote manipulated output value
SUB:	Auxiliary output terminal	RLVn:	Reset signal
OUT:	Output terminal	MV:	Manipulated output value
		TSW:	Tracking switch

1. FUNCTIONS OF THE REGULATORY CONTROL BLOCKS

The regulatory control blocks have the following four processing functions:

- ***Input Processing***
  Receives a signal from the input terminal and outputs a process variable (PV).

- ***Control Computation Processing***
  Performs control computation processing by reading the process variable (PV) and outputs a manipulated output value (MV).

- ***Output Processing***
  Reads the manipulated output value (MV) and outputs the result of control computation processing to the output terminal as an output signal.

- ***Alarm Processing***
  Detects an abnormality in the process variable (PV) or manipulated output value (MV) and notifies the operation and monitoring functions. Control computation processing can be performed independently via data setting or data reference between the function blocks, without involving input processing or output processing.

2. TYPES OF THE REGULATORY CONTROL BLOCKS

The regulatory control blocks vary by the types of data handled and control computation processing functions provided. The blocks are classified into these blocks below.

- ***Input Indicator Blocks***
- ***Controller Blocks***
- ***Manual Loader Blocks***
- ***Signal Setter Blocks***
- ***Signal Limiter Blocks***
- ***Signal Selector Blocks***
- ***Signal Distributor Blocks***
- ***Pulse Count Input Block***
- ***Alarm Block***
- ***YS Blocks***

3. FUNCTION BLOCK DETAIL SPECIFICATION OF PID BLOCK

- ***Tag names***
  The control station function blocks and control elements are assigned with tag names for identification. HIS uses the tag names to identify operation and monitoring targets such as calling up a function block. The tag names are also used in sequence tables and arithmetic expressions to represent the corresponding function blocks. One tag name only represents one function block. Do not define duplicate tag names in one project.

Highlight the function block and click 
A detailed specification dialog of that block is displayed. The detail specification of every function block varies depending on the parameters to be set. The following section explains the PID controller function block detail specification.

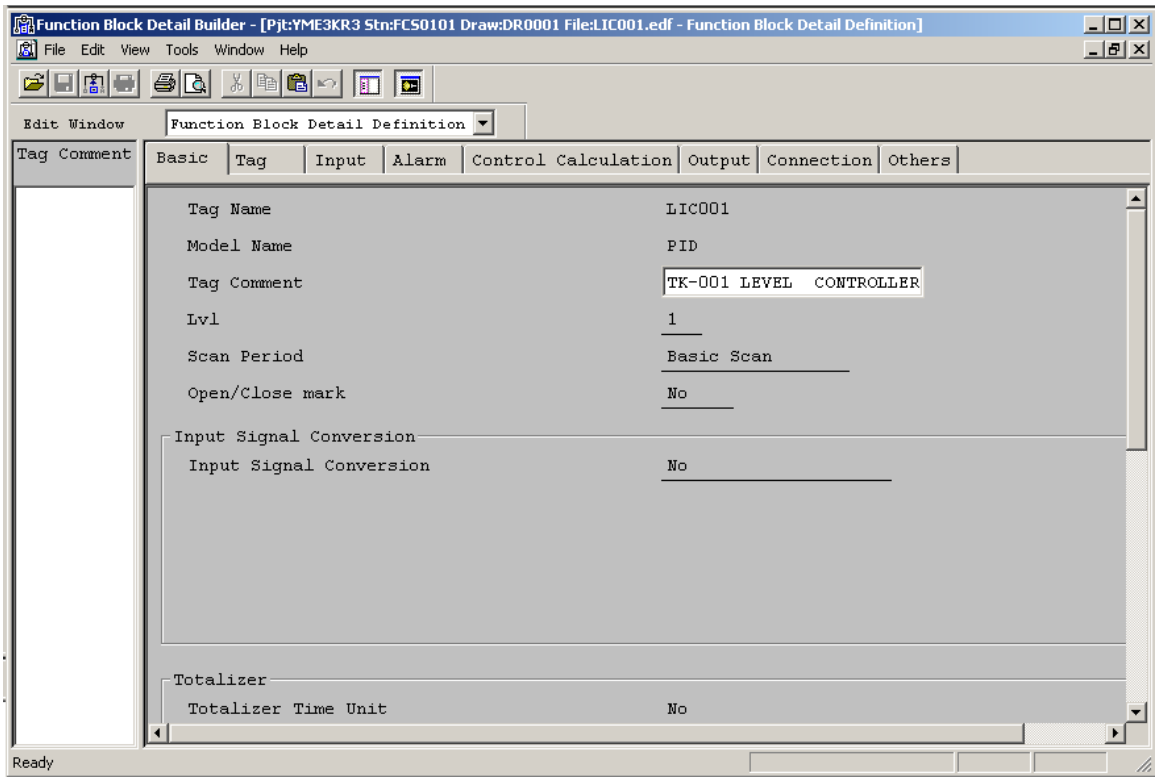


Figure: Function block detail builder for PID block.

BASIC

- ***Tag Comment***
  An explanatory description for each function block can be defined with up to 24 single-byte characters or 12 double-byte characters. The defined tag comment is displayed in the window along with the tag name in two lines of 12 characters each.

- ***Security Levels***
  The security level exerted by operation mark assigned to a function block determines the restriction on operating the function block. The greater the security level number is, the severer restriction applies. Several operations and monitoring authority tables classified by data items, each corresponding to a different function security level is

provided. As the security level changes, the operation and monitoring authority changes over each data item.

Security level may be set from level 1 to level 8. The security level definition of function blocks may be carried out on the Function Block Detail Builder. Level 4 is the default security level set for the function blocks.

- *Scan Period*
  Scan period determines a period for the periodic execution of the function block. There are three types of scan periods: basic scan, medium-speed scan and high-speed scan. The scan time for high-speed and medium-speed is implied as configured in the FCS properties while the basic scan time is 1 sec.

- *Open/Close Mark - Instrument Display Area*
  This mark indicates the open/close status of a device in response to manipulated output. The open/close marks include the following types. "OPN" indicates the open status and "CLS" indicates the close status.

  - *Null*
  - *OPN-CLS*
  - *CLS-OPN*
  - *OPN-CLS-OPN*
  - *CLS-OPN-CLS*
  - *OPN-OPN-CLS*
  - *OPN-CLS-CLS*
  - *CLS-OPN-OPN*
  - *CLS-CLS-OPN*

- *Input Signal Conversion*
  The input signal conversion is the function that converts the input signal read from the input module or other function blocks into process variable (PV). Input Signal Conversion Common to Regulatory Control

  - *No Conversion*
  - *Square Root*
  - *Pulse-train/ Control Priority Type Pulse Train Input/ Exact Totalization Pulse Train Input*
  - *Communications*

  Input signal conversion is performed only when the signal input through the input terminal is the data connection type, one of the I/O connection types. And only the signal transmitted via IN terminal (main input signal) may be converted. Furthermore,

the conversion behaves differently according to the signals connected to the IN terminal.

- ***Totalizer time unit***
  The time scale conversion coefficient (Tk) is set corresponding to the totalizer time unit. The table below lists the correlation between the time scale conversion coefficient and the totalizer time unit.

Totalizer time unit	Time Scale Conversion Coefficient (Tk)
Second	1
Minute	60
Hour	3600
Day	86400

Table: Time Scale Conversion Coefficient and Totalizer Time Unit

The time scale conversion coefficient (Tk) is automatically determined when the totalizer time unit is set on the Function Block Detail Builder. The totalizer time unit must be set in the same unit as the measurement value (PV). For example, if the unit of PV is "m3/min," set the totalizer time unit to "minute"

- ***Number of digits for integrator value***
  Up to 8 digits can be used. If the integrator value exceeds 8 digits, the value returns to 0 and the integration processing continues.
- ***A negative integration input signal value can be integrated as a negative value. However, integration of negative values can be executed only when the low-input cutoff value is negative.***
- ***Unit***
  Engineering unit is used.

- ***Low-Input Cut***
  The integration operation differs by the integration low-input cut value setting as explained below.
  - ***If the low-input cut value is positive (including 0): Integration is not executed for the input signal (including negative value) less than the low-input cut value.***
  - ***If the low-input cutoff value is negative: Integration is not executed for the input signal if the absolute value of the input signal is less than that of the low-input cut value.***

Totalizer Low-Input Cut Value:

Set the data in the same unit of integrator value (PV), or percentage value for the PV scale span. If a percentage value is used, add % after the value. The default setting is 0 %.

- ***Control Action Direction***
  The control action direction function switches between direct action and reverse action that reflect the increase or decrease of manipulated output value. The direct action and reverse action indicate the increase and decrease directions of the manipulated output value (MV) corresponding to deviation changes. When the setpoint value (SV) is fixed, the relationship between the process value (PV) and the manipulated output value (MV) in direct action and the reversed action is shown as follows.
  - ***Direct action***
    The control action in which the manipulated output value (MV) increases as the process variable (PV) increases, or decreases as the process variable decreases.
  - ***Reverse action***
    The control action in which the manipulated output value (MV) decreases as the process variable (PV) increases, or increases as the process variable decreases.

- ***Measurement Tracking***
  The process variable tracking function prevent the abrupt changes in the manipulated output value (MV) when change from the manual (MAN) mode to automatic (AUT) mode, by forcing the setpoint value (SV) to agree with the process variable (PV).
  When switching from the manual (MAN) mode to automatic (AUT) mode, the existence of a large deviation is harmful, since it makes the manipulated output change very large. If force the setpoint value (SV) to agree with the process variable (PV) in manual mode operation via process variable tracking, abrupt Control Action can be avoided when the mode switches to automatic (AUT).
  Suppose a primary loop is in cascade connection and controls in the automatic (AUT) or cascade (CAS) mode. If the mode of the secondary loop in the cascade connection switches from cascade (CAS) to automatic (AUT), the cascade connection becomes open and the control action of the primary side loop can stop. In this situation, the setpoint value (SV) of the primary loop can be forced to agree with the process variable (PV) by the process variable tracking function. Define process variable tracking as below
  - ***MAN mode: Select "Yes" or "No."***
    The default is "No."
  - ***AUT and CND mode: Select "Yes" or "No."***
    The default is "No."
  - ***CAS and CND mode: Select "Yes" or "No."***
    The default is "Yes."

- ***Output Signal Conversion***
  The output signal conversion may be used for the processes that are common to the Regulatory Control Blocks and the Calculation Blocks, and for the specific function blocks, which have specific output process function.

  - ***No-Conversion Output***
    The manipulated output value (MV) resulted from the control-calculation process is No Conversion output.
  - ***Pulse Width Output Conversion***
    The changes of manipulated output value (ΔMV) is output after converted into a pulse width signal.
  - ***Communication Output Conversion***
    The manipulated output value (MV) resulted from the control-calculation process is converted into the format compatible with the destination subsystem.

- ***Tight-Shut Function and Full-Open Function***
  The Tight-shut function fully close an operation valve and the Full-open function fully open it when a manipulated output value (MV) is 0% or 100 %. With these functions, an actual tight-shut output value (Ms) is set to a value less than 0% or greater than 100%, fully closing an operation valve. And an actual full-open output value (Mf) is set to a value less than 0% or greater than 100%, fully opening the valve. When set "No" to "Tight-shut/full-open Specifications", these functions are not added.

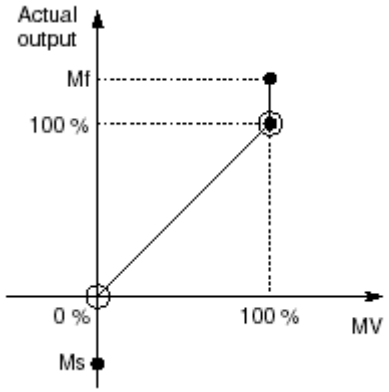


Figure: Tight-shut function

Define the Tight-shut/full-open specifications, as below.

- ***Tight-shut/full-open Specifications:***
  Choose "Yes" or "No."
  The default setting is "Yes."
- ***Output Value for tight-shut (Ms):***

The actual output value for tight-shut
Setting range is -17.19 to 117.19 % (5 significant figures). Default is -17.19 % for direct output setting, and -6.25 % for reverse output setting.

- ***Output Value for full-open (Mf):***
  The actual output value for full-open
  Setting range is -17.19 to 117.19 % (5 significant figures). Default is 106.25 % for direct output setting, and 117.19 % for reverse output setting.

The analog output module outputs 4 to 20 mA (or 1 to 5 V) against the 0 to 100 % range of manipulated output values (MV). However, it can also output in the reverse direction, e.g.20 to 4 mA (or 5 to 1 V). The following figure shows the relationship between the manipulated output value (MV) and output current. The reverse settings are shown in a dotted line.

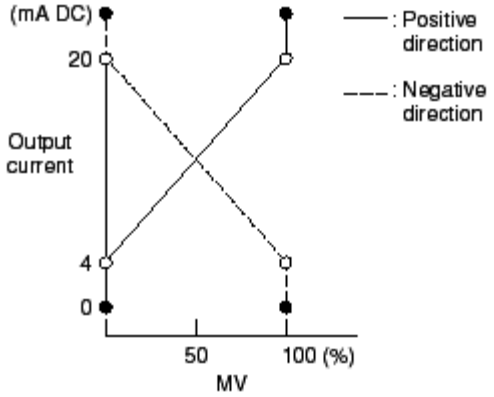


Figure: Relationship between the Manipulated Output Value and Output Current

TAG

- ***Tag Mark***
  This mark indicates the tag priority level of the displayed function block. All function blocks are provided with tag marks to reflect their priority levels. One of the 8 tag marks are selected.

- ***Double Authentication***
  When manipulating the important function blocks, other than the logged-on user, one more user's confirmation may be required. In this case, the confirmation may be performed on the Double Authenticated Confirmation dialog box. In order to activate the double authentication for confirmation, [Double Authentication] setting on the Function Block Detail Builder must be set to [Yes]. And the tag mark of the function block must be set as [Important]. There is no requirement that user of [Name2] must be superior than user of [Name1]. Any user registered on HIS other than the user of [Name1] can be act as user of [Name2] for double authentication.

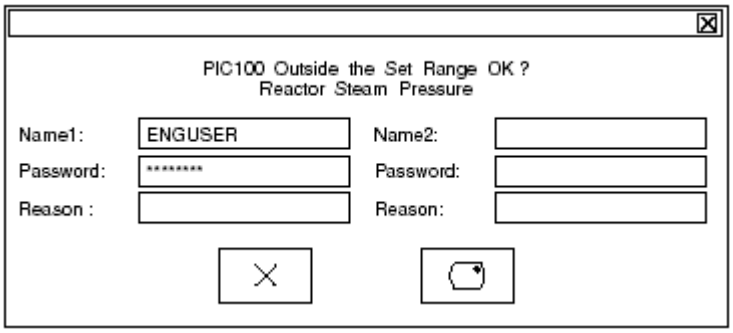


Figure: Double Authenticated Confirmation Dialog Box

- ***The Status Change Message***
  When function blocks such as sequence control blocks change block mode, the event recording function sends the status change message from FCS to HIS to inform the operator.
  - ***Status Change Message Bypass:***
    Select "Yes" or "No."
    The default is "No."

  In case of the sequence table block (ST16), the default is "Yes."
  When status change message is set as Bypass, the message of status change is not recorded in the historical message file in HIS. When the status change is performed manually on HIS, the status change message will all be recorded in the historical message file in HIS regardless the setting of bypass.

- ***Upper window***
  An upper window can be specified for each function block and connection I/O in the System Builders beforehand. The specified upper window can be called up by pushing the graphic button or the upper graphic key while the function block is selected.

- ***Help***
  The user-definable help dialog messages are treated as dialog names that may be specified as HW0001 to HW9999.

- ***MV Display on Faceplate***
  The manipulated output value (MV) may be displayed in percentage (%) or real amount. The real amount display is the same way as process variable (PV) and setpoint value (SV) that reflects the amount in a specific engineering unit. When displayed in percentage (%), the MV is converted into percentage and displayed in %MV.

- ***CAS Mark***

This mark indicates that the function block displayed on the instrument faceplate may be set to cascade mode. However, the definition may be set AUTO to let system decide according to function block's real connection.

- ***Kind of CAS Mark***
  An APCS mark is designated in [Kind of CAS Mark] of the Function Block Detail Definition window. The behavior of the Instrument Faceplate depending on the designation of [CAS Mark] and [Kind of CAS Mark] is shown in the table below.

CAS Mark / Kind of CAS Mark	AUTO: Automatic Determination (*1)	YES: Display	NO: No Display
CAS: General (*1)	Displays a CAS mark when there is a connection to the SET terminal. Does not display it when there is not connection to the SET terminal.	Displays a CAS mark	Does not display both a CAS mark and an APCS mark.
APCS: APCS	Displays an APCS mark when there is a connection to the SET terminal. Does not display it when there is not connection to the SET terminal.	Displays an APCS mark.	Does not display both a CAS mark and an APCS mark.

****1: Indicates the default.***

Table: Behavior of the Instrument Faceplate by the Designation of [CAS Mark] and [Kind of CAS]

- ***CMP Mark***
  This mark indicates that the block mode of the function block displayed on the instrument faceplate is RCAS (remote cascade) or ROUT (remote output).

- ***Scale Low/High Limit, Scale Reverse Display***
  The scale high limit (SH) and scale low limit (SL) of engineering unit data, up to 7 digits including a sign and a decimal point, can be set. Default values are "100.00" for SH and "0.0" for SL. Up to nine digits can be specified for a batch set block. When the reverse scale display is specified, the low limit is displayed at the top of the scale and the high limit at the bottom of the scale.

- ***MV Reverse Display***
  In the standard display of a function block faceplate, the high limit displays at the top and the low limit displays at the bottom. To designate the MV reverse-display may upside-down the standard display. In this case, the pointer of manipulated output value (MV) behaves oppositely in accordance to the digital value of parameters. This designation only changes the display of function block's faceplate and does not relate to the actual output value. If a valve's Open/Close is opposite, it is convenient to use this function when aligning the valves function block faceplate with other blocks in the same group.

- ***Index***
  This function displays two indexes in the manipulated output value (MV) scale on the operation monitoring window of the operation and monitoring function. These are called the manipulated output indexes. By setting these indexes at the operable limits of the manipulated output values (MV), they can be used as manipulation guides in the manual mode, or as guides for verifying normal status in the automatic mode. For a Regulatory Control Block with manipulated output value (MV), both the high output limit (OPHI) and low output limit (OPLO) indexes can be set on the tuning window. These limits are displayed in the operation and monitoring window of the operation and monitoring function. The indexes may be defined on the Function Block Detail Builder.
    - ***Set Indexes: Selectable from "Yes" and "No."***
      Default is "Yes."

- ***Scale-Division***
  The scale divisions may be specified as 1, 2, 3, 4, 5, 7 divisions. Auto-division may be used.

- ***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.

INPUT

- ***Process variable range; High and low limits***
  Numerical values of seven digits or less, where the sign or decimal point takes one digit each. The default is "100.0" for the upper limit and "0.0" for the lower limit.

- ***Engineering unit***
  Consists of six or less standard-width characters or three double-width characters. The default is "%."

- ***Input Signal Filtering***
  The digital filter may be defined for each function block in "Input Signal Filtering" on the Function Block Detail Builder. Input Signal Filtering: "None," "Auto," "1," "2" and "3." The default setting is "Auto."
  When Auto is selected; if the IN terminal is connected to I/O module other than communication module, "Digital Filter Coefficient 1" is used. If the IN terminal is

connected to neither communication module nor I/O module, no filtering process is performed.

- ***PV Overshoot***
  When the data status of input signal becomes invalid (BAD), the PV overshoot function overshoots the process variable (PV), or upscale it to scale high-limit or downscales it to scale low-limit. Select "Overshoot PV" or "Holding PV." The default setting is "Holding PV." With "Holding PV," when the data status of process variable (PV) becomes invalid, the last good process variable is held. Furthermore, when the input signal is not a process input signal, the operation becomes "Holding PV" even though "Overshoot PV" is specified.

ALARM

- ***Alarm Level***
  Designating an alarm processing level to a function block or an element, the alarms from the function block or the element will have the designated priority and display the designated color. The definitions for level1 to level4 are fixed for a whole system. The alarm priorities and colors for level5 to level16 can be defined by users.

- ***Input Open Alarm***
  The input open alarm check is a function that determines whether the input values read from the field by the I/O module is out of the range of the high and low limit input open detection setpoint values. The high-limit input open alarm (IOP) is initiated when it is determined that the input value exceeds the input open high detection setpoint value. Similarly, the low-limit input open alarm (IOP-) is initiated when the input value is below the low-limit input open detection setpoint value. The high and low limit input open alarm (IOP, IOP-) indicates that a failure such as severed wires in the detection terminal or transmitter has occurred. IOP alarm detection on both sides, high, low and no IOP alarm is selected.

- ***PV High-High/Low-Low Limit Alarm***
  The input high-high and low-low limit alarm check is a function that determines whether the input process variable (PV) is out of the range of the high-high and low-low limit alarm setpoint value (HH, LL).

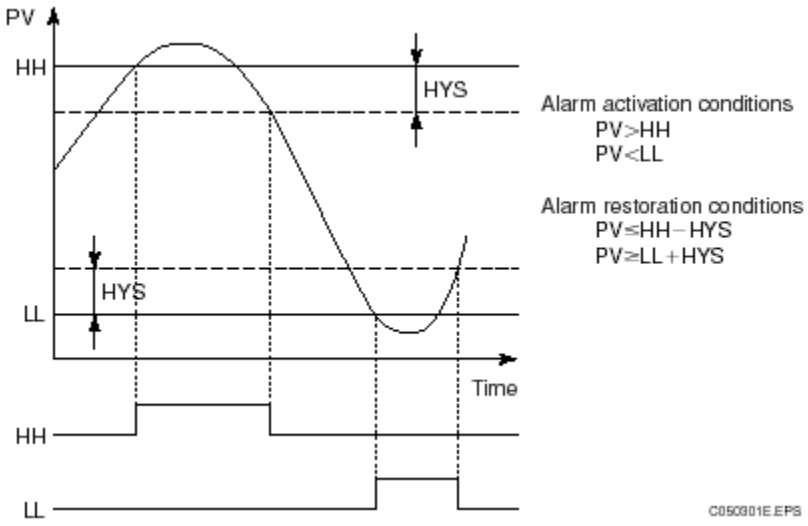


Figure: Input High-High and Low-Low Limit Alarm Check

- ***Input velocity limit alarm***
  The following types of input velocity alarm checks are available.
  The default is "detection of both directions."
  - ***Detection of both directions:***
    Monitors velocity in both directions, positive and negative
  - ***Detection of single direction:***
    Monitors velocity only in positive direction or negative direction
  - ***No Detection:***
    Detection is not conducted

- ***Number Of Samplings (N) And Sampling Interval (Tp)***
  The sampling intervals (Tp) and the number of samplings (N) is defined.
  - ***Number of samplings (N): 1 to 12 points***
    The default setting is 1 point
  - ***Sampling interval (Tp): 1 to 10,000***
    Unit is scan interval. The default setting is 1

- ***Deviation Alarm***
  The deviation alarm check is a function that determines whether the absolute value of the deviation (DV=PV-SV) between the process variable (PV) and the setpoint value (SV) exceeds the absolute value of the deviation alarm setpoint value (DL). When it is determined that the former exceeds the latter, a deviation alarm in the positive direction (DV+) is activated if the deviation is in the positive direction. Similarly, if the deviation is in the negative direction, a deviation alarm in negative direction (DV-) is activated.

The type of deviation alarm check can be defined on the "deviation alarm check" item of the Function Block Detail Builder. The types of deviation alarm checks are listed below. The default is "detect both directions."

- ***Detection of both directions:***
  Monitors deviation in both directions
- ***Detection of single direction:***
  Monitors deviation in only one direction, positive or negative
- ***No detection:***
  Detection is not conducted

When single direction is selected for detection, if the deviation alarm setpoint value is plus symbol, only the deviation in the positive direction is detected and if the deviation alarm setpoint value is negative symbol, only the deviation in the negative direction is detected.

♦ ***Deviation Check Filter***
The deviation check filter gain and time constant can be defined.

- ***DV check filter gain: Deviation check filter gain***
  0.000 to 10.000. Default is 0.
- ***DV check filter time constant: Deviation check filter time constant***
  0 to 10,000 seconds. Default is 0.

♦ ***Output Open Alarm***
The output open alarm check is a function that determines the data status received from the I/O module. Based on the data status (OOP) received from the I/O module, an output open alarm (OOP) is activated. This alarm indicates that the control output line has been physically severed. Choose from "Enabled" or "Disabled". Default is "Enabled."

♦ ***Output High/Low Limit Alarm***
The output high and low limit alarm check is a function that determines whether the manipulated output value (MV) exceeds the range of the manipulated output variable high limit/low-limit setpoint (MH, ML) for the output limiter. The types of output high and low limit alarm checks are listed below. The default is set as "high and low limit alarms."

- ***Both high and low limit alarms: Output high and low limit alarm check enabled***
- ***High-limit alarm only: Output high-limit alarm check enabled***
- ***Low-limit alarm only: Output low-limit alarm check enabled***
- ***Alarms disabled: No alarm checking***

♦ ***Bad Connection Alarm***

The bad connection status alarm check is a function that determines whether there is a faulty connection to the function block or data at the I/O connection destination. When it is determined that the connection status is bad, the bad connection alarm (CNF) is activated. When the connection is restored, the system recovers from the alarming state. The bad connection is judged as follows.

- ***The connected destination function block is in out of service (O/S) mode.***
- ***The connection information is abnormal, and the data reference or data set cannot be performed.***
- ***The connected destination function block's data type is invalid (cannot be convert to the appropriate data type).***

CONTROL CALCULATION

- ***PID Control algorithm***

  For PID control computation, the input variables of the proportional, integral and derivative terms are different for each PID control algorithm. The table below shows the PID control algorithms and the input variable of each term:

PID control algorithm	Trinomial input variables		
	Proportional term	Derivative term	Integral term
PID	En	En	En
I-PD	PV	PV	En
PI-D	En	PV	En
Automatic determination	Same as I-PD in the AUT mode. Same as PI-D in the CAS or RCAS mode.		
Automatic determination 2	Same as I-PD in the AUT or RCAS mode. Same as PI-D in the CAS mode.		

Table: PID Control Algorithms and the Input Variables

Use the Function Block Detail Builder to define the PID control algorithm.

- ***PID Control Algorithm:***
  Select one of the following algorithms:
  "Basic Type"
  "Proportional PV Derivative Type PID Control (I-PID)"
  "PV Derivative Type PID Control (PI-D)"
  "Automatic Determination"
  "Automatic Determination 2"
  The default is "Automatic Determination 2."

When the block mode of the PID Controller Block is remote cascade (RCAS), the PID control algorithm "Automatic Determination" and "Automatic Determination 2" act as follows:

- ***Automatic determination type: Same actions as in the cascade (CAS) mode.***
- ***Automatic determination type 2: Same actions as in the automatic (AUT) mode.***

♦ ***Control period***

The controller block executes the input processing per scan period. However, the control calculation and output processing are executed per each control period.
The control period of controller block is always an integer-multiple of the scan period.
There are 2 types of the control periods of controller block as shown below:

- ***The control period of the regulatory control action.***
- ***The control period of the intermittent control action.***

Control calculation is executed at every control period in regulatory control action.

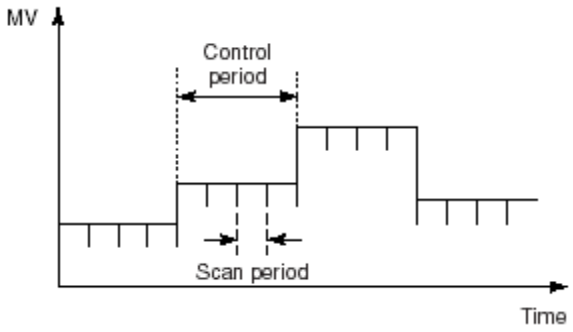


Figure: The Control Period in the Regulatory Control Action

♦ ***I/O Compensation***

The Input or Output Compensation function adds the compensation value (VN) received from outside to the input signal or output signal of PID control computation, while the controller block is operating automatically in the automatic (AUT), cascade (CAS), or remote cascade (RCAS) mode. The Control Action of Input or Output Compensation include the following two types:

- ***Input compensation***
- ***Output compensation***

The parameters of the I/O compensation:

- ***I/O compensation gain (CK): -10.000 to +10.000.***
  The default is 1.000.
- ***I/O compensation bias (CB): Arbitrary engineering unit data.***
  The default is 0.0.

- ***Non-Linear Gain***

  The non-linear gain function changes the proportional gain in accordance with the deviation of the process variable (PV) from the setpoint value (SV) in the control computation. As a result, a non-linear relationship is formed between the manipulated output change (ΔMV) and the deviation of the process variable (PV) from setpoint value (SV). The non-linear gain function is used for pH control, in which the process gain often becomes too high near the target value, or for buffer tank level control, whose purpose is to stabilize the discharge volume while maintaining the tank level within the limits. The actions that realize the non-linear gain function include "gap actions" and "squared deviation actions."

  The gap action moderates control effects by lowering the proportional gain when the deviation is within the preset gap width (GW). The parameter of the gap action:

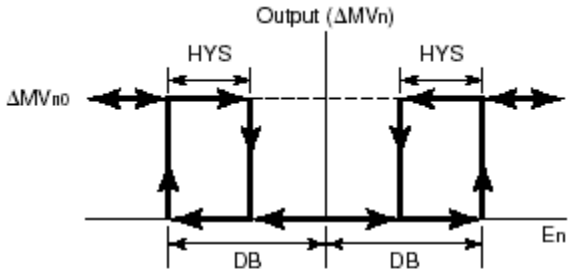
  - ***Gap width (GW):***
    Engineering unit data between 0 and the PV scale span range limit. The default is 0.

  The squared deviation action changes the proportional gain in proportion to the degree of deviation when the deviation is within the preset gap width (GW). The parameter of the squared deviation action:

  - ***Gap width (GW):***
    Engineering unit data between 0 and the PV scale span range limit.
    The default is 0.

- ***Deadband Action***

  The deadband action stops the manipulated output value (MV) from changing while the deviation (DV) is within the preset deadband (DB) range, by causing the manipulated output change (ΔMV) to be "0."



ΔMVn:	Manipulated output change after the deadband action
ΔMVn0:	Manipulated output change before the deadband action
DB:	Deadband width
En:	Deviation (data of the same unit as PV)
HYS:	Hysteresis (data of the same unit as PV)

Figure: Characteristics of Deadband Action

To set the deadband action - Select "Yes" or "No." The default is "No." When the deadband action is set as "Yes," the hysteresis (HYS) must be set. Hysteresis: Engineering unit data between 0 and the PV scale span range limit. The default is the value equivalent to 1.0 % of the PV scale span.

- ***AUT Fallback***
  The AUT fallback is an error processing function that switches the block mode from cascade (CAS) or primary direct (PRD) to automatic (AUT) when the AUT fallback condition is established. Thus the set value of the control loop can be set by the operator. The AUT fallback condition is established when the data status of the cascade setpoint value (CSV) become invalid (BAD) or communication error (NCOM).

- ***Computer Backup Mode***
  When the computer fail is detected, the function block suspends the action in the remote cascade (RCAS) mode or remote output (ROUT) mode temporarily and switches to the computer backup mode.

OUTPUT

- ***Output Change***
  The output velocity limiter limits the amount of change in the output value according to the output velocity limit setting. The output velocity limit is a permissible amount of output change over one scan period. The output velocity limiter and the bypass for MAN-mode output velocity limiter can be defined.
  - ***Output Velocity Limiter:***
    Engineering unit data or percentage within the range from 0 to the MV scale span setting in positive values only (six significant figures). The default setting is 100.0 %.
  - ***MAN Mode Output Velocity Limiter Bypass:***
    Selectable between "Yes" and "No." Default is "No."

- ***Auxiliary Output***
  The auxiliary output is used when output a signal through the SUB terminal to a destination other than the final control element. The signal is often used as compensation data to other function blocks, or to the indicator outside of the FCS, etc. In the Regulatory Control Blocks, the process variable (PV), change in process variable (ΔPV), manipulated output value (MV), or the change in manipulated output value (ΔMV) is output via the SUB terminal. The connection method is the data setting.

  Output Type is selectable from "Positional Output Action" and "Velocity Output Action." Default is "Positional Output Action." When the output action for auxiliary output is set to "Positional Output Action," the output values (MV, ΔMV, PV, or ΔPV)

can be set in the connection destination as it is. Also, when set to the "Velocity Output Action" type, the value read back from the connection destination is added to the output value and set in the connection destination.

- ***MV Display Style***
  Use the Function Block Detail Builder to set the display form for the manipulated output value (MV).
  - ***MV Display Style:***
    Select "Automatic Determination" or "User Define."
    The default is "Automatic Determination."

  When "Automatic Determination" is selected, the engineering unit and scale range of the manipulated output value (MV) change according to the connected destination of the OUT terminal. When "User Define" is selected, set the engineering unit and scale range for the manipulated output value (MV).

- ***Limit Output in Direction when Clamped***
  When the data status of the cascade connection destination is CLP+ or CLP-, the output direction of the manipulated output value (MV) is restricted, i.e., the value cannot be changed to exceed or falls below the present output value, so that only the manipulated output value (MV) in the direction that cancels CLP+ or CLP- is output. Limit output in direction when clamped is selectable from "Yes" and "No." Default is "Yes."

- ***Control Calculation Output Type***
  A Regulatory Control Block outputs its manipulated output value (MV) or the vicissitude of that value (ΔMV). There are two types output action: positional and velocity:
  - ***In positional output action, the output value connects to its destinations unchanged.***
  - ***In velocity output action, the amount of change for the current output (ΔMV) is added to the value read back from the connection destination of the output terminal.***

  The output operation can be selectable from "positional" or "velocity." Default is the "positional" action.

CONNECTION

The wiring configuration done using the control drawing builder appears on this sheet.

OTHERS – CONSTANT

Constants are preset tuning parameters; they can be set in the Constant text box on others tab. Up to 1,024 alphanumeric characters can be used for each constant. Upon online downloading to an FCS, the constants are always substituted for the current tuning parameters for any changed function block. The saved tuning parameters take precedence over the constants upon offline downloading to an FCS, while the constants take precedence over the unsaved tuning parameters upon initial offline downloading to an FCS.

- ***Example of setting constants.***
  PH=80,PL=20

4. OTHER REGULATORY CONTROL FUNCTION BLOCKS

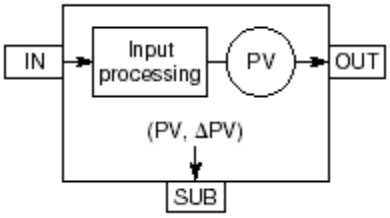


Figure: Function Block Diagram of Input Indicator Block (PVI)

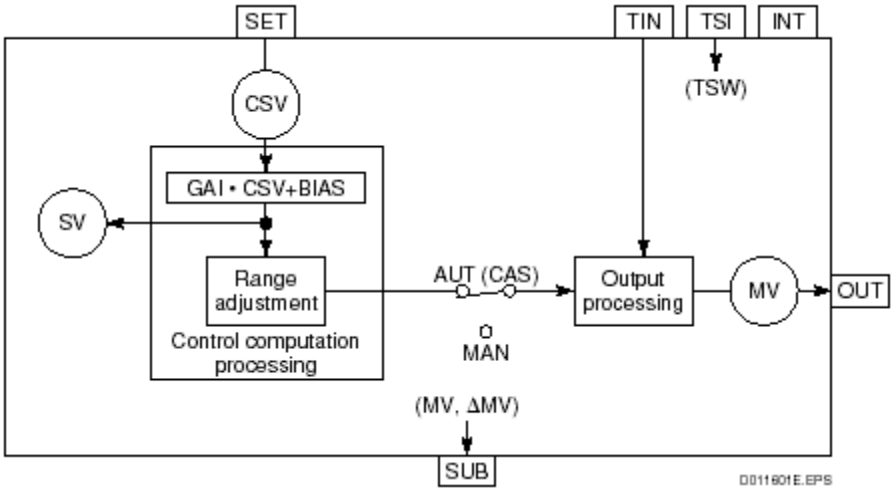


Figure: Function Block Diagram of Manual Loader Block with Auto/Man SW (MLD-SW)

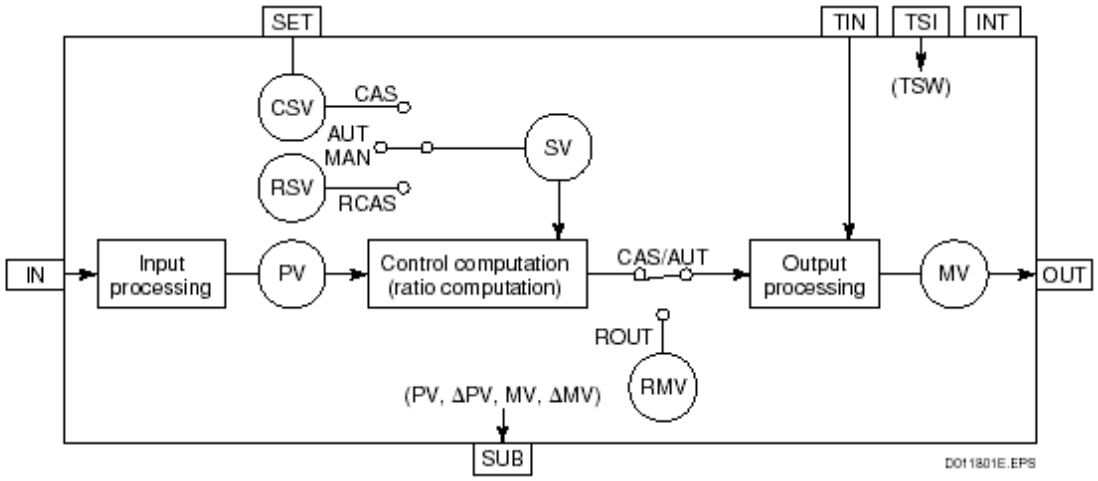


Figure: Function Block Diagram of Ratio Set Block (RATIO)

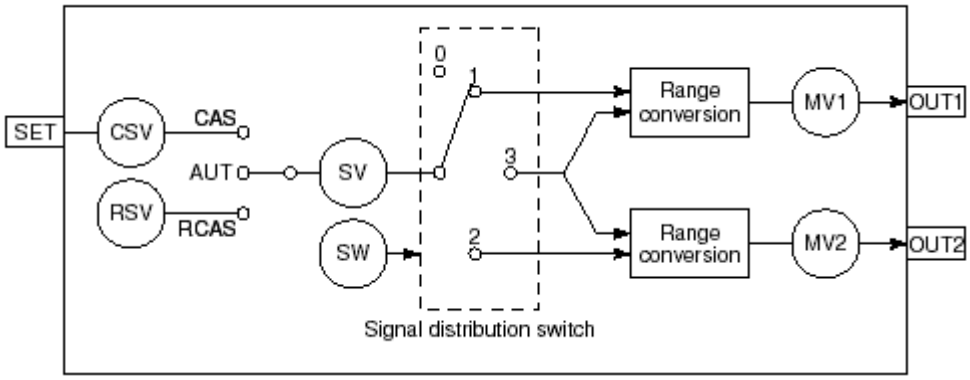


Figure: Function Block Diagram of Control Signal Splitter Block (SPLIT)

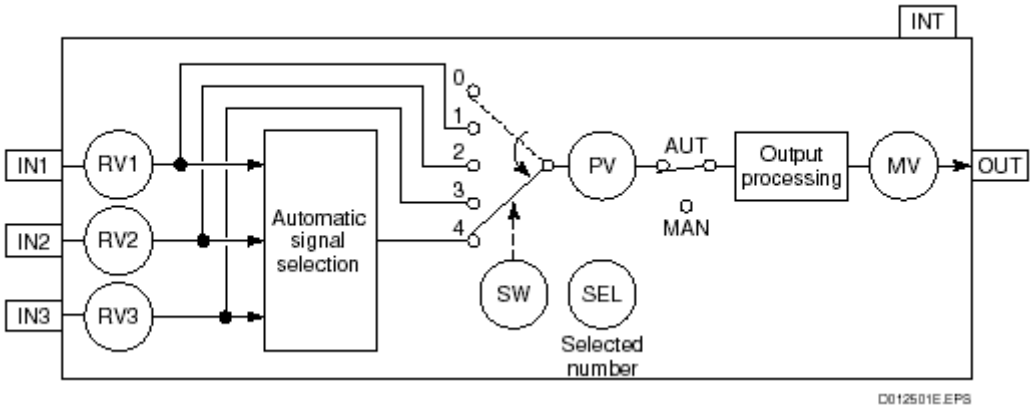


Figure: Function Block Diagram of Auto-Selector Blocks (AS-H/M/L)

Instrumentation & Control Services

Table of Contents

CHAPTER 8
SEQUENCE CONTROL FUNCTION

SEQUENCE CONTROL FUNCTION

Sequence Control Blocks which execute the sequence control function include Sequence Table Blocks, Logic Chart Blocks, SFC Blocks, Switch Instrument Blocks, Sequence Element Blocks, and Valve Monitoring Block.

1. TYPES OF SEQUENCE CONTROL BLOCKS

The table below lists various sequence control blocks.

- ***Sequence Table Block***

This function block realizes sequence control by operating other function blocks and/or process I/O or software I/O. The following two models of blocks are categorized as Sequence Table Block.

  - ***Sequence Table Block (ST16)***
  - ***Rule Extension Block (ST16E)***

- ***Logic Chart Block***

This function block performs interlock sequence control programmed in the expression of a logic chart diagram. The following model of block is categorized as Logic Chart Block.

  - ***Logic chart with 32 inputs, 32 outputs and 64 logic elements (LC64)***

- ***SFC Block***

This function block realizes sequence control by the program described in sequential function chart. The following three models of blocks are categorized as SFC Block.

  - ***Three-Position Switch SFC Block (_SFCSW)***
  - ***Pushbutton SFC Block (_SFCPB)***
  - ***Analog SFC Block (_SFCAS)***

- ***Switch Instrument Block***

This function block monitors and operates devices such as opening/closing valves, start/stop motors or pumps, and final control elements for contacts. 10 types of blocks are available with various I/O points and output methods, usually used in combination with a sequence table. The following ten models of blocks are categorized as Switch Instrument Block.

- ***Switch Instrument Block with 1 Input (SI-1)***
- ***Switch Instrument Block with 2 Inputs (SI-2)***
- ***Switch Instrument Block with 1 Output (SO-1)***
- ***Switch Instrument Block with 2 Outputs (SO-2)***
- ***Switch Instrument Block with 1 Input, 1 Output (SIO-11)***
- ***Switch Instrument Block with 1 Input , 2 Outputs (SIO-12)***
- ***Switch Instrument Block with 2 Inputs, 1 Output (SIO-21)***
- ***Switch Instrument Block with 2 Inputs , 2 Outputs (SIO-22)***
- ***Switch Instrument Block with 1 Input , 2 One-Shot Outputs (SIO-12P)***
- ***Switch Instrument Block with 2 Inputs , 2 One-Shot Outputs (SIO-22P)***

♦ ***Sequence Element Blocks***

This function block assists with sequence control. It is activated by the sequence table. The following seven models of blocks are categorized as Sequence Element Block.

- ***Timer Block (TM)***
- ***Software Counter Block (CTS)***
- ***Pulse Train Input Counter Block (CTP)***
- ***Code Input Block (CI)***
- ***Code Output Clock (CO)***
- ***Relational Expression Block (RL)***
- ***Resource Scheduler Block (RS)***

♦ ***Valve Monitoring Block (VLVM)***

This function block monitors valve opening and closing, and starts an alarm when abnormal conditions are detected.

2. SEQUENCE TABLE CONFIGURATION

Sequence tables consist of condition signals, action signals, rule numbers, condition rules, action rules and step labels.

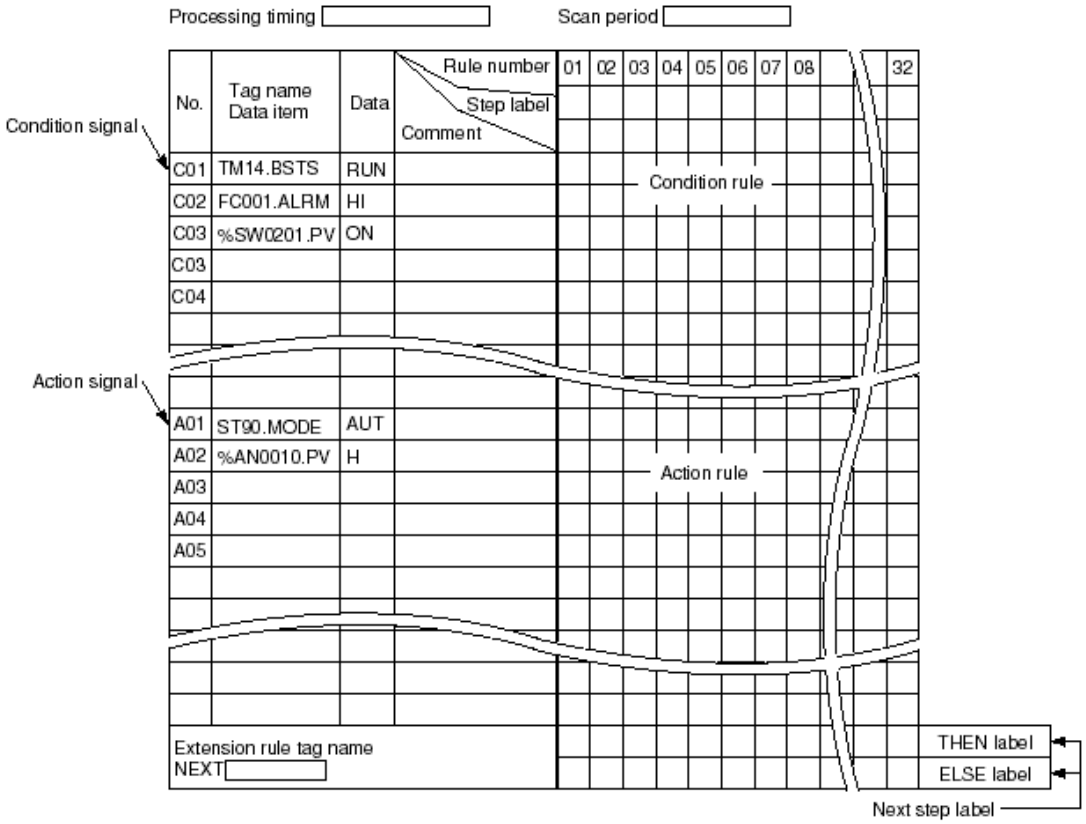


Figure Conceptual Diagram of Complete Sequence Table

OUTLINE OF SEQUENCE TABLE ELEMENTS

The following describes various sequence table elements.

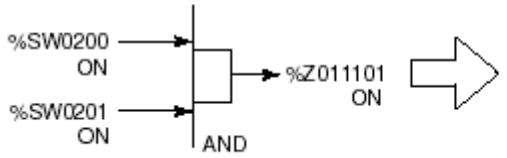
- ***Condition Signal***
  Enter the element symbol and data item into the Tag name. Data item column as the input connection information, then enter the condition specification to Data column.
- ***Action Signal***
  Enter the element symbol and data item into the Tag name. Data item column as the input connection information then enter the action specification to Data column.
- ***Rule Number***
  Up to 32 rules per block may be used. The output is based on each rule condition and condition testing result.
- ***Condition Rule***
  Describe the Y/N (Y: true, N: false) pattern (combination) to condition rule. If the testing result of condition signal corresponds with the Y/N pattern, the condition of the rule is satisfied.

- ***Action Rule***
  Describe the Y/N (Y: Positive action; N: Negative action) pattern (combinations) to action rule. Perform manipulated output according to the Y/N pattern of the action rule for the rule number whose condition is satisfied.
- ***Step Label***
  These labels are attached for phase identification purposes when performing step sequence control using a sequence table. Step labels are character strings that combine two or less alphanumeric characters (A to Z, 0 to 9).
  If two characters are combined while one is not alphanumeric and the other is alphanumeric, the label is managed as the same step name, even if the order of characters is reversed (e.g., "_A" and "A_"). Up to 100 steps can be described in one sequence table group. However, same step labels cannot be described at multiple locations inside the sequence table group. The step labeled 00 is activated every scan cycle.

- ***Next Step Label (THEN, ELSE)***
  Describe the step label that is to be executed in the next scan.
  Next step labels include THEN and ELSE labels according to case conditions being true or false. If both labels are blank, the step does not transfer.
  - ***THEN label***
    Describe the next step label when the corresponding rule condition status is true. Transition to the step described in the THEN label is executed after the manipulated output is completed.
  - ***ELSE label***
    Describe the next step label when the corresponding rule status is false. The described step labels must exist in the same sequence table group. To execute a step from another sequence table group at the next scan, it must be described as an action signal.
- ***Tag Name.Data Item***
  Describe the input connection information of the condition signal or the output connection information of the action signal.
- ***Data***
  Describe the condition specification of the condition signal or the operation specification of the action signal.
- ***Comment***
  Comments are defined by users for the condition and action signals. The meaning of symbols and the contents of status manipulation may be put in these texts, by using up to 24 single-byte alphanumeric characters, or 12 double-byte characters. By clicking the task [Referencing Signal Comment] from the [Tool] menu, the user-defined comment text may be displayed at the right area of signals. By this Referencing Signal Comment operation, the comment texts defined by users for the condition signals and action signals and the tag comments are all displayed. The comment text for the referenced signals cannot be edited on the sequence table editing window.

SEQUENCE DESCRIPTION EXAMPLE

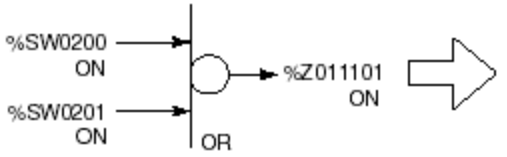
The basic logical circuit figure for the AND and OR commands is described in the sequence table as shown in the following figure.



				01	02	03	
	No	Tag Name and Data Item	Data				
Condition	C01	%SW0200.PV	ON	Y	N		
	C02	%SW0201.PV	ON		Y	N	
	C03						
Action	A01	%Z011101.PV	H	Y	N	N	
	A02						
	A03						

Figure : AND Circuit Example

In the example in this figure, for AND operator, only when two condition signals are satisfied, the operation may be performed.



				01	02	03	
	No	Tag Name and Data Item	Data				
Condition	C01	%SW0200.PV	ON	Y		N	
	C02	%SW0201.PV	ON		Y	N	
	C03						
Action	A01	%Z011101.PV	H	Y	Y	N	
	A02						
	A03						

Figure: OR Circuit Example

In the example in this figure, for OR operator, any one of the two conditions is established, the operation may be performed.

SEQUENCE TABLE PROCESSING FLOW

The figure below shows the sequence table processing flow.

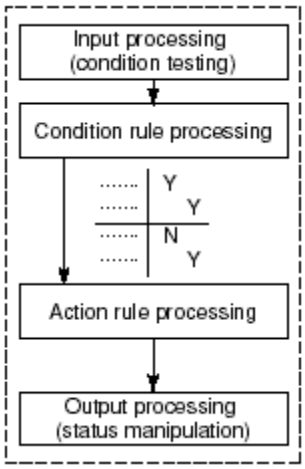


Figure: Sequence Table Processing Flow

- ***Input Processing***
  The true/false status of the condition signal is determined by performing condition testing based on the input signal.
- ***Condition Rule Processing***
  The true/false status of the rule condition is determined by comparing the true/false status of the condition signal with the Y/N pattern of the condition rule described in the sequence table.
- ***Action Rule Processing***
  The action signal output is determined by the Y/N pattern of the action rule when the status of condition is true.
- ***Output Processing***
  Status manipulation of the action target is performed based on the description of the action signal. The status manipulation, start command transmission, data setting, and status change can be performed to the contact outputs and other function blocks. There are two types of sequence tables: step and non-step. Rule processing differs by the type of sequence table.

ACTION OF STEP SEQUENCE

In a step sequence table, the process control sequence of a phase-step process is divided into the smallest phase units (steps) of the condition monitoring and operation, and then these steps are executed one by one. In a step sequence table, only step label 00 and the rule corresponding to the current step number are subject to condition testing and operation. The following shows the action of a step sequence table.

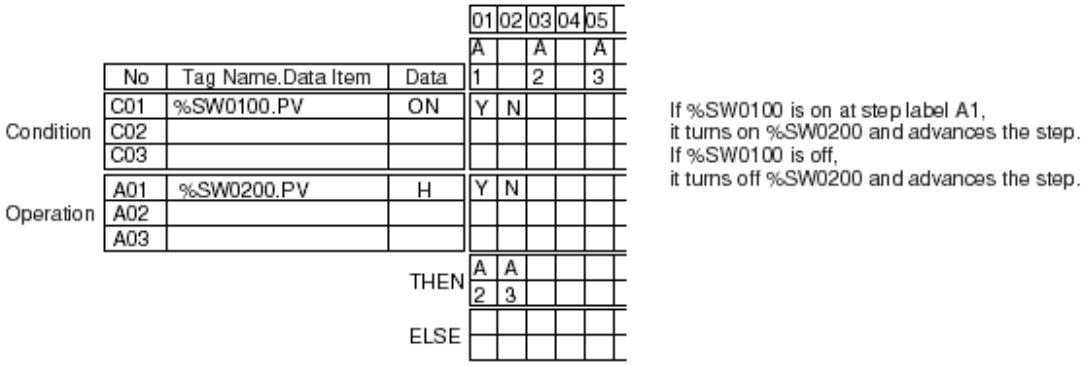


Figure: Example of Conditional Branch in step sequence

RULE EXTENSION

The number of rules in one sequence table is fixed at 32 and cannot be modified. However, if the number of rules in a sequence table is not enough to describe one phase unit, it can be extended in the 32-rule unit by connecting to another sequence table. The number of rules can be extended for a step-type sequence table.

- ***Method of Rule Extension***
  To extend the number of rules, specify a tag name for the rule extension block (ST16E) in the sequence table setting area of the extending sequence table (ST16). It does not matter if the number of signals and signal contents are different between the extending sequence table (ST16) and extended sequence table (ST16E). The number of rules can be extended in the 32-rule unit per block. An example of the number of rules extended to 64 is shown below.

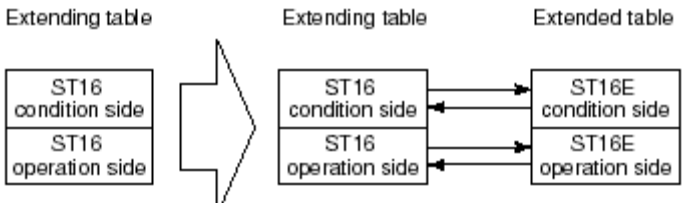


Figure: Examples of Rule Extension

PROCESSING TIMING

A sequence control block and a logic chart block have the following four types of execution timing:

- ***Periodic Execution (T)***
- ***One-Shot Execution (O)***
- ***Initial Execution/Restart Execution (I)***
- ***Restricted Initial Execution (B)***

OUTPUT TIMING OF SEQUENCE CONTROL BLOCK

The output timing of sequence control block and logic chart block indicates the conditions to execute the output processing when the sequence table is started periodically or as a one shot. There are two types of output timing as below:

- ***Output only when conditions change (C)***
- ***Output each time conditions are satisfied (E)***

The output timing of function blocks excluding sequence control blocks is "Output each time conditions are satisfied (E)."

CONTROL PERIOD FOR SEQUENCE TABLE BLOCKS

The control period for the ST16, ST16E blocks refers to the interval at which the periodic execution- type ST16 or ST16E block executes the sequence table. The control period can be set in the Function Block Detail Builder.

- ***Control period: Set a value between 1 and 16 seconds. Default is 1 second.***

CONTROL PHASE FOR SEQUENCE TABLE BLOCKS

The control phase for the ST16, ST16E blocks refers to the timing at which the sequence table is executed in the control period. It sets the execution timing relative to the execution timing of the phase-zero sequence table. The control phase can be set in the Function Block Detail Builder.

- ***Control phase: Set a value between 0 and 15 seconds. Default is 0 second.***

3. LOGIC CHART BLOCK (LC64)

Logic Chart Block (LC64) may combine or arrange the signals of other function blocks; process I/O and software I/O into an application for interlock sequence control. An architecture of LC64 Logic Chart Block is shown as follows.

LC64 block is a sequence control function block with 32 input and 32 output signal channels and it can handle 64 logic operators.

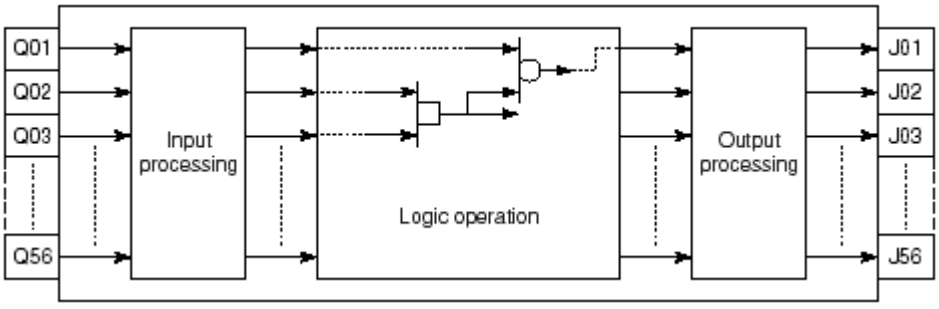


Figure: Function Block Diagram of Logic Chart Block (LC64)

CONFIGURATION OF A LOGIC CHART

A logic chart consists of condition signals, action signals and logic operators.

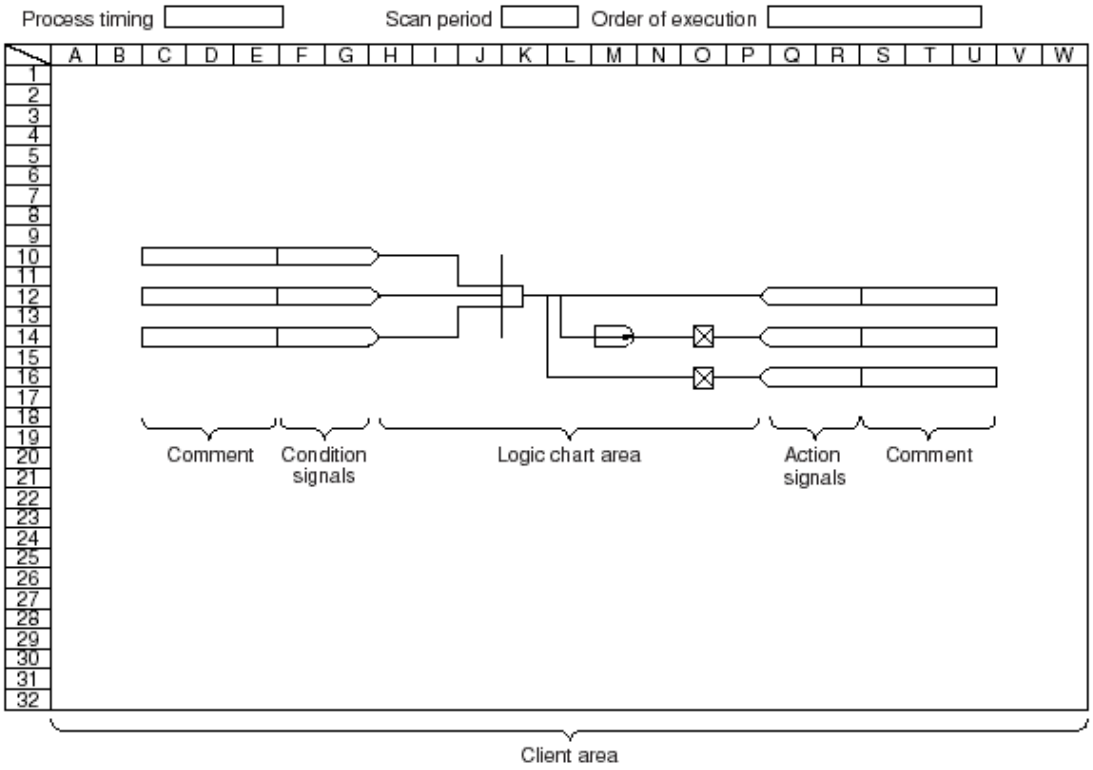


Figure: Configuration of the Entire Logic Chart

LOGIC CHART PROCESSING FLOW

In the logic chart, the logic calculation is performed based on the result of input processing. Output processing is then performed for the output action to the operation target.

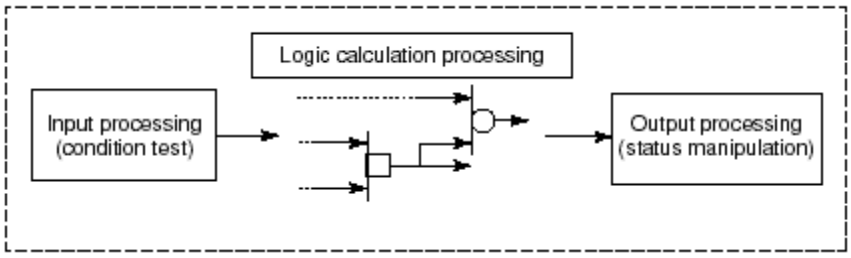


Figure: Logic Chart Processing Flow

- ***Input Processing***

  The true or false status of a condition signal is determined by the condition test performed on the input signal.

- ***Logic Calculation Processing***
  The logic calculation is based on the result of condition test of the input signal (true = 1, false = 0). The logic calculation algorithm is expressed by combinations of logic operators.
- ***Output Processing***
  Status manipulation output is determined based on the result of logic calculation processing. The status manipulation will be output as the output signals to the operation target. The status manipulation can send commands such as starting, data setting, and status change to the contact output terminals or to other function blocks.

LOGICAL OPERATORS

- ***AND: Logic Product***
  It gives one output based on multiple inputs. When all the inputs are True, the output becomes True. The maximum number of inputs is 21.

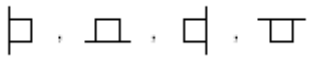


Figure: AND symbols

- ***OR: Logic Sum***
  It gives one output based on multiple inputs. When any of inputs is True, the output becomes True. The maximum number of inputs is 21.

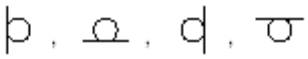


Figure: OR symbols

- ***NOT: Negation***
  It gives the inverse of the input as an output.

Figure: NOT symbol

- ***SRS1-R (1 output), SRS2-R (2 outputs): Flip-Flop (Reset-Dominant)***
  It gives one output or two outputs shown in the following truth table based on the set and reset input signals. One flip-flop operation is counted as two logic operation elements.

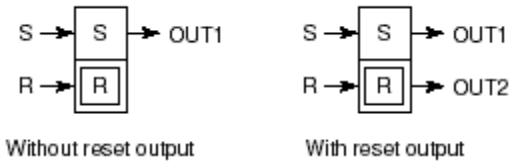


Figure: SRS1-R and SRS2-R symbols

Input	S	0	1	0	1
	R	0	0	1	1
Output	OUT1	Latched	1	0	0
	OUT2	Latched	0	1	1

D030912E.EPS

Latched: The previous state is maintained.

Table: Reset-Dominant Truth Table

- ***SRS1-S (1 output), SRS2-S (2 outputs): Flip-Flop (Set-Dominant)***
  It gives one output or two outputs shown in the following truth table based on the set and reset input signals. One flip-flop operation is counted as two logic operation elements.

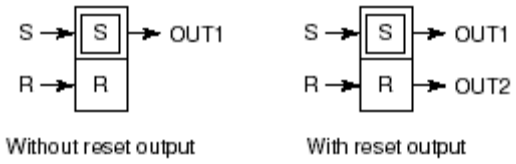


Figure: SRS1-S and SRS2-S symbols

Input	S	0	1	0	1
	R	0	0	1	1
Output	OUT1	Latched	1	0	1
	OUT2	Latched	0	1	0

D030914E.EPS

Latched: The previous state is maintained.

Table: Set-Dominant Truth Table

- ***WOUT: Wipeout***
  It gives an output which is an inverse of reset signal when reset signal is true, otherwise, it gives the set signal as output, shown in the following truth table based

on the set and reset input signals. One wipeout operation is counted as two logic operation elements. Its symbol is shown below. (W. O)

Input	S	0	1	0	1
	R	0	0	1	1
Output	OUT	0	1	0	0

Table: WOUT Truth Table

- ***OND: On-Delay Timer***
  When the input status changes from 0 to 1, the internal timer starts. When the set time t elapsed, its output changes from 0 to 1. When the input status changes to 0, the output will be reset to 0 immediately.

Figure: On-Delay Timer symbol

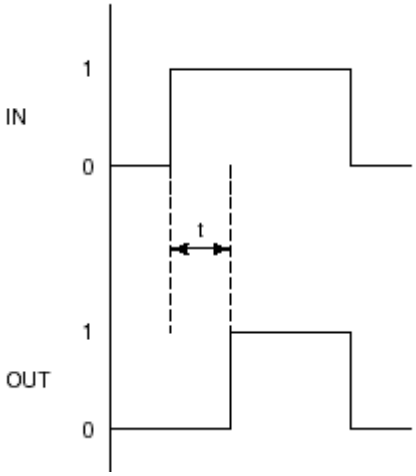


Figure Behavior of On-Delay Timer

- ***OFFD: Off-Delay Timer***
  When the input status changes from 1 to 0, the internal timer starts. When the set time t elapsed, its output changes from 1 to 0. When the input status changes to 1, the output will be reset to 1 immediately.

Figure Off-Delay Timer symbol

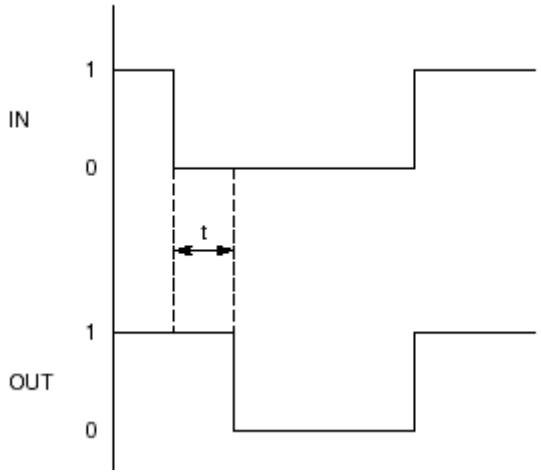


Figure Behavior of Off-Delay Timer

- ***TON: One-Shot (Rise Trigger)***
  When the input status changes from 0 to 1, it gives an output 1 for a one scan cycle. The output is always 0 except for that 1 scan cycle.

Figure One-Shot (Rise Trigger) symbol

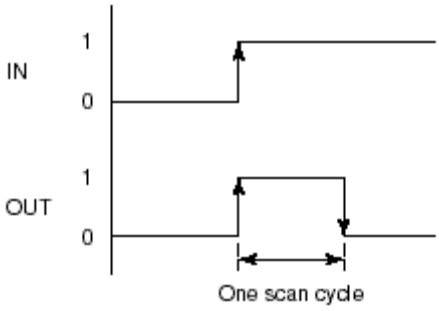


Figure Behavior of One-Shot (Rise Trigger)

- ***TOFF: One-Shot (Fall Trigger)***

When the input status changes from 1 to 0, it gives an output 1 for a one scan cycle. The output is always 0 except for that 1 scan cycle.

Figure: One-Shot (Fall Trigger) symbol

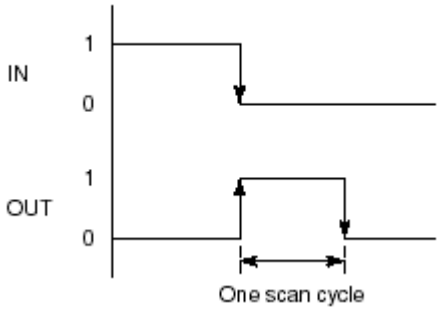


Figure: Behavior of One-Shot (Fall Trigger)

- ***CMP-GE: Comparator***
  It compares the logic values of input 1 and input 2. It gives an output 1 when input 1 is greater than or equal to input 2, otherwise it gives an output 0. One Comparator operation is counted as two logic operation elements.

Figure: CMP-GE symbol

Input	IN1	0	0	1	1
	IN2	0	1	0	1
Output	OUT	1	0	1	1

Table: CMP-GE Truth Table

- ***CMP-GT: Comparator***
  It compares the logic values of input 1 and input 2. It gives an output 1 when input 1 is greater than input 2, otherwise it gives an output 0. One Comparator operation is counted as two logic operation elements.

Figure: CMP-GT symbol

Input	IN1	0	0	1	1
	IN2	0	1	0	1
Output	OUT	0	0	1	0

Table : CMP-GT Truth Table

- ***CMP-EQ: Comparator***
  It compares the logic values of input 1 and input 2. It gives an output 1 when input 1 is equal to input 2, otherwise it gives an output 0. One Comparator operation is counted as two logic operation elements.

Figure: CMP-GT symbol

Input	IN1	0	0	1	1
	IN2	0	1	0	1
Output	OUT	1	0	0	1

Table: CMP-EQ Truth Table

4. SOFTWARE INPUT/OUTPUT

Software inputs/outputs are identified by their element serial numbers. The classification of element numbers for the CS 3000 is shown below.
%XXnnnn
%XX: Software input/output element identifier. Varies according to the type of software input/output signal.
nnnn: Serial numbers. Some software input/output elements do not have serial numbers.

Name	Element Number	Element Number Convention
Common switch	%SWnnnn	nnnn: Serial no.(0001 to 4000)
Global switch	%GSnnnmm	nnn: Serial no.(001 to 256) mm: Station no.(01 to 64)
Annunciator message	%ANnnnn	nnnn: Serial no.(0001 to 0500) (0001 to 1000) (for KFCS2 or LFCS2)
Print message	%PRnnnn	nnnn: Serial no.(0001 to 0200) (for SFCS) nnnn: Serial no.(0001 to 0400) (for KFCSor LFCS) (0001 to 1000) (for KFCS2 or LFCS2)
Operator guide message	%OGnnnn	nnnn: Serial no.(0001 to 0200) (0001 to 0500) (for KFCS2 or LFCS2)
Multimedia start message (%VM)	%VMnnnn	nnnn: Serial no.(0001 to 0100)
Sequence message request	%RQnnnn	nnnn: Serial no.(0001 to 0200)
Supervisory computer event message (%CP)	%CPnnnn	nnnn: Serial no.(0001 to 9999)
Supervisory computer event message for PICOT	%M3nnnn	nnnn: Serial no.(0001 to 9999)
Signal event message	%EVnnnn	nnnn: Serial no.(0001 to 0200) (0001 to 0500) (for KFCS2 or LFCS2)
SFC/SEBOL return event message	%RE	–

Table: Software Input/output Element number

In factory plant operation, for monitoring purposes user may assign a tag name for each common switch, global switch and annunciator message output when required.

COMMON SWITCH

Common switches are internal switches used by various control functions to save the shared logical values in an FCS.
The logical value of a common switch is not directly output to an external FCS, but are used by various control functions in an FCS for condition testing and status manipulation. Common switches in the CS 3000 with element number %SW0201 to %SW4000 may be freely defined by users. Common switches with element number %SW0001 to %SW0200 are fixed as system switches. They are used to indicate the different statuses of the FCS.

- ***Condition Testing***
  When common switch ON/OFF status is applied as a condition test signal to a sequence table block and logic chart block or to a designated function block in sequence connection via its signal input terminal, the testing of the condition establishment is referred to as common switch condition testing. The syntax form for condition testing is shown below.

  %SWnnnn.PV.ON/OFF
  %SWnnnn: Element number
  ON/OFF: Either ON or OFF must be specified.

- ***Status Manipulation***

  When common switch ON/OFF status is applied as a manipulated signal from a sequence table block and logic chart block or from a designated function block in sequence connection via its signal output terminal, the common switch status reflecting the manipulated signal status is referred to as common switch status manipulation. Two types of manipulation signal outputs are available: a "latched" type and a "non-latched" type. The syntax form for status manipulation is shown below.

  %SWnnnn.PV.H or %SWnnnn.PV.L
  nnnn: Element number
  H: Latched type (*1)
  L: Non-latched type
  ****1: Latched type output is only supported by sequence table block.***

COMMON SWITCH DEFINITION

- ***Tag Name***
  Tag names may be defined by users. A user defined tag name is a string up to 16 alphanumeric characters (capital letters only for the English alphabet), [_] (underscore) and [-] (hyphen). However, a [_] (underscore) and [-] (hyphen) may not be placed at the beginning of a tag name.

  Here is an example of a tag name:
  Example: FIC1000

- ***Tag Comment***
  An explanatory description for each function block can be defined with up to 24 single-byte characters or 12 double-byte characters. The defined tag comment is displayed in the window along with the tag name.

- ***Switch Position Label***
  Up to 64 sets numbered Nos.1 to 64 of switch position labels can be defined for one project. One set consists of four labels (label 1, label 2, label 3, and label 4). The figure below shows an example of the label for switch position list file.

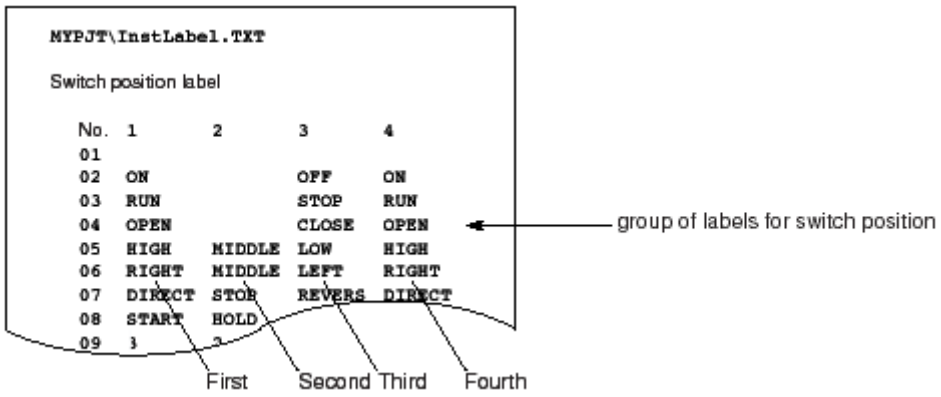


Figure: Label for Switch Position List

- ***Label***
  There are two types of label display formats for switch position; direct format and reverse format. For instance, when the label numbered 09 (3,2,1,0) is specified to be displayed in direct format, it appears as shown below.

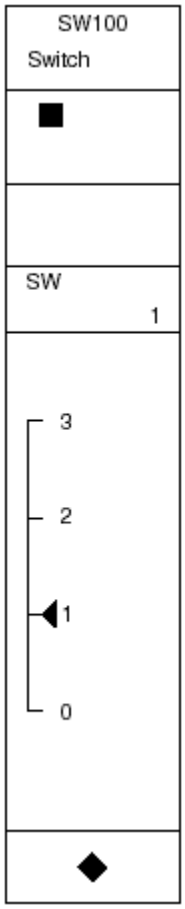


Figure: Switch Position Label in Direct Format

When displayed in reverse format, it appears as shown below.

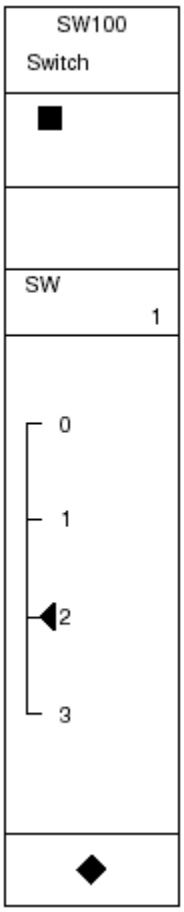


Figure: Switch Position Label in Reverse Format

- ***Btn1, Btn2, Button Color***
  The button color as well as the switch position label can be designated for some of the SFC blocks, the unit instrument, and the logic operation blocks. Any of the following 16 colors can be specified for each switch position label:

  R: Red N: Black G: Green Y: Yellow
  B: Blue M: Magenta C: Cyan W: White
  SB: Steel blue PK: Pink SG: Spring green OR: Orange
  YG: Yellow green VO: Violet DB: Deep sky blue GR: Gray

  The button color changes when the button (switch) is pressed. In the Function Block Detail Builder, two colors can be designated for the top and bottom buttons. For a three-button faceplate, the top two buttons are defined as [upper] and the bottom button as [lower].

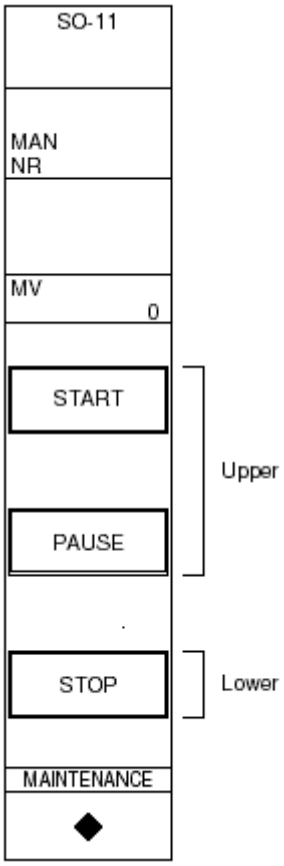


Figure: 3-Button Faceplate Color Specification

- ***Level***
  Security level may be set from level 1 to level 8. Level 4 is the default security level set for the function blocks.

GLOBAL SWITCH

A global switch is an internal switch with the same logical value on all stations in the same domain.
The value of global switch assigned to the present station can be checked and defined from any application on a station. Up to 256 write-enable global switches can be assigned to each station. The defined value is broadcasted to each station in the system via V net scan transmission when data transfer to other stations is defined in Scan Transmission Definition on the FCS Constants Builder. When the values of global switches under the control of other stations are sent via scan transmission, the global switch on the present station is updated when data receipt is defined at Scan Transmission Definition on the FCS Constants Builder. The values of global switches under the control of other stations can be checked. The values of global switches are updated at the same time mostly on all stations in the system. The

values are updated by 100 msec, which is fixed. With this function, status information can be transferred from one station to the control function of another station with very little delay.

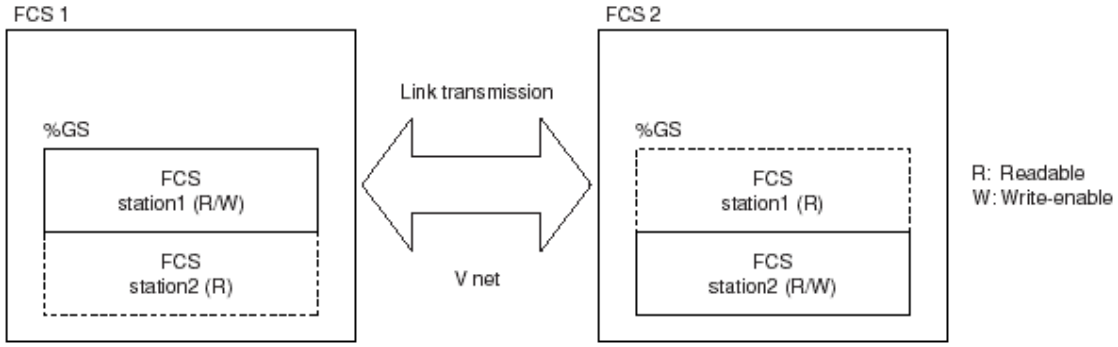


Figure: Global Switch

ANNUNCIATOR MESSAGE OUTPUT (%AN)

The HIS annunciator function simulates the annunciator instrument panel. This function informs the HIS of the occurrence or recovery of an alarm message.
These special message outputs are used to simulate the annunciator panels of the instrument panels. Unlike other message outputs, annunciator message outputs store alarm occurrence statuses as logical values. When the alarm occurrence status changes, the annunciator message informs the HIS of the occurrence or recovery of the message. When an alarm occurs, the alarm symbol will flash to prompt the operator for acknowledgment. The alarm symbol will stop flashing once it has been acknowledged. Annunciator message outputs are processed at the basic scan cycles only.

- ***Condition Testing***
  When annunciator message ON/OFF status is applied as a condition test signal to a sequence table block and logic chart block or to a designated function block in sequence connection via its signal input terminal, the testing of the condition establishment is referred to as annunciator message condition testing. The syntax form for condition testing is shown below.

  %ANnnnn.PV.ON/OFF -----Condition testing
  %ANnnnn: Element number
  ON/OFF: Either ON or OFF must be specified.

- ***Status Manipulation***
  When annunciator message ON/OFF status is applied as a manipulated signal from a sequence table block and logic chart block or from a designated function block in sequence connection via its signal output terminal, the annunciator message status reflecting the manipulated signal status is referred to as annunciator message status

manipulation. Two types of condition signal outputs are available: a "latched" type and a "non-latched" type. The syntax form for status manipulation is shown below.

%ANnnnn.PV.H or %ANnnnn.PV.L
%ANnnnn: Element number
H: Occurrence/recovery of a latched annunciator message (*1)
L: Occurrence/recovery of a non-latched annunciator message
****1: Latched type output is only supported by sequence table block.***

In the case of latched annunciator messages, recovery can be made by N-status manipulation of the sequence table. The following syntax form is for the recovery of an annunciator message output.

%ANnnnn.PV.H -----N

OPERATOR GUIDE MESSAGE (%OG)
Operator guide messages are used to prompt the operator's acknowledgment for certain operation during certain progress of the process.

- ***The Occurrence of Operator Guide Messages***
  Operator guide messages are triggered by the sequence control of the control station. When the Operation and Monitoring Functions detect an operator guide message, a character string that corresponds to the message number is displayed in the Operator Guide window, then the operator guide message is saved to the historical message log file. The occurrence of operator guide messages is shown as below:

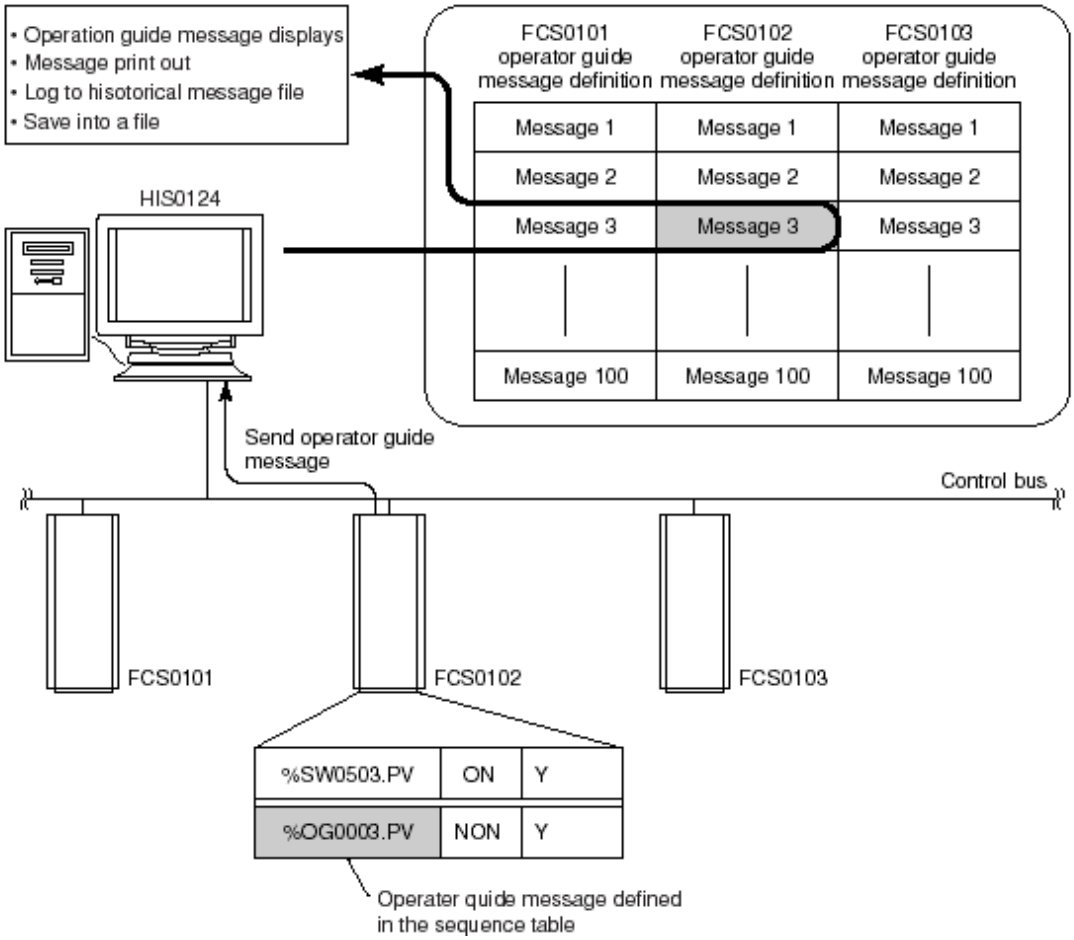


Figure: Occurrence of an Operator Guide Message

- ***Specification***
  The syntax form for an operator-guide message output specification is shown below.

  %OGnnnn.PV.NON -----To output an operator guide message
  %OGnnnn: Element number

- ***Message, Color, Related Window Name***
  Define the following item for the fixed element number.
  - ***Operator guide message***
    Define the character strings to transmit as an operator guide message. Up to 70 alphanumeric characters are used.
  - ***Color***
    Define the color of the operator guide message. Default color is white.
  - ***User-definable label name.***
    For each operator guide message, labels can be defined.
    Labels may be omitted.

- ***Defining Linked Windows***
  If it is required to display a window upon acknowledging the operator guide message, the window can be designated as a related window by defining the name, the type of function, the display size, and the display position. With the related window defined, clicking the message displayed in the Operator Guide Message window will display the related window in the defined format.

PRINT MESSAGES (%PR)

Print messages are triggered by the Sequence Control Function to print out the message to indicate certain timing of the process. When a print message request is sent from a field control station to an HIS, the Operation and Monitoring Functions print the character string that correspond to the message number, then saves the print message to the historical message log file. The print message may be printed as in one of following formats.

- ♦ ***Comment message plus up to 3 process data in the order of data1, data2, and data3 may be printed out.***
- ♦ ***The integer constant specified in the action column of sequence table plus 2 process data in the order of integer constant, data1, data2 may be printed out.***

- ♦ ***Occurrence of the Print Message***
  The occurrence, transmission and output of print messages are shown as below:

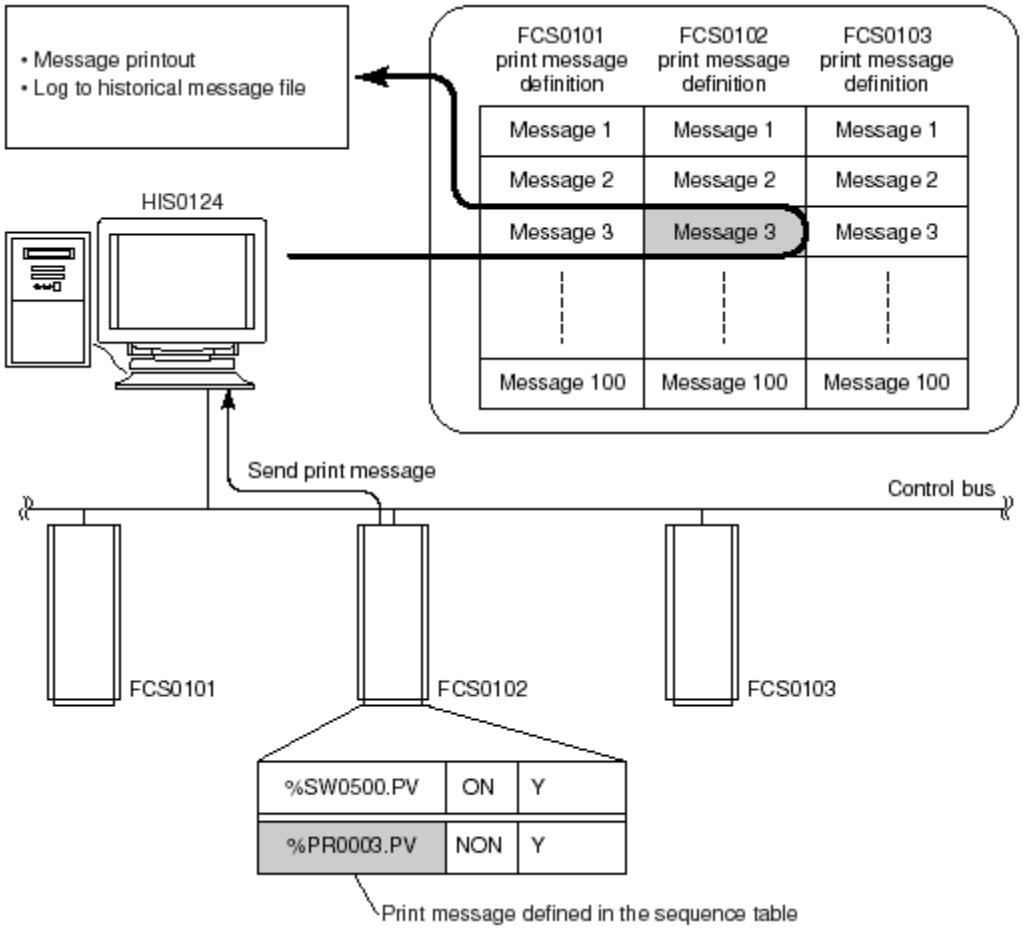


Figure: Occurrence of a Print Message

- ***Definition Items of the Printout Message Builder***
  Define the following items for the fixed element number.
  - ***Print message character strings***
    Up to 80 alphanumeric characters (40 double-byte characters) may be defined as print message. When printing process data, the data may be indicated by symbol. The data values are printed in the order of data items (data1, data2, data3).
  - ***Data 1 to 3***
    Data may be defined in the format of TagName.DataItem.
    For array data, TagName.DataItem [subscript1, subscript2] may be specified, the data may be specified less than 34 alphanumeric characters.
  - ***Format 1 to 3***

Specify the format of the print message. Integer data value and the real number data value are right justified and the character strings are left justified when printed out. The print format is as follows:
[Leading Zeros] [Total Digits]. [Digits after DP] [Conversion]

- ***User-defined label name***
  For each operator guide message, labels can be defined. Labels may be omitted.

♦ ***Defining Print Message***
An example of print message definition is shown as follows.

Element No.	Message	Data1	Format1
%PR0001	Tank A△Injection complated△Quantity=^△L	FIC100.SUM	5
%PR0002			
%PR0003			

[Leading Zero]	[Digits] .	[DP]	[Conversion]
=	=	=	=
Default	5	Default	Default

%PR0001 Printout

Tank A△Injection completed△Quantity=12345△L

FIC100.SUM value

△: Space

Figure: Example of Printout

SEQUENCE MESSAGE REQUEST

The sequence message request is sent by the Process Sequence Control Function at a certain process timing to an HIS to execute certain Operation and Monitoring Functions. The functions to be executed for the corresponding request message numbers may be defined in the HIS. After the Operation and Monitoring Functions' execution, the request messages are logged into the historical message log files. The trigger of request messages is shown as below:

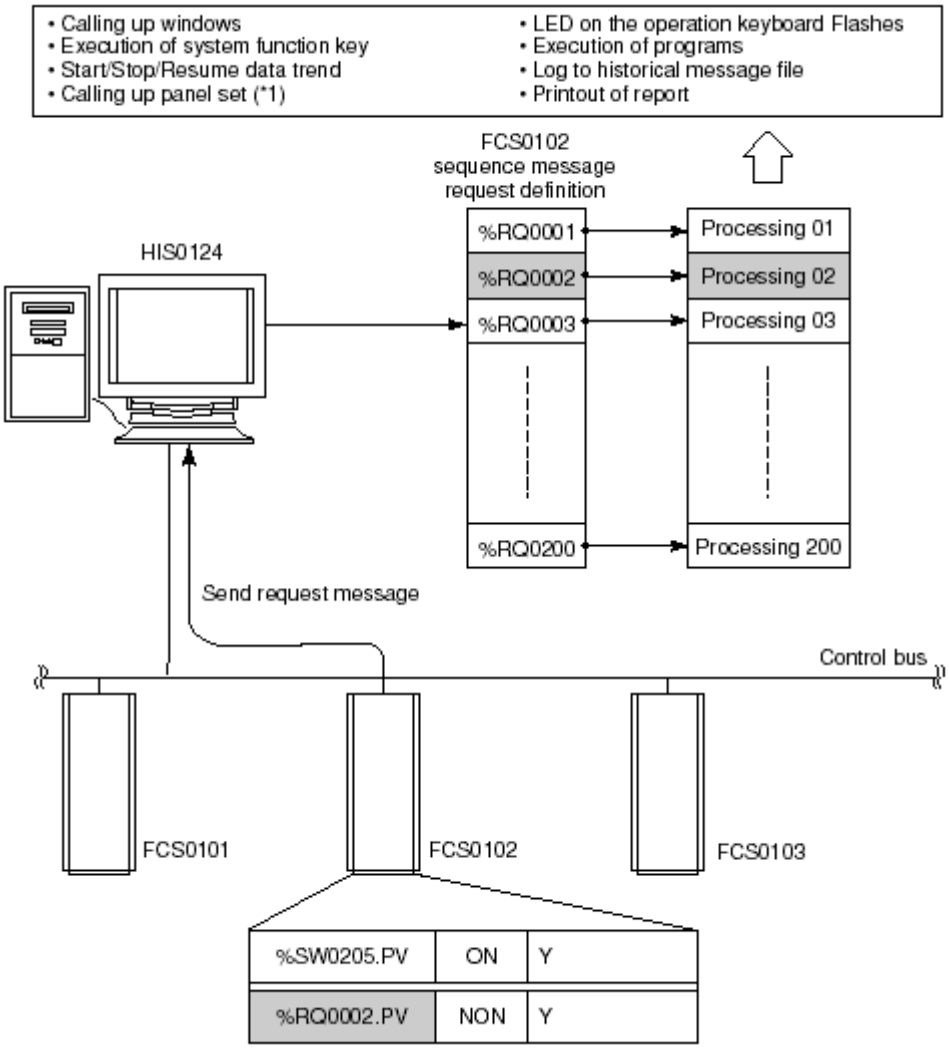


Figure: Occurrence of a Request Message

SIGNAL EVENT MESSAGE OUTPUT (%EV)

Signal event message outputs enable a function block to inform the SEBOL control function of event changes.

- ***Specification***
  The syntax form for a signal event message output specification is shown below.

  %EVnnnn.PV.k -----To output a signal event message
  %EVnnnn: Element number
  k: Parameter (0 to 65535)

- ***Destination of Output***
  Signal event messages are used to exchange event information among the internal control functions of an FCS. They are not output to a window, printer or file.

Instrumentation & Control Services

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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.

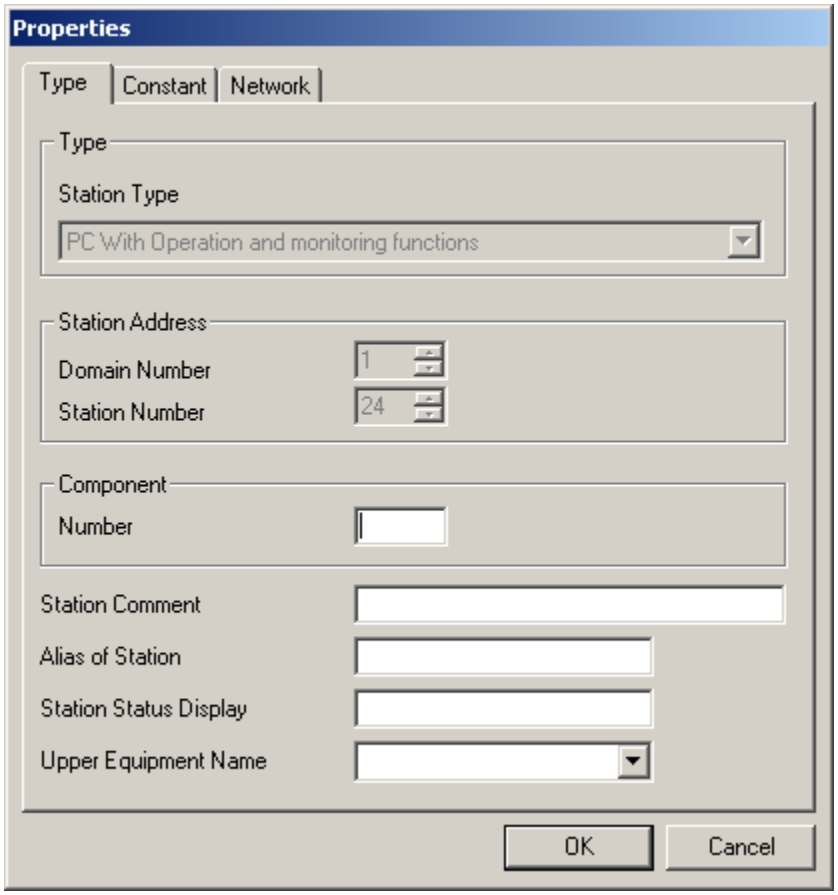

Figure: HIS Properties dialog

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

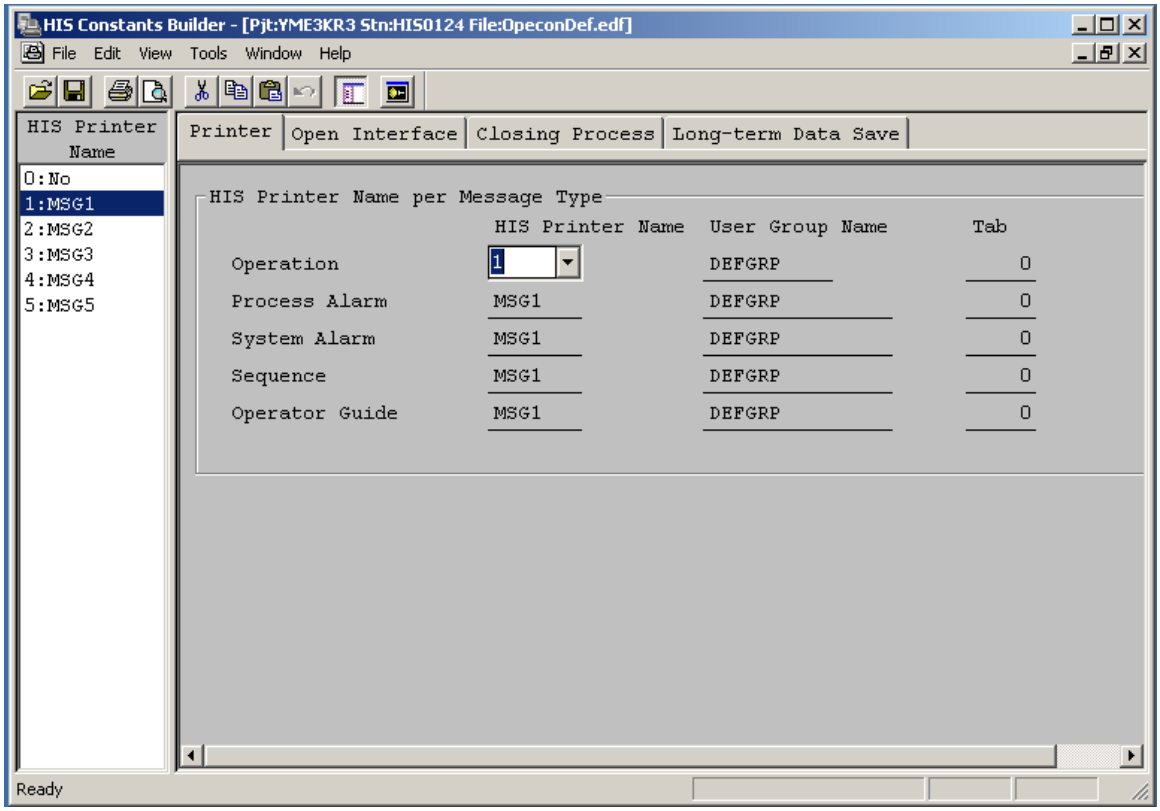

Figure: HIS Constants builder dialog.

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.

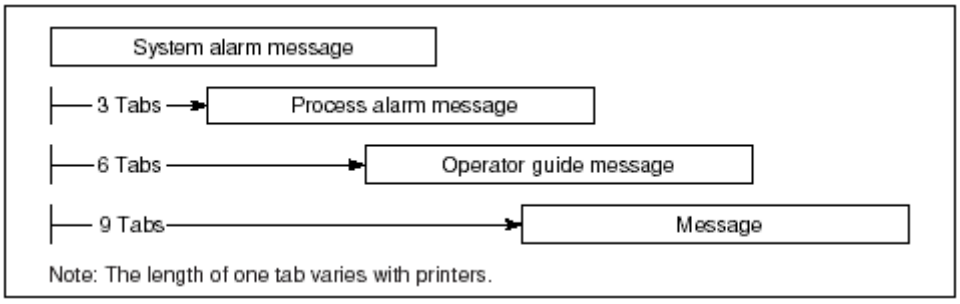

Figure Message Print Start Position

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.

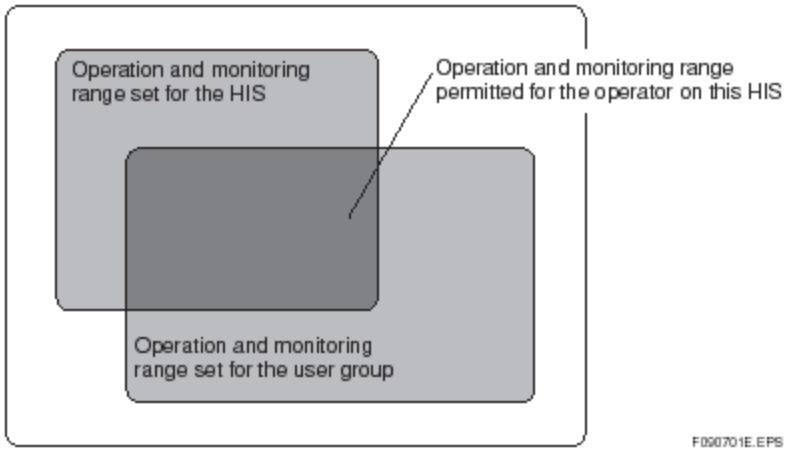

Figure: Operation and Monitoring Range Permitted for Operator

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.

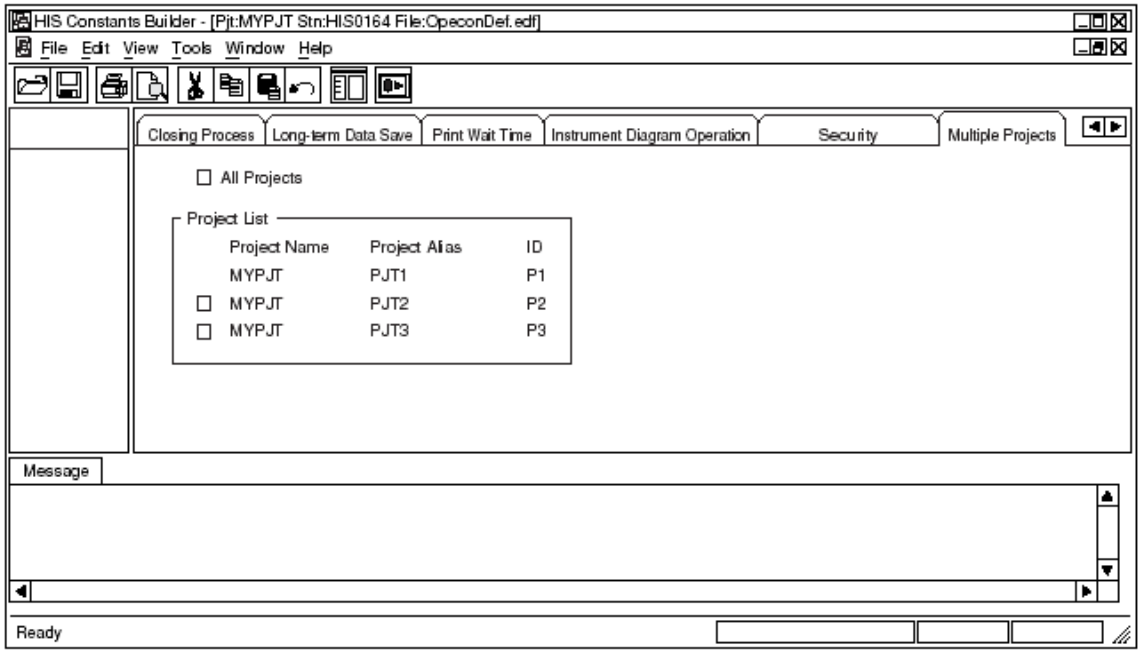

Figure Multiple Projects Tab

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.

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CHAPTER 10
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)

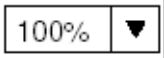
Button	Tool	Function
	Undo	Cancels the previous edit operation.
	Grid	Switches the grid display between on and off.
	Snap to grid	Switches the snap to grid setting between on and off.
	Zoom In	Enlarges the display area.
	Zoom Out	Reduces the display area.
	Area Zoom	Enlarges a specific area.
	Specify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

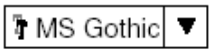
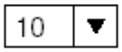
Button	Tool	Function
	Font Type	Selects font type of text.
	Font Size	Selects font size of text.
	Bold	Displays text in boldface.
	Italic	Displays text in italics.
	Underline	Underlines text.
	Text Color	Displays the menu from which a text color is selected.
	Fill Color	Displays the menu from which a 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

FILE PROPERTY SHEET 

The property sheet of the file being edited via the Graphic Builder is displayed by selecting [Properties] from the [File] menu of the Graphic Builder. The file property sheet consists of the following four types of tabs.

- *Outline tab*
  Tab used to display a file name, a project name, file creation date/time, and update date/time. The user does not need to set these items.

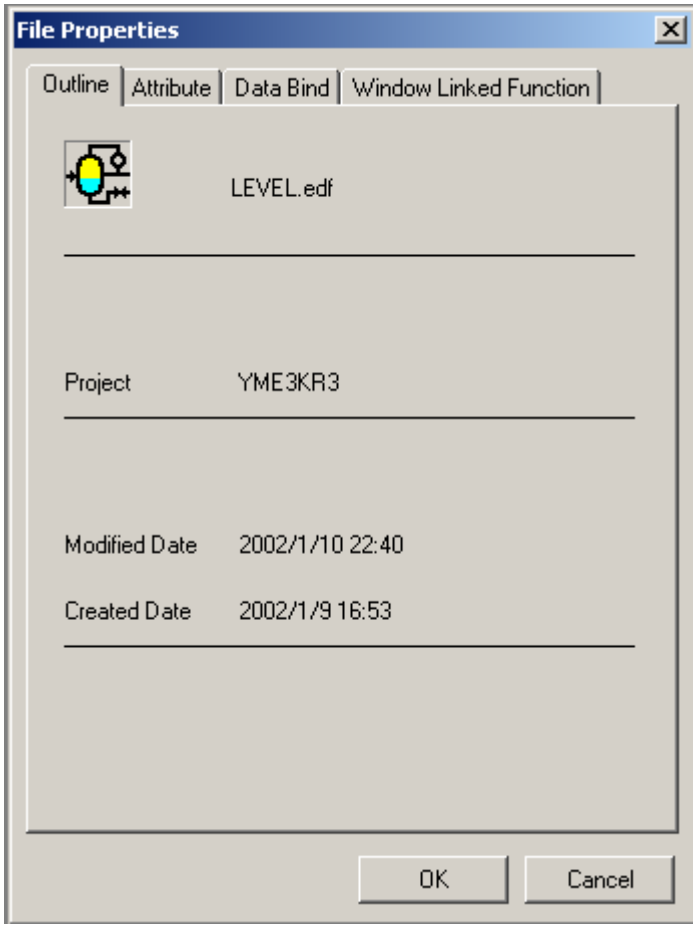


Figure: Outline tab of file properties

♦ *Attribute tab*
Tab used to display or set properties related to the windows

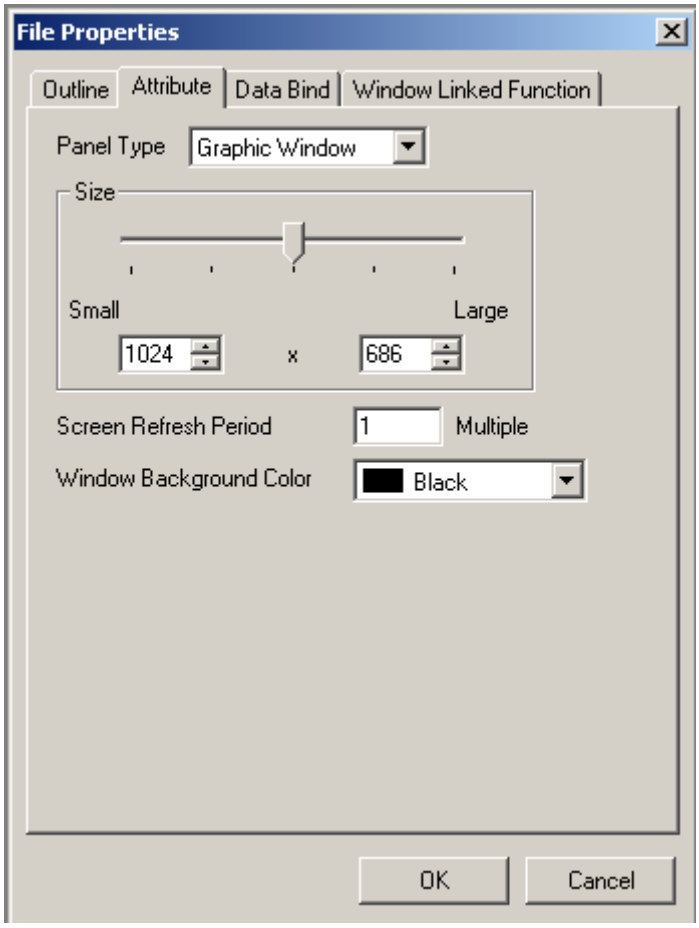


Figure: Attribute tab of file properties

- *Panel Type*
  These are the types of windows displayed. They include three types of windows: [Graphic window], [Overview window], and [Control window].
- *Window Size*
  The size of new graphic windows can be set in dot units, using a slider. The following shows the selection of sizes.
  - ***1600x1072***
  - ***1280x858***
  - ***1024x686 (Default)***
  - ***800x536***
  - ***640x429***

When setting the window to a user defined size, the number of vertical pixels and horizontal pixels can be set using the spin boxes. The setting values can also be directly entered to the boxes. One screen can display total of 3,686,400 pixels. (*1)

****1: 1280x720 (pixels)x4 (windows)***

- *Screen Refresh Cycle*
  This is the interval at which the entire graphic window display is updated. The unit for update intervals is a multiple of the basic update cycle unit (1 Sec.) for HIS operation and monitoring windows. The default setting is the same as the basic update cycle unit.

- *Window Background Color*
  This is the background color used when displaying Graphic windows. The background color set here is also used in the work areas of the Graphic Builder. Choose one color from 256-color palette for the background color.

♦ *Data Bind tab*

Tab used to set the Set name and comment, Generic name and data bound to the graphic generic name.

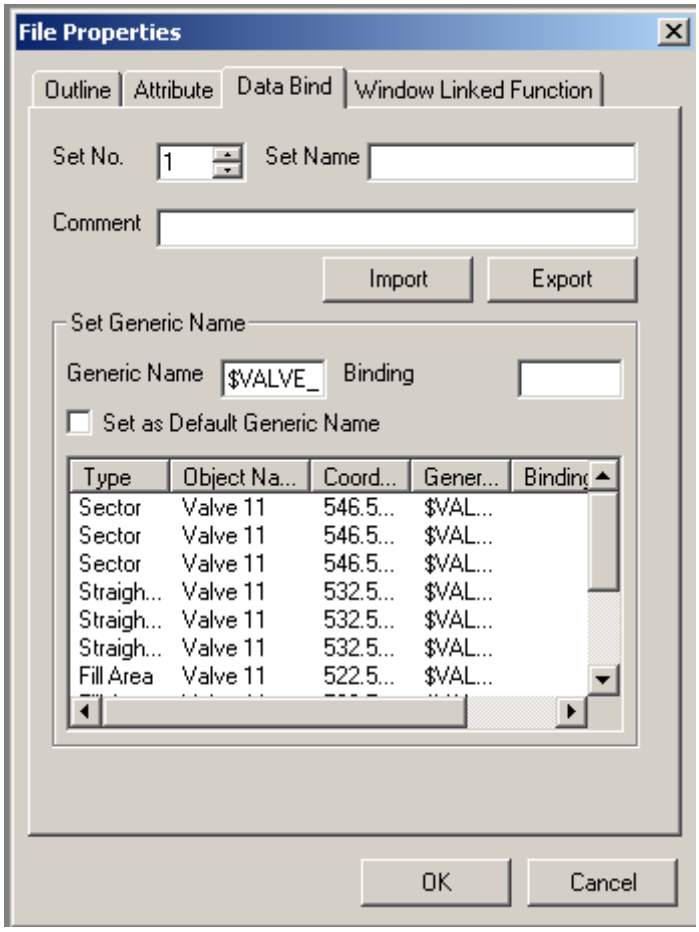
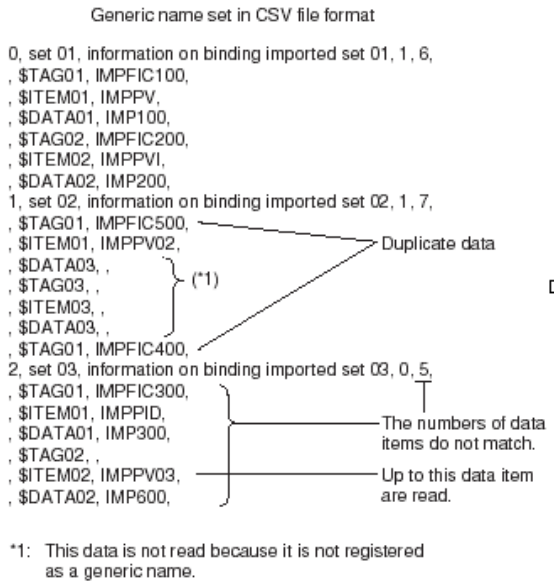


Figure: Data bind tab of file properties

- *Set No., Set Name, Comment*
  This sets the set name, set number and comment for graphic generic name set. Set number can be defined in the range of 1 to 200, for the set name; up to 16 alphanumeric characters can be used. For the comment, up to 30 alphanumeric or 15 double-byte characters can be used.

- *Import*
  This reads the data file created in the CSV file format. The data file can be specified in the file selection dialog displayed by clicking on the [Import] button. When reading a generic name set data file, it will replace the currently used generic name set data and do the following:

- ***Among "generic names" set for the generic name set data file, only those that match "generic names" currently registered in the builder file are read.***
- ***If any data has an invalid format, only the preceding data are read. For example, if "the number of generic names" set for the generic name set data file does not match that of data items, data before "the number of generic names" are read.***
- ***If multiple generic name sets are designated as a default generic name set, the last generic name set is read as a default generic name set.***
- ***If one generic name set has multiple identical generic names with different initial values set for them, the first initial value is read. The generic name set data file is read as follows:***



Definition Contents on the Data Binding Tab

Generic name set number	Set name	Comment	Generic name	Initial value
1	Set 01	Information on binding imported set 01	$TAG01 $ITEM01 $DATA01 $TAG02 $ITEM02 $DATA02	IMPFIC100 IMPPV IMP100 IMPFIC200 IMPPVI IMP200
2 (*2)	Set 02	Information on binding imported set 02	$TAG01 $ITEM01 $DATA01 $TAG02 $ITEM02 $DATA02	IMPFIC500 IMPPV02
3	Set 03	Information on binding imported set 03	$TAG01 $ITEM01 $DATA01 $TAG02 $ITEM02 $DATA02	IMPFIC300 IMPPID IMP300 IMPPVI03

*2: Designated as a default generic name set

Figure: Reading Generic Name Set Data File

- *Export*
  This exports the generic name set data in the CSV file format. The data file can be specified in the file selection dialog displayed by clicking on the [Export] button. The generic name set data is written in the format as shown below:

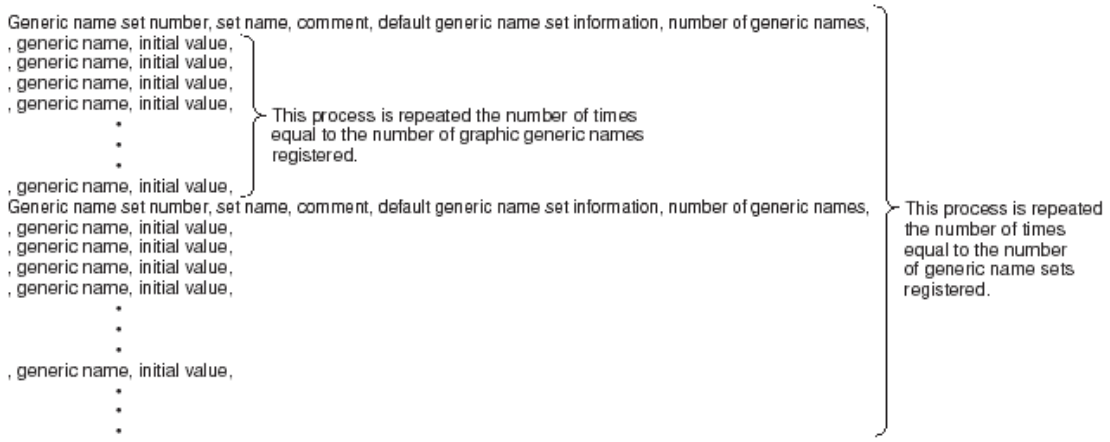


Figure: Generic Name Set Data Format

The table below shows the components of the generic name set data written:

Components	Explanation
Generic name set number	Indicates the generic name set number for which an initial value is registered. The generic name set number to be written is "the registered generic name set number - 1."
Set name	Indicates the set name registered.
Comment	Indicates the set comment registered.
Default generic name set information	Indicates whether the generic name set is set as a default generic name set. If set as a default generic name set, 1 is written. Otherwise 0 is written.
Number of generic names	Indicates the number of graphic generic names registered.
Generic name	Indicates the graphic generic name registered. This is not written if the system-fixed graphic generic name is designated.
Initial value	Indicates the initial value registered.

Table: Components of the Generic Name Set Data Written

The generic name set data is written as follows:

Definition Contents on the Data Binding Tab

Generic name set number	Set name	Comment	Generic name	Initial value
1	Set 01	Information on binding imported set 01	$TAG01 $ITEM01 $DATA01 $TAG02 $ITEM02 $DATA02	FIC100 PV 100 FIC200 SV 200
2	Set 02	Information on binding imported set 02	$TAG01 $ITEM01 $DATA01 $TAG02 $ITEM02 $DATA02	
3 (*1)	Set 03	Information on binding imported set 03	$TAG01 $ITEM01 $DATA01 $TAG02 $ITEM02 $DATA02	FIC300 PV 300

*1 : Designated as a default generic name set

Generic name set in CSV file format

```
0, set 01, information on binding imported set 01, 0, 6,
, $TAG01, FIC100,
, $ITEM01, PV,
, $DATA01, 100,
, $TAG02, FIC200,
, $ITEM02, SV,
, $DATA02, 200,
1, set 02, information on binding imported set 02, 0, 6,
, $TAG01, ,
, $ITEM01, ,
, $DATA01, ,
, $TAG02, ,
, $ITEM02, ,
, $DATA02, ,
2, set 03, information on binding imported set 03, 1, 6,
, $TAG01, FIC300,
, $ITEM01, PV,
, $DATA01, 300,
, $TAG02, ,
, $ITEM02, ,
, $DATA02, ,
```

Figure: Writing Generic Name Set Data

- *Generic Name*
  The graphic generic name selected in the list view will be displayed. The selected graphic generic name can be changed, except for the generic name of the system-specific window and the generic name of the object whose property sheet is defined with [Set an Individual Generic]. When a graphic generic name is changed, whether the new name is defined within 16 alphanumeric characters including underscore (_) and hyphen (-) and whether it begins with "$" are checked. When the setting for the graphic generic name is changed, the setting for corresponding objects will be changed automatically.

- *Binding of Graphic Generic Name*
  The binding of the graphic generic name selected in list view can be defined except for the generic name of the system-specific window and the generic name of the object whose properties sheet is defined with [Set an Individual Generic].
  The length of the graphic generic name will be checked for not exceeding 200 bytes. One generic name can be bound with different variants in accordance with different graphic generic name sets.

- *Set Default Generic Name*
  A selected graphic generic name set may be specified as the default generic name set. When a graphic window is started, if the arguments for the generic name set are omitted, the default generic name set will be used. In the case that the default generic name set is not defined, the name set with the smallest number is taken as the initial generic name set.

♦ *Window Linked Function tab*
Tab used to set functions to be executed by linking with Graphic windows. The attribute tab, data bind tab and window linked function tab are specific to the Graphic Builder.

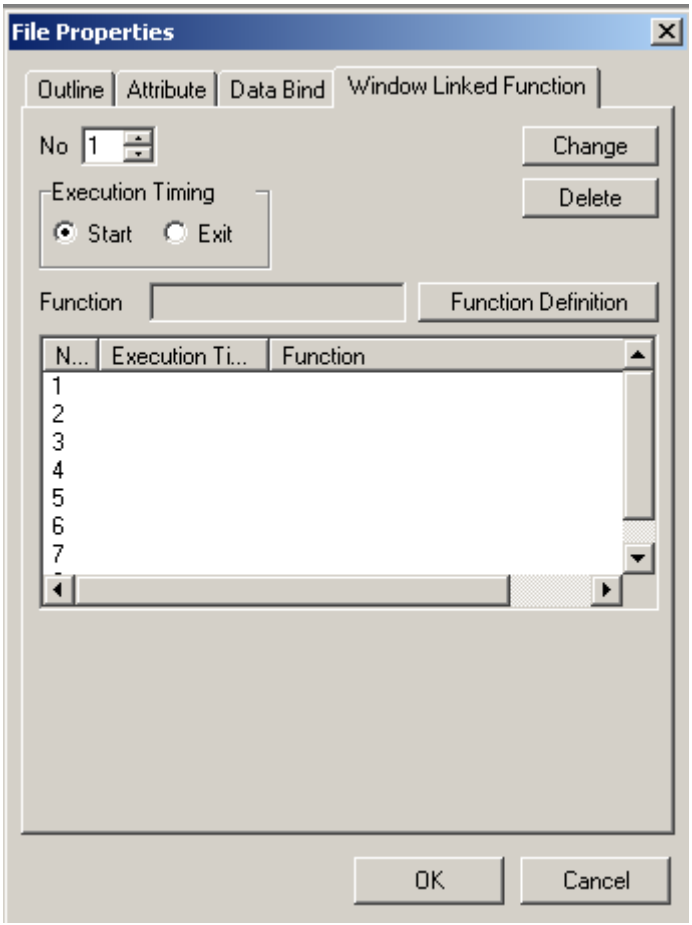


Figure: Window linked function tab

- *Function Number*
  This is the number to assign to a function to be executed. Select from numbers 1 to 8 by using the spin box.

- *Execution Timing*
  This is the timing to execute the assigned function. Selected the execution timing from display start or display end of Graphic windows.

- *Assigning Functions*
  This sets the assigning function. Functions used in soft keys and touch target can be set on this tab, as well. The assigning function is set using the dialog displayed when the [Function Definition] button is pressed.

SETTING THE OPTIONS

The option dialog box is used to set the Graphic Builder's operating environment, such as the properties that are used to create a new object. The Options dialog box consists of the Options and Debug tabs. The Options dialog box can be displayed by selecting [Options] from the [Tool] menu of the Graphic Builder. This section explains setup items for each tab of the Options dialog box.

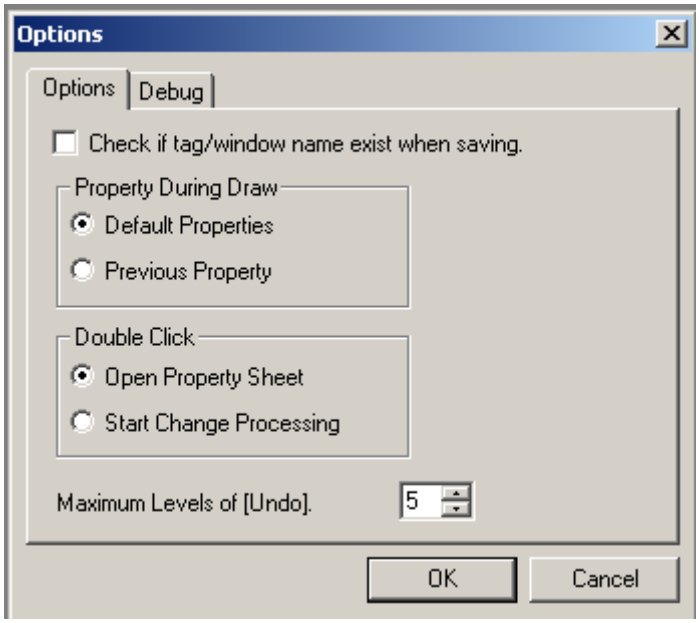


Figure: Options tab

- *Checking the Tag Name/Window Name when Saving*
  When saving a file, the system checks whether or not a tag name or window name linked with an object on the graphic window exists, and determines whether or not to display the result in the message area. If the tag name or the window name linked with the object does not exist, such objects will not properly function on the graphic windows.

- *Draw Property*
  This is the setting for property values used to create a new graphic object.
  Select one of the following.
  - ***Default property value***
  - ***Property value when the previous graphic object was created.***

- *Double-Click Operation*
  This is the setting for operation when an object is double-clicked.
  Select either one of the following.
  - ***Open the property setting menu dialog box for the double-clicked object.***
  - ***Start point correction of the double-clicked object.***

- *Maximum Number of Valid "Undo" Operations*
  Set the number of times to undo the most recent actions by selecting the [Undo] on the edit menu bar or standard tool bar. The maximum number of times that can be set for valid "undo" operations is five.

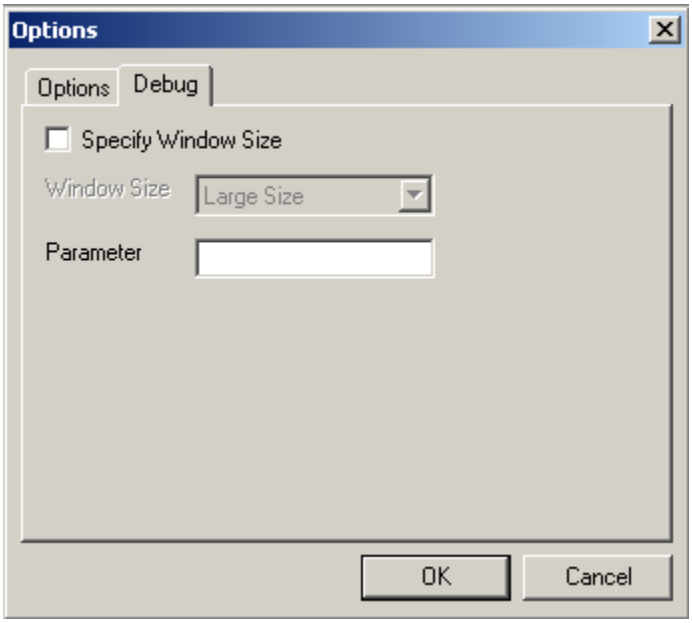


Figure: Debug tab

- *Specifying Window Size*
  Set whether the size of the debug window is specified or not.

- *Window Size*
  Specify the size of the graphic window to start up.
  Select one from [Large Size], [Medium Size], [Special Size].

- *Parameter*

Specify the parameter to be passed to the graphic window by start command. Limited to 2000 byte.

TOOLS USED TO CREATE AND EDIT GRAPHIC OBJECTS

The Graphic Builder provides specific tools to create and edit graphic objects that compose a Graphic window.

Button	Tool	Button	Tool	Button	Tool
	Select Mode		Marker		Two-dimensional graph
	Point Correction		Text		Touch target
	Pen		Process Data-character		Push Button
	Straight line		Process Data-Bar		Faceplate
	Polyline		Process Data-Arrow		Instrument Diagram
	Arc		Process Data-Circle		Window
	Rectangle		Line-Segment graph		Message
	Fill area		User-defined Line-segment Graph		Dialog Name
	Circle		Bar Graph		Trend
	Ellipse		Step Graph		Overview
	Sector		Radar Chart		Control

Figure: List of Tools

- *Selecting the Objects*
  The selection tool is used to select the graphic object.

- *Selection Mode*
  To switch to the selection mode, perform any one of the operations described below:
  - ***Select [Selection Mode] from the [Edit] menu.***
  - ***Select [Select All] from the [Edit] menu.***

- ***Select [Find...] from the [Edit] menu.***
- ***Select the [Select Mode] button from the draw toolbar.***
- ***Select [Selection Mode] from the pop-up menu by clicking the right mouse button in the document window.***
- ***Double-click in the area with no objects. (*1)***
- ***Press the [ESC] key. (*1)***

****1: Some types of object do not support this operation.***

When an object is selected in the selection mode, the selected object is surrounded by the handles.

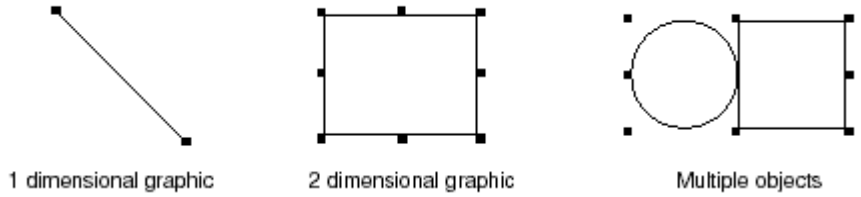


Figure: Selected Objects

When the cursor is positioned over a handle, the cursor shape changes as shown below, enabling the handle to be selected.

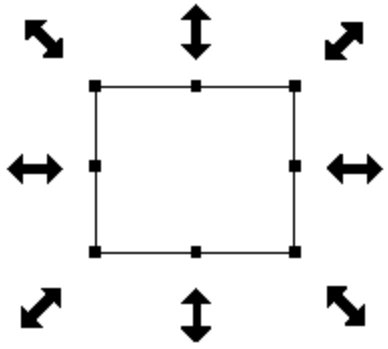


Figure: Change in the Shape of Cursor

Dragging the handle changes the size of an object. The selected object can be copied by just dragging it, or dragging it holding down the [Ctrl] key.

- *Modifying the objects*
  To add, move or delete the point of an object, use the point modification tool.

  - *Point Correction*
    To use the point modification tool, perform one of the following operations after selecting an object.
    - ***Select [Edit Point] from the [Edit] menu.***
    - ***Select [Point Correction] button from the draw tool bar.***
    - ***Select [Edit Point] from the pop-up menu displayed by clicking the right mouse button after selecting an object.***
    - ***Double-click the object. (Only when the double-click operation is specified to "Start Change Processing" via the [Options] Dialog box called up from the [Tools] menu.) Perform one of the above operations, to edit the object by selecting the points of an object. At this time, the handles change as follows.***

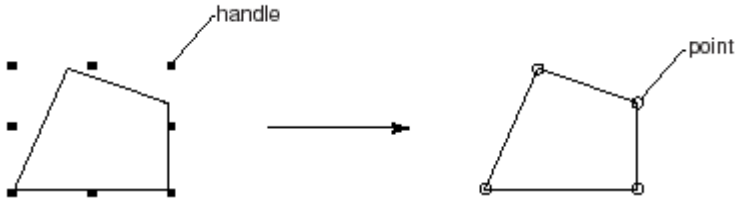


Figure: Change in the Handles

When the cursor is positioned over the handle, it changes the shape as shown in the figure below, enabling the handle to be selected.

Figure: Change in the Shape of Cursor

PROCESS DATA CHARACTER DISPLAY TOOL

Select [Data Display]-[Process Data-Character] from the [Insert] menu or [Process Data-Character] button on the HIS functions tool bar to change the cursor shape as shown below. Similarly all the other graphic builder tools are used.

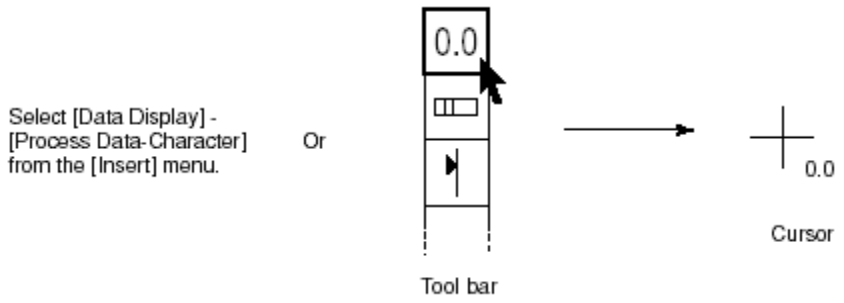


Figure: Change in the Shape of Cursor

Click the mouse to draw a data character display object. The position clicked will be the top left corner of the drawn object. At this time, the default will be displayed as shown below.

RRRRRRR

- *Property of the Data Character Display Object*
  Various attributes such as name, type and display method can be set for a data character display object. The data character display property setting menu box is used to set the attributes for the text object. To display the text property setting menu box, select [Properties] from the popup menu displayed by clicking the right mouse button, while the data character display is selected. The property setting menu box of data characters display consists of the following tabs. The attributes can be set or changed in each tab.

  - *General Tab*
    This tab is used to set the attributes that are common to all graphic objects created. The tab sets the object name, position and size, as well as whether the object can be used as a tag object and whether data setting is possible during debugging.
  - *Text Tab*
    This tab is used to set the text format. The color of text itself as well as its background can be set.
  - *Graphic Modify Tab*
    This tab is used to set change conditions for the attributes such as color, shape and lighting/flashing status of a graphic object.
  - *Modify Coordinates Tab*
    This tab is used to set change conditions for the position of a graphic object.
  - *Process Data-Character Tab*
    This tab is used to set the process data to be displayed as numeric values or character strings. The process data-character tab is specific to the data character display object.
  - *Data Bind Tab*

This tab is used to bind different variants to graphic generic names.

GRAPHIC MODIFY TAB

The graphic modify is a function that changes the object's color and blinking status based on the process data and the conditional formula. In the Graphic Modify tab, the timing for changing the object, the display status of the object such as color, shape and blinking, and conditions to modify the display attributes of a graphic object may be set.

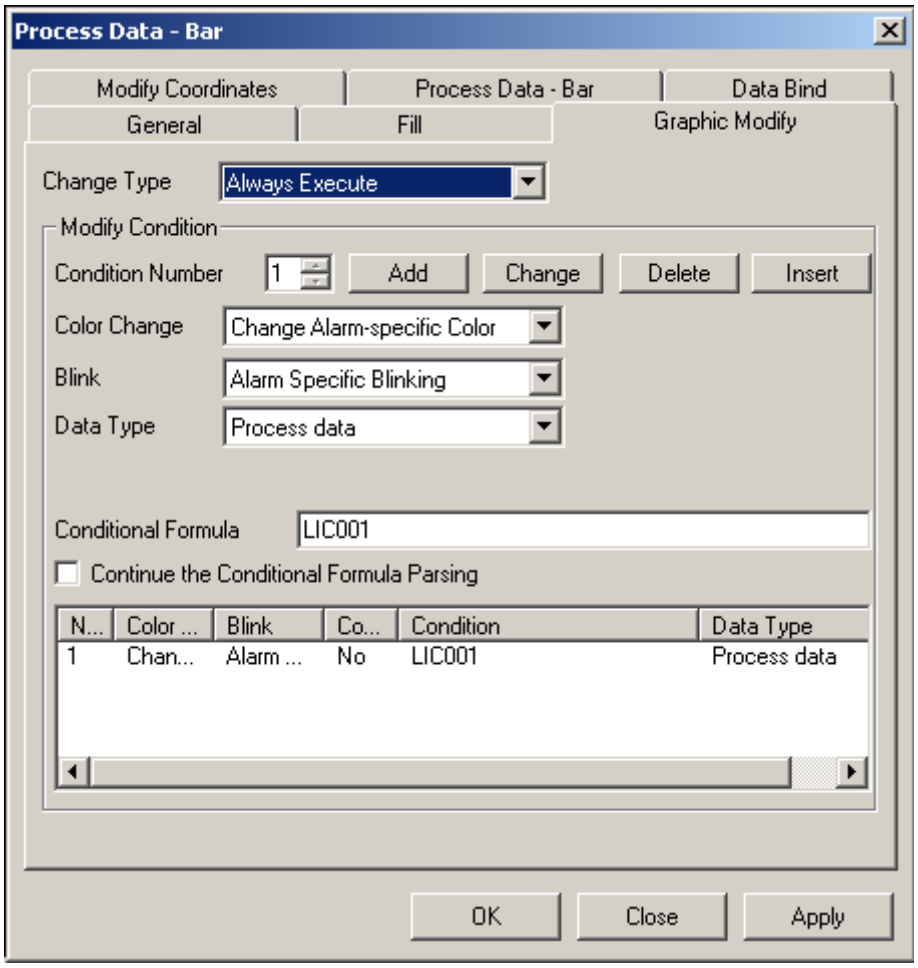


Figure: Graphic Modify Tab

When setting the following two objects, definition items specific to each object is added to the Graphic modify tab.

- ***For text object***
  The definition items, [Modify String] and [Invert String] are available.

- ***When importing a bitmap file as an object***
  The definition item [With Changes in Bitmap] and a [Preview] button are available.

5. GRAPHIC MODIFIER FUNCTION

The Graphic window tests the establishment of the condition in conditional formula at each window update scan cycle. If the conditional formula is satisfied, the object will have visible change such as changing color or blinking.
Up to 8 graphic modifier conditions can be set for each graphic object. The graphic modifier conditions are tested in order of the graphic modifier condition number. And if the conditional formula is satisfied, a change action corresponding to the conditional formula is executed, thereby completing the test. Even when one of the conditions is satisfied, however, this function can continue the conditional formula testing for the next condition number.

CHANGE TYPE

This sets when to perform the testing on graphic modifier conditions. The execution timing for the conditional testing can be selected from [Execute Always], or [Execute First Time Only].

- ***Always Execute***
  While the conditional formula is true, change actions such as change color and blinking or the default drawing are performed at any given time.
- ***Execute First Time Only***
  If the conditional formula is true when the Graphic window is called, change actions such as change color and blinking is performed only once.

GRAPHIC MODIFIER CONDITION

The [Condition Number] item displays the condition number assigned to a graphic modifier condition currently displayed. Specifying a condition number using the spin box or selecting a condition from the graphic modifier condition list view displays the graphic modifier condition corresponding to the condition number.

- ***Press the [Add] button to add a new graphic modifier condition. The [Add] button is disabled when 8 conditional formulas already exist.***
- ***Press the [Change] button to reflect the contents of the graphic modifier condition change to the data of current number.***
- ***Press the [Delete] button to delete the graphic modifier condition currently displayed. If any of the condition numbers is freed, the remaining numbers will be automatically reassigned.***

CHANGE ACTION

After a conditional formula is tested, visible change actions on the Graphic window screen, such as change color and blinking are executed in response to the conditional formulas. The available actions include [Color Change], [Blink], [Transparent], [Modify String], [Invert String] and [With Changes in Bitmap]. Multiple actions can be set for an object.

- *Change Color*

  This action changes the color of an object. A change color type can be selected from the following 4 types: [Normal Color Change], [Change Alarm-Specific Color], [Overview Color], and [No Color Change]. The changed color varies by the type of change color selected.

  - ***Normal Change Color***
    This displays an object in the color specified. Select a color from the color palette in the [Change Color].
  - ***Change Alarm-specific Color***
    This displays an object in the alarm color of a function block. Set a tag name of the function block in the conditional formula.
  - ***Overview Color***
    This displays an object in the alarm color that is subject to monitoring specified by the tag name or window name. The tag name or window name is set in the conditional formula.

- *Transparent*

  This action makes an object transparent upon satisfaction of modifier conditions. Upon satisfaction of modifier conditions, a push button object set to be transparent seems hidden in the Graphic window, as shown below:

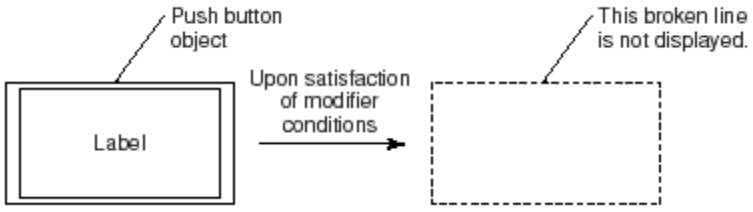


Figure: Push Button Object upon Satisfaction of Modifier Conditions

Clicking or touching the hidden push button object will not activate the function assigned to the push button. The arrow keys on the keyboard cannot be used either to position the cursor over the push button object. The cursor will skip over the object.

BLINKING

This action makes an object blink (blinking action). A blinking type can be selected from the following 5 types: [Yes], [Alarm Specific Blinking], [Screen Blinking], [Overview Blinking] and [No].

- *Yes*
  This enables an object to blink.
- *Alarm Specific Blinking*
  This makes an object blink according to the alarm status of the instrument diagram. Use the acknowledgment key may acknowledge the alarm message.
- *Screen Blinking*
  This makes an object blink. If this is selected, the object blinking will be stopped when the acknowledgment operation is performed. If the status of conditional formula changes after the acknowledgment operation, the blinking will resume.
- *Overview Blinking*
  A tag name or a window name may be defined in the formula for overview blinking test condition. The overview will have the same blinking behavior as those for the tag name and the window name defined in the formula. When a tag name is defined in the formula, the graphic object shows ON/OFF blinking in accordance to the ON/OFF alarm blinking of the instrument faceplate with the tag name. The alarm blinking may be acknowledged by acknowledgment operation. Furthermore, the tag name defined may also be treated as a representative tag name for the Graphic window.
- *No*
  This disables an object from blinking. All colors may be set to blink in Graphic windows.

MODIFY STRING
Only available for text object. This action changes a character string to another character string. Up to 16 alphanumeric characters for Modify String can be entered.

INVERT STRING
This sets the character string to be displayed in reverse video.

BITMAP CHANGE
This changes the bitmap that has been imported as a graphic object.
When setting the bitmap change, the [Preview] button is displayed on the Graphic modify tab as shown below.

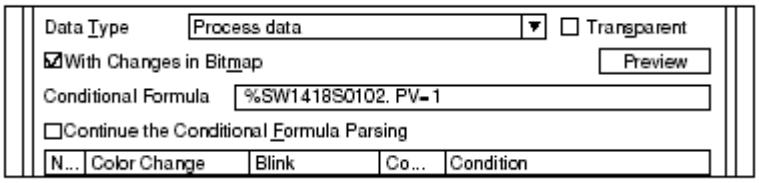


Figure: Items Added When Setting the Bitmap Change

When the change bitmap enabled is set, the [Preview] button is enabled. Use this button to display the bitmap preview dialog.

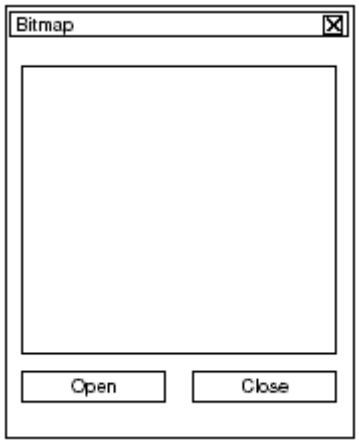


Figure: Bitmap Preview Dialog Box

Select the changed bitmap file, as a file selection common dialog is displayed when the [Open] button is pressed. The selected bitmap is displayed on the bitmap preview dialog. Use the [Close] button to close the bitmap preview dialog.

DATA TYPE
Specify the data type.
The data types include [Process Data], [Recipe Data (Unit Name Specification)], [Recipe Data (Batch ID Specification)].

CONTINUATION/NON-CONTINUATION OF GRAPHIC MODIFIER
This sets whether or not to continue testing of the graphic modifier conditional formula. In the default setting, the testing is performed in sequence, starting from the graphic modifier conditional formula of the condition number 1. If the condition is satisfied, the change action will be executed and the graphic modifier conditional formula testing is then completed. When the continuation of testing is selected, the graphic modifier conditional formula testing is continued even after the condition is satisfied. In this case, all change actions associated with satisfied conditions are executed. However, when multiple conditions with the same change action are satisfied, the execution of the condition of a larger number will precede.

GRAPHIC MODIFIER CONDITIONAL FORMULA

This sets the graphic modifier conditional formula to be used as the criteria of the testing that is performed when modifying a graphic. The following can be used for the graphic modifier conditional formula:

- ***Process data***
  (Example) PIC300.SV
- ***Integer constant***
  (Example) 100, 0
- ***Real number constant***
  (Example) 50.0, 0.50
- ***Hexadecimal constant***
  (Example) 0x0001
- ***Text constant***
  (Example) MAN, AUT

The condition formula for graphic modification varies with the different data type. The condition formulas for different data types are described as follows.

- *Process Data*
  Process data can be used in conditional test formula for graphic modification.
  The formula using process data is in "TagName.DataItem" syntax format. When using the data status of a function block, the formula can be set in "TagName.#DataItem" format. Up to 45 alphanumeric can be used to script a conditional formula. Unary operators, comparison operators and brackets can be used for conditional formulas.

  - ***The applicable unary operators are shown below.***
    +, -, *, /, & (bitwise AND), | (bitwise OR), % (remainder)
  - ***The comparison operators may be applied to conditional formulas are shown below.***
    =, <> (not equal), >, <, >=, <=, and (AND conditional formulas), or (OR conditionalformulas)
  - ***Actual notation examples are shown below.***
    FIC100.PV > 50.0
    FIC100.PV + FIC300.PV <= FIC400.PV
    FIC100.PV > 50.0 AND FIC200.PV < 20.0
    FIC100.ALRM = "HI" or "HH"
    %CI0001.PV & 0x00FF <> 0

- ***Block mode, alarm status and block status can be applied as following.***

  MODE
  The mode with highest priority and the mode with lowest priority (String)
  ALARM
  Alarm with highest priority (String)
  BSTS
  Block status (String)
  @MODE
  Memory image of mode (unsigned integer)
  @ALARM
  Memory image of alarm (unsigned integer)
  @BSTS
  Memory image of block status (unsigned integer)
  @AS
  Memory image of alarm status (unsigned integer)
  They can be actually scripted as follows.

  FIC100.ALARM="HI"

  Since the alarm HH has the highest priority, when HH occurs, this condition will be ignored.

  FIC100.@ALARM="HI"

  This condition exists even when HH occurs.

Total conditional formulas can contain up to 8 data items and a total of 400 alphanumeric characters. Examples of setting data and counting data items are shown below. To display the average of process variables of the TIC100, TIC200, and TIC300, specify as follows:

(TIC100.PV+TIC200.PV+TIC300.PV)/3

In this case, the three data items are used, namely TIC100.PV, TIC200.PV and TIC300.PV.

♦ *Recipe Data Unit Name Specification*
When recipe data (Unit name specification) is the selected data type for graphic object modification, the graphic calculation may be used. The syntax is as follows.

UnitName.CommonBlockName.DataItem[X,Y]
(X, Y are array data.)

- *Recipe Data Batch ID Specification*
  When recipe data (Batch ID specification) is the selected data type for graphic object modification, the graphic calculation may be used. The syntax is as follows.

  BatchID.CommonBlockName.DataItem[X,Y]
  (X, Y are array data.)

Instrumentation & Control Services

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CHAPTER 11
PROJECT COMMON DEFINITION

PROJECT COMMON DEFINITION

1. ALARM PRIORITY

The alarm processing level is defined for each function block. The output operation for each alarm priority can be selected. The HIS performs alarm output action according to the alarm processing level.

ALARM PRIORITY AND ALARM PROCESSING

The Operation and Monitoring executes the following alarm processing according to the alarm priority:

Alarm priority	Status	Display in a window	Printout to a printer	Buzzer sound	Log to a file	Alarm flashing action	Repeated warning alarm	Operation upon returning to normal
High-priority alarm	Alarm initiated	Y	Y	Y	Y	Lock type	Y	Dependent on the alarm in action
	System recovered	Y	Y	Y	Y	Lock type	Y	Dependent on the alarm in action
Medium-priority alarm	Alarm initiated	Y	Y	Y	Y	Lock type	N	N
	System recovered	Y	Y	Y	Y	Lock type	N	N
Low-priority alarm	Alarm initiated	Y	Y	Y	Y	Non-lock type	N	N
	System recovered		Y	Y	Y	Non-lock type	N	N
Logging alarm	Alarm initiated	N	Y		Y	Self-acknowledge type (system-fixed)	N	N
	System recovered	N	Y		Y	Self-acknowledge type (system-fixed)	N	N
Reference alarm	Alarm initiated	N	N			Self-acknowledge type (system-fixed)	N	N
	System recovered	N	N			Self-acknowledge type (system-fixed)	N	N

Y: Yes
N: No
Blank: The function is unavailable.

Table: Designating the Alarm Priority (Default)

- *CRT*
  Designate in the Alarm Priority Builder whether or not the status change is to be displayed in a window upon occurrence of the alarm or upon recovery of the system.

- *PRT*
  Designate in the Alarm Priority Builder whether or not the status change is to be printed out to a printer upon occurrence of the alarm or upon recovery of the system.

- *Historical File*
  Designate in the Alarm Priority Builder whether or not the status change is to be logged in a historical message save file upon occurrence of the alarm or upon recovery of the system. A message logged in a historical message save file can be displayed in a Historical Message Report window.

- *Alarm Action*
  Basically, the alarm flashing action starts upon receiving a message that indicates occurrence of an alarm. The action stops upon receiving a message that indicates returning to a normal status, or when acknowledgment operation is performed by the operator. The alarm actions are classified into the following types based on the flashing actions that correspond to alarm occurrence, returning to a normal status and acknowledgment operation:

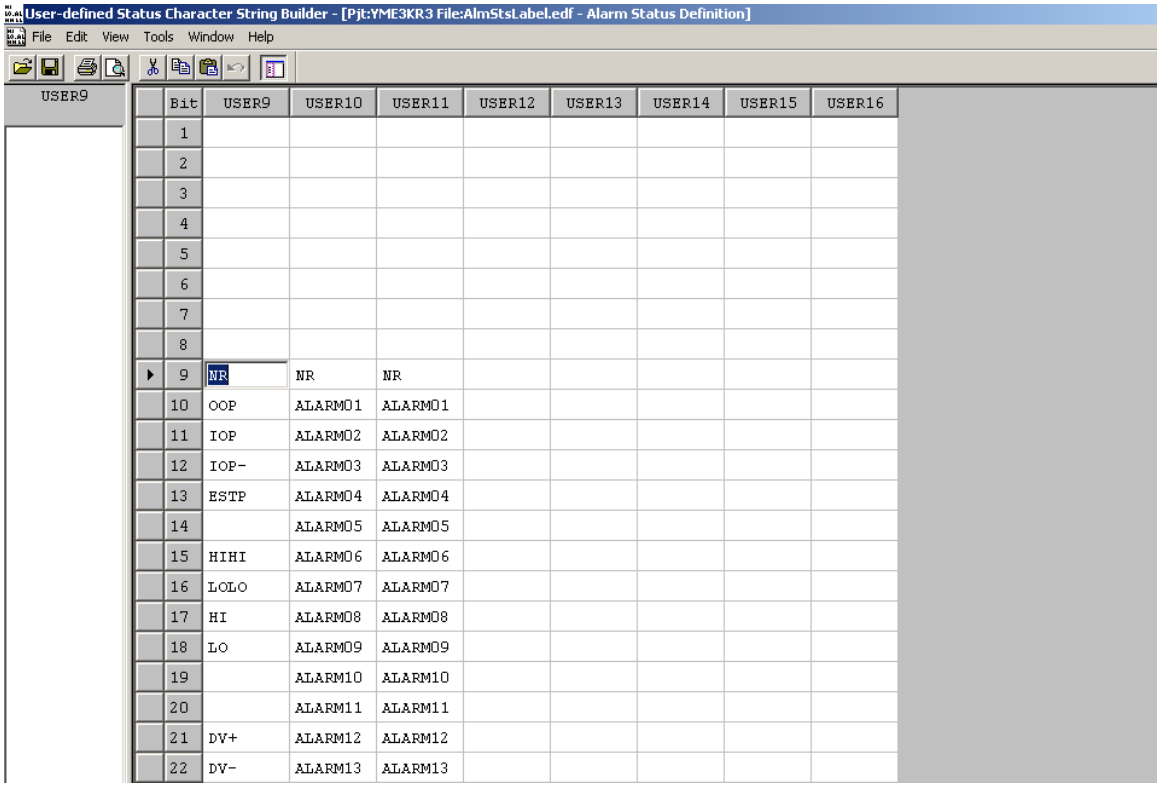
  - ***Lock type (for high-priority and medium-priority alarms)***
  - ***Non-lock type (for low-priority alarms)***
  - ***Self-acknowledge type (for logging alarms)***

  Different types of alarm flashing actions can be set for different alarm priorities.

- *Rewarning*
  There are two types of repeated warning alarm actions, the timer type and the event type. The timer type repeated warning alarm is processed at specified time intervals. The event type repeated warning alarm processing is processed by a command issued from a sequence table block, etc.

2. USER-DEFINED ALARM STATUS CHARACTER STRING

Besides the system-fixed alarm status character strings, there are eight tables (USER9 to USER16) for alarm status character strings that the user can designate in the User-Defined Status Character String Builder for user-defined blocks.



Bit	USER9	USER10	USER11	USER12	USER13	USER14	USER15	USER16
1								
2								
3								
4								
5								
6								
7								
8								
9	NR	NR	NR					
10	OOP	ALARM01	ALARM01					
11	IOP	ALARM02	ALARM02					
12	IOP-	ALARM03	ALARM03					
13	ESTP	ALARM04	ALARM04					
14		ALARM05	ALARM05					
15	HIHI	ALARM06	ALARM06					
16	LOLO	ALARM07	ALARM07					
17	HI	ALARM08	ALARM08					
18	LO	ALARM09	ALARM09					
19		ALARM10	ALARM10					
20		ALARM11	ALARM11					
21	DV+	ALARM12	ALARM12					
22	DV-	ALARM13	ALARM13					

Figure: User-Defined Status Character String Builder

The function blocks that can use the alarm status character strings designated here are faceplate blocks, SFC blocks, and unit instruments. There is a table reserved for each of these function blocks, used for designating the alarm status character strings. The figure below shows the relationship between the alarm status character string and the bit position (default) for each function block:

For bit position	For faceplate block	For SFC block	For unit instrument
	USER9	USER10	USER11 to USER16
1			
2			
3			
4			
5			
6			
7			
8			
9	NR	NR	NR
10	OOP	ALARM01	ALARM01
11	IOP	ALARM02	ALARM02
12	IOP-	ALARM03	ALARM03
13	ESTP	ALARM04	ALARM04
14		ALARM05	ALARM05
15	HIHI	ALARM06	ALARM06
16	LOLO	ALARM07	ALARM07

For bit position	For faceplate block	For SFC block	For unit instrument
	USER9	USER10	USER11 to USER16
17	HI	ALARM08	ALARM08
18	LO	ALARM09	ALARM09
19		ALARM10	ALARM10
20		ALARM11	ALARM11
21	DV+	ALARM12	ALARM12
22	DV-	ALARM13	ALARM13
23		ALARM14	ALARM14
24		ALARM15	ALARM15
25	TRP	ALARM16	ALARM16
26	SCBL	ALARM17	ALARM17
27	INT	ALARM18	ALARM18
28	ERR	ALARM19	ALARM19
29	DISC	ALARM20	ALARM20
30	BLCK	ALARM21	ALARM21
31		ALARM22	ALARM22
32	CNF	ALARM23	ALARM23
33			

Table: Alarm Status Character String Definition (Default)

PRECAUTION ON DESIGNATING THE CHARACTER STRING

Designate the character string for Nos.9 to 32 (with up to eight alphanumeric characters starting with an alphabetical character).

- ***Designate for No.9 the alarm status character string indicating the normal status.***
- ***The same character string cannot be designated more than once in one table. For example, with "NR" designated for No.9, "NR" cannot be designated for Nos.10 to 32 in the same table.***
- ***If using the same character string in multiple tables, add the same number to the string in all of the tables. For example, with "NR" designated for No.9 in table USER9, if designating "NR" in other tables (USER10 to 16), use No.9 in all of these tables.***
- ***Designate for No.33 the character string for default processing. The character string for default processing refers to a character string output in the user-defined block status other than that for Nos.1 to 32.***

3. ALARM PROCESSING TABLE BUILDER

The alarm status conforms to the designation performed in the Alarm Processing Table Builder and the User-Defined Status Character String Builder. The alarm status bit positions in the Alarm Processing Table Builder correspond to the character string Nos. in the User-Defined Status Character String Builder. Alarm status bit positions 1 to 6 are not displayed in a window because they are system fixed. Alarms processing level Nos. 1 to 4 are also system-fixed. The user can designate the color and the priority for alarm processing level Nos. 5 to 16 for alarm status bit positions 7 to 32. The user can change alarm status bit positions 7 and 8 that are for existing control stations.

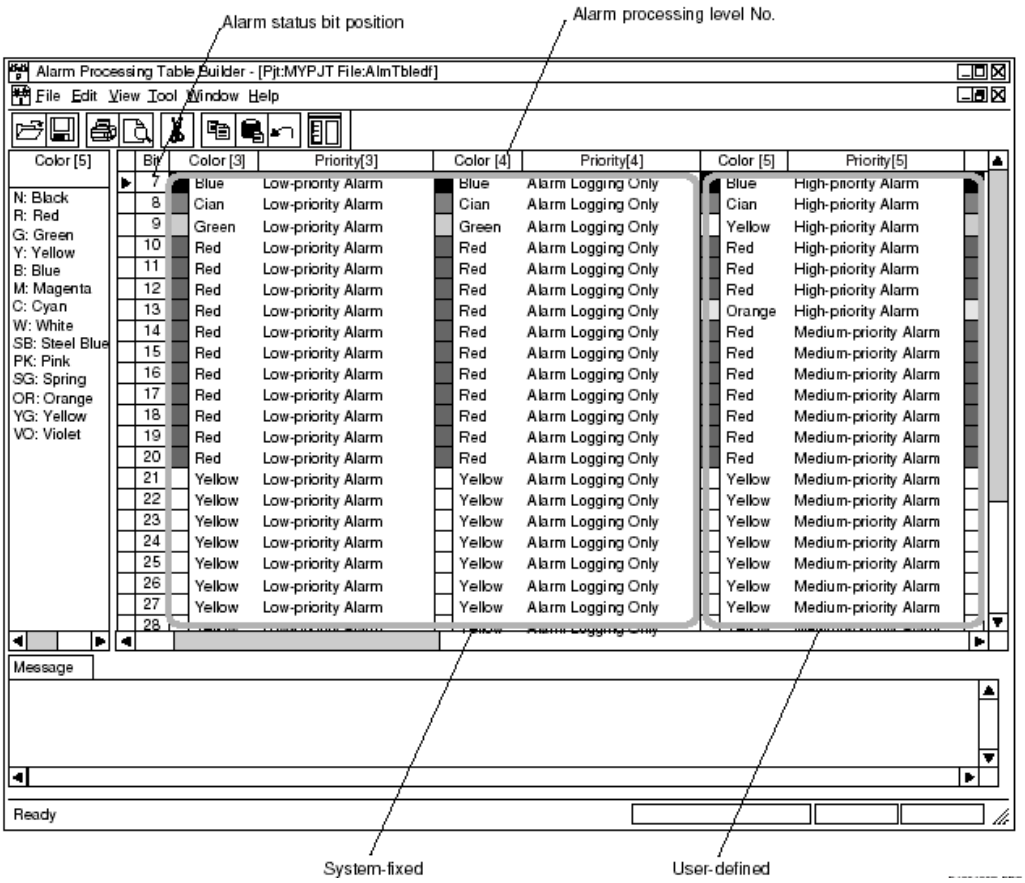


Figure: Alarm Processing Table Builder

DESIGNATING THE ALARM STATUS COLOR AND PRIORITY

Designate the color and the priority for alarm processing level Nos. 5 to 16 for alarm status bit positions 7 to 32. At the same alarm processing level, designate a higher priority in

ascending order of the bit positions. For example, with a medium-priority alarm designated for bit position 8, a high-priority alarm cannot be designated for bit positions 9 to 32.

- ***Color***
  Choose from 16 colors corresponding to the alarm.
- ***Priority***
  Designate the alarm priority.

The system-fixed alarm status character string itself cannot be changed, but its color and priority can be changed. For example, the PID controller block assigns "HI" to bit position 17. By default this will be processed as a medium-priority alarm upon its occurrence, and displayed in red. To change the above medium-priority alarm to the high-priority alarm and display "HI" in magenta, do the following:

- ***To change it to the high-priority alarm, use the Alarm Priority Builder. Note that changes made here will be effective for high-priority alarms of other function blocks.***
- ***In the Alarm Processing Table Builder, select the field for alarm processing level No.5 for bit position 17, and then select [M: Magenta] for [Color (5)], and [1: High-priority Alarm] for [Priority (5)]. (The color and the priority can be changed for any of alarm processing level Nos. 5 to 16.)***

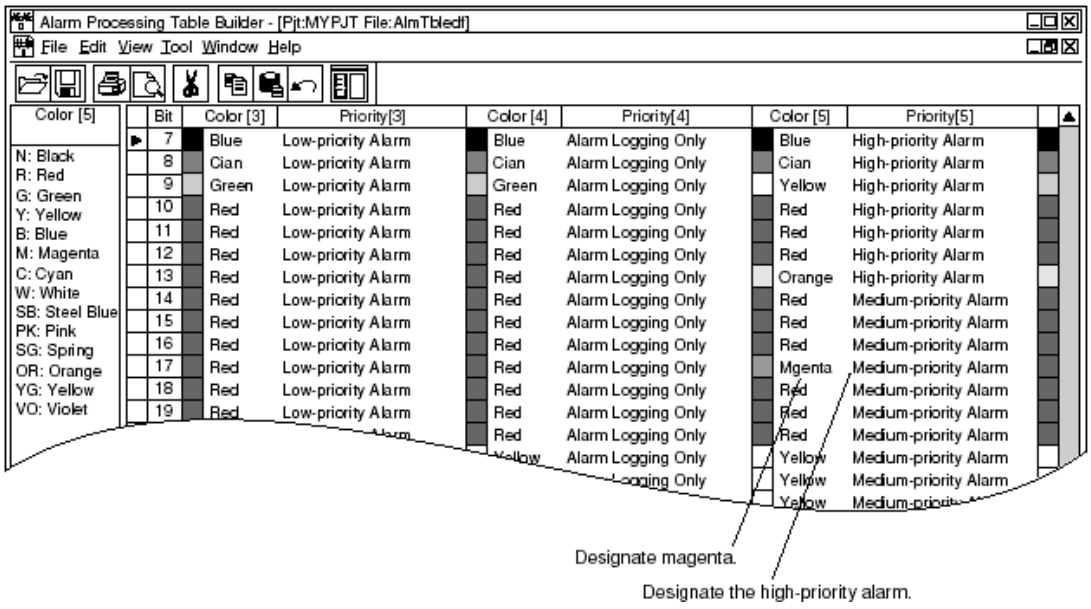
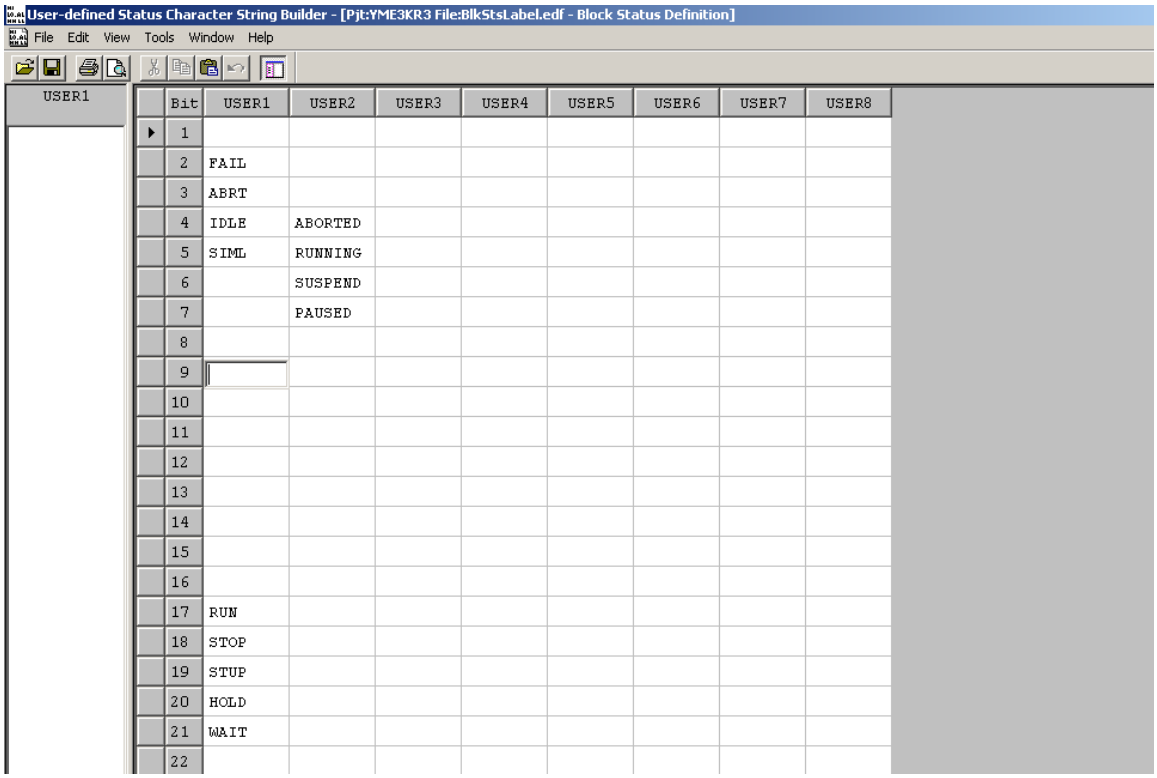


Figure: Designation in the Alarm Processing Table Builder

- ***Select the [Alarm] tab in the Function Block Detail Builder, and then select [5: User defined Alarm Process (5)] at [Alarm Processing Level].***

4. USER DEFINED STATUS CHARACTER STRING BUILDER

When there is no block status connection, the block status strings defined on the user-defined Status Character String Builder unique to the faceplate block can be used. The default status strings for faceplate blocks are shown in the table below.



Bit	USER1	USER2	USER3	USER4	USER5	USER6	USER7	USER8
1								
2	FAIL							
3	ABRT							
4	IDLE	ABORTED						
5	SIML	RUNNING						
6		SUSPEND						
7		PAUSED						
8								
9								
10								
11								
12								
13								
14								
15								
16								
17	RUN							
18	STOP							
19	STUP							
20	HOLD							
21	WAIT							
22								

Figure: User defined status character string builder.

Priority	Block status		States
	Symbol	Name	
3	FAIL	Fail	Specific meanings of each status can be defined freely using the application.
	ABRT	Abort	
	IDLE	Idle	
	SIML	Simulation	
1	RUN	Run	
	STOP	Stop	
	STUP	Startup	
	HOLD	Hold	
	WAIT	Wait	
	END	End	
0	SDWN	Shutdown	
	ESD	Emergency shutdown	
	RSTR	Restart	

Table: Behavior of Faceplate Status without Block Status Connection

The character strings for faceplate block status are the user-defined status character string defined in column USER1 on the Status Character String Builder. In the table, the position 33 is system reserved, cannot be used. A block status string can be defined with up to 8 alphanumeric characters including underscore (_).

5. PLANT HIERARCHY BUILDER

If you need equipment that is specifically designed to meet the unique operating needs of your plant, you can register the custom equipment using the Plant Hierarchy Builder. The custom equipment allows for a hierarchical structure that caters to the user's application needs. Up to 1,000 equipment IDs can be assigned for custom equipment. There are no limits on the number of function blocks and elements to be contained in a single equipment object. Custom equipment is registered using the Plant Hierarchy Builder.

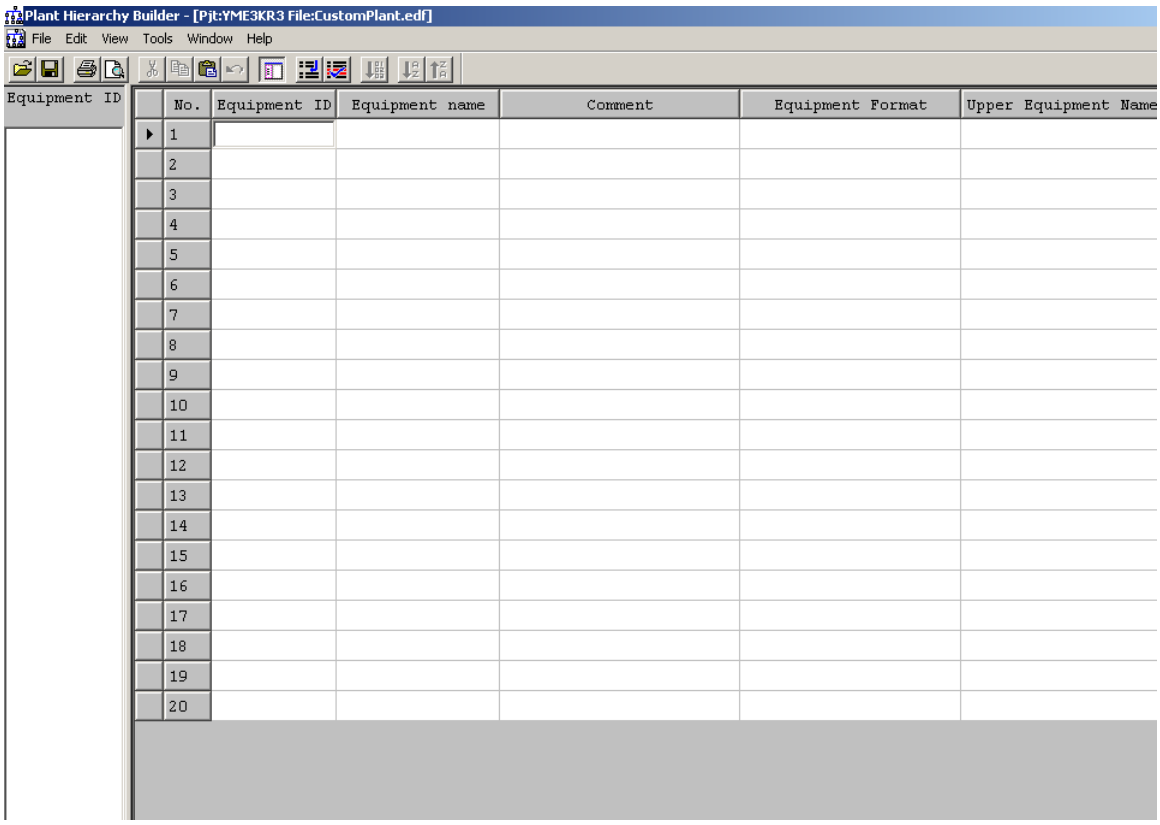


Figure: Plant hierarchy builder.

EQUIPMENT ID

A unique ID number is assigned for each equipment. The equipment ID range is 1 to 32767 with default and custom equipment combined. The equipment ID is assigned when the equipment name is specified in the Plant Hierarchy Builder. The equipment ID is added to the message generated by the FCS as a UAID (User Application ID).

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.

The following cannot be used as the equipment name.

- ***ALL***
- ***NONE***
- ***Names that begin with "%DR."***

The following characters cannot be used for the equipment name.

- ***, (comma)***
- ***@ (at mark)***
- **** (asterisk)***
- ***: (colon)***
- ***Δ Single-byte space***

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 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.

EQUIPMENT FORMAT

The equipment format indicates the hierarchical layer in which an equipment object is located. The following lists the equipment format in descending order of hierarchy.

- ***Site***
- ***Area***
- ***Cell***
- ***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.

- *Specifying an Upper Equipment Name for an Equipment Object*
  The upper equipment name can be chosen from a selection of registered names using the menu area or combo box. The upper equipment name can also be entered using up to 16 single-byte alphanumeric characters.

  The following cannot be used as the equipment name.
  - ***ALL***
  - ***NONE***
  - ***Names that begin with "%DR."***

  The following characters cannot be used for the equipment name.

- *, (comma)*
- *@ (at mark)*
- ** (asterisk)*
- *: (colon)*
- *Δ Single-byte space*

6. ENGINEERING UNIT SYMBOL BUILDER

The engineering unit symbol is a unit symbol attached to a data value including flow rate and pressure, and is used on all the projects. Up to 256 engineering unit symbols can be used for one project. One engineering unit symbol can be defined with up to six alphanumeric characters or three double-byte characters.

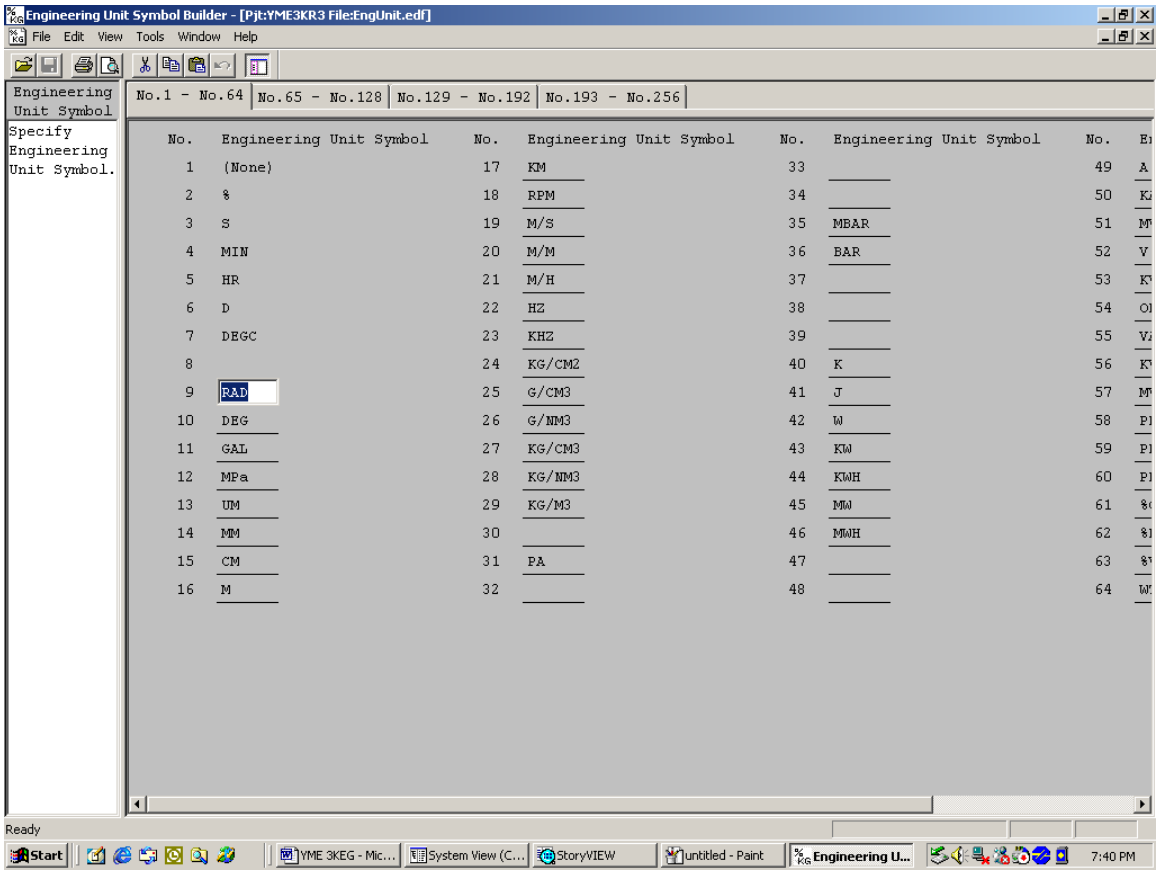


Figure: Engineering unit symbol builder

SETTING THE AUTO OR MANUAL MODE

The engineering unit symbol can be set either automatically or manually.

- *Auto mode*
  Direct entry into the engineering unit symbol field in the Function Block Detail Builder will automatically define the engineering unit symbol. The Engineering Unit Symbol Builder can also be used to define the symbol.

- *Manual mode*
  The engineering unit symbol can only be defined in the Engineering Unit Symbol Builder.

Use the System View to switch between the auto and manual modes. Use the Detailed Setting tab of the project properties to switch between the modes. Check the corresponding check box to select the manual mode.

7. SWITCH POSITION LABEL BUILDER

Up to 64 sets numbered Nos.1 to 64 of switch position labels can be defined for one project. One set consists of four labels (label 1, label 2, label 3, and label 4).

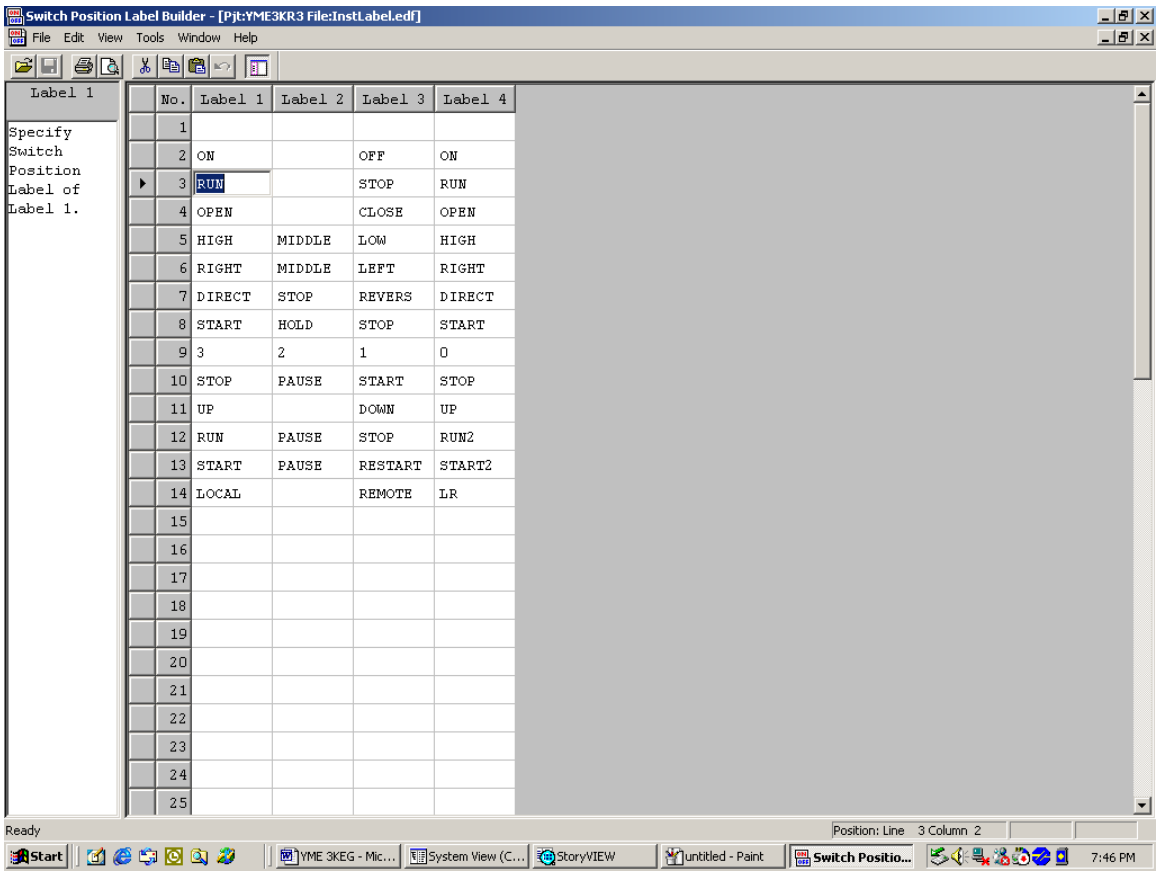


Figure: Switch position label builder

SETTING THE AUTO OR MANUAL MODE

The switch position label can be set either automatically or manually.

- *Auto mode*
  Direct entry into the switch position label field in the Function Block Detail Builder will automatically define the switch position label. The Switch Position Label Builder can also be used to define the symbol.
- *Manual mode*
  The switch position label can only be defined in the Switch Position Label Builder.

Use the System View to switch between the auto and manual modes. Use the Detailed Setting tab of the project properties to switch between the modes. Check the corresponding check box to select the manual mode.

How to Define the Switch Position Label

The switch position label can be defined with up to eight alphanumeric characters or four double-byte characters. The label 4 character string is not displayed on the instruments with up to three switches. Define a unique character string for each set. Note that the following characters cannot be used to define the switch position label:

, (comma), | (pipe), ‘ (single quotation mark), “ (double quotation mark), @, \ (backslash), and #

Switch position labels Nos.1 and 2 cannot be changed or deleted:
Define the switch position label starting from No.3.
Default values are predefined for Nos.3 to 13. No default values are predefined for the subsequent Nos. The figure below shows an example of the label for switch position list file.

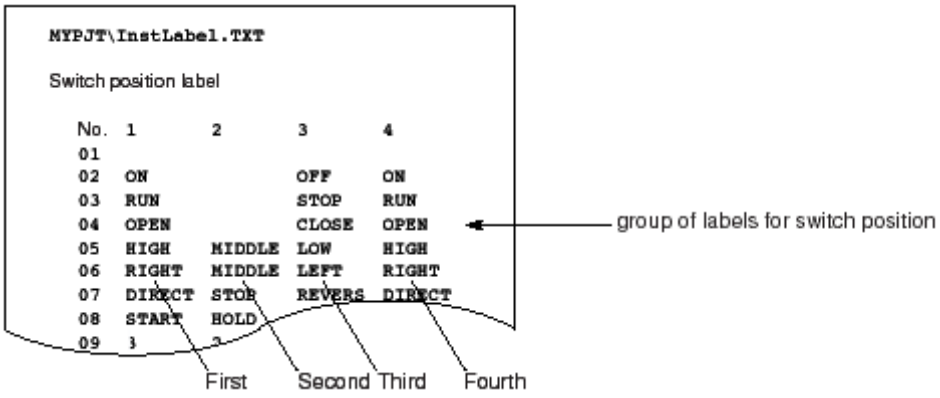


Figure: Label for Switch Position List

8. MULTIPLE PROJECTS CONNECTION BUILDER

The following describes how to operate and Monitor multiple projects that have been connected.

ALLOW IDENTICAL TAG NAMES

If tag names between integrated projects are identical, a project ID will be added to the tag name as a suffix in order to avoid identical tag names between projects. Project ID can be defined in multiple projects connection builder of the upper project, with two alphanumeric characters.

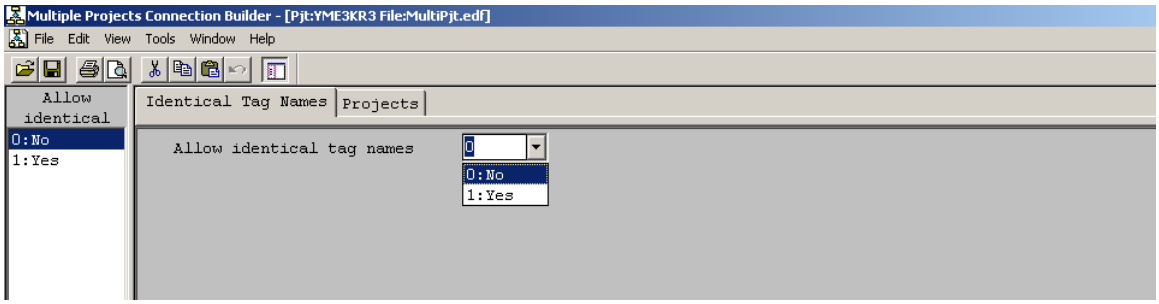


Figure: Multiple project connection builder

- *Project ID Attachment Format*
  "Tag Name" + "@" + "Project ID" (a maximum of 16 characters)
  (Example) FIC100@P1
  Without adding a project ID suffix to the tag name, specify the operation to be performed when the function block/element is called. In the Multiple Project Connection Builder of the upper project, specify the operation by choosing "Unique Tag Name Range" from the following two options:

  - ***No identical tag names (unique for all projects)***
    If there are no duplicate tag names in any of the projects, select "No" for "Allow identical tag names" in the Multiple Project Connection Builder. This will search all projects. If the specified tag name is unique for all the projects, the function block/element to which the tag name is attached will be called. If there are duplicate tag names, it is not predictable as to which of the function blocks/elements having the same tag name will be called.

  - ***Identical tag names (unique within the current project)***
    If tag names conflict between the integrated projects, specify "Yes" for "Allow identical tag names" in the Multiple Project Connection Builder. This will search

all projects. If the specified tag name exists in the current project, the function block/element to which that tag name is attached will be called. If the called tag name doesn't exist in the current project, an error will be generated.

A tag can be called without the use of suffixes within the range in which tag names are all unique. However, suffixes are required if all tag names are not unique. This rule regarding the tag name call applies to the CS3000 system. Examples of tag name calls include calling instruments and tuning windows in the Operation and Monitoring, and handling tag names via the Graphic Builder and Trend Collection Pen Assignment Builder in the Engineering.

Unique tag name range	Location of function block/element to be called	Calling procedure	
		No Suffix Example: FIC100	With suffix Example: FIC100@P1
All projects	Current project	× (*1)	×
	Other project	× (*1)	×
Current project	Current project	× (*1)	×
	Other project	-	× (*1)

x : Calling enabled
- : Calling disabled (Suffixes are required even if tag name is unique for all projects.)
****1 : Tag names used for the Process Report window, Message window, and message printing.***

When there are identical tag names within the range that should be unique, the function blocks/elements having the same tag name to be called will be unreliable. The Tag Name Duplication Check Function can be used to check for duplicate tag names.

DEFINING PROJECTS TO BE CONNECTED

Define a list of all projects to be connected in the "Projects" tab. Up to 16 projects can be defined including the current project.

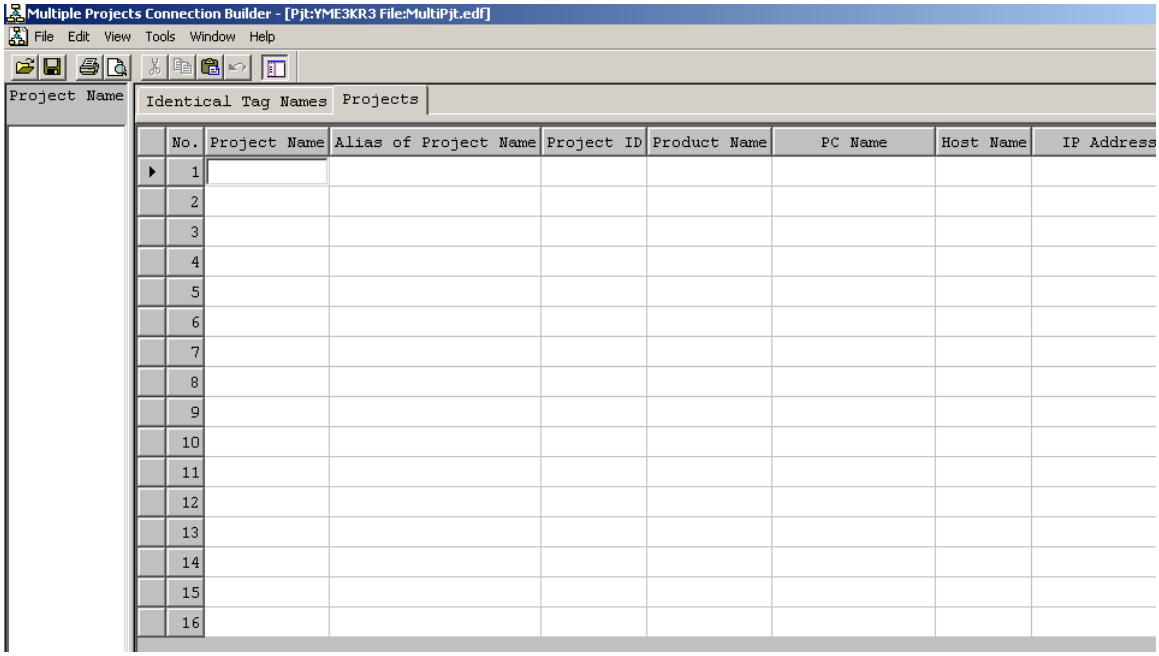


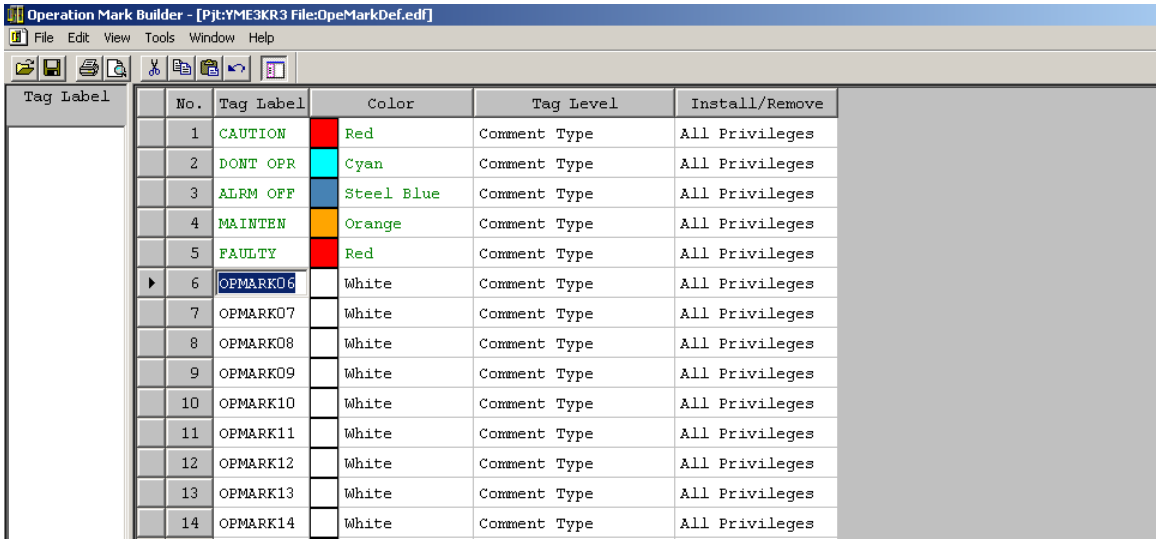
Figure: Multiple project connection builder

The following describes definition items for the Project tab. By default, all of its fields are blank.

- *Project Name*
  Enter the project name using up to 8 characters.
- *Alias of Project Name*
  If there are duplicate project names, enter an alias. Enter the project name set in the properties of that project as the alias.
- *Project ID*
  Enter the project ID using up to 2 characters. The project ID must be unique across all projects.
- *Product Name*
  Select an applicable product name from "CS," "CS1000," or "CS3000."
- *PC Name*
  This field is enabled only when "CS 1000" or "CS 3000" is selected in the Product Name. Enter the computer name of the HIS in which the project is located.
- *Host Name*
  This field is enabled only when "CS" is selected in the Product Name. Enter the EWS host name.
- *IP Address*
  This field is enabled only when "CS" is selected in the Product Name. Enter the EWS IP address.
- *User Name*
  This field is enabled only when "CS" is selected in the Product Name. Enter the username of the CS Project.

- *Alias of Host Name*
  This field is enabled only when "CS" is selected in the Product Name. Enter an alias of the host name using up to 8 characters when EWS host name conflict with a station name in CS 1000/CS 3000 project.
- *Saving the Definition Contents*
  To save the changes made to definition contents, select [Save] from the [File] menu of the Multiple Project Connection Builder.
- *Importing/Exporting the Definition Contents*
  The contents defined in the Multiple Project Connection Builder can be imported and exported. In a hierarchical connection, the connected projects are defined only from the upper level, so this function is not used. This function is useful for bi-directional connections when two projects must be defined in the same manner. To export or import definition contents, select [External File] from the [File] menu in the Multiple Project Connection Builder.

9. OPERATION MARK BUILDER



No.	Tag Label	Color	Tag Level	Install/Remove
1	CAUTION	Red	Comment Type	All Privileges
2	DONT OPR	Cyan	Comment Type	All Privileges
3	ALRM OFF	Steel Blue	Comment Type	All Privileges
4	MAINTEN	Orange	Comment Type	All Privileges
5	FAULTY	Red	Comment Type	All Privileges
6	OPMARK06	White	Comment Type	All Privileges
7	OPMARK07	White	Comment Type	All Privileges
8	OPMARK08	White	Comment Type	All Privileges
9	OPMARK09	White	Comment Type	All Privileges
10	OPMARK10	White	Comment Type	All Privileges
11	OPMARK11	White	Comment Type	All Privileges
12	OPMARK12	White	Comment Type	All Privileges
13	OPMARK13	White	Comment Type	All Privileges
14	OPMARK14	White	Comment Type	All Privileges

Figure: Operation mark builder

TAG LABEL

Operation mark's label can be set using the Operation Mark Builder. Up to 4 double-byte characters or 8 single-byte characters can be entered as the text on the label (string). The operation mark label may be temporarily changed during the operation on Operation Mark tab on the HIS Setup window.

COLOR

The color of the operation mark may be defined on the Operation Mark Builder. The following colors may be used on operation marks.

Color	Color Code	Color	Color Code
Black	N	Steel Blue	SB
Red	R	Pink	PK
Green	G	Spring Green	SG
Yellow	Y	Orange	OR
Blue	B	Yellow Green	YG
Magenta	M	Violet	VO
Cyan	C	Deep Sky Blue	DB
White	W	Gray	GR

Table: Colors of Operation Mark

The color of the operation mark may be temporarily changed on Operation Mark tab on the HIS Setup window.

INSTALL OR REMOVE OPERATION MARK

The unauthorized user is prohibited to install or remove the operation mark.
The setting of installing/removing is performed in Operation Mark Builder.

- *Install/Remove*
  Select from "All privileges," "S2, S3 Privileges" and "S3 Privilege."
  The default is "All privileges." The relationship between user's privilege level and the operation rights on installing/removing mark authority is shown below:

Install/Remove Operation Mark	Privilege level		
	S1	S2	S3
All Privileges	Y	Y	Y
S2, S3 Privileges	N	Y	Y
S3 Privilege	N	N	Y

Y: Installing/removal operation permitted
N: Installing/removal operation not permitted

Table: User's rights on Installing/Removing Operation Mark

No	Tag Lable	Color	Tab Level	Install/Remove
1	RUNING	Blue	Comment Type	All Privileges
2	ABNORMAL	Red	S3 Privileges	S3 Privilege
3	MAINTENANCE	Cyan	S2, S3 Privileges	S3 Privilege
4	PROHIBIT	Magenta	Operation Guard Type	S2, S3 Privileges

Table: Examples of the Operation Mark Setting

10. STATION CONFIGURATIOIN VIEWER

This is a station configuration viewer and a read-only file. This file is updated for every new station added to the configuration.

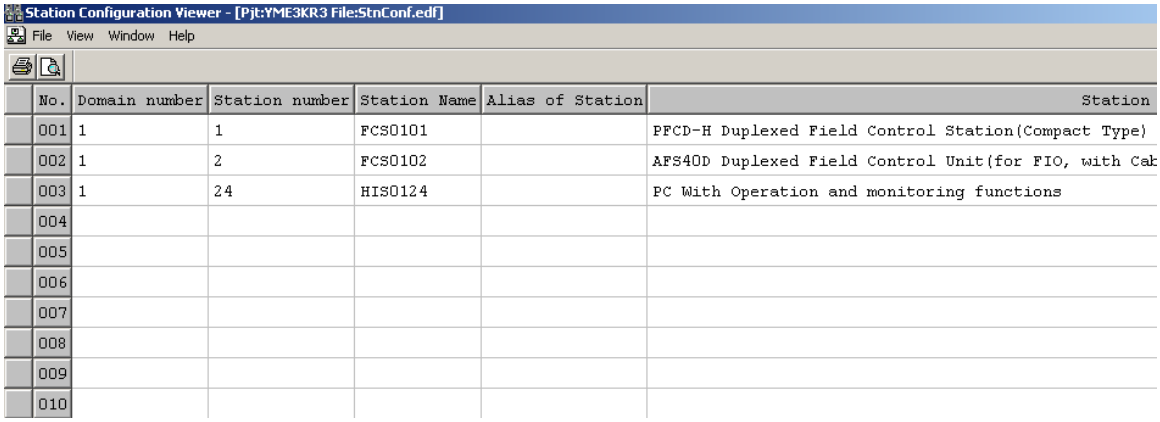


Figure: Station configuration viewer

11. STATUS CHANGE COMMAND BUILDER

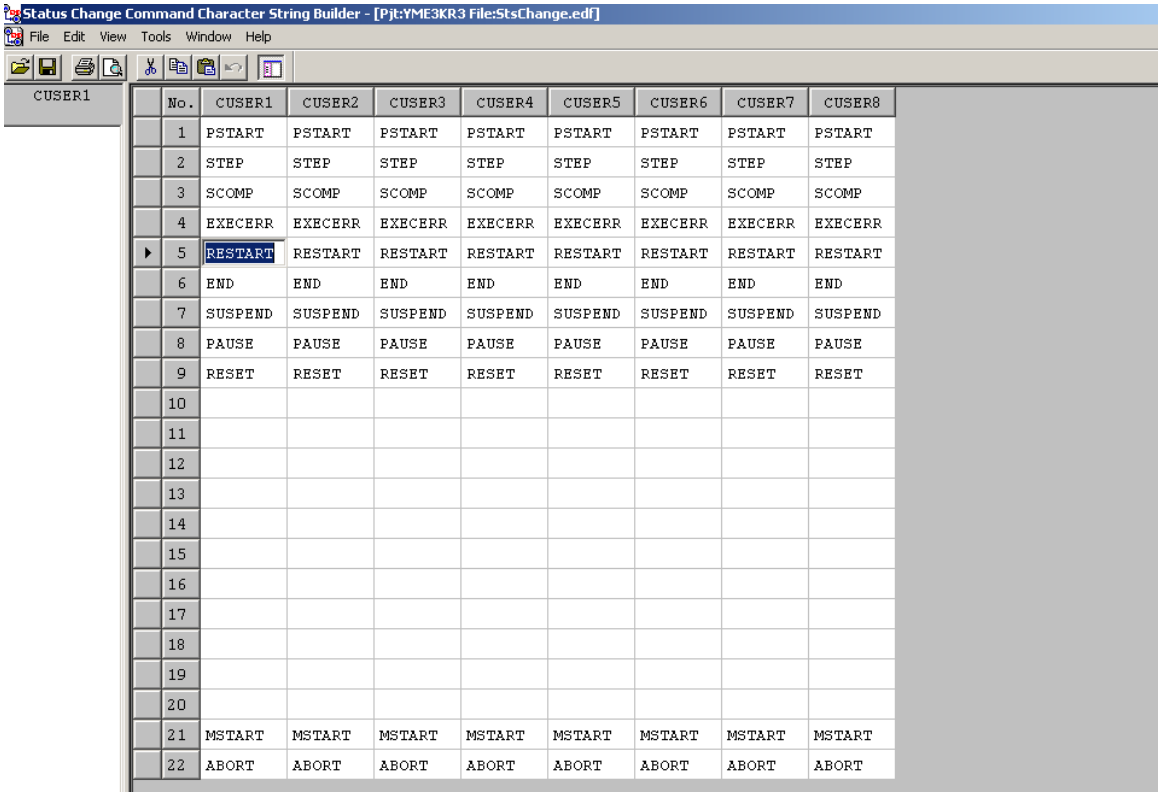
The character strings for user-defined status change commands can be specified in tables of CUSER1 to CUSER8 in Status Change Command Character String builder. The user-defined status change command character strings (CUSER1 to CUSER8) can be used only when they are designated in State Transition Matrix builder. A character string for a status change command can be defined using up to 8 alphanumeric characters including underscore (_) started with an alphabet letter. The identical character strings cannot defined in the same table. The reserved strings [RUN], [STOP] and [PAUS] can not be defined.

The following default character strings for status changes commands cannot be changed by user.

String Number 1 PSTART

String Number 2 STEP

String Number 3 ***SCOMP***
String Number 4 ***EXECERR***
String Number 21 ***MSTART***
String Number 22 ***ABORT***



No.	CUSER1	CUSER2	CUSER3	CUSER4	CUSER5	CUSER6	CUSER7	CUSER8
1	PSTART	PSTART	PSTART	PSTART	PSTART	PSTART	PSTART	PSTART
2	STEP	STEP	STEP	STEP	STEP	STEP	STEP	STEP
3	SCOMP	SCOMP	SCOMP	SCOMP	SCOMP	SCOMP	SCOMP	SCOMP
4	EXECERR	EXECERR	EXECERR	EXECERR	EXECERR	EXECERR	EXECERR	EXECERR
5	RESTART	RESTART	RESTART	RESTART	RESTART	RESTART	RESTART	RESTART
6	END	END	END	END	END	END	END	END
7	SUSPEND	SUSPEND	SUSPEND	SUSPEND	SUSPEND	SUSPEND	SUSPEND	SUSPEND
8	PAUSE	PAUSE	PAUSE	PAUSE	PAUSE	PAUSE	PAUSE	PAUSE
9	RESET	RESET	RESET	RESET	RESET	RESET	RESET	RESET
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21	MSTART	MSTART	MSTART	MSTART	MSTART	MSTART	MSTART	MSTART
22	ABORT	ABORT	ABORT	ABORT	ABORT	ABORT	ABORT	ABORT

Figure: Status change command character string builder

12. SYSTEM FIXED STATUS CHARACTER STRING VIEWER

This is a system fixed status character string viewer and a read-only file.

DATA STATUS

Data status is the information that represents the quality of data. It is used for judging the proper operations according to the reliability of the data.

Symbol	Name	Description
BAD	BAD value	Indicates a state in which a normal data value cannot be obtained. The data value stored when this status occurs may be a meaningless value or the last normal value which has been stored.
QST	QueSTionable value	Indicates that the data value is questionable and cannot be determined whether it is normal or bad. The data value stored when this status occurs may be a value inputted from outside while it is in the QST status, a manually set value using the CAL function, or the last normal value which has been stored.
NCOM	No COMmunication	Indicates that when data is inputted or outputted through communication, the communication has been disconnected and the data has not been updated. Used only for I/O data that is exchanged with other control stations.
NFP	Not From Process	Indicates that the data value is not derived from a process I/O. The data value stored when this status occurs may be a value inputted from outside while it is in the NFP status, a calculated value, or a manually set value using the CAL function.
PTPF	Path To Process Failed	Indicates a state in which output is being disabled due to the abnormality of the block itself or the output destination. If the output destination is a PI/O, this status occurs when output open (OOP), not ready (NRDY) or power failure has occurred. If the output destination is a function block, this status occurs when the output destination block is in the out of service (O/S) mode.
CLP+	CLamP high	Indicates that output is clamped at the high-limit value. This status occurs when the block itself is limited by the output high limit or when the data status of the output destination is clamp high (CLP+).
CLP-	CLamP low	Represents that output is clamped at the low-limit value. This status occurs when the block itself is limited by the output low limit or when the data status of the output destination is clamp low (CLP-).
CND	CoNDitional	Indicates that cascade connection is open. This status occurs when a downstream function block changes to the non-cascade mode or the cascade connection path has been disconnected due to switching, etc. Used only for data that is the object of cascade connection (MV, CSV, etc.)
CAL	CALibration	Indicates a state in which the data value can be replaced manually as an emergency This status occurs when a downstream function block changes to the non-cascade mode or value will not be updated until it is replaced manually.
NEFV	Not EFfecTive	Indicates a state in which the data value is invalid. This is a state in which no setpoint value has been set manually after the CAL status was obtained or the value is yet to be updated after the CAL status was turned off.

Table: Data Status (1/2)

Symbol	Name	Description
O/S	Out of Service	Indicates that the function block of the I/O destination is in O/S mode. If the operation is input, the data value is not updated.
MNT	MaiNTenance	Indicates that the function block of the I/O destination is undergoing online maintenance. If the operation is input, the data value is not updated. Normally, data reference is not performed while this data status in on, since online maintenance is performed as a group between function block executions and data access processing.
IOP+	Input Open high	Indicates that the process I/O of the input destination is in a high limit input open state due to disconnection or other failure. The data value is not updated. The PV value is forcibly set to a special value only when the PV overshoot function is activated.
IOP-	Input OPen low	Indicates that the process I/O of the input destination is in a low limit input open state due to disconnection or other failure. The data value is not updated. The PV value is forcibly set to a special value only when the PV overshoot function is activated.
OOP	Output OPen	Indicates that the process I/O of the output destination is in an output open state due to disconnection or other failure.
NRDY	PI/O Not ReaDY	Indicates that the process I/O of the I/O destination is in an operation disabled state due to power failure, maintenance or a failure. If the operation is input, the data value is not updated.
PFAL	PI/O Power FAiLure	Indicates that the process I/O of the I/O destination is not responding due to power failure or other reason and is in an operation disabled state. If the operation is input, the data value is not updated.
LPFL	PI/O Long Power FaiLure	Indicates that the process I/O of the I/O destination has been non-responsive for a long time due to power failure or other reason and is in an operation disabled state. If the operation is input, the data value is not updated.
MINT	Master INiTialize	Indicates that the upstream side of the cascade connection is in a state where a balance operation should be performed.
SINT	Slave INiTialize	Indicates that the downstream side of the cascade connection is in a state where a balance due to power failure or other reason and is in an operation disabled state. If the operation
SVPB	SV PushBack	Indicates that the downstream side of the cascade connection is in a state where the CSV should be made to match SV by the SV pushback operation.

Table: Data Status (2/2)

BASIC BLOCK MODE

The following table lists the basic block modes. The basic block mode that can be applied to the particular function block varies from the types of the function block.

Symbol	Name	Description
O/S	Out of Service	All functions of the function block are currently stopped.
IMAN	Initialization MANual	Calculation processing and output processing are currently stopped.
TRK	TRacKing	Calculation processing is currently stopped and the specified value is forced to be output.
MAN	MANual	Calculation processing is currently stopped and the manipulated output value, which is set manually, is output.
AUT	AUTomatic	Calculation processing is being executed and the calculation result is output.
CAS	CAScade	Calculation processing is being executed, the set value CSV is from the cascade connected upstream block, and the calculation result referred to this CSV is output.
PRD	PRimary Direct	Calculation processing is currently stopped, the set value CSV is from the cascade connected upstream block, this CSV is output directly.
RCAS	Remote CAScade	An control and calculation processing is being executed using the remote setpoint value (RSV) which is set remotely from a supervisory system computer, and the calculation results is output.
ROUT	Remote OUTput	Calculation processing is currently stopped, and the remote manipulated output value (RMV) which is set remotely from a supervisory system computer is output directly.

Table: Basic Block Modes

BLOCK STATUS

The operating state of a function block may be monitored via block status.

Priority level	Function block name									
	Regulatory control block			Sequence control block						Arithmetic-calculation block
	MC-2 MC-3	BSETU-1 BSETU-2	PTC	SO-1 SO-2	SIO-11 SIO-12 SIO-21 SIO-22 SIO-12P SIO-22P	TM CTP	CTS	CI	CO	INTEG AVE-C
3	ANCK	-	-	-	ANCK	PAUS	-	ERR	-	-
2	OFF LOCK	-	PAUS	-	-	PALM CTUP NR	PALM CTUP NR	HI LO NR	HI LO NR	-
1	SIM NR	STRT IBCH STUP STDY ERLY PBCH END NCNT RSET EMST EEMS RSTR	CTUP PALM NR	SIM NR	SIM NR	RUN STOP	RUN STOP	-	-	RUN STOP

Table: Block Status of Each Function Block

ALARM STATUS

The process alarm may be monitored and managed via alarm statuses of data items.

Symbol	Name	Description
NR	Normal	Indicates a state in which no alarm has occurred.
OOP	Output OPen Alarm	Indicates a state in which the output data status has become output failure (PTPF) as a result of the failure or disconnection of an operation terminal or process I/O device or the abnormality of output destination data. Normally, the output function is stopped.
IOP	High Input Open Alarm	Indicates a state in which the input data status has become bad value (BAD) as a result of the failure or disconnection of a detection terminal or process I/O device or the abnormality of input destination data. Normally, any processing that uses input signals is stopped. If the input signal has been overshot due to disconnection, etc., this alarm indicates a state in which input is overshot to the high-limit direction.
IOP-	Low Input Open Alarm	Indicates a state in which the input signal has been overshot to the low-limit direction due to disconnection, etc. The input data status becomes bad value (BAD). Normally, any processing that uses input signals is stopped.
HH	High High Alarm	Indicates a state in which the process variable exceeds the high high-limit alarm setpoint.
LL	Low Low Alarm	Indicates a state in which the process variable falls below the low low-limit alarm setpoint.
HI	High Alarm	Indicates a state in which the process variable exceeds the high-limit alarm setpoint.
LO	Low Alarm	Indicates a state in which the process variable falls below the low-limit alarm setpoint.
DV+	Deviation Alarm +	Indicates a state in which the deviation between the process variable and the setpoint value exceeds the deviation alarm setpoint in the positive direction.
DV-	Deviation Alarm -	Indicates a state in which the deviation between the process variable and the setpoint value exceeds the deviation alarm setpoint in the negative direction.
VEL+	Velocity Alarm +	Indicates a state in which the change amount of the input signal within a specified time exceeds the velocity limit alarm setpoint in the positive direction.
VEL-	Velocity Alarm -	Indicates a state in which the change amount of the input signal within a specified time exceeds the velocity limit alarm setpoint in the negative direction.
MHI	Output High Alarm	Indicate a state in which the output signal almost exceeded the output high-limit value. The actual output is limited to the output high-limit value.
MLO	Output Low Alarm	It indicates a state in which the output signal almost fell below the output low-limit value. The actual output is limited to the output low-limit value.
CNF	Connection Failure Alarm	Indicates a state in which a block mode of the function block in the I/O connection destination is in the out of service (O/S) mode. This alarm controls a temporary out of service state due to maintenance, and indicates a function block which is still in operation. Normally, IOP or OOP occurs simultaneously.

Table: Alarm Status Common to Regulatory Control Blocks

ALARM FLASHING STATUS, ALARM OUTPUT OFF STATUS, ALARM DETECTION

The alarm status character string is displayed in the system-fixed status character string viewer. By designating the alarm status character string color in the Alarm Processing Table Builder, the display color of the alarm status will change when the corresponding alarm occurs.

Bit position	Alarm flashing status	Alarm off status	Alarm detection designation
	AFLS	AOFS	AF
1	AFL		
2		AOF	
3			AF
4			
5			
6			
7			
8			
9			
10			
...			
32			
33			

Table: System-Fixed Alarm Status Character String (Other than the Alarm Status)

13. USER SECURITY

The operators performing the operation and monitoring functions are classified based on their privilege level (authority). This classification is called user.

USER NAME, COMMENT
User name definition may be carried out on the Security Builder. Each user name must be unique, consisting of eight alphanumeric characters or fewer. Up to 250 users can be defined. Upper- and lower-case letters are not distinguished.

Up to 32 single-byte characters or 16 double-byte characters may be entered as comment for each user name.

USER GROUP
The users are classified into groups based on their operation and monitoring authorities. Each group is called user group. For each user, an user group is defined on the Security Builder by selecting one from the [User Group Name] on the user group tab.

PRIVILEGE LEVELS
The users' operation and monitoring rights on HIS are defined according to privilege levels. The following attributes are assigned to each privilege level:

- ***Whether or not monitoring is permitted***
- ***Whether or not operation is permitted***
- ***Whether or not operation and monitoring on windows is permitted***

Privilege level	Monitoring	Operation	Maintenance (*1)
S1	Y	N	N
S2	Y	Y	N
S3	Y	Y	Y

Y: Authorized
N: Unauthorized
****1: Rights on operating and monitoring the window for system administration.***

Table: Rights and Abilities of three levels of privilege

AUTOMATIC USER-OUT TIME

When automatic users out-time is defined, the user automatically changes to the OFFUSER when the automatic user-out time elapsed. However, automatic User-out may be delayed when waiting for a confirmation upon an operation of function block. User may be automatically be logged out under the following optional conditions.

- ***Automatically Logout due to No operation timeout***
  If the keyboard or the mouse has not been touched for a designated time period, the user is automatically logged out.
- ***A certain time elapsed since user logged In***
  User may automatically logs out after a certain time elapsed since the user logged in.

USER GROUP NAME, COMMENT

The user group name may be defined on the Security Builder.
Each user group name must be unique and in 8 or less alphanumeric characters. 50 user groups may be assigned to one project. There is no distinction using capital or small case characters when defining the user group names. User group may be used to classify the messages sent to different printers.

Up to 32 single -byte characters or 16 double-byte characters may be entered as the comment for a user group name.

INCLUSIVE DEFINITION

Monitoring Range, Operation and Monitoring Range, Window Range, Acknowledgment, Process Message Receiving, System Alarm Receiving

Specify the following items:

- ***Monitoring Range***
  Specify the scope of data to be read. Specify a plant hierarchy name.
- ***Operation and Monitoring Range***
  Specify the scope of data to be read and written. Specify a plant hierarchy name. Operation and Monitoring Range should be within the Monitoring Range.
- ***Window Range***
  Specify a window name a user can operate and monitor after user-in. Specify window name.
- ***Acknowledgment***
  Specify the scope of acknowledged process alarms. Specify a plant hierarchy name.
- ***Process Message Receiving***
  Specify the scope of monitored messages. Specify a plant hierarchy name.
- ***System Alarm Receiving***
  Specify the scope of monitored system alarms by station name.
  The following keywords are used in setting operation and monitoring scope:
- ***ALL***
  Operation and monitoring rights on all stations and windows connected to the control bus
- ***NONE***
  No monitoring rights on any station

When setting operation and monitoring rights on designated station names or window names, the wild card character " * " can be used instead of part or all characters in a character string.

The default setting is that all stations and windows are within the operation and monitoring range.

EXCLUSIVE DEFINITION

Exclude Operation, Exclude Operation and Monitoring, Exclude Acknowledgment, Exclude Process Message, Exclude System Alarm

Specify the following items:

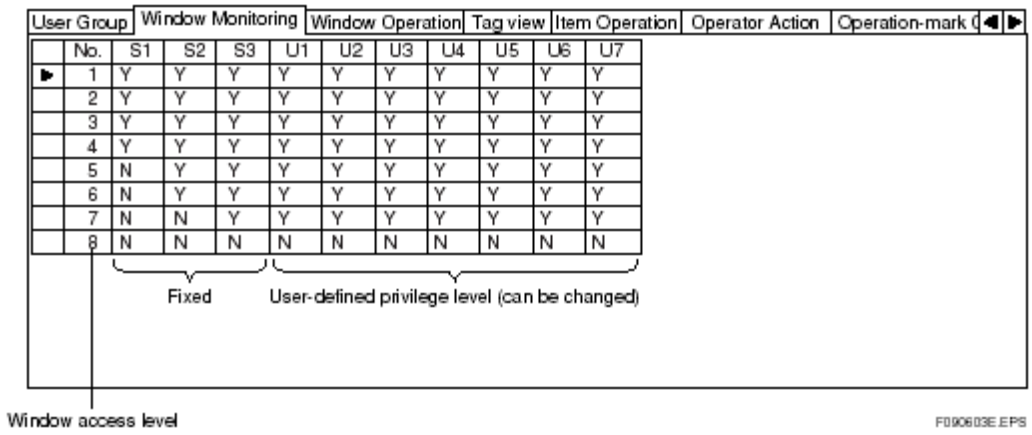
- ***Exclude Operation***
  Specify the scope of data not to be written. Specify a plant hierarchy name.
- ***Exclude Operation and Monitoring***
  Specify the scope of data not to be read or written. Specify a plant hierarchy name.
- ***Exclude Acknowledgment***
  Specify the scope of non-acknowledged process alarms. Specify a plant hierarchy name.
- ***Exclude Process Message***

Specify the scope of non-monitored messages. Specify a plant hierarchy name.

- ***Exclude System Alarm***
  Specify the scope of non-monitored system alarms by station name.

WINDOW MONITORING

Specifies whether the window can be displayed or not for each user-defined privilege level and for each window access level in the Window Monitoring tab of Security Builder.



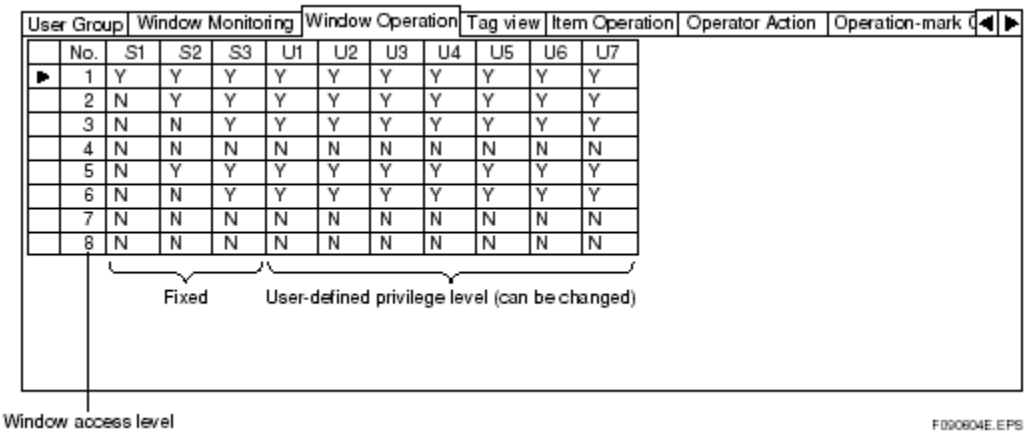
Y: Window can be displayed
N: Window cannot be displayed

Figure: Window Monitoring Tab (default setting)

WINDOW OPERATION

Specifies whether the following windows can be operated for each user-defined privilege level and for each window access level in the Window Operation tab of Security Builder.

- ***Batch trend starting and stopping in the Trend window***
- ***Starting and stopping of control station and downloading to IOM in the system maintenance window***

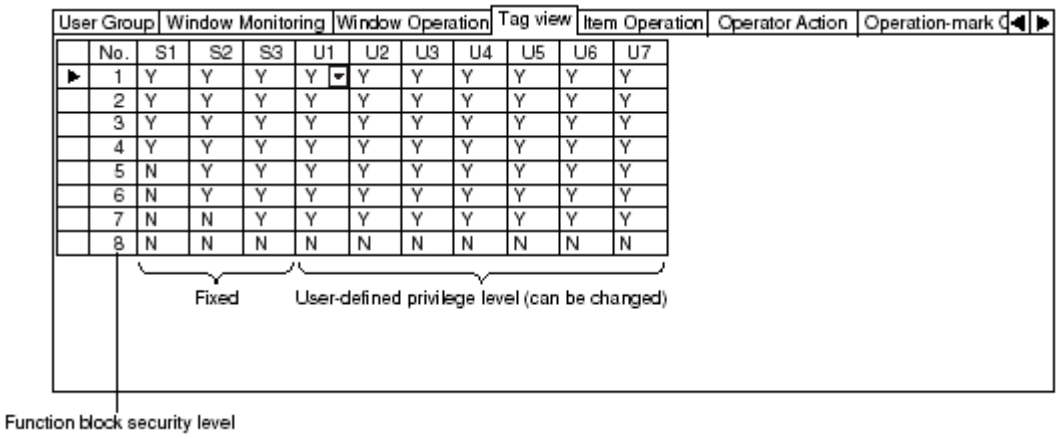


Y: Operation is allowed
N: Operation is not allowed

Figure: Window Operation Tab (default setting)

TAG VIEW

Specifies whether the Tuning and Faceplate windows of a function block are displayed or not for each user-defined privilege level and for each function block security level in the Tag View tab of Security Builder.



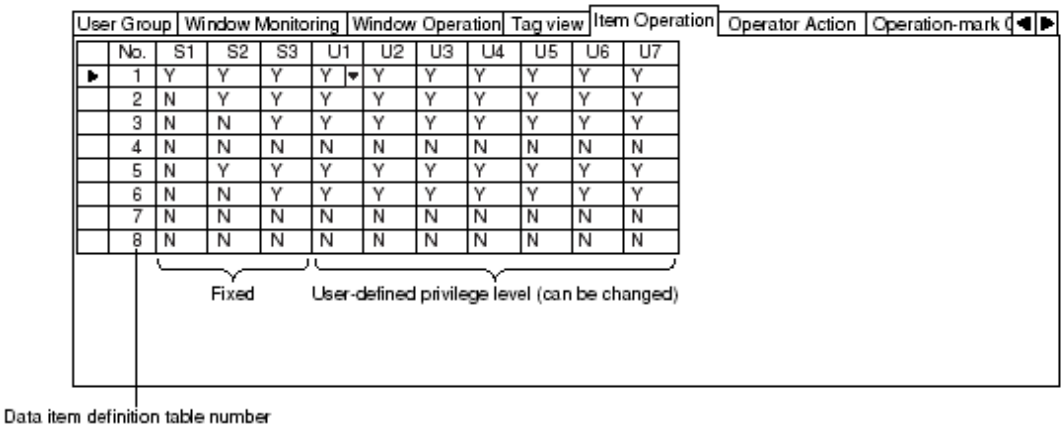
Y: Tuning and Faceplate windows can be displayed
N: Tuning and Faceplate windows cannot be displayed

Figure: Tag View Tab (default setting)

ITEM OPERATION

As for each user-defined privilege level, whether writing a data item of a function block is allowed or not can be changed for each data item definition table number. Whether writing a

data item of a function block is allowed or not is defined for each user-defined privilege level and for each data item definition table number in the Item Operation tab of Security Builder.

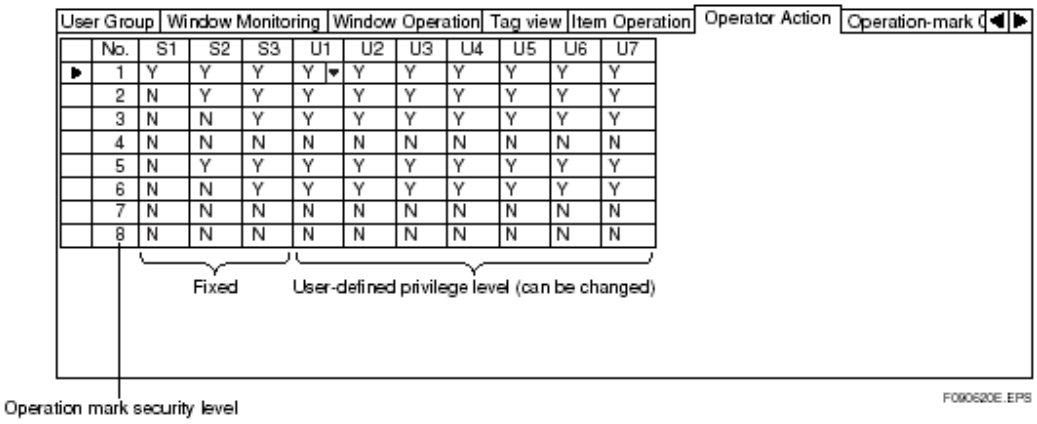


Y: Data items can be written
N: Data items cannot be written

Figure: Item Operation Tab (default setting)

OPERATOR ACTION

Specifies whether a function block can be operated or not for each user-defined privilege level and for each operation mark security level in the Operator Action tab of Security Builder.

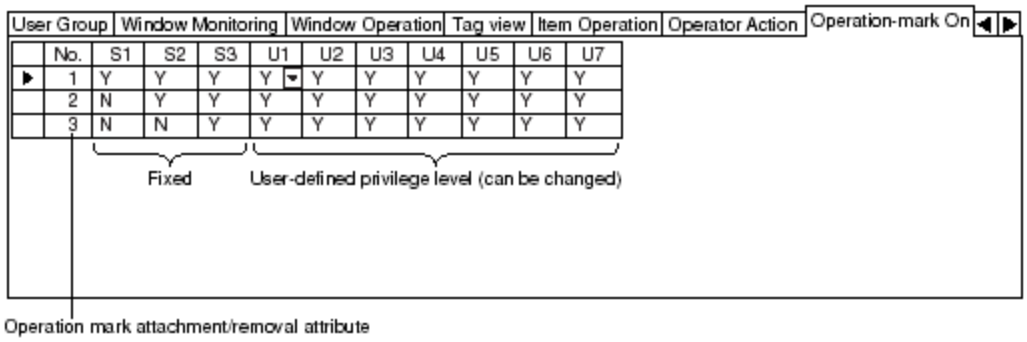


1: Comment type
2: S2, S3 Privileges
3: S3 Privilege
4: Operation Guard type
Y: Operation of function blocks allowed by the operation mark security level
N: Operation of function blocks prohibited by the operation mark security level

Figure: Operator Action Tab (default setting)

OPERATION-MARK ON

If an operation mark is installed to a Function Block, the operation and monitoring rights of the corresponding Function Block will be temporarily changed.
The attachment/removal attribute of an operation mark is defined in the Operation-mark On tab of Security Builder.



1: All Privileges
2: S2, S3 Privileges
3: S3 Privilege
Y: Installing and removal are allowed.
N: Neither installing nor removal is allowed.

Figure: Operation-mark On Tab (default setting)