

**CS3000 Fundamental  
Training Manual**

TE Y109JA01-3KFD

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# Introduction

The objective of the Training manual is to acquaint the user with the system layout, operations screens and the terminologies used in the CS3000 System.

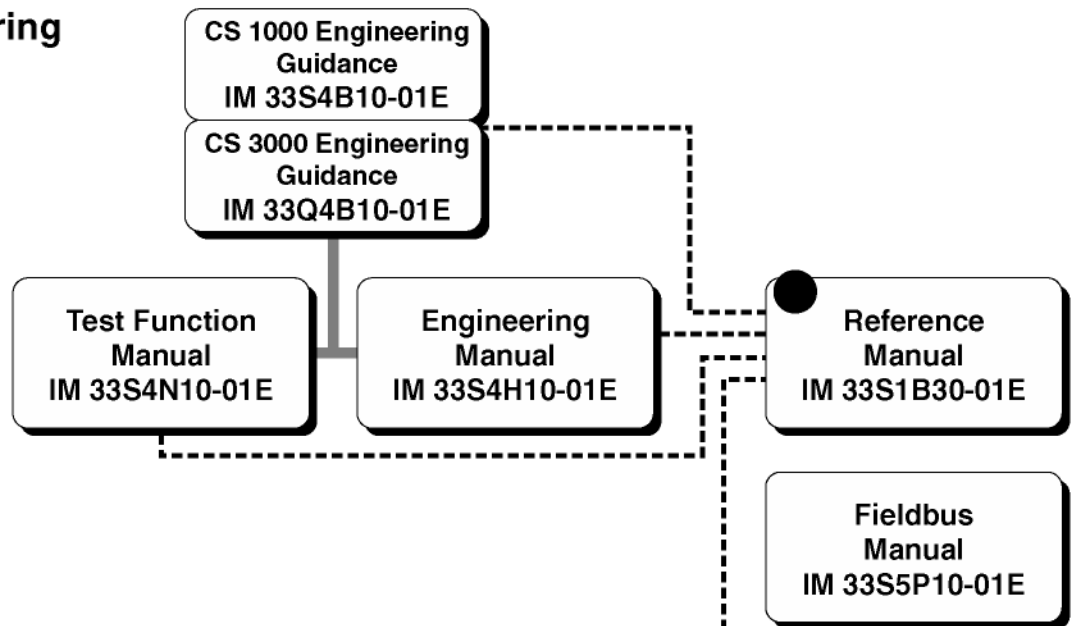
This training module is designed to add more value to the traditional training. The participant can acquire basic knowledge on the CS3000 System.

The Training manual consists of multiple chapters

Each chapter consists of multiple topics.

# CS 1000/CS 3000 Document Map

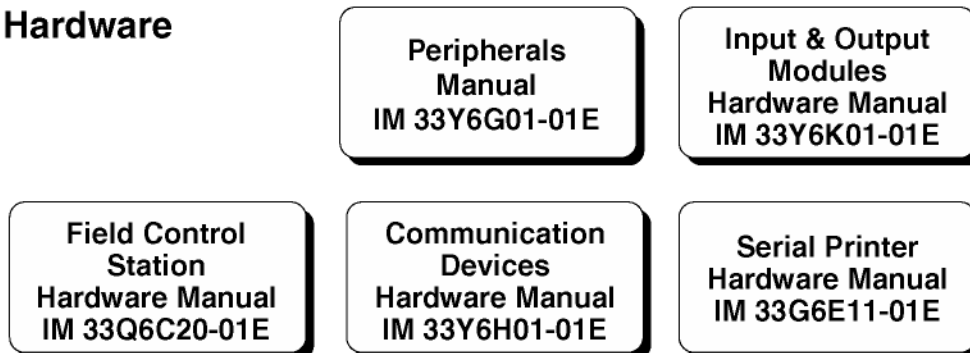
## ■ Engineering



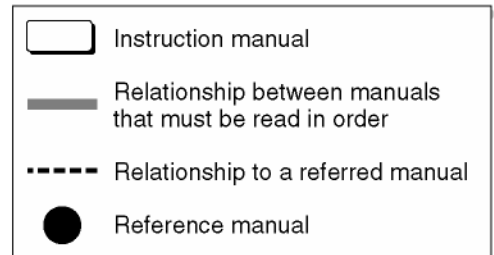
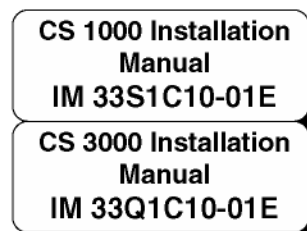
## ■ Operation and Monitoring



## ■ Hardware



## ■ Installation



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Identifies a protective grounding terminal. Before using the product, ground the terminal.



Identifies a functional grounding terminal. Before using the product, ground the terminal.



Indicates an AC supply.



Indicates a DC supply.



Indicates that the main switch is ON.



Indicates that the main switch is OFF.

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## □ Typographical Conventions

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### □ Commonly used conventions throughout manuals:

#### Character string enclosed by a set of single angle-brackets:

Indicates a portion provided with a link. Clicking the string in angle-brackets calls up related topics.

Example:

[<Toc>](#) [<Ind>](#)

#### Character string to be entered:

The characters that must be entered are shown in monospace font as follows:

Example:

FI.PV=50.0

#### ▼" Mark

This symbol indicates the description for an item for which you should make a setting in the product's engineering window.

While operating an engineering window, the help information for the selected item can be accessed from "Builder Definition Items" in the Help menu.

Listing more than one definition item after this symbol implies that the paragraph on the page describes more than one definition item.

Example:

▼ Tag name, Tag importance, Window name

#### "△" Mark

Indicates a space between character strings that must be entered.

Example:

.AL△PIC010△ -SC

#### Character string enclosed by brackets ({ }):

Indicates an option that can be omitted.

Example:

.PR△TAG{△.sheet name}

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- **Conventions used to show key or button operations:**

- **Characters enclosed by brackets ([ ]):**

Characters enclosed by brackets within any description on a key or button operation, indicate either a key on the HIS (Human Interface Station) keyboard, a key on the operation keyboard, a button name on a window, or an item displayed on a window.

Example:

To alter the function, press the [ESC] key.

- **Conventions used in command syntax or program statements:**

The following conventions are used within a command syntax or program statement format:

- **Characters enclosed by angle-brackets:**

Indicate character strings that user can specify freely according to certain guidelines.

Example:

```
#define <Identifier><Character string>
```

- **“...” Mark**

Indicates that the previous command or argument may be repeated.

Example:

```
lmax (arg1, arg2, ...)
```

- **Characters enclosed by brackets ([ ]):**

Indicate those character strings that can be omitted.

Example:

```
sysalarm format_string [output_value ...]
```

- **Characters enclosed by separators ( ):**

Indicate those character strings that can be selected from more than one option.

Example:

```
opeguide | <format_character_string> [, <output_value> ...] |
          | OG,<element number> |
```

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## Symbol Marks

Throughout this manual, you will find several different types of symbols are used to identify different sections of text. This section describes these icons.

**CAUTION**

Identifies instructions that must be observed in order to avoid physical injury and electric shock or death of the operator.

**WARNING**

Identifies instructions that must be observed in order to prevent the software or hardware from being damaged or the system from becoming faulty.

**CAUTION**

Identifies additional information required to understand operations or functions.

**TIP**

Identifies additional information.

**SEE ALSO**

Identifies a source to be referred to.

Clicking a reference displayed in green can call up its source, while clicking a reference displayed in black cannot.

## Drawing Conventions

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Some screen images depicted in the manual may have different display positions or character types (e.g., the upper / lower case). Also note that some of the images contained in this manual are display examples.



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# **CS3000 Fundamentals Training Manual**

TE Y109JA01 1st Edition  
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# **1. INTRODUCTION TO PROCESS CONTROL SYSTEM**

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**Objective:**

This chapter deals with the,

- Introduction to process control system.
- System concepts of distributed control system.
- Developmental history of process control system.
- Developmental history of Yokogawa DCS.

# 1.0 Introduction to Process Control System

**What is Controller?**

Most industrial processes require that certain variables, such as flow, temperature, pressure and level, remain at or near some reference value, called **SET POINT**.

The device that serves to maintain a process variable value at the set point is called **Controller**.

The controller looks at a signal that represents the actual value of the process variable, compares this signal to the set point and acts on the process to minimize any difference between these two signals.

**Types of Controls****Continuous Control:**

A process is where the production is all through the year. The process continues to produce the product till the interruption of the process due to any problem or for the maintenance work in the plant. The controls used in such process are all continuous control.

Example: Fertilizer plant, Petrochemicals plants, Power plants, Textiles industry etc.

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**Batch Control:**

The production will be in batches or mass production and is carried out with discrete quantities of materials or limited no. of items. There may be some time duration between each batch production.

Example: In pharmaceutical process before the production, the vessel may be sterilized and then the bio-material may be added to the vessel.

Then some agitator may be started for some period and ultimately before the product is generated there may be some time. Before starting the second batch, the vessels may have to be re-sterilized again.

**Discrete Control:**

Here the control is not continuous but it is discrete.

Example: **On-Off control:** Suppose, for a particular process, the temperature has to be maintained at 120 deg. C. When the temperature exceeds 120 deg. C with some dead band, the output will be off and if the temperature falls below 120 deg. C considering the dead band then, the output will be on, to heat the contents of the vessel.

## 1.1 Process Control Functions

The method to directly control process is roughly divided into two categories:

**The loop control:** This inputs analog measured values. It includes feedback control and feed forward control functions.

◆ **Feedback Control**

The Control that acts, to correct the process variable (e.g. Temperature in a tank), to agree with the target value (set point) by comparing both.

◆ **Feed forward Control**

The Control which takes a corrective action by measuring the disturbances (e.g. ambient temperature) and directly driving the valve before it affects the process.

**Sequential control:** this inputs operating sequences and process status signals. This control successively advances each control step in accordance with the pre-determined sequence

## 1.2 Process Control System

To perform control application of any process, a control system is required. There are many control systems available, which are generally classified into analog and digital control system.

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

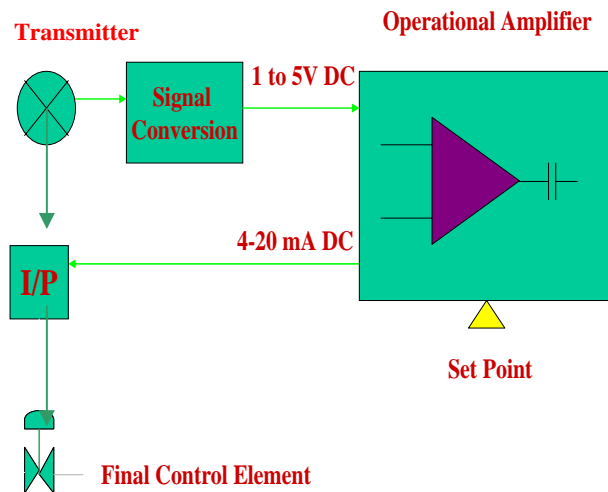


Figure: Analog Control System

**1.2.2 Digital Control System:** Digital Control system uses microprocessors to do the control function. Here, the feedback and feed forward controls (called DDC-Direct digital controls collectively) and sequential controls are available.

Digital control systems are preferred over analog control systems since it is easy to interface with Computers for data analysis.

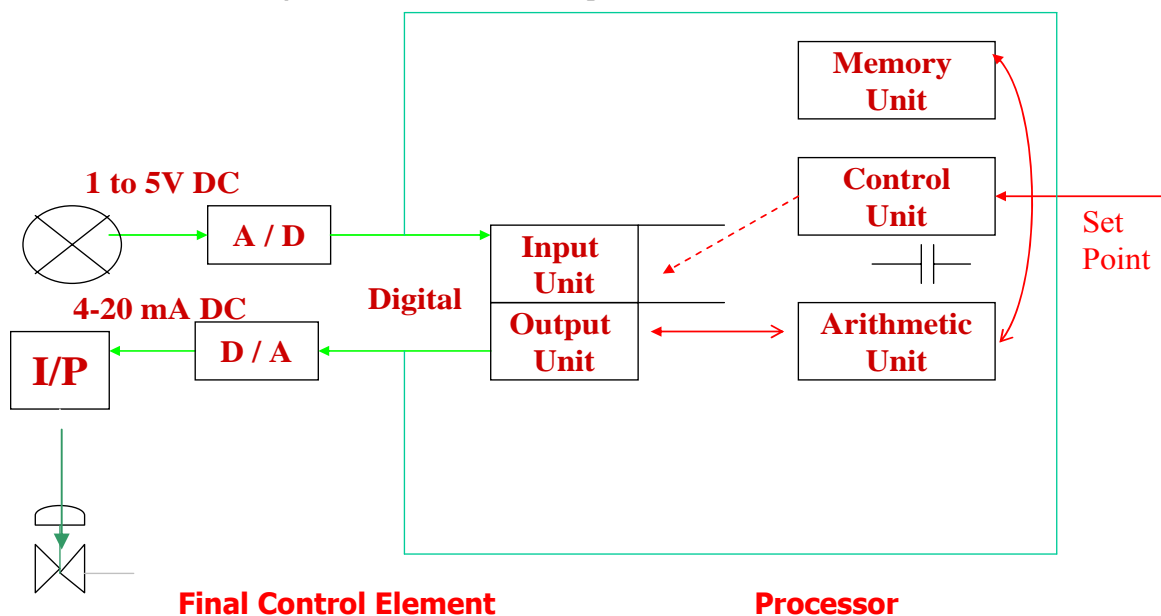


Figure : Digital Control System

## 1.3 Classification of Digital Control system

**1.3.1 Centralized Control System (CCS):** Here, the control and monitoring actions are centralized.

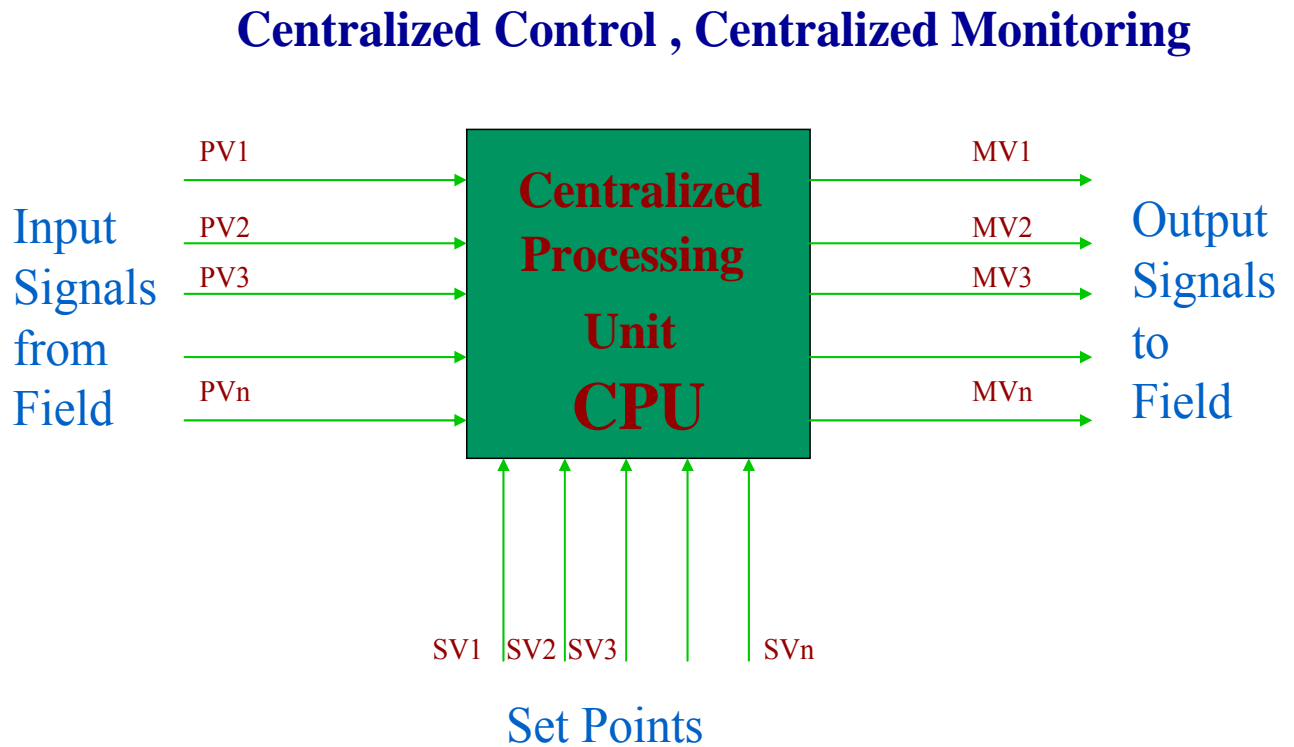


Figure: Centralized Control System

The draw backs of CCS are,

- If the CPU fails the entire plant gets affected.
- Redundancy concept is not available- i.e. Redundancy is having two controllers.

One would be active and the other would be standby. If the active controller fails, the standby controller takes over.



**1.3.2 Distributed Control System (DCS):** Here, control action is distributed and monitoring action is centralized.

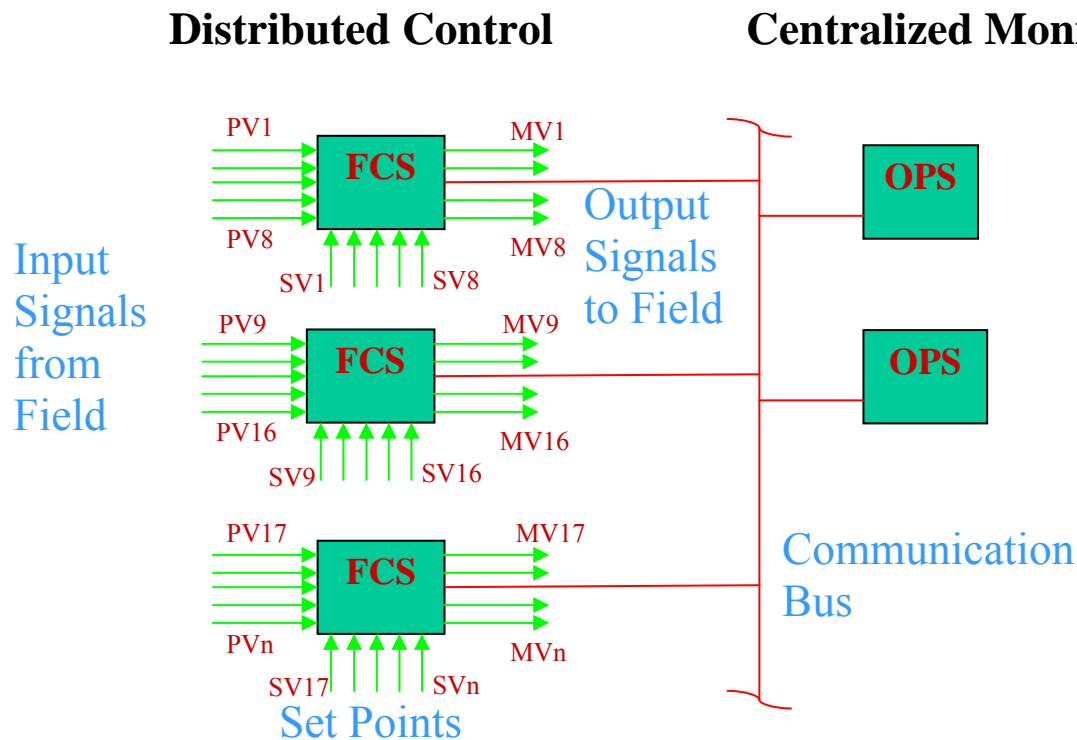


Figure: Distributed Control System

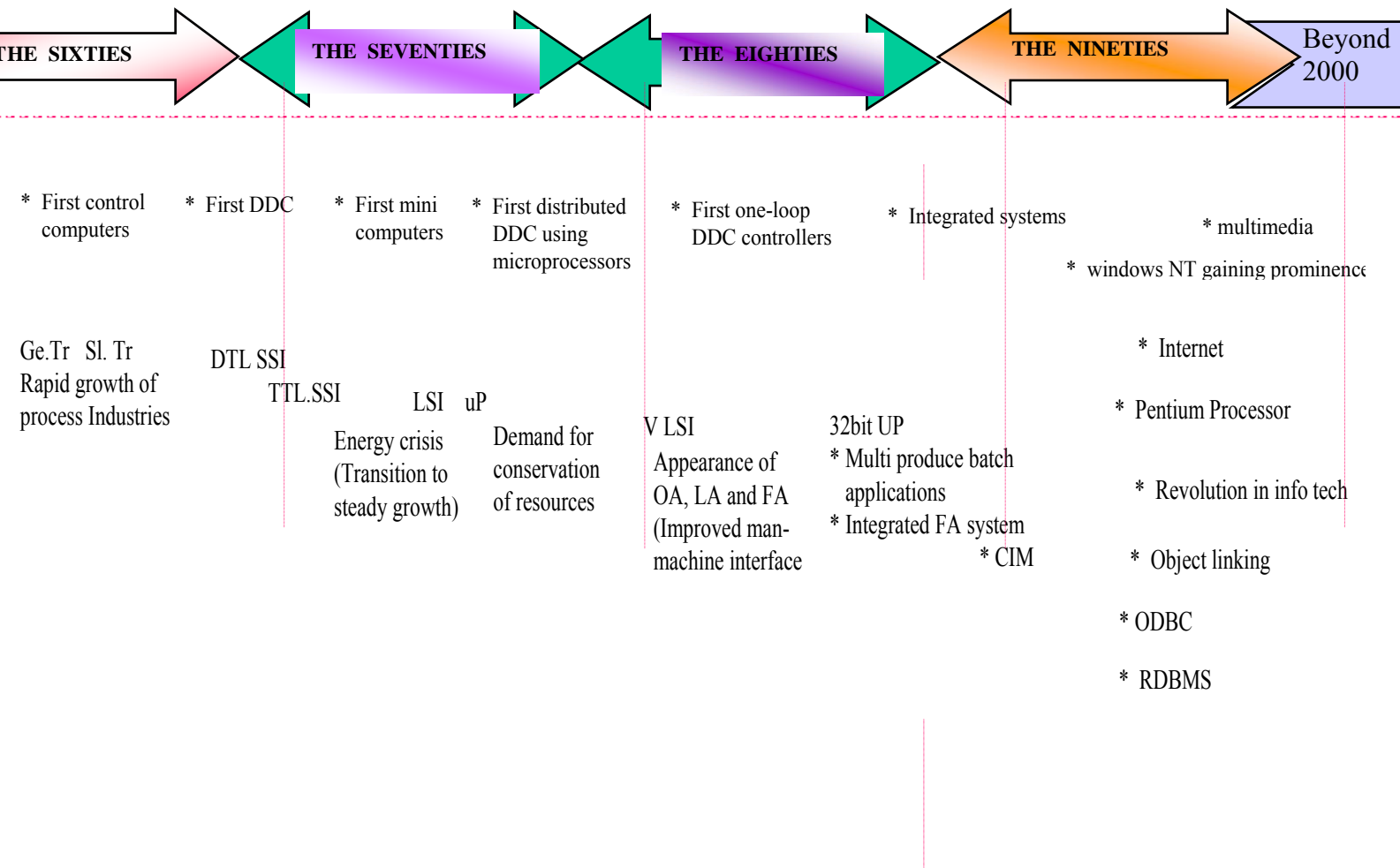
### Advantages of DCS

- ✓ Control function is distributed among multiple CPUs (Field Control Stations). Hence failure of one FCS does not affect the entire plant.
- ✓ Redundancy is available at various levels, Instruments and interlocks are created by software.
- ✓ Generation and modifications of the interlocks are very flexible and simple.
- ✓ Information regarding the process is presented to the user in various formats.
- ✓ Field wiring is considerably less. Maintenance and trouble shooting becomes very easy.
- ✓ Cost effective in the long run.

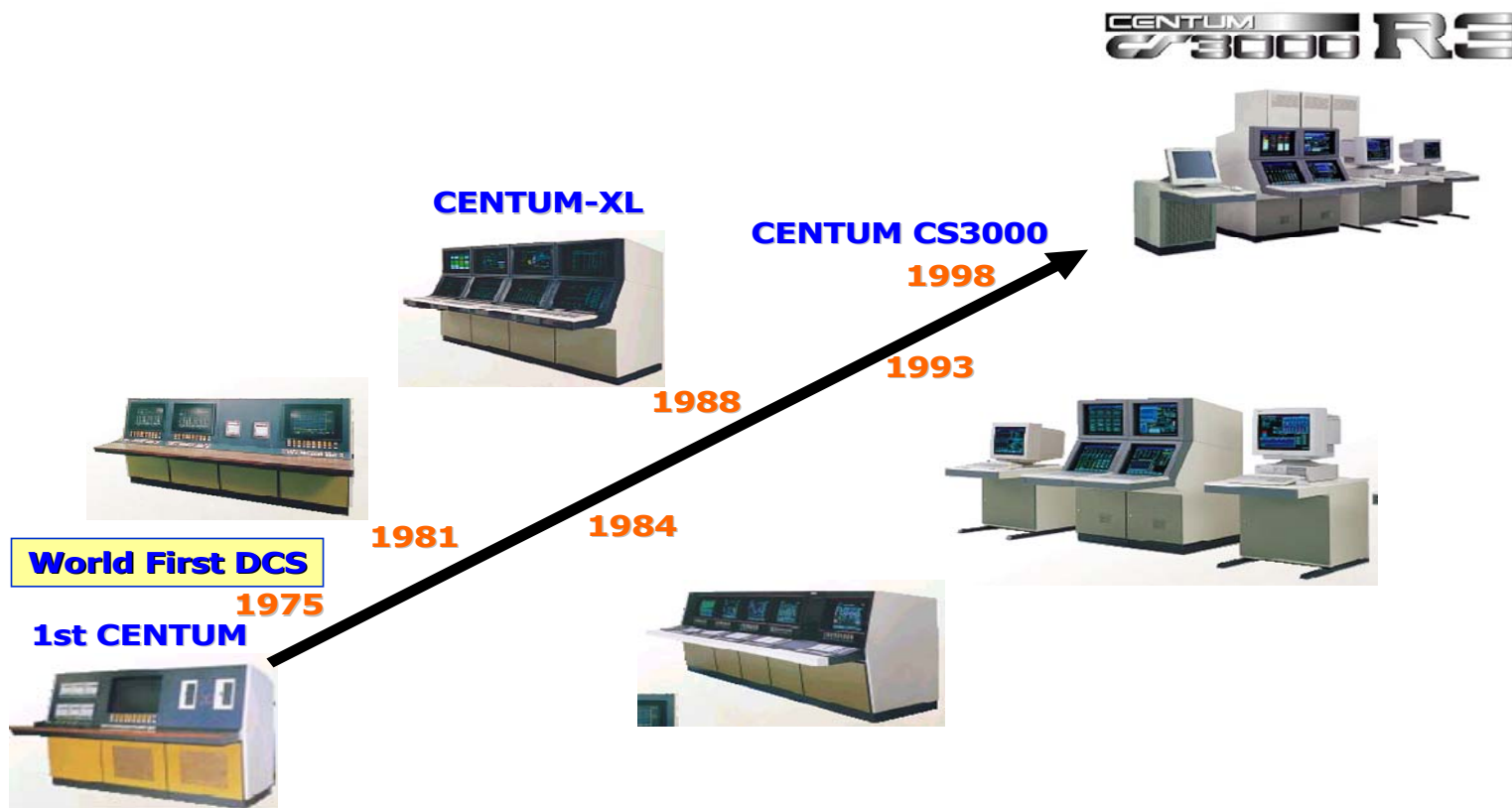
## 1.4 Basic Components of DCS

- **CPU: Central Processing Unit** also called as Field Control Station is used to control the process.
  - All the instruments and interlocks created by software reside in the memory of this unit.
  - All the field instruments like transmitters and control valves are wired to the FCS.
- **OPS (Operator Station):** Used to monitor the process and to operate various instruments.
- **Communication Bus:** Used to communicate between the FCS and the OPS.

## 1.5 Evolution of Control System



## 1.6 Evolution of Yokogawa DCS



Systems	Year	Platform
Centum/Centum V	1975	MS – DOS based
Centum–XL / Micro-XI	1988	MS-DOS / UNIX based
Centum CS	1993	UNIX based
CS 3000	1998	Windows based

## **2. CS 3000–SYSTEM CONFIGURATION**

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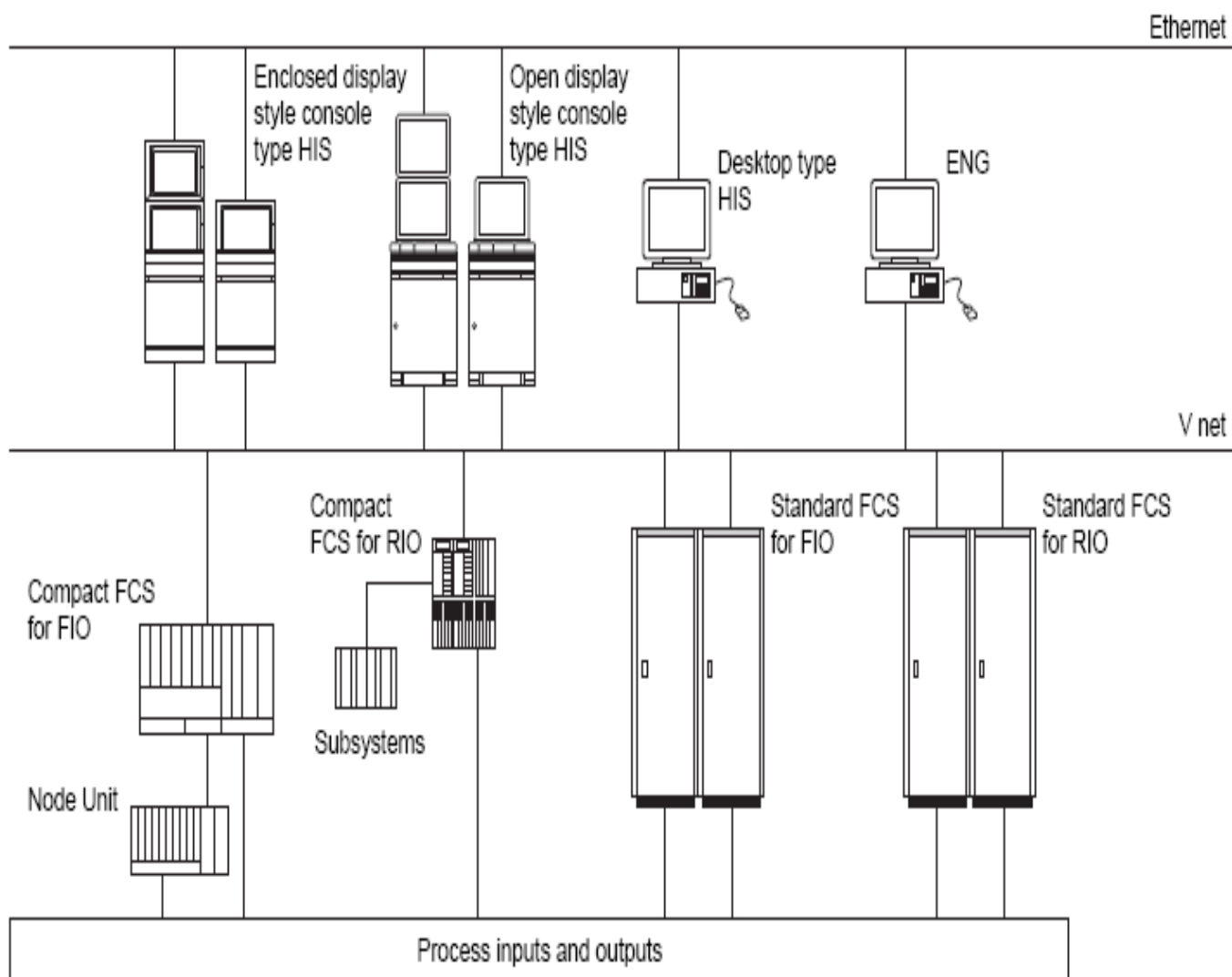
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**Objective:** This chapter deals with

- CS 3000 - System Configuration
- CS 3000 – Major Components
- CS 3000 - Communication Networks
- Domain Concept

## 2.0 System Configuration – CENTUM CS 3000

The System Configuration of CS 3000 is as shown in below.



F020001.a)

**Figure: CENTUM CS 3000 System Configuration (Basic)**

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## 2.1 CENTUM CS 3000 – Equipment Details

The equipment details of CS3000 are as follows.

### 2.1.1 Human Interface Station (HIS)

The HIS is mainly used for operation and monitoring purposes. It displays process variables, control parameters, and alarms necessary for the users to quickly grasp the operating status of the plant.

It also incorporates open interfaces so that supervisory computers can access trend data, Messages and process data.

The operator station is based on Windows XP or Windows2000. (Both are selectable)  
The types of HIS are,

- **Console Type HIS:** This is a new console type human interface station, to which a general purpose PC is installed.

It can be composed of dual stacked LCD, touch panel function, eight-control-key operation keyboard, auxiliary contact I/O and a number of console types HIS which can be installed in a row.

There are two types of console type HIS. They are

- (i) Enclosed display style - the appearance of which is usual style.
- (ii) Open display style - the configuration of which is selectable.



---

**Desktop Type HIS:** This HIS uses a general purpose PC. An IBM PC/AT compatible machine is generally used. The minimum specifications of the PC are given below.

<b>CPU</b>	: Pentium 466 or better
<b>Main Memory</b>	: 512 Mb or more
<b>Hard Disk</b>	: 20Gb or more (User space should be 500 Mb or more)
<b>Video Display</b>	: 1024 x 768 or more (256 colors)
<b>Video Memory</b>	: 2 Mb or more
<b>CRT Monitor</b>	: Multi-scan, 17 inch or larger. LCD display can also be used.
<b>Serial Port</b>	: RS232C or port or more (Dsub9pin)
<b>Parallel Port</b>	: One port or more
<b>Extension Slot</b>	: PCI, ISA (1 slot for VF 701 /VI 701 card) (1 slot for Ethernet card)
<b>Power Supply</b>	: 110 VAC or 220 VAC
<b>Optional accessory</b>	: Yokogawa Operator Keyboard.
<b>Sec. Storage Media</b>	: Cartridge Drives, DAT Drive or CD Writer.
<b>Basic O/S Software</b>	: WINDOWS NT with SP 6A / WINDOWS 2000 with SP 4A/ WINDOWS XP with SP 2
<b>Software</b>	: CS3000 R3 Packages with necessary software licenses.



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## 2.1.2 Engineering Station (ENG)



- Engineering Station is used to do the engineering builder for all the stations like HIS, FCS, CGW, BCV etc.
- ENG station is a PC loaded with engineering software (Standard builder function). It is mainly used to perform CS3000 system generation and maintenance management.
- The HIS can be loaded with engineering software, so that it can be used as HIS as well as ENG station.
- By having HIS operation and monitoring functions on the same PC, we can use the test (control station emulation) functions to provide an efficient and easy-to-use engineering environment.

## 2.1.3 Application capacity of HIS

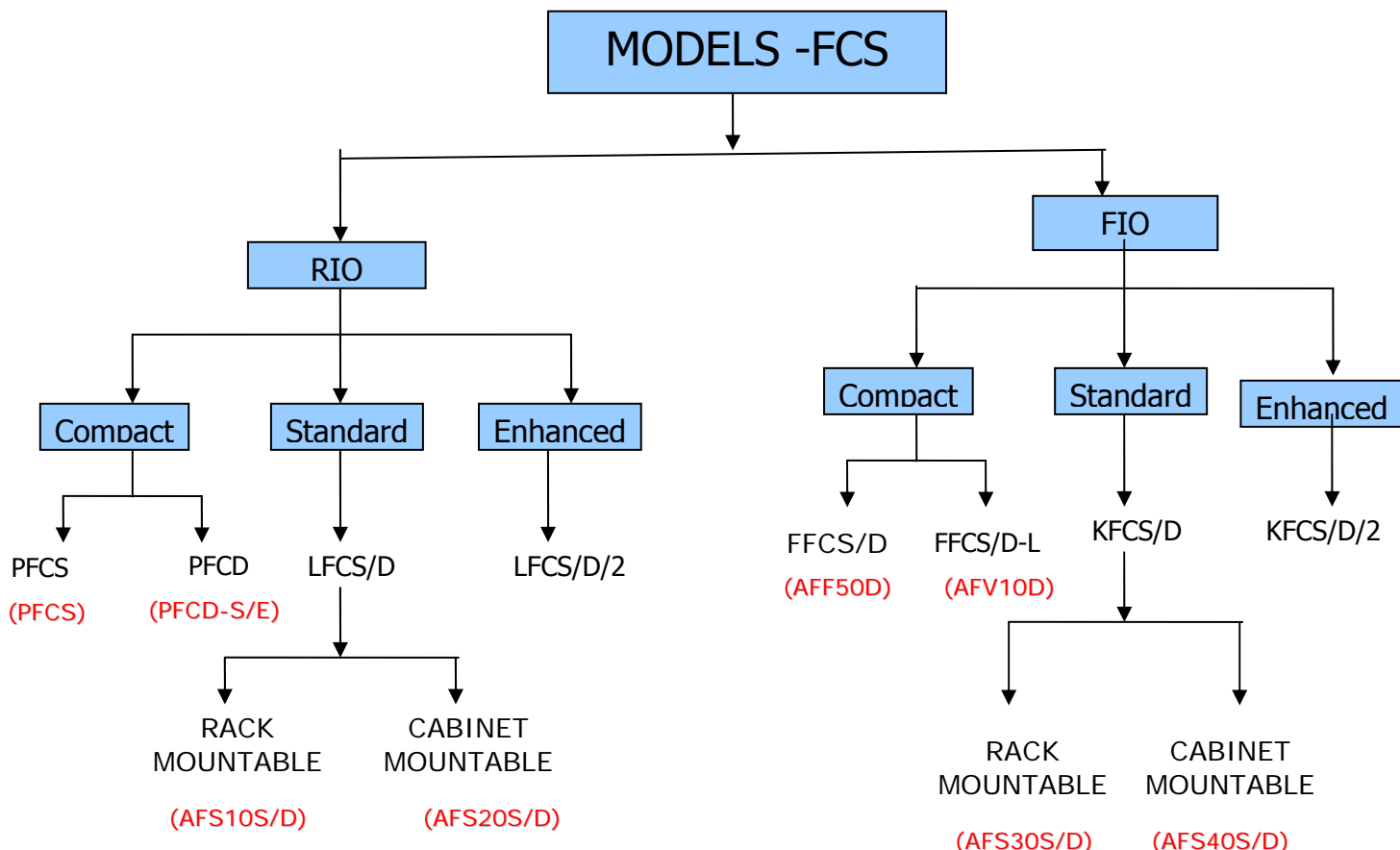
- ⇨ Maximum number of tags that can be monitored from HIS : 100,000  
(expandable up to 1,000,000 tags)
- ⇨ Maximum number of windows that can be created per HIS : 4000
- ⇨ Maximum number of Trend Recording Points per HIS : 2304

## 2.2 FCS-Overview

The FCS controls the plant. This is the component where all the control functions are executed and hence it is a very important and critical component in the overall system.



### Field Control Station Models



## 2.3 Compact Field Control Station RIO Type (PFCD)

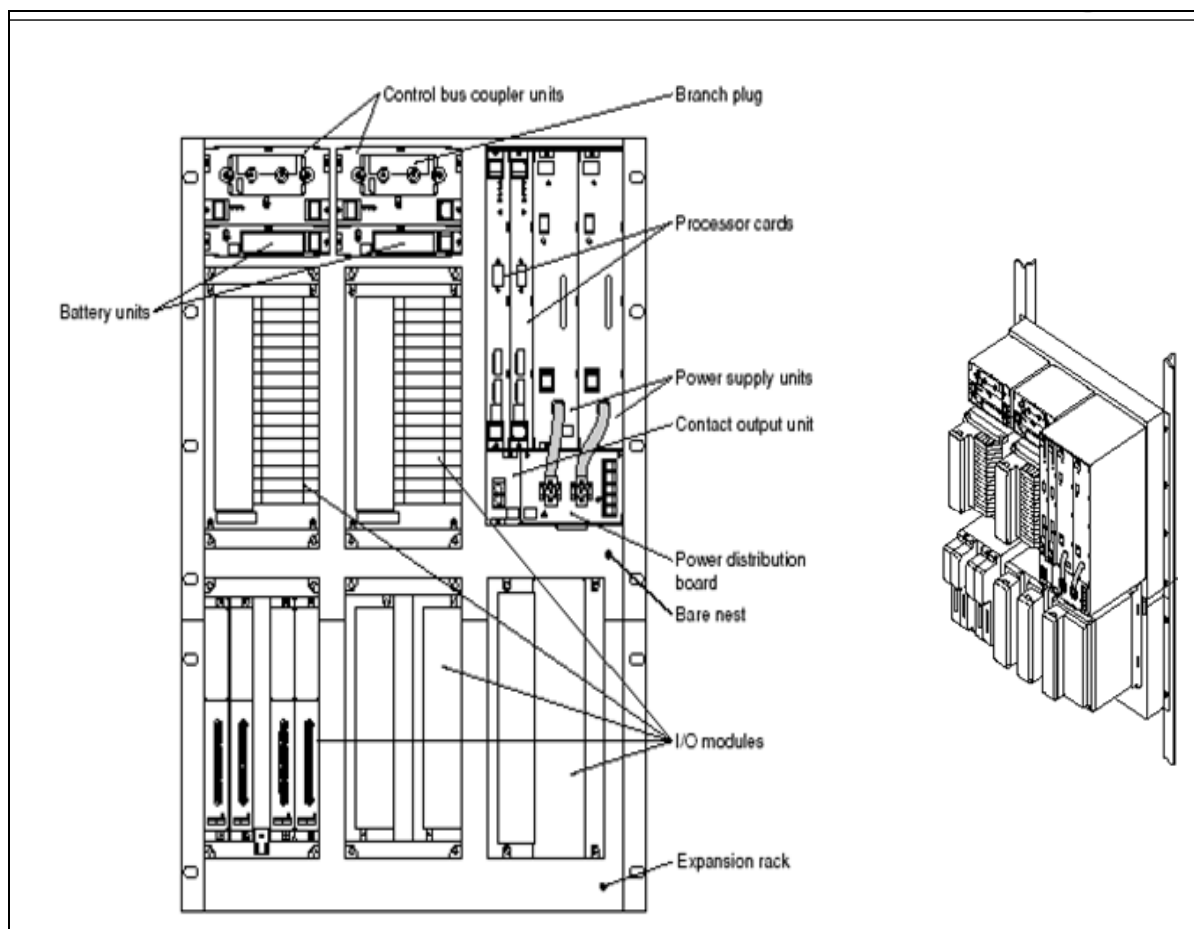


Figure: Portable FCS (PFCS) is Compact type FCS

## Hardware Details:

- The PFCS consists of two Power supply units, redundant CPU's and two VL net coupler units.
- Maximum of five I/O nests can be connected to one PFCS.
- VL net cable can be interfaced with V Net cable using 10base 2 to 10 base 5 convertor.

### 2.3.1 Dual Redundant Configuration of PFCD

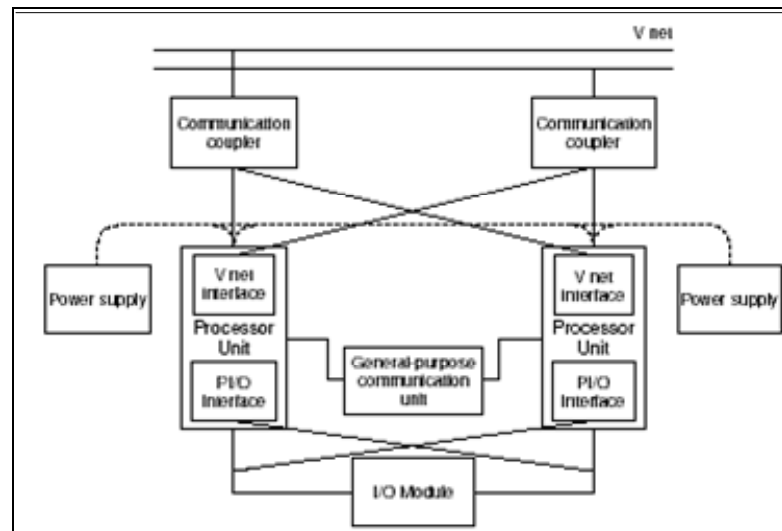


Figure: Dual Redundant Configuration of PFCD

- In the compact FCS, the processor card, V net coupler, power supply card and the process I/O interface are all dual redundant.
- Of the two processor cards, one will be active and the other will be standby card. The duplexed processor cards can switch from active to standby card without any interruption to control.
- The duplexed processor cards perform control computations in sync. The switch over from active to standby does not interrupt the control.
- If an invalid CPU memory access is detected, the invalid data is not used, and the corresponding CPU is stopped. If the error occurs in the active CPU, switchover to standby causes no interruption to control.
- A Watch Dog Timer is used to detect if the active processor card is abnormal, which results in a switch from active to standby processor card.
- Each CPU performs I/O via a Process I/O (PIO) interface card. Both the active and standby sides check that the PIO bus interface is normal. If an abnormality is detected in the active side, the standby side is switched in to use.



### 2.3.2 Configuration of PFCD

UNIT NAME	SINGLE CONFIGURATION PFCS	DUPLEXED CONFIGURATION PFCD
Power supply unit (100-120 V AC)	PW701 (1 or 2 nos.)	PW701 (2 nos.)
Power supply unit (220-240 V AC)	PW702 (1 or 2 nos.)	PW702 (2 nos.)
Power supply unit (100-120 V AC)	PW704 (1 or 2 nos.)	PW704 (2 nos.)
Processor Card (Standard)	CP701 1 no.	CP701 (2 nos.)
Processor card (Enhanced)	CP703 1 no.	CP703 (2 nos.)
Control bus coupler unit	AIP521 (1 or 2 nos.)	AIP521 (2 nos.)
Branch plug (for VL net or V net cable)	S9764UK (1 or 2 nos.)	S9764UK (2 nos.)
Branch plug (for V net cable)	S9628UK (2 nos.)	S9628UK (2 nos.)
Battery Unit	S9766UK 1 no.	S9766UK (2 nos.)

---

### 2.3.3 Details of component of PFCS

#### Control Processor Unit (CPU):

Processor card performs control operations. There are two types of processor cards:

- CP701 Standard type with 12 MB RAM and
- CP703 Enhanced type with 16 MB RAM

#### Status Lamps:

**HRDY:** The processor card performs self diagnosis. If the processor card hardware is functioning normally, the green light turns on. If abnormality is found, the light turns off.

**RDY:** The green light turns on if both the hardware and software are functioning normally. If either of them is abnormal, the light turns off.

**CTRL:** In the duplex PFCS/SFCS, the green light turns on if the processor card is the control side and turns off if it is the waiting side.

When starting up the duplex PFCS/SFCS, the right side becomes the control side. In the single PFCS/SFCS, the green light is always on.

**COPY:** In the duplex PFCS/SFCS, the green light turns on when program copy is executed and turns off when program copy is completed.

When a processor card has been replaced or when the unit is stopped then started again, the standby-side processor card automatically copies the program of the control-side processor card.

When copy is completed, the light turns off. In the single PFCS/SFCS, the light is always off.

**START/STOP:** This maintenance switch is used for forcing stop or restarting the processor card CPU.

If this switch is pressed when the processor card is still operating, the CPU will stop. If this switch is pressed when the processor card is not operating, the CPU will restart.

This switch is located inside a hole next to the START/STOP sign. Push the switch using a slender bar of around 2 mm in diameter.

#### CN1 Connector:

Do not connect anything to the CN1 connector, since it is used for maintenance purposes only.

### 2.3.4 Bus Coupler Unit

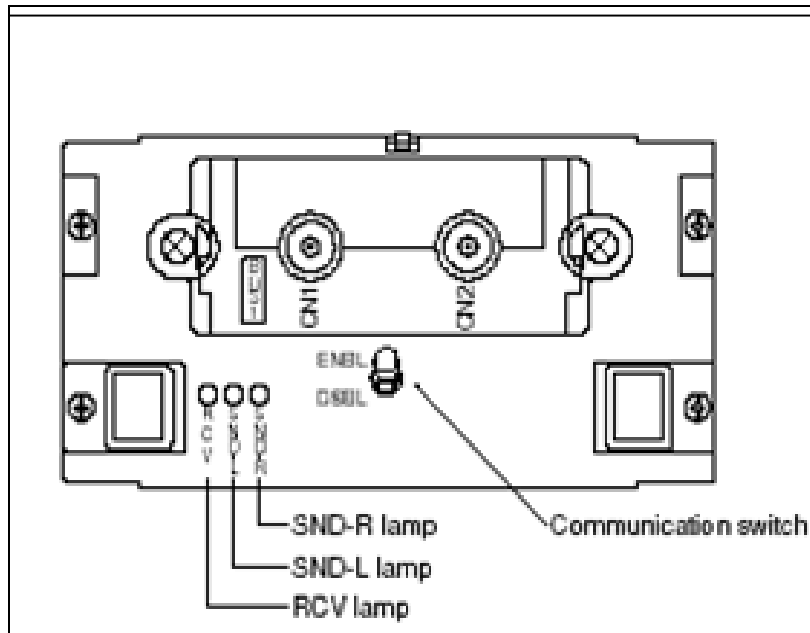


Figure: Bus Coupler Unit

The control bus coupler is located between the control bus cable and the PFCS processor card, and performs insulation and level conversion of control bus signals.

Either a single or duplex control bus coupler can be used

#### Status Lamps:

**RCV:** The green light turns on when the communication carrier is receiving signals from control bus. Otherwise, the lamp is off.

**SND-L:** The green light turns on when the processor card located on the left side of the PFCS/SFCS is sending data to control bus. Otherwise, the light is off.

**SND-R:** The green light turns on when the processor card located on the right side of the PFCS/SFCS is sending data to control bus. Otherwise, the light is off.

When the communication switch is tilted toward the DSBL side, all lamps are off.

### 2.3.5 Communication Switch:

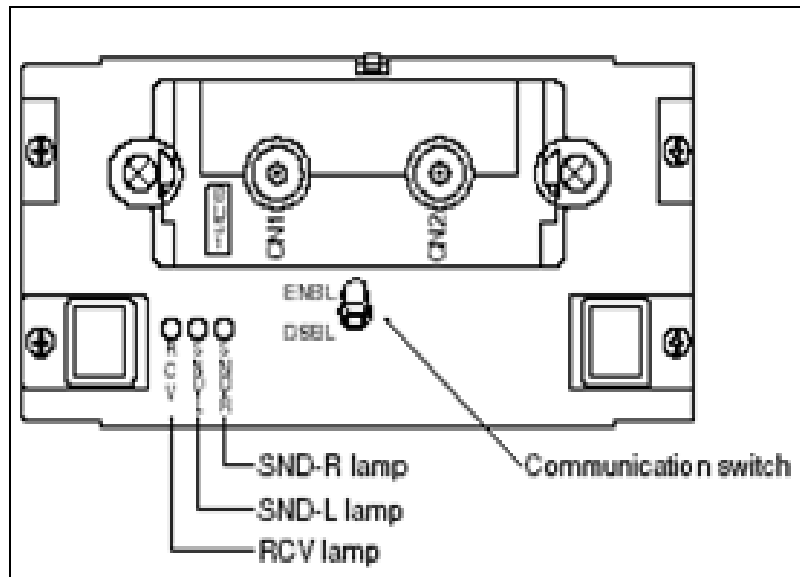


Figure: Communication Switch

**ENBL:** Performs communication with control bus. Set the switch in this position during normal operation.

**DSBL:** Set the switch in this position if communication with control bus is to be stopped. A lock-type switch is used for the toggle switch.

When switching, do so while pulling the knob forward. Tilt the switch upward to obtain the ENBL setting and downward to obtain the DSBL setting.

### 2.3.6 Power Distribution Board

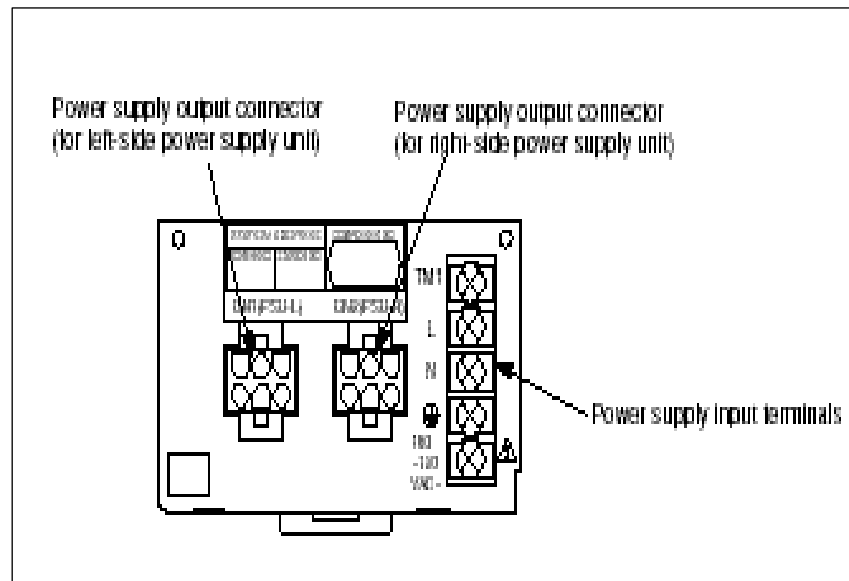


Figure: Power Distribution Board

- The power distribution board receives a specified power supply at the power supply input terminals, and outputs it through a noise filter to the power supply output connectors.
- To turn off the power to the cards, disconnect the power supply output connectors (CN1 and CN2) on the power distribution board.
- **TM1 terminals:** M4 screw terminals for power supply input
  - L: Ungrounded
  - N: Grounded
  - Protective grounding terminal: Ground
- **CN1 connector:** Power supply output connector- Connect the cable from the left-side power supply unit of a duplexed FCU.
- **CN2 connector:** Power supply output connector, Connect the cable from the right-side power supply unit.
- The maintenance connector (CHK) is used by a service engineer during maintenance work. Do not use this connector during normal operations.

### 2.3.7 Battery Unit

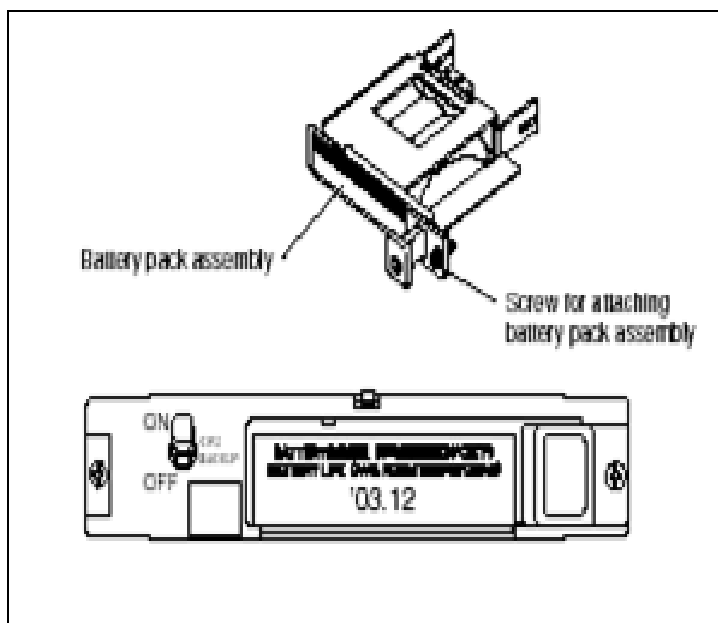


Figure: Battery unit

Part number battery pack is S9765UK. Battery Type: Cadmium Lithium

**Battery life:** Changes according to the ambient temperature.

- Three years if the average ambient temperature is 30 degree or less.
- One year and a half if the average ambient temperature is 40 degree or less.
- Nine months if the average ambient temperature is 50 degree or less.
- As for battery output, the left battery unit backs up the left CPU and the right battery unit the right CPU.
- In the single system, the battery unit is installed on the left side.

### 2.3.8 Application capacity of PFCD

	ITEMS	STANDARD	ENHANCED
CPU model		CP701	CP703
Process I/O	No. of I/O units	5	5
	No. of control loops	16	16
	Total no. of analog points	128	128
	Total no. of contact (Digital) I/O points	512	512
Communication I/O	Number of data (in 16-bit units)	1000	4000
Internal Switches	No. of common switches	1,000	1,000
Message Outputs	No. of annunciator message outputs	200	200
	No. of message outputs (print message, operator guide, message request, event)	100	100
Control Functions	No. of control drawings	50	50

---

### 2.3.9 Specifications of PFCD

- ⇒ **Maximum number of stations** : **256/System**
- ⇒ **Maximum number of domains** : **16/System**
- ⇒ **Numbering of domains** : **1 to 64**
- ⇒ **Domain number for CS3000 domain (V-net domain)** : **1 to 16**
- ⇒ **Domain number for Virtual Domain (Non V-net domain)** : **17 to 64**
- ⇒ **Maximum number of stations per domain** : **64**
- ⇒ **Maximum number of HIS per domain** : **16**
- ⇒ **Station number for HIS** : **1 to 64 in descending Order**
- ⇒ **Station number for FCS** : **1 to 64 in ascending Order**
- ⇒ **Maximum number of I/O nests per PFCS** : **5**
- ⇒ **Maximum length of VL-net** : **185 m**
- ⇒ **Maximum length of VL-net with optical adapters** : **20 Km**
- ⇒ **VL net can be interfaced with V net using 10 base 2 to 10 base 5 convertor.**



## 2.4 Field Control Station for Remote Input Output (RIO) - LFCS

This FCS uses the Remote I/O (RIO) modules, which have many installation bases and M4 screw terminals to connect signal cables.

According to the application capacity, there are

- a) Standard Type FCS for RIO - Large FCS (LFCS) – AFS10D, AFS20D
- b) Enhanced Type FCS for RIO – Large FCS2 (LFCS2)

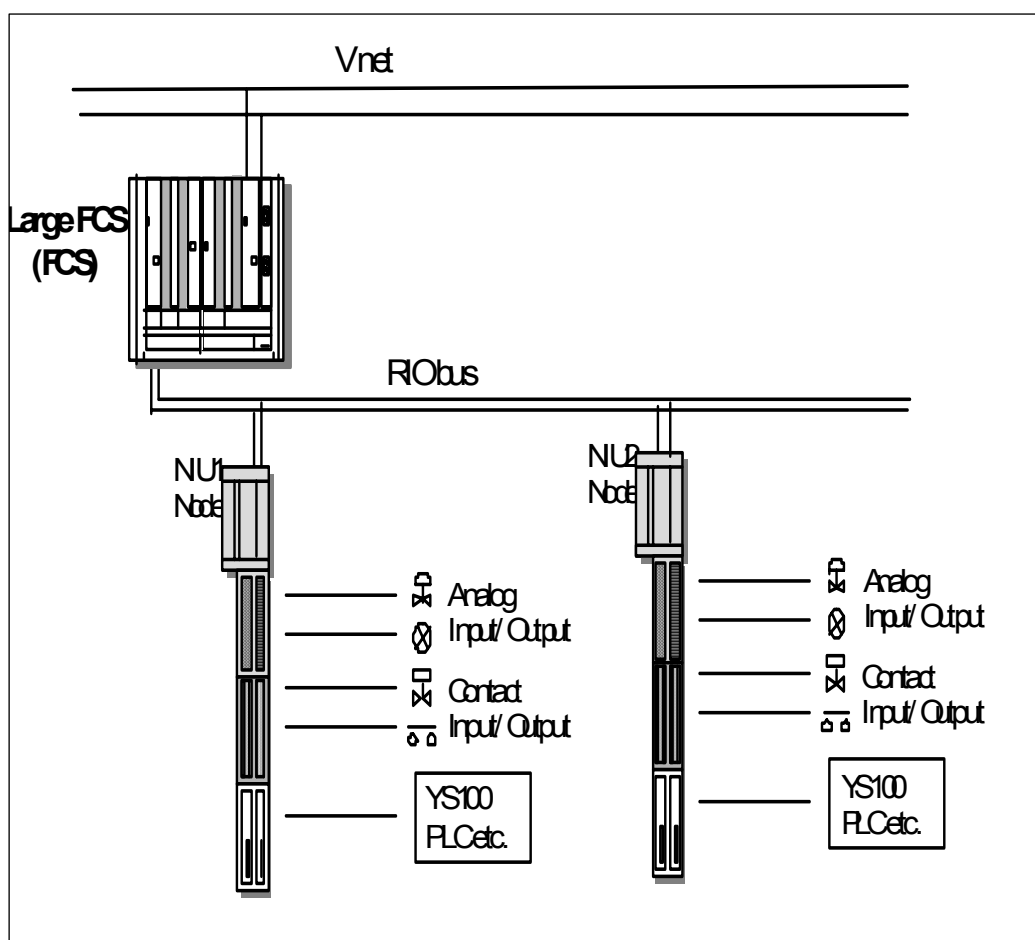


Figure: Large Field Control Station

### Components of LFCS

- a) Field Control Unit (FCU)
- b) Node Interface Unit (NIU)
- c) Input Output Unit(IOU)/ Input Output nest.
- d) RIO or Remote IO bus is used to communicate between Nodes and the FCU.

## 2.4.1 Field Control Unit (FCU)

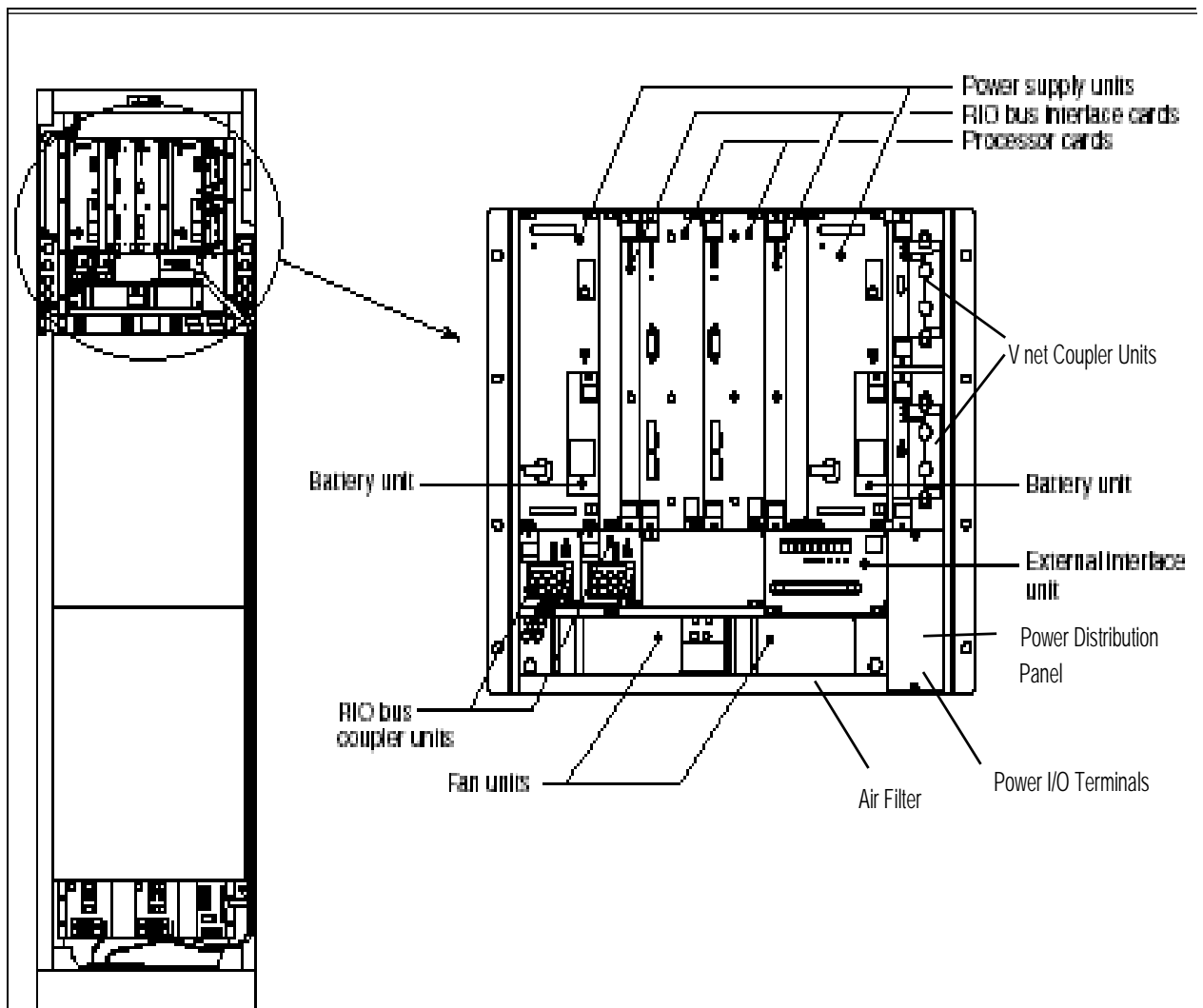


Figure: Field Control Unit (FCU)

### Details of Field Control Unit (FCU):

- The FCU for RIO consists of **two processor cards, two power supply units** along with battery units and **two RIO bus interface cards**.
- Two V net coupler units are available for connecting V net cables. Two RIO Bus Coupler units are available for connecting RIO Bus Cables.
- V net is a coaxial cable and RIO Bus is a twisted pair cable.
- Additionally, the FCU also consists of Power I/O terminal to connect the main power for the FCU.
- Power distribution panel to distribute power to the Power Supply units.
- Fan units to maintain FCU temperature and air filters to filter dust.

## 2.4.2 Node Interface Unit (NIU)

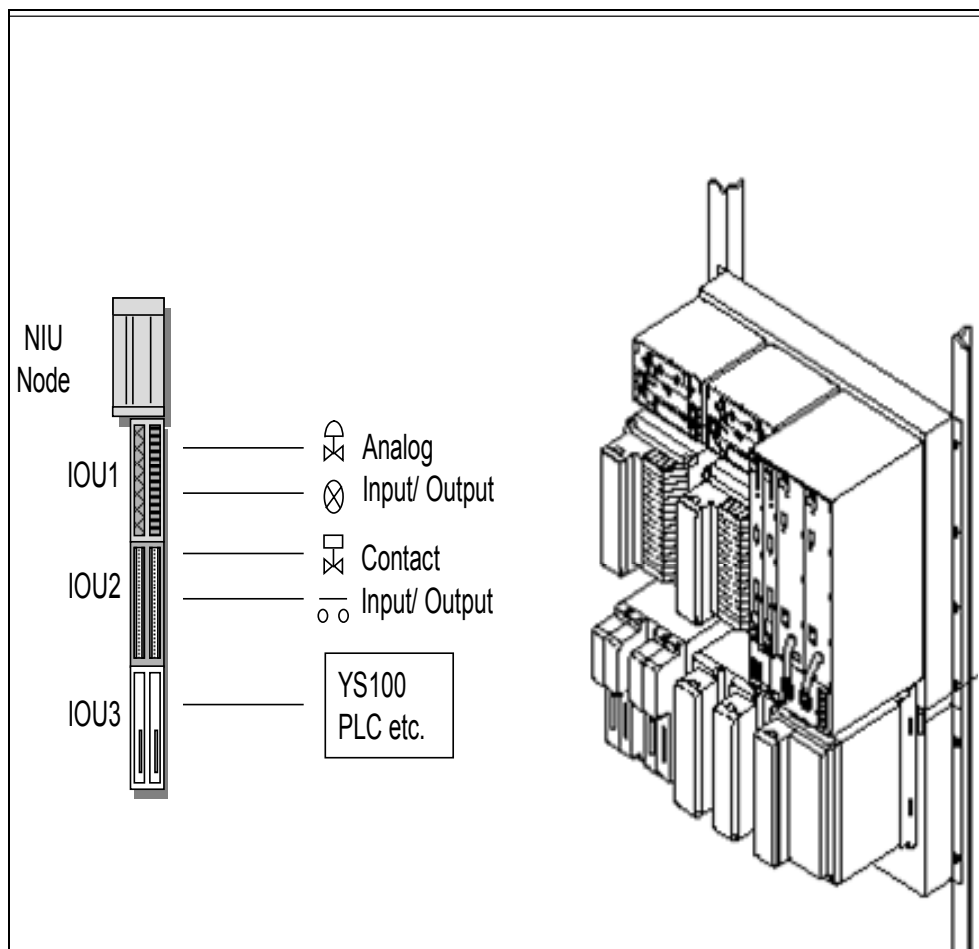


Figure: Node Interface Unit of LFCS

### Details of Node Interface Unit (NIU)

#### Nodes

A node consists of I/O Units, which interface with analog and digital field signals, and Node Interface Units which communicate via the RIO Bus with Field Control Units (FCU).

#### Node Interface Units (NIU)

Node Interface Units consist of RIO bus communication cards and power supply cards, both of which can be dual redundant.

#### I/O Units (IOU)

I/O units consist of I/O Module Nests containing I/O Modules, which connect to the process.

---

**Specifications:**

Maximum Number of Nodes or NIU's connected to one FCU	: 8
Maximum Number of I/O Units connected to each Node	: 5
Maximum Number of I/O units connected to one LFCS	: $8 \times 5 = 40$

**Arrangement of Components in LFCD**

In LFCD, the CPU redundancy and RIO Bus redundancy options are available.

The 19" Rack mounting and cabinet mounting versions of LFCS are available.

**Dedicated cabinets Mounted FCS**

- One FCU along with three nodes and up to four IO units in each node can be mounted on the front side of the FCS.
- Up to three nodes and up to five IO units in each node can be mounted on the rear side of the FCS.

**In I/O Expansion cabinets**

- Up to three nodes and up to five IO units in each node can be mounted on the front side of the cabinet.
- Up to three nodes and up to five IO units in each node can be mounted on the rear side of the cabinet.

**Rack Mounted FCS**

Up to five I/O Units may be connected to one node. They may be mounted in the same general-purpose 19-inch rack.

### 2.4.3 Remote Input Output Bus

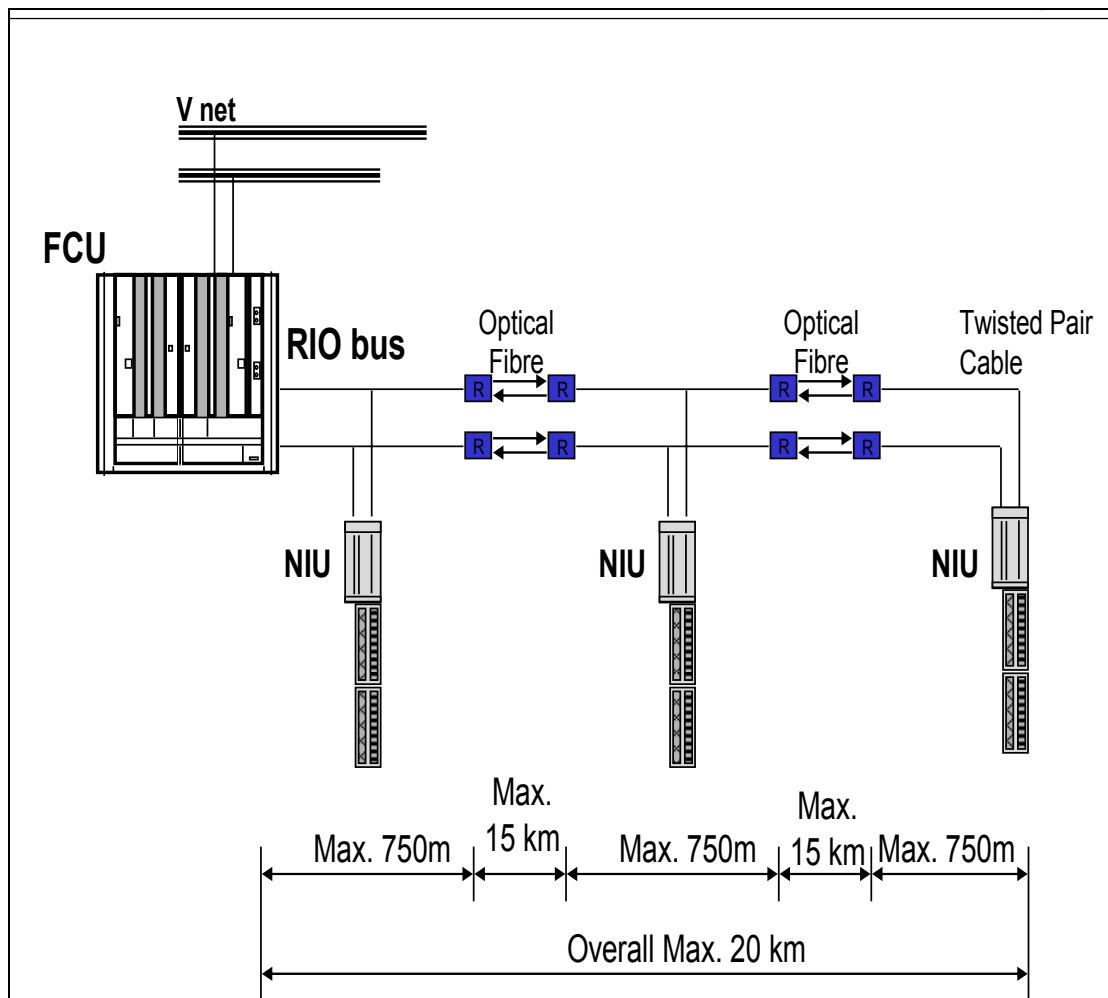


Figure: Remote Input-Output Bus

#### Details of Remote Input output Bus

- The Remote IO or RIO Bus connects the FCU to the I/O nodes and can be dual redundant. I/O nodes need not be always in the FCU cabinet. They can also be mounted remotely.
- Maximum length of RIO Bus is 750 m. However the RIO bus can be extended to 20 Kms with the help of Optical adapters.
- Shielded twisted pair cable is used for distances up to 750m.
- Bus repeaters and optical fiber links can be used for longer distances up to 20 Km. Bus repeaters and optical fiber links can be mixed, up to four in total.

## 2.4.4 Hardware Configuration of LFCD

CARD UNIT/ MODEL	FIELD CONTROL UNIT LFCS	DUPLEXED FIELD CONTROL UNIT LFCD
POWER SUPPLY UNIT (100– 120V AC)	PW301 1 no.	PW301 2 nos.
POWER SUPPLY UNIT (220- 240 V AC)	PW302 1 no.	PW302 2 nos.
POWER SUPPLY UNIT (24 V DC)	PW304 1 no.	PW304 2 nos.
PROCESSOR CARD	CP345D 1 no.	CP345D 2 nos.
RIO BUS INTERFACE CARD	RB301 1 no.	RB301 2 nos.
VNET COUPLER UNIT	AIP502 2 nos.	AIP502 2 nos.
RIO BUS COUPLER UNIT	AIP512 1 or 2 nos.	AIP512 2 nos.

## 2.4.5 Hardware Specification:

**Processor card:** This performs control operations. There are two types of processor cards:

CP333D with 16 MB RAM and CP334D with 12MB RAM.

### Status Lamps on the Processor Card

**HRDY:** The processor card performs self diagnosis. If the processor card hardware is functioning normally, the green light turns on. If abnormality is found, the light turns off.

**RDY:** The green light turns on if both the hardware and software are functioning normally. If either of them is abnormal, the light turns off.

**CTRL:** In the duplex LFCD, the green light turns on if the processor card is the control side and turns off if it is the waiting side. When starting up the duplex LFCD, the right side becomes the control side. In the single LFCS, the green light is always on.

**COPY:** In the duplex LFCD, the green light turns on when program copy is executed and turns off when program copy is completed.

When a processor card has been replaced or when the unit is stopped then started again, the standby-side processor card automatically copies the program of the control-side processor card. When copy is completed, the light turns off. In the single LFCS, the light is always off.

**START/STOP:** This maintenance switch is used for forcing stop or restarting the processor card CPU. If this switch is pressed when the processor card is still operating, the CPU will stop.

If this switch is pressed when the processor card is not operating, the CPU will restart. This switch is located on the CP card.

### CN1 Connector:

It is used for maintenance purposes only.

## 2.4.6 Synchronous Hot-Standby System

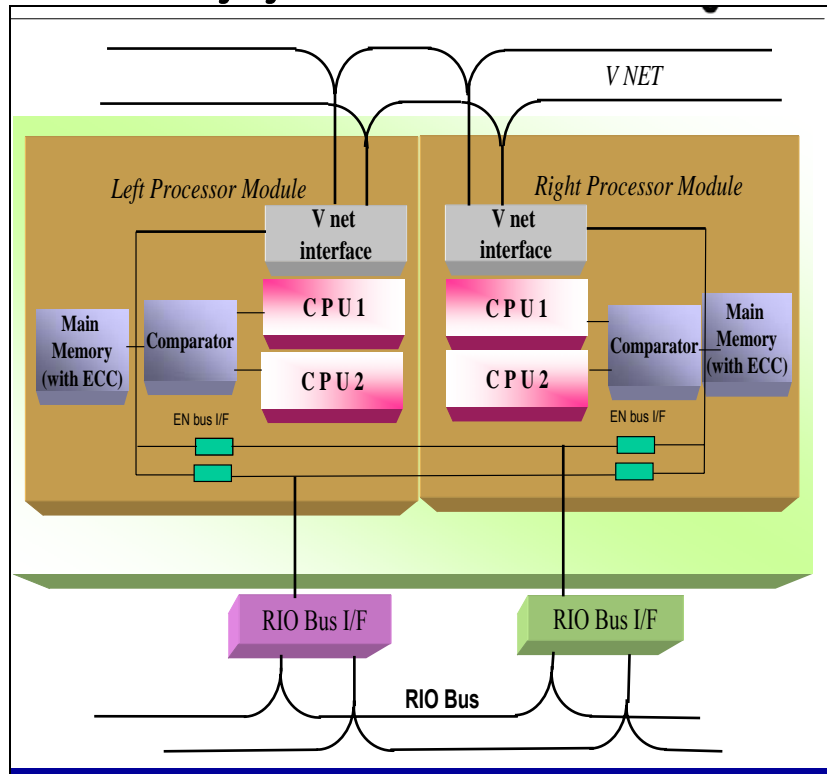


Figure: Synchronous Hot-Stand System

- There are two processors on each processor card. Each CPU performs the same control computations, and the results are compared after each computation.

If the results agree, then the card is assumed to be normal and the results are transferred to memory and bus interface card. The main memory uses ECC (error-correcting code) which can correct transient reversed-bit errors.

- If the results from CPU1 and CPU2 do not agree, then the comparator takes this as “CPU abnormal” and switches to the standby processor card.
- A Watch Dog Timer is used to detect if the active processor card is abnormal, which results in a switch from active to standby processor card.
- The standby processor card will be performing the same computations as the active card, and when it is switched to active status then the results it has just computed are transferred to the bus interface. There is no interruption in control.
- If a “CPU abnormal” error is detected in a CPU card, a self-diagnostic check is performed on the card. If the hardware is not abnormal, then the error is treated as a transient error and the card reverts back from “abnormal” to “standby” status.
- The V net and V net interface are dual redundant.



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## **RIO Bus Interface Card**

- **Dual-redundant (RB301) RIO bus interface cards can be installed in the FCU.**
- **The two cards are controlled by the software residing in the active CPU to determine their active and standby status. Normally the card on the active CPU side is given the active status and the other card the standby status.**
- **The standby side “Sleeps” and performs only diagnostic communications.**
- **Dual-redundant RIO buses are used alternately, if an abnormality is detected in one bus then the other is used. The abnormal bus is tested periodically to see if it has returned to normal.**

## 2.4.7 Bus Coupler Unit

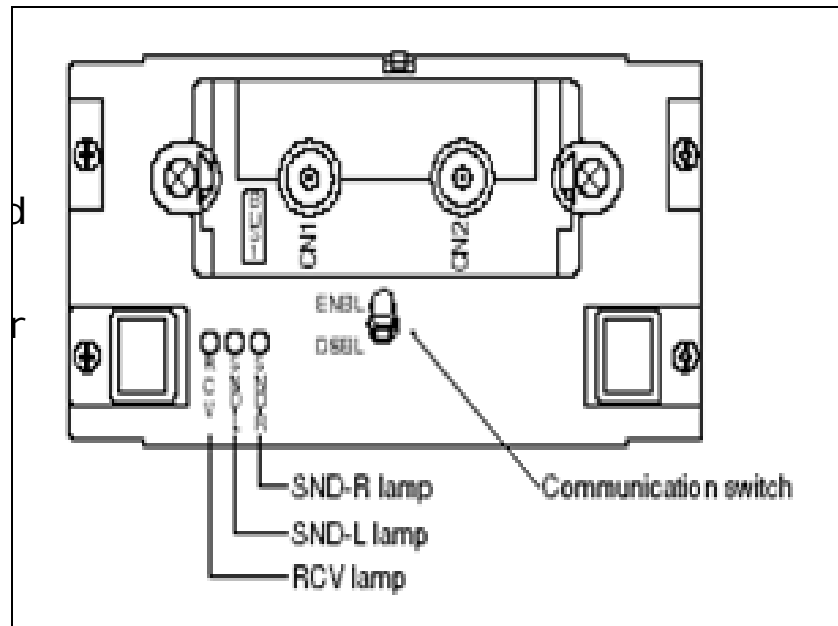


Figure: Bus Coupler Unit

The control bus coupler is located between the control bus cable and the LFCD processor card, and performs insulation and level conversion of control bus signals. Redundancy option is present.

### Status Lamps:

**RCV:** The green light turns on when the communication carrier is receiving signals from control bus. Otherwise, the lamp is off.

**SND-L:** The green light turns on when the processor card located on the left side of the LFCD is sending data to control bus. Otherwise, the light is off.

**SND-R:** The green light turns on when the processor card located on the right side of the LFCD is sending data to control bus. Otherwise, the light is off.

When the communication switch is tilted toward the DSBL side, all lamps are off.

### Communication Switch:

**ENBL:** Performs communication with control bus. Set the switch in this position during normal operation.

**DSBL:** Set the switch in this position if communication with control bus is to be stopped. A lock-type switch is used for the toggle switch.

When switching, do so while pulling the knob forward. Tilt the switch upward to obtain the ENBL setting and downward to obtain the DSBL setting.

## 2.4.8 Power Distribution Board

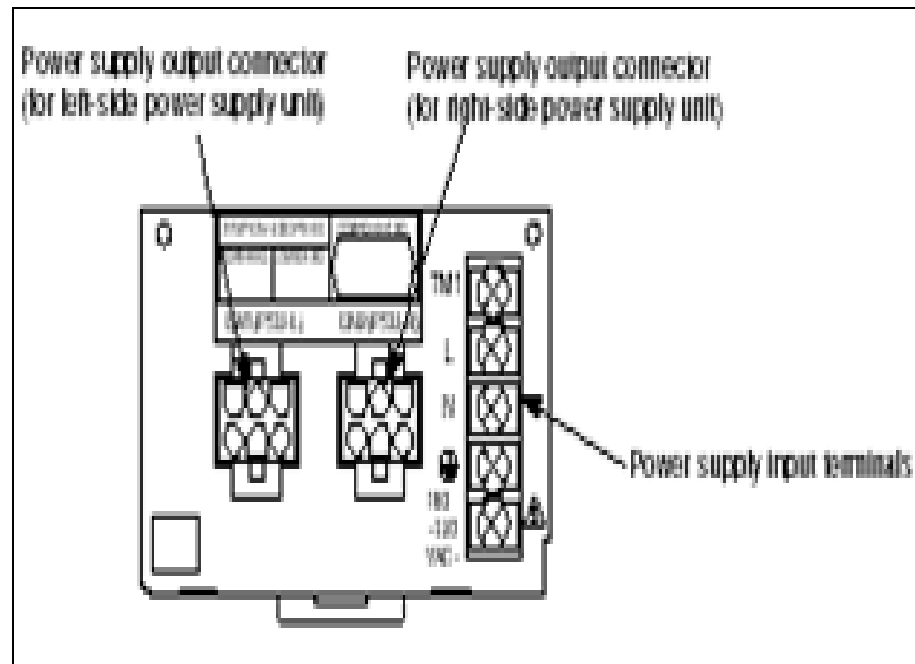


Figure: Power Distribution Board

The power distribution board receives a specified power supply at the power supply input terminals, and outputs it through a noise filter to the power supply output connectors.

To turn off the power to the cards, disconnect the power supply output connectors (CN1 and CN2) on the power distribution board.

### Details of the P.D Board

- **TM1 terminals:** M4 screw terminals for power supply input
- **L :** Ungrounded
- **N :** Grounded
- **Protective grounding terminal :** Ground
- **CN1 connector:** Power supply output connector, Connect the cable from the left-side power supply unit of a duplexed FCU.
- **CN2 connector:** Power supply output connector, Connect the cable from the right-side power supply unit.
- **The maintenance connector (CHK):** this is used by a service engineer during maintenance work. During normal operations, this connector is not used.

## 2.4.9 Battery unit

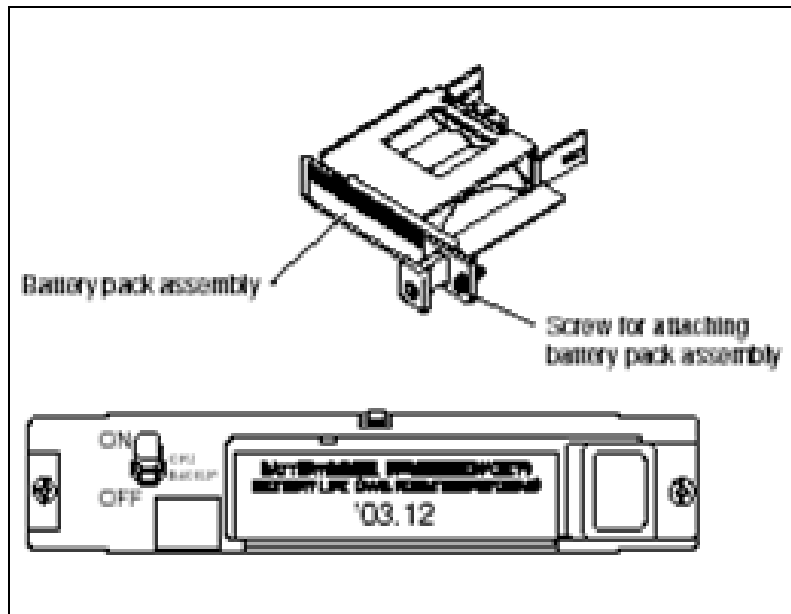


Figure: Battery Unit

**Details of Battery** (Part number battery pack is S9765UK).

**Battery life:** changes according to the ambient temperature.

- Three years if the average ambient temperature is 30 degree or less.
- One year and a half if the average ambient temperature is 40 degree or less.
- Nine months if the average ambient temperature is 50 degree or less.

**Battery output:** The left battery unit backs up the left CPU and the right battery unit the right CPU. In the single system, the battery unit is installed on the left side.

**Battery Type:** Cadmium Lithium. Battery backup is for 72 hours and charging time is for 48 hours.

### 2.4.10 Application Capacity of LFCS

Items		Max. capacity LFCS
<b>Process I/O</b>	Total of analog I/O points	1280
	Total of contact I/O points	4096
<b>Communication I/O</b>	Data volume (in 16 bit units)	4000
<b>Internal switch</b>	No. of common switches	4000
	No. of global switches	256
<b>Message output</b>	No. of annunciator messages	500
	No. of messages (print, operator guide, request, event)	200
<b>Control function</b>	No. of control drawings	200
	No. of function blocks	8000

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### 2.4.11 Specifications of LFCS

<b>Maximum number of stations connected on the V net</b>	<b>: 256/System</b>
<b>Maximum number of domains configured in CS3000</b>	<b>: 16</b>
<b>Numbering of domains</b>	<b>: 1 to 64</b>
<b>Numbering of V-net domain</b>	<b>: 1 to 16</b>
<b>Domain number for Virtual Domain or Non V-net domain</b>	<b>: 17 to 64</b>
<b>Maximum number of stations per domain are</b>	<b>: 64</b>
<b>Maximum number of HIS per domain</b>	<b>: 16</b>
<b>Numbering of HIS (in descending order) of FCS (in ascending order)</b>	<b>: 1 to 64 Numbering : 1 to 64</b>
<b>Maximum length of V-net(without repeaters)</b>	<b>: 500 m</b>
<b>Maximum Length of V-net(with optical adapters)</b>	<b>: 20 Km</b>

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## 2.4.12 Process Input Output Module

Input modules convert process signals to the digital data format used in the FCS. Output modules convert the digital data format used in the FCS to analog or contact signals.

Using process inputs/outputs, an FCS can receive signals from process detectors and output signals to process control elements.

Process inputs/outputs are used to exchange signals between field equipment and an FCS.

There are different types of process inputs/outputs:

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

**Analog Inputs:** Analog inputs are the DC current or DC voltage analog signals from the field equipment connected to the FCS. The following types of signal can be used as Analog inputs.

- Current Input
- Voltage Input
- mV Input
- Thermocouple Input
- Resistance Temperature Detector Input
- Potentiometer Input
- Pulse Input

All the data passed into the IOM is transmitted to PI/O image of the processor unit and accessed at the beginning of every basic scan cycle or high-speed scan cycle of the function blocks.

**Analog Output:** Analog outputs, an FCS can output analog signals to field equipment. Analog output is the DC current or DC voltage analog signals output from FCS to the field equipment.

The following types of signal can be used as analog outputs.

- Current Output
- Voltage Output

**Digital IOM:** Digital I/O modules are also referred as Contact I/O modules. Using contact inputs/outputs, an FCS can receive and output ON/OFF signals from and to field equipment.

Contact inputs/outputs are process inputs/outputs which can handle ON/OFF signals such as DC voltages and currents.

The ON/OFF signal is a digital value of either 0 or 1, which together with an indication of the quality of that value, shows the status of the process data item.

**Contact Input Modules** are classified into the following two types according to the input signal.

- ✓ **Status Input Module:** This is used for monitoring the status of contact inputs. ON/OFF status of input contact signals is used as the measured value (raw data).
- ✓ **Pushbutton Input Module:** This is used for the input signal from pushbutton switches where the signal status changes from ON to OFF or vice versa is momentary.

**Contact Output Modules** are classified into the following three types

- ✓ **Status Output**
- ✓ **Pulse-Width Output**
- ✓ **Time-Proportioning On/Off Output**



### 2.4.13 RIO IOM Nest

The RIO modules are used in the FCS for RIO and Compact FCS. They are designed basically by the isolated channels and M4 Screw connections.

The RIO modules are installed in the I/O module nests.

The following type of I/O Nests is available for RIO type FCS.

**AMN11:** Nest for Analog I/O Modules

**AMN12:** High-Speed Nest for Analog I/O Modules (for LFCS only)

**AMN21:** Nest for Relay I/O Modules

**AMN31:** Nest for Terminal-type I/O Modules

**AMN32:** Nest for Connector-Type I/O Modules

**AMN33:** Nest for Communication Modules

**AMN34:** Nest for Multipoint Analog I/O Modules

### 2.4.14 Analog Input Output Modules

#### IOMs in the Nest AMN11

Current/Voltage Input	(AAM10/AAM11/AAM11B)
Multi-point Control Analog I/O Module	(AMC80)
mV, Thermocouple, RTD Input	(AAM21/AAM21J)
Pulse Input	(APM11)
Current Output Module	(AAM50)
Current/Voltage Output	(AAM51)

## Multipoint Control Analog I/O Module

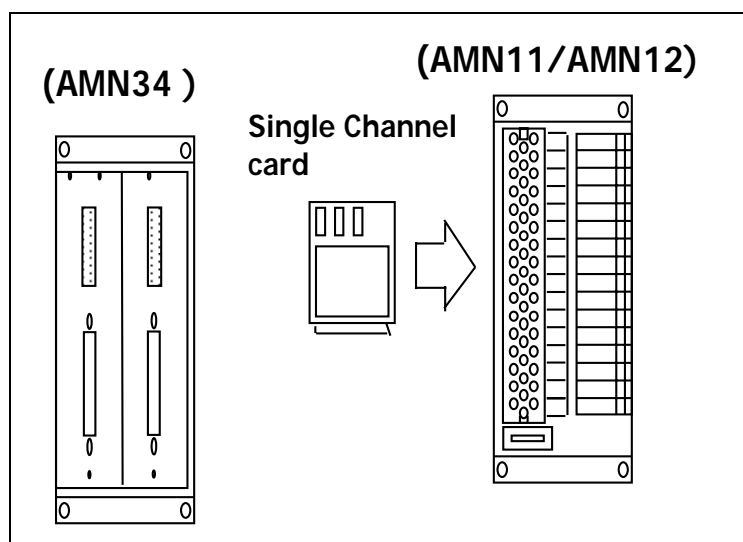
AMC80 Multipoint Control Analog I/O Module is installed in the Nest for Multipoint Control Analog I/O Modules (AMN34).

Up to two modules can be installed in one nest. One module can process 8 inputs and outputs for control.

Two modules installed in one nest may separately process different inputs and outputs or be dual-redundant.

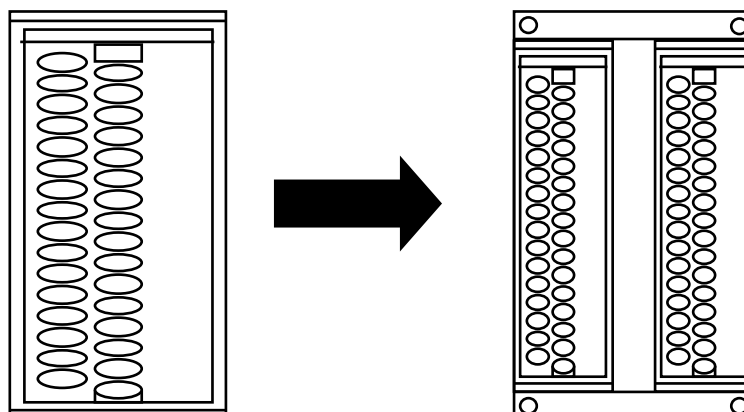
A KS1 cable connects the module to the MHM Signal Conditioner Nest. The field input signals are connected to the MHM Signal Conditioner Nest.

### Multi channel Card AMC80



## Multiplexer I/O module

### Multiplexer Nest



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## Types of Multiplexer IOM:

There are two types of multiplexer IOMs based on signal connectivity.

- 1) Terminal type                      2) connector type

### Terminal Type Multiplexer I/O Module

The terminal type multiplexer module is installed in the Nest for Terminal type I/O module (AMN31).

Up to two modules can be installed in one nest. Signal cables from the field devices are connected through M4 screws on the terminals of the I/O module.

Two or three signal cables are connected for each I/O channel.

### Connector Type Digital I/O Module

The Connector Type multiplexer Module is installed in the Nest for connector type I/O Modules (AMN32).

Up to four modules can be installed in one nest. Using a KS2 or a KU2 cable, it is connected to the Signal Conditioner Nest, MUB/MUD Terminal Board or TE16/TE32 Terminal Block.

Signal cable from field devices are connected by M4 screws to the terminal board or terminal block.

### Multiplexer Input Output Modules

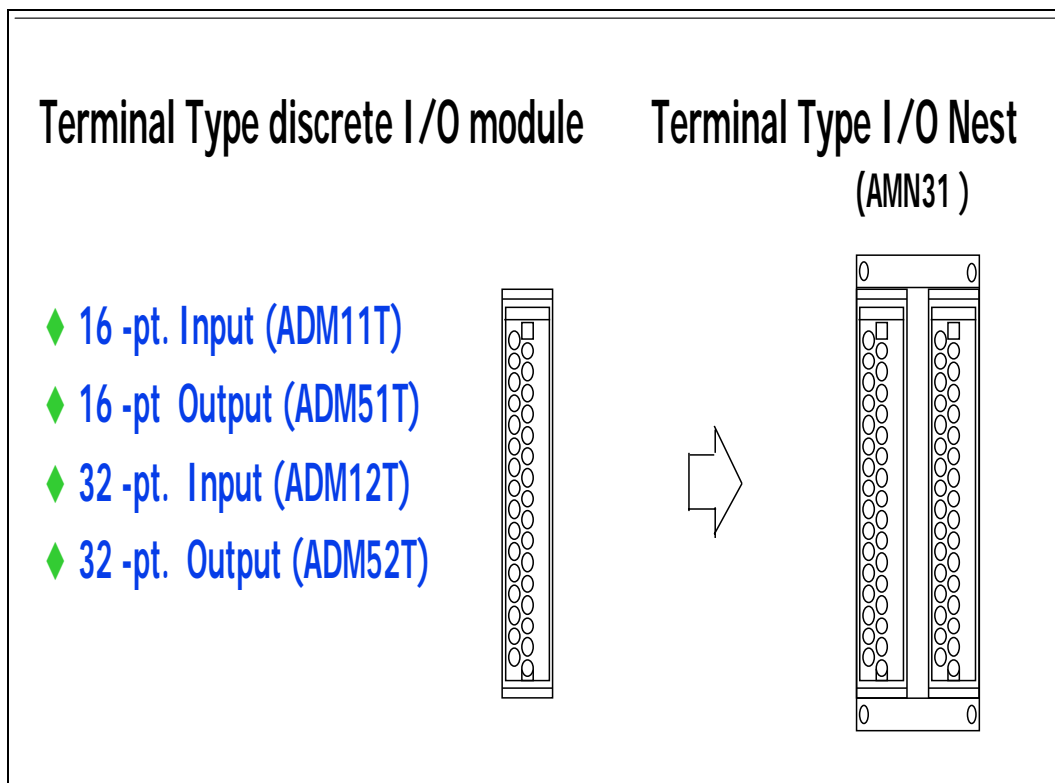
Voltage Input	(AMM12T/AMM12C)
Thermocouple Input	(AMM22T)
RTD Input	(AMM32T/AMM32C)
Thermocouple Input	(AMM22T/AMM25C)
2 wire Transmitter Input	(AMM42T)
Current Output	(AMM52T)
mV Input	(AMM22M/AMM22C)

### 2.4.15 Digital Input Output modules:

There are two types of Digital Input Output Modules based on signal connectivity.

- 1) Terminal type                      2) connector type

#### Terminal Type IOM



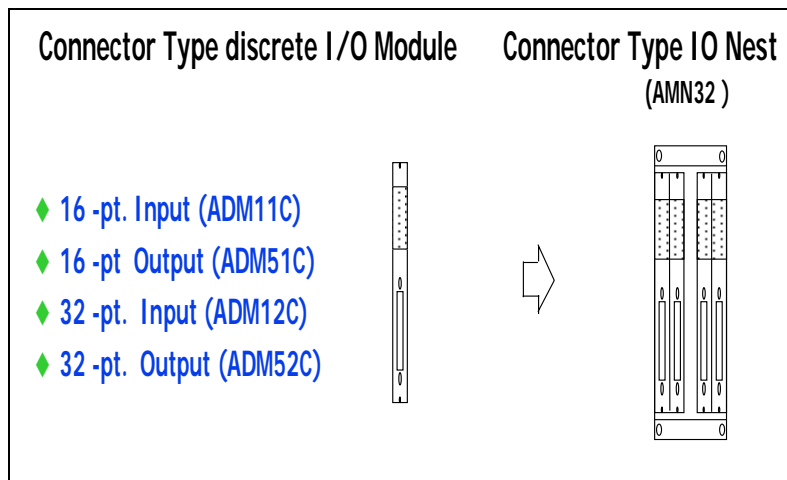
Terminal type and connector type Digital I/O modules are supported by RIO type FCS.

Up to two terminal types digital I/O modules can be installed in one AMN11 Nest for Terminal type I/O modules.

In terminal type module, individual signal cables from the field devices are connected through M4 screws terminals on the terminals of the I/O module.

For each I/O Channel, one or two signal cables are connected.

## Connector Type Digital I/O Module



The Connector Type Digital I/O Module is installed in the Nest for connector type I/O Modules (AMN32). Up to four connector type digital I/O modules can be installed in one nest.

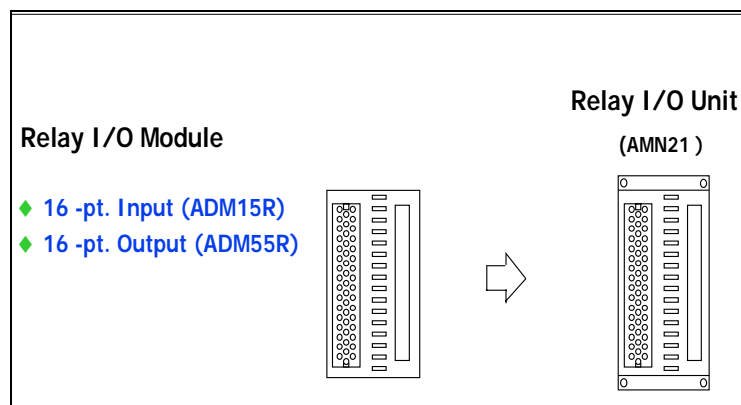
To connect to the MUB/MUD Terminal Board or TE16/TE32 Terminal Block, a KS2 cable is used for ADM11C and ADM51C 16-point modules and a KS9 cable for ADM12C and ADM52C 32-point modules.

Signal cable from field devices are connected by M4 screws to the terminal board or terminal block. One or two signal cables are connected to each I/O channel.

## 2.4.16 Relay I/O Module

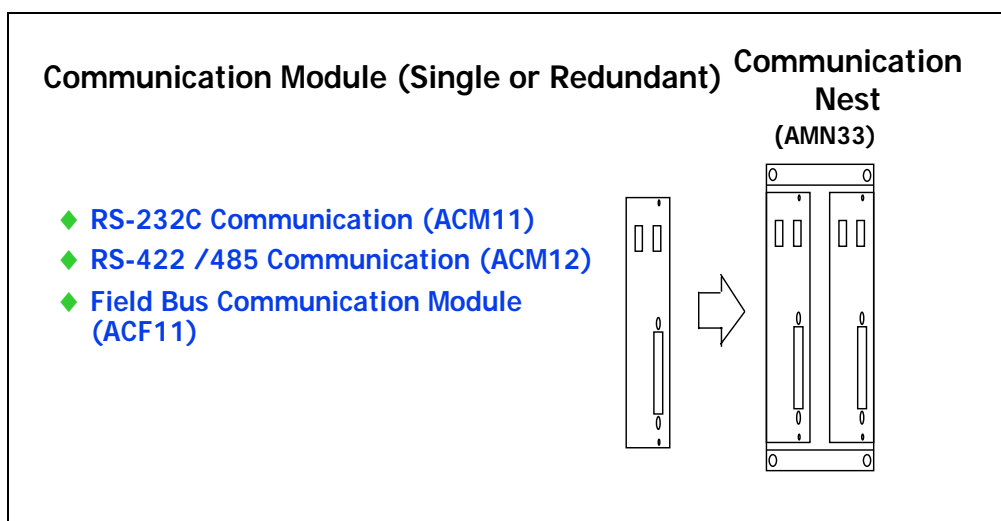
The relay I/O module is installed in the Nest for Relay I/O modules (AMN21). Only one module can be installed in one nest.

Signal cables are connected to the terminals of the module with M4 screws. Two or three signal cables are connected for each I/O channel.



## Communication Input Output Modules

Communication I/O modules are used for RS232c or RS422 communication.

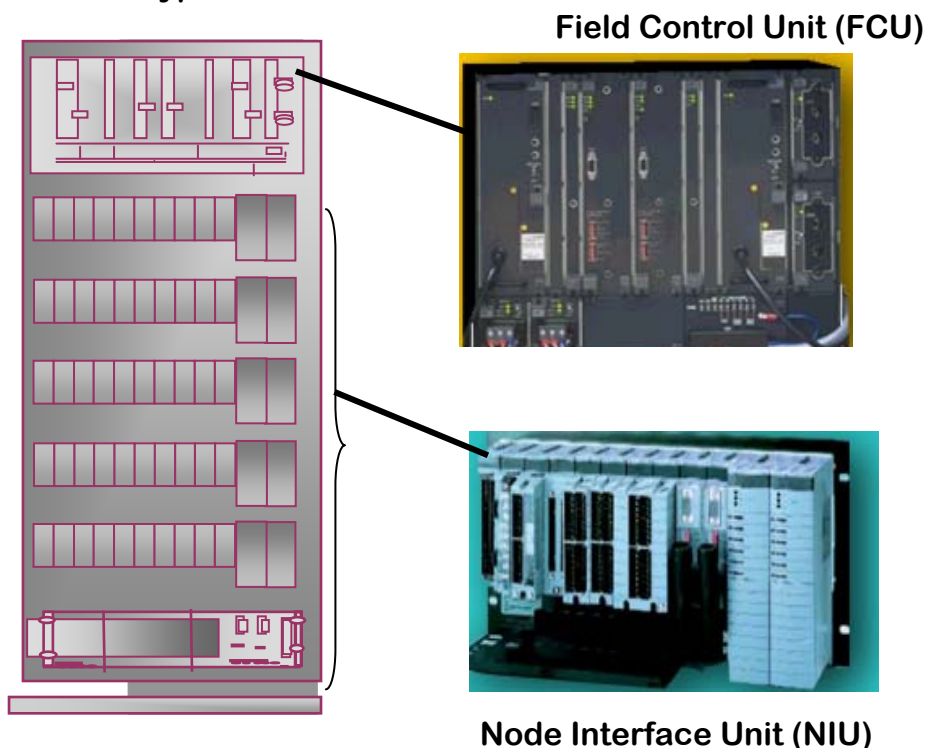


## 2.5 Field Control Station for Field Input Output (FIO) - KFCS

This FCS uses the Field network I/O (FIO) modules, which are compact and consist of various lineup such as the connector types and so forth.

According to the application Capacity, there are

- a) Standard Type FCS for FIO – KFCS
- b) Enhanced Type FCS for FIO - KFCS2



**Figure: System Configuration of Field Input Output (KFCS)**

The image shows the system configuration of KFCS. KFCS supports Field Network I/O referred to as FIO.

The FCS for FIO is composed of an FCU, ESB Bus, ER Bus and node units.

**CPU architecture: Single or Duplexed**

**Mounting: Cabinet mounting or rack mounting**

**ESB Bus: Single or dual redundant**

**ER Bus: Single or dual redundant**

Up to 10 node units can be connected to the FCU for standard FCS and up to 15 for enhanced FCS. Up to 8 I/O modules can be installed in each node unit.

**In Dedicated Cabinet:** 1 FCU and 5 node units can be placed on the front and 4 node units can be placed in the rear side of the cabinet.

**In I/O Expansion Cabinet:** 1 FCU and 4 node units can be placed on the front and 4 node units can be placed in the rear side of the cabinet.

### 2.5.1 Configuration of KFCS

The table shows the hardware configuration of KFCS.

<b>CARD UNIT/ MODEL</b>	<b>Field Control Unit</b>	<b>Duplex Field Control Unit</b>
POWER SUPPLY UNIT (100 – 120 V AC)	PW301 1 no.	PW301 2 nos.
POWER SUPPLY UNIT (220 - 240 V AC)	PW302 1 no.	PW302 2 nos.
POWER SUPPLY UNIT (24 V DC)	PW304 1 no.	PW304 2 nos.
PROCESSOR CARD	CP345 1 no.	CP345 2 nos.
ESB BUS INTERFACE CARD	SB311 1 no.	SB311 2 nos.
VNET COUPLER UNIT	AIP502 2 nos.	AIP502 2 nos.
ESB BUS COUPLER UNIT	AIP511 1 or 2 nos.	AIP511 2 nos.



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## 2.5.2 Component Details of KFCS

The FCU consists of control cards and I/O cards and executes control computation for the FCS.

For the duplexed FCU, the processor cards are duplexed and power units, battery units and ESB Bus interface cards are dual redundant.

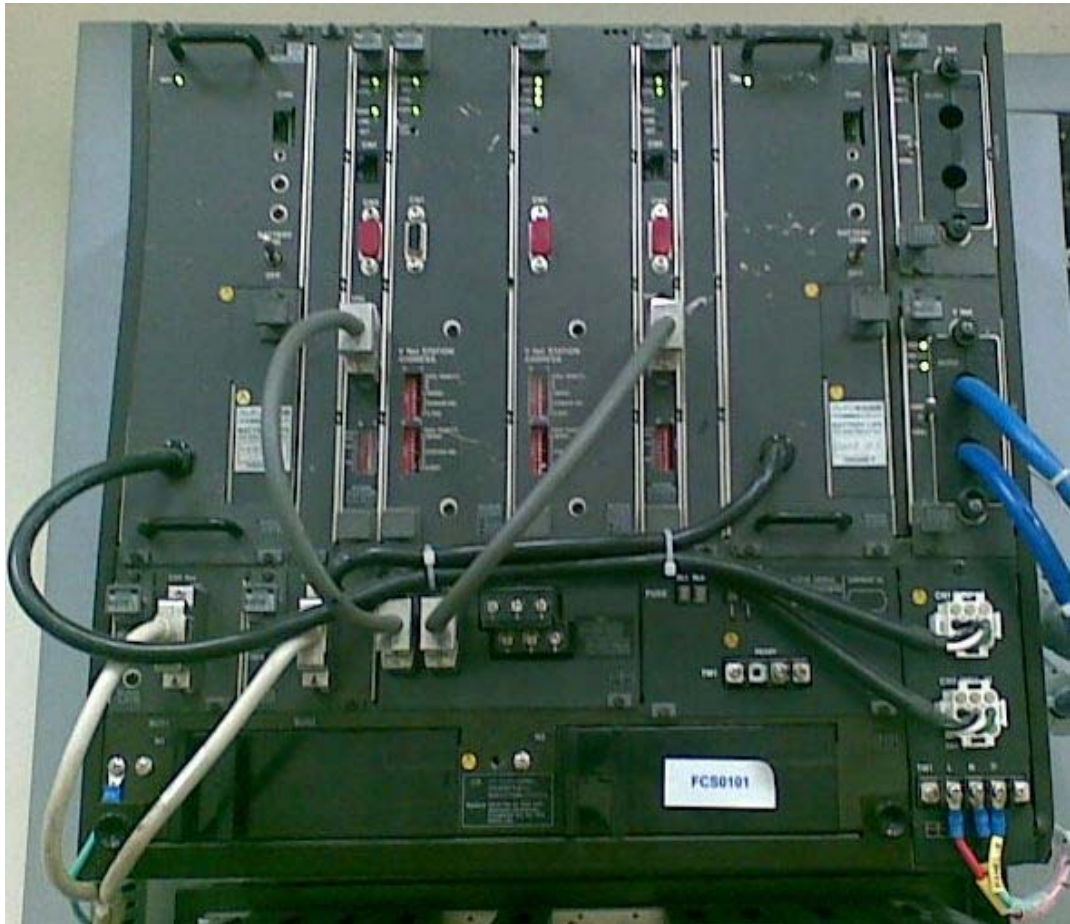


Figure: Field Control Unit (FCU) of KFCS

## 1) Control Processor Unit

Processor card performs control operations. The model of the processor card used in KFCS is CP345 with 16 MB RAM.

### Status Lamps:

**HRDY:** The processor card performs self diagnosis. If the processor card hardware is functioning normally, the green light turns on. If abnormality is found, the light turns off.

**RDY:** The green light turns on if both the hardware and software are functioning normally. If either of them is abnormal, the light turns off.

**CTRL:** In the duplex KFCS, the green light turns on if the processor card is the control side and turns off if it is the waiting side. When starting up the duplex KFCS, the right side becomes the control side.

**COPY:** In the duplex KFCS, the green light turns on when program copy is executed and turns off when program copy is completed.

When a processor card has been replaced or when the unit is stopped then started again, the standby-side processor card automatically copies the program of the control-side processor card. When copy is completed, the light turns off.

**START/STOP:** This maintenance switch is used for forcing stop or restarting the processor card CPU. If this switch is pressed when the processor card is still operating, the CPU will stop.

If this switch is pressed when the processor card is not operating, the CPU will restart. This switch is located inside a hole next to the START/STOP sign.

Push the switch using a slender bar of around 2 mm in diameter.

### CN1 Connector:

Do not connect anything to the CN1 connector, since it is used for maintenance purposes only.

### 2.5.3 Dual Redundant Configuration of KFCS

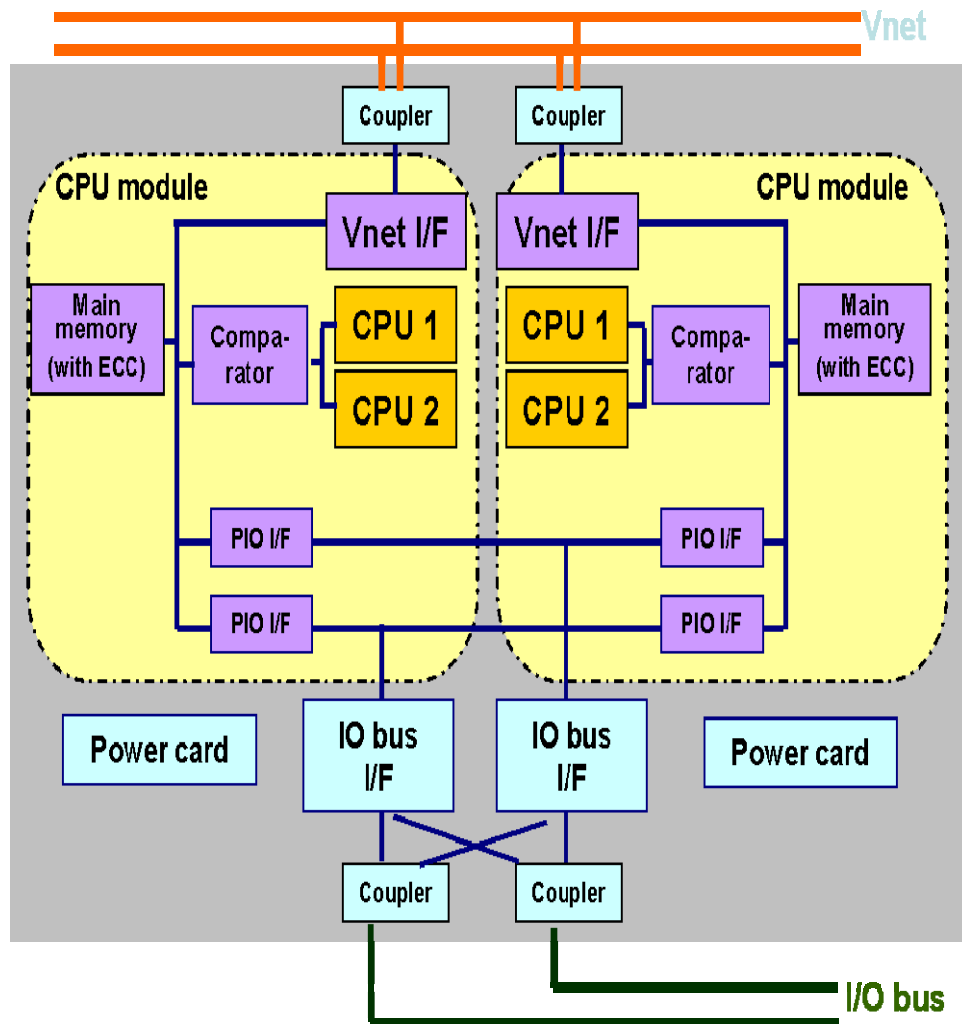


Figure: Dual Redundant Configuration of KFCS

The FCS for FIO is equipped with ESB bus interface cards and couplers for its nodes.

#### CPU

- There are two processors on each processor card. Each CPU performs the same control computations, and the results are compared after each computation.
- If the results agree, then the card is assumed to be normal and the results are transferred to memory and bus interface card.

- 
- The main memory uses ECC (error-correcting code) which can correct transient reversed-bit errors.
  - If the results from CPU1 and CPU2 does not agree, then the comparator takes this as “CPU abnormal” and switches to the standby processor card.
  - A watch Dog Timer is used to detect if the active processor card is abnormal, which results in a switch from active to standby processor card.
  - The standby processor card is performing the same computations as the active card, and when it is switched to active status then the results it has just computed are transferred to the bus interface. There is no interruption in control.
  - If a “CPU abnormal” error is detected in a CPU card, a self-diagnostic check is performed on the card.
  - If the hardware is not abnormal, then the error is treated as a transient error and the card reverts back from “abnormal” to “standby” status.
  - The V net and V net interface are dual redundant.

### **ESB Buses**

- Two ESB bus interface cards (SB311) can be installed in the FCU to form dual redundant system.
- The two cards are controlled by the software residing in the active CPU to determine their active and standby status. Normally the card on the active CPU side is given the active status and the other card the standby status.
- The SB301 in the active status is the ESB bus master and it communicates with the node units. The standby side “Sleeps” and performs only diagnostic communications.
- Dual-redundant ESB buses are used alternately, if an abnormality is detected in one bus then the other is used. The abnormal bus is tested periodically to see if it has returned to normal.

## 2.5.4 Control Bus Coupler Unit

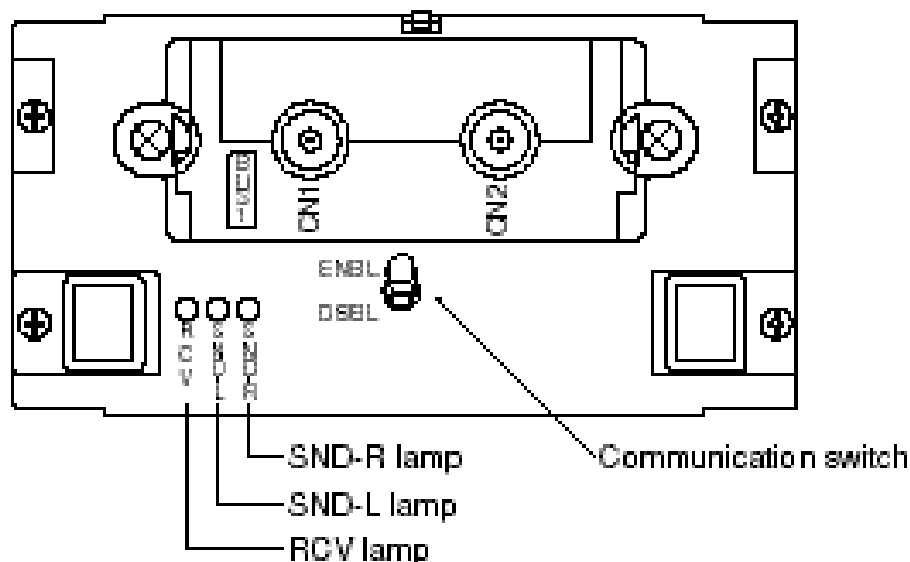


Figure: Control Bus Coupler Unit

The control bus coupler is located between the control bus cable and the KFCS processor card, and performs insulation and level conversion of control bus signals. Either a single or duplex control bus coupler can be used.

### Status Lamps:

**RCV:** The green light turns on when the communication carrier is receiving signals from control bus. Otherwise, the lamp is off.

**SND-L:** The green light turns on when the processor card located on the left side of the LFCD is sending data to control bus. Otherwise, the light is off.

**SND-R:** The green light turns on when the processor card located on the right side of the LFCD is sending data to control bus. Otherwise, the light is off. When the communication switch is tilted toward the DSBL side, all lamps are off.

## 2.5.5 Communication Switch:

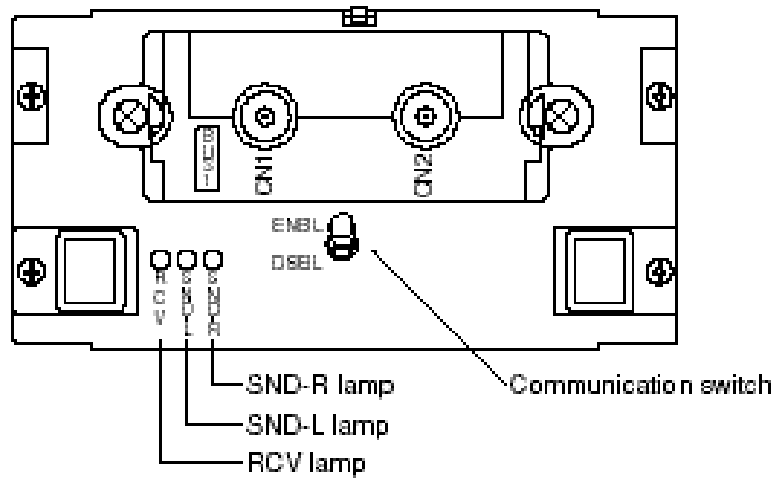


Figure: Communication Switch

**ENBL:** Performs communication with control bus. Set the switch in this position during normal operation.

**DSBL:** Set the switch in this position if communication with control bus is to be stopped. A lock-type switch is used for the toggle switch. When switching, do so while pulling the knob forward.

Tilt the switch upward to obtain the ENBL setting and downward to obtain the DSBL setting.

## 2.5.6 Power Distribution Unit

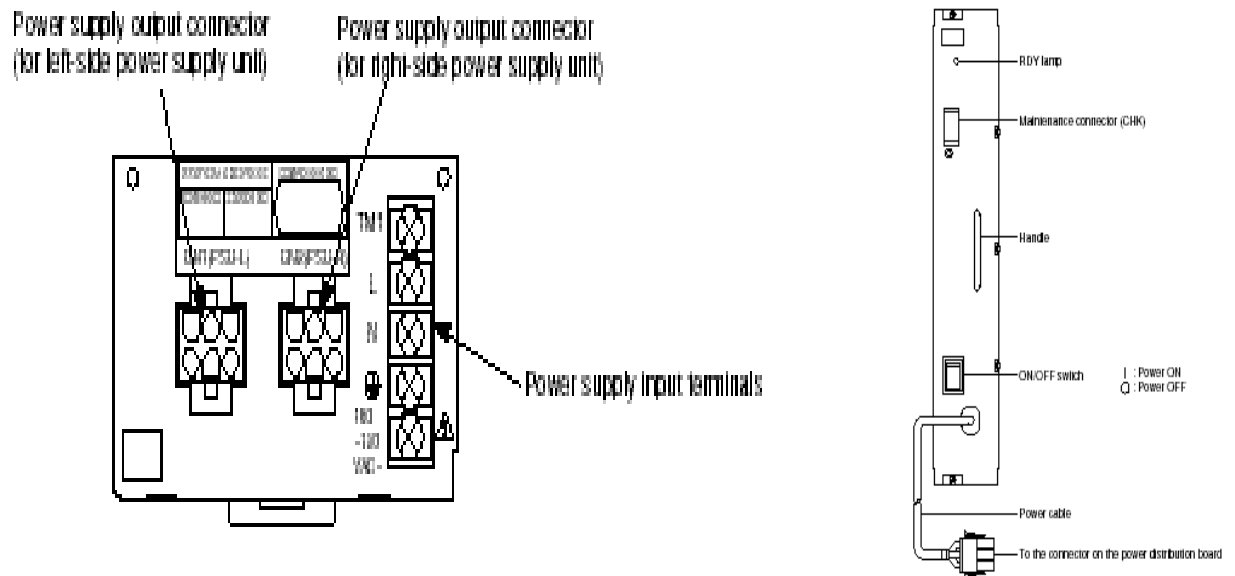


Figure: Power Distribution Unit

- The power distribution board receives a specified power supply at the power supply input terminals, and outputs it through a noise filter to the power supply output connectors.
- To turn off the power to the cards, disconnect the power supply output connectors (CN1 and CN2) on the power distribution board.
- **TM1 terminals:**M4 screw terminals for power supply input

**L:** Ungrounded

**N:** Grounded

**Protective grounding terminal:** Ground

- **CN1 connector:** Power supply output connector: Connect the cable from the left-side power supply unit of a duplexed FCU.
- **CN2 connector:** Power supply output connector, Connect the cable from the right-side power supply unit.
- The maintenance connector (CHK) is used by a service engineer during maintenance work. Do not use this connector during normal operations.

## 2.5.7 Battery Unit

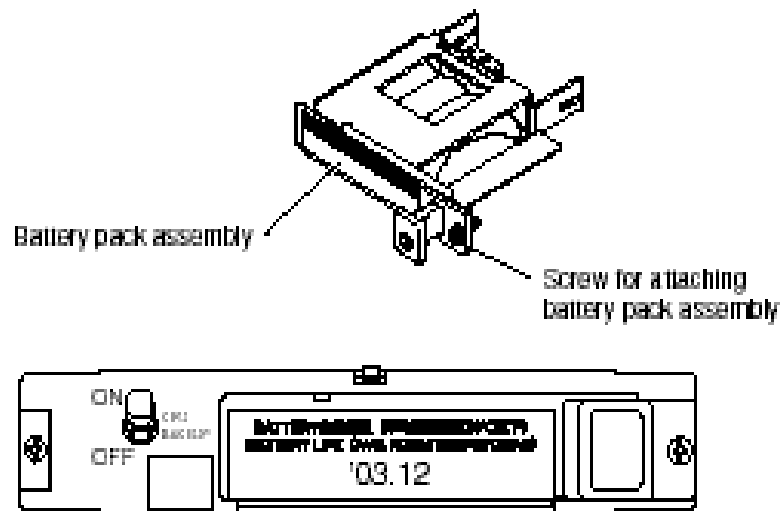


Figure: Battery Unit

Part number battery pack is S9765UK. Battery type: Cadmium Lithium

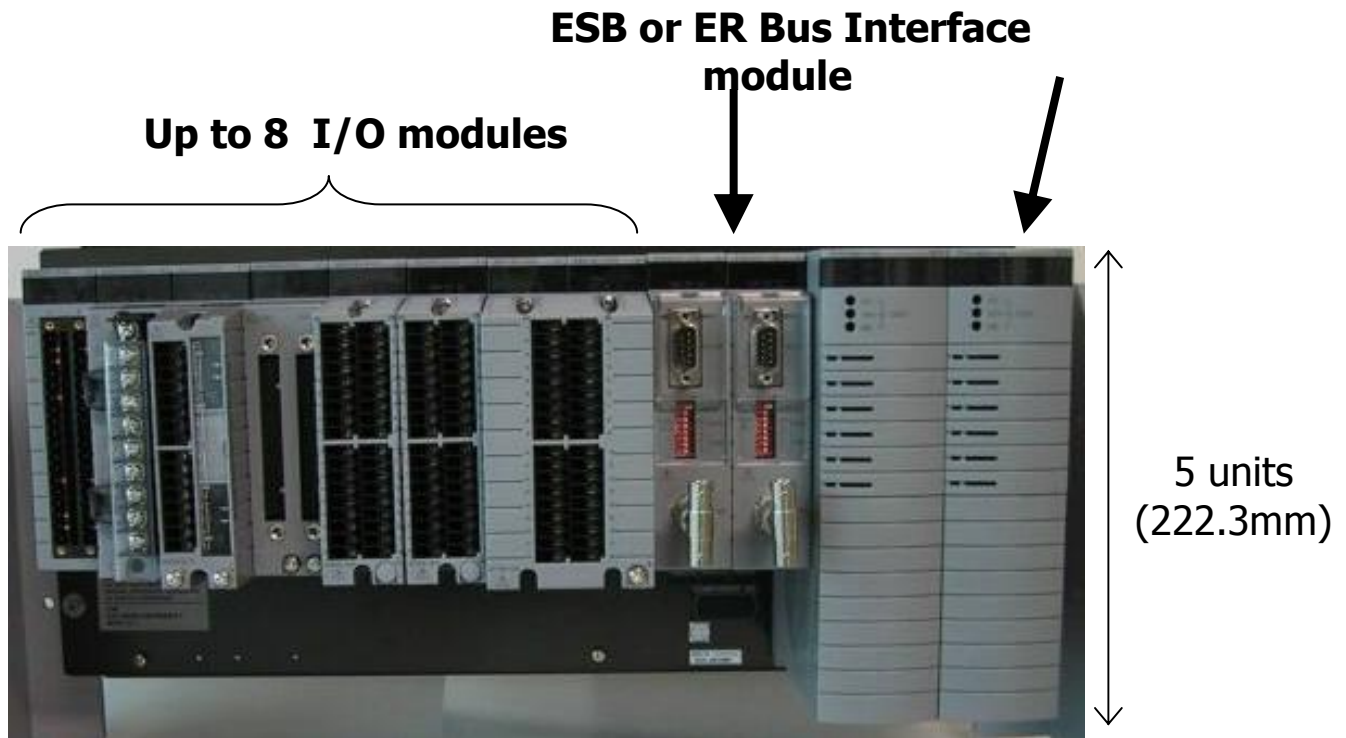
**Battery life:** Changes according to the ambient temperature.

- Three years if the average ambient temperature is 30 degree or less.
- One year and a half if the average ambient temperature is 40 degree or less.
- Nine months if the average ambient temperature is 50 degree or less.
- As for battery output, the left battery unit backs up the left CPU and the right battery unit the right CPU.
- In the single system, the battery unit is installed on the left side.



## 2) FIO Node Unit

In nodes, the Node Interface Card and the Node Power Supply can be dual redundant. The I/O module bus from the Node Interface Unit to each I/O unit can also be dual redundant.



The node units (NU) for FIO are signal processing units which convert and transmit analog or digital process I/O signals received from the field devices to the FCU for FIO.

The node units (NU) for FIO have ESB bus node units for local nodes installed at the FCS station and ER bus node units for remote nodes installed in cabinets on the plant site.

The node units are composed of an ESB Bus slave interface module or ER Bus slave interface module and I/O module.

**ESB Slave Interface Module:** This module is installed in the local node to enable communication with the FCU. The module can be duplexed.

**ER Bus Interface Module :** This module has an interface master module, which is installed in the local node and an interface slave module which is installed in the remote node. Both modules can be dual redundant.

**I/O Module:** These modules receive input signals, convert them to appropriate signals required for the CPU and generate output analog and digital field signals.

## 2.5.8 KFCS with Local Nodes / Remote Nodes

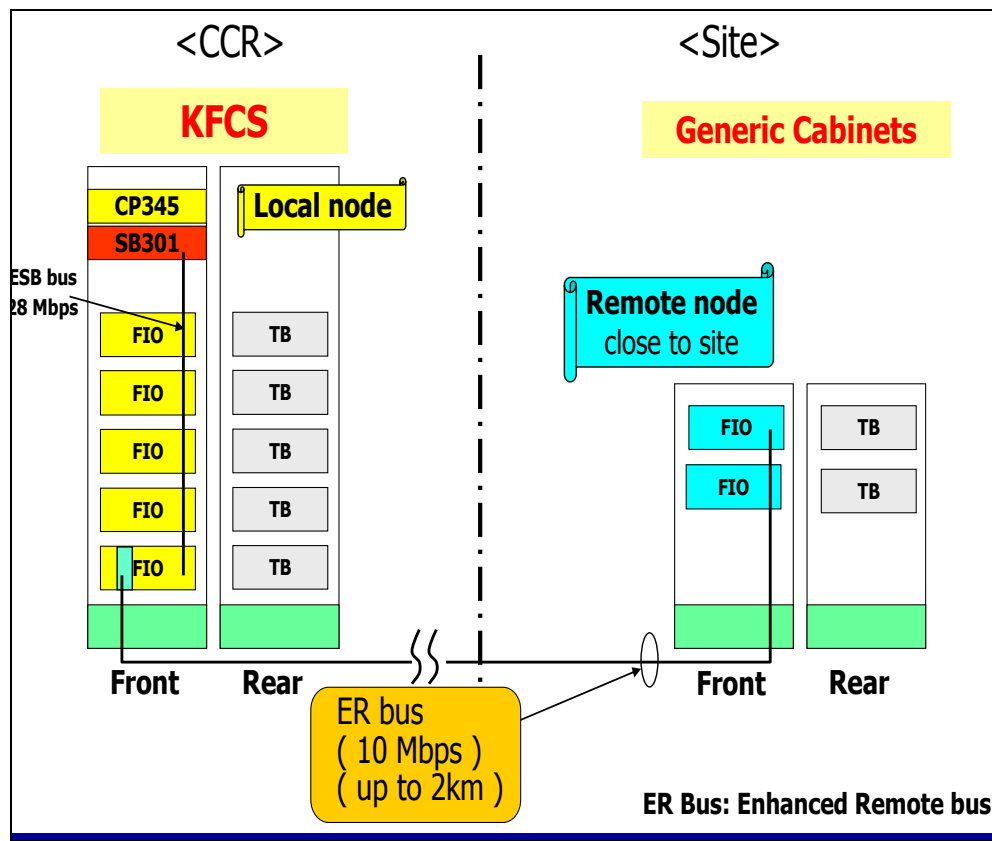


Figure: KFCS with Remote Nodes

**ESB (Extended Serial Backboard bus):** It is a communication bus used in connecting the local nodes, which are installed in the same cabinet for FCU, with the FCU. This bus can be dual redundant. **The transmission speed is 128Mbps. Maximum distance is 10 meters.**

**ER bus (Enhanced Remote Bus):** It is a communication bus used in connecting the remote nodes with the FCU by means of the ER bus interface module installed on the local node.

This bus can also be dual-redundant. Using this bus, the nodes can be installed in the same cabinet for FCU or at locations away from the cabinet.

### Specification:

- The maximum transmission distance is 185 meters using a Ethernet compatible 10 BASE-2 coaxial cable or 500 meters using a 10 BASE-5 coaxial cable, or up to 2 kilometers using general purpose optical bus repeaters.
- Up to 4 series of ER bus are available per FCU.
- Up to 14 remote nodes can be installed on a standard FCU.
- Up to 15 nodes can be installed on an enhanced FCU.

### 2.5.9 Specification of KFCS

Maximum number of stations	: 256/System
Maximum number of domains	: 16/System
Numbering of domains	: 1 to 64
Domain number for CS3000 domain (V-net domain)	: 1 to 16
Domain number for Virtual Domain (Non V-net domain)	: 17 to 64
Maximum number of stations per domain	: 64
Maximum number of HIS per domain	: 16
Station number for HIS	: 1 to 64 in descending order
Station number for FCS	: 1 to 64 in ascending order
Maximum number of Nodes per KFCS	: 10 for standard FCS and 15 for enhanced FCS
Maximum number of I/O modules per node	: 8
Maximum length of ESB Bus	: 10 m
Maximum length of ER Bus	: 500 m
Maximum length of ER Bus with optical adapters	: 2 Km
Maximum length of V-net	: 500 m
Maximum length of V-net with optical adapters	: 20 Km

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## 2.6 Compact Type FIO - Field Networked Field Control Station (FFCS)

FFCS is the Compact FIO type Field Control Station supported by CS3000. FIO means Field network Input Output.

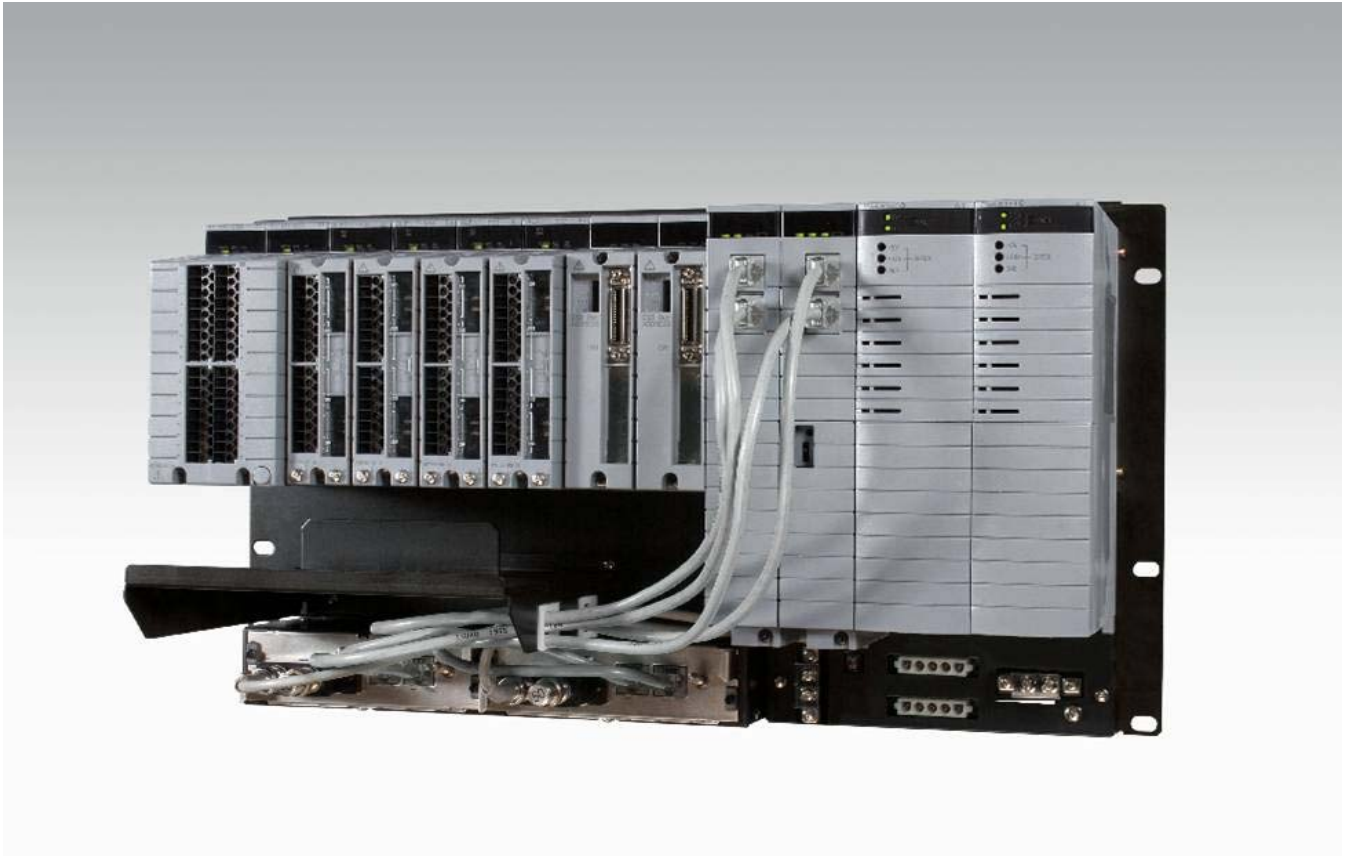


Figure: Snap Shot of FFCS –AFF50D

Components of FFCS:

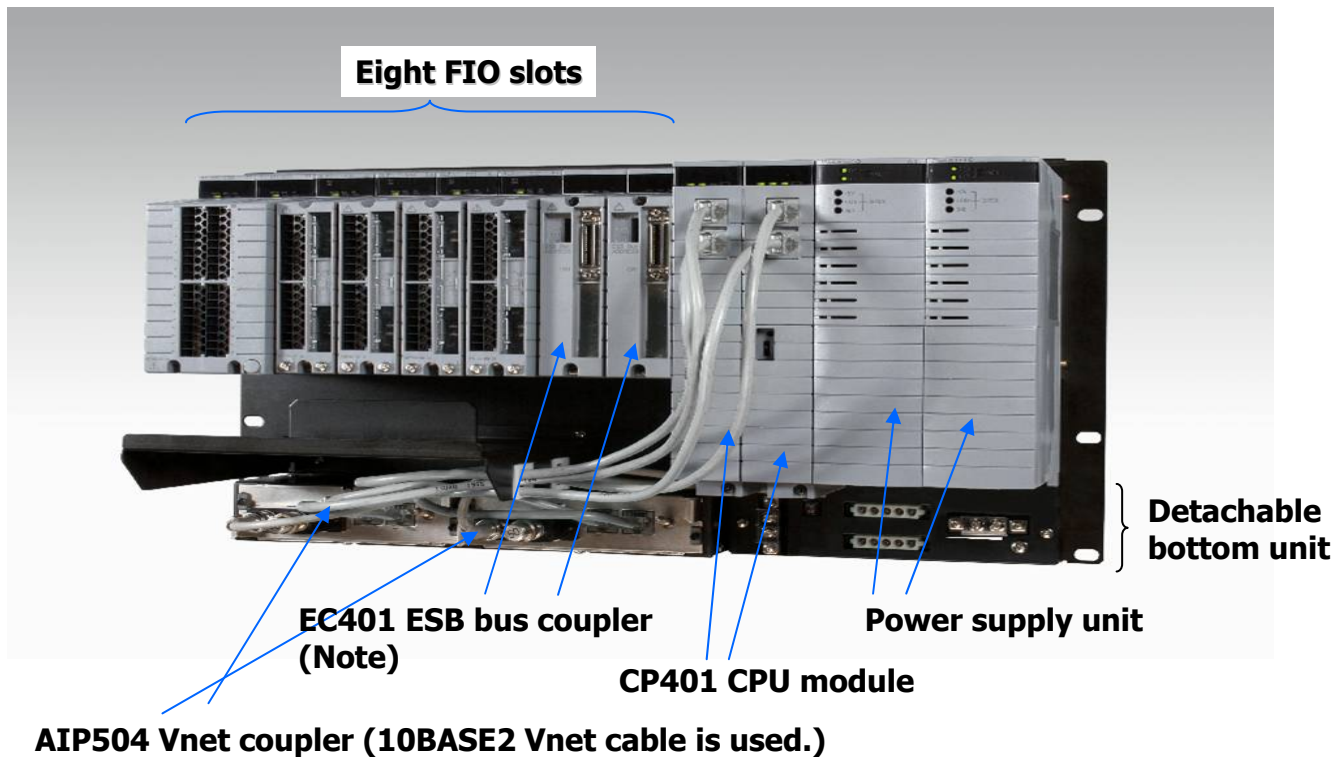
- a) Field Control Unit (FCU)
- b) Nodes for FIO
- c) Local / Remote Communication Bus

---

**Details:**

- The FCU consists of control cards and I/O cards and executes control computation for the FCS. For a duplexed FCU, the processor modules, power modules and I/O modules are all dual redundant.
- If nodes are added, a bus interface module has to be installed in an I/O module slot. Two bus interface modules are required for dual-redundant use.
- A compact FCS for FIO includes one node unit integrated in to the FIO. It also allows the installation of an ER Bus interface module in a node unit integrated into the FCU.
- An FCS on which FCU's and I/O modules are mounted can be mounted in a rack. Up to 3 node units (NUs) for FIO can be connected to an FCS. Up to 30 I/O modules can be mounted on an FCS, adding to the additional node units for FIO.
- If node units are added, up to six I/O modules can be mounted on node units integrated into the FCU for installing communication modules for NU connection.

## 2.6.1 Field Control Unit of FFCS



Note: Two I/O slots are to be used for NIU extension.

Figure: Field Control Unit of FFCS-AFF50D

The FCU consists of

- Two Power Supply Units
- Two processor modules
- Eight slots for Input Output cards

Out of these eight I/O slots, if I/O expansion is required, two slots are used for ESB module and the rest six slots are used for IO modules.

It has two V net coupler units for connecting V net Cables.

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## 2.6.2 Node Unit of FFCS

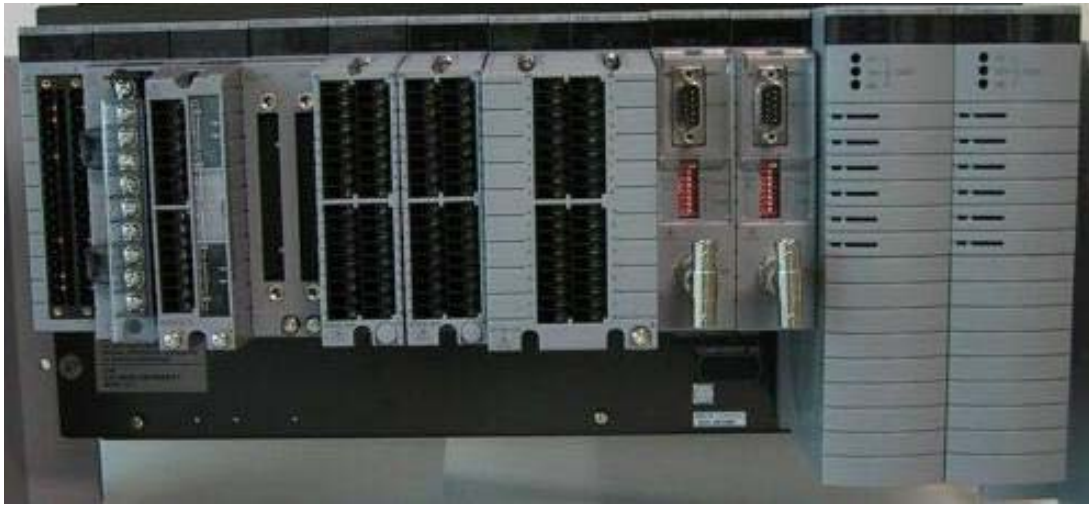


Figure: Node Unit of FFCS-AFF50D

### Node Unit

The node units (NU) for FIO are signal processing units which convert and transmit analog or digital process I/O signals received from the field devices to the FCU for FIO.

The node units (NU) for FIO have **ESB bus node units** for local nodes installed at the FCS station and **ER bus node units** for remote nodes installed in cabinets on the plant site.

### ESB Slave Interface Module

This module is installed in the local node to enable communication with the FCU. The module can be duplexed.

### ER Bus Interface Module

This module has an interface master module, which is installed in the local node and an interface slave module which is installed in the remote node. Both modules can be dual redundant.

### I/O Module

These modules receive input signals, convert them to appropriate signals required for the CPU and generate output analog and digital field signals.

2.6.3 Hardware Configuration –Local Nodes

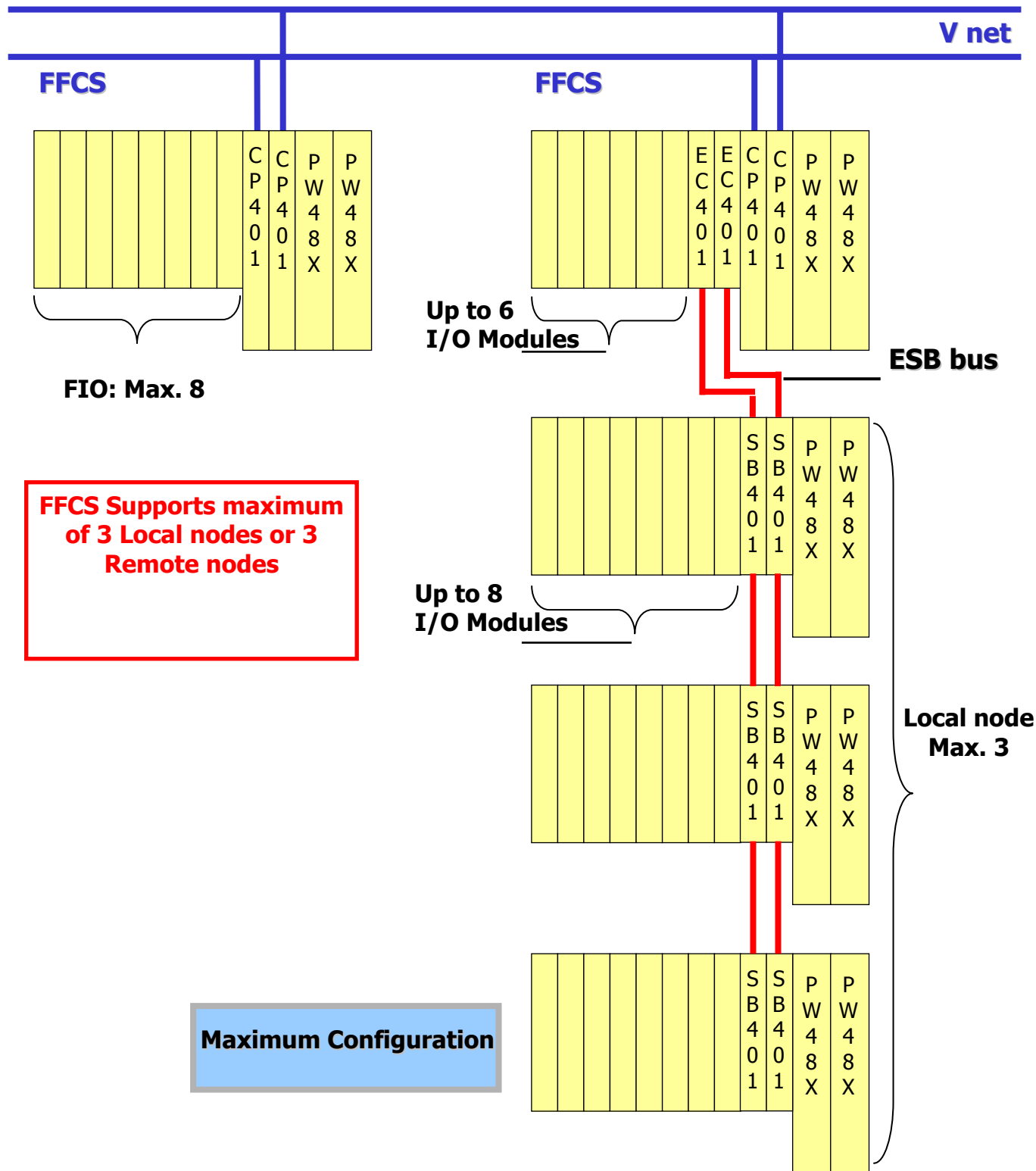


Figure: Hardware Configuration of FFCS-AFF50D



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## Details of the minimum and maximum configuration for the FFCS with Local Nodes

### FFCS supports a maximum of 3 local nodes

- Field inputs and outputs are wired to the IO cards placed in the main FFCS unit as well as in the nodes.
- Local nodes communicate to the main FFCS unit by ESB bus.

### ESB (Extended Serial Backboard bus)

- It is a communication bus used in connecting the local nodes, which are installed in the same cabinet for FCU, with the FCU. This bus can be dual redundant.
- For ESB bus communication, EC401 modules are placed in the main FFCS unit and SB401 modules are placed in the individual nodes.
- The communication between the main FFCS unit and individual nodes is done by ESB bus.
- The ESB Bus provides 128Mbps –data transmission rate. The maximum length of ESB Bus is 10m and minimum distance is 20cm.

2.6.4 Hardware Configuration – Remote Node

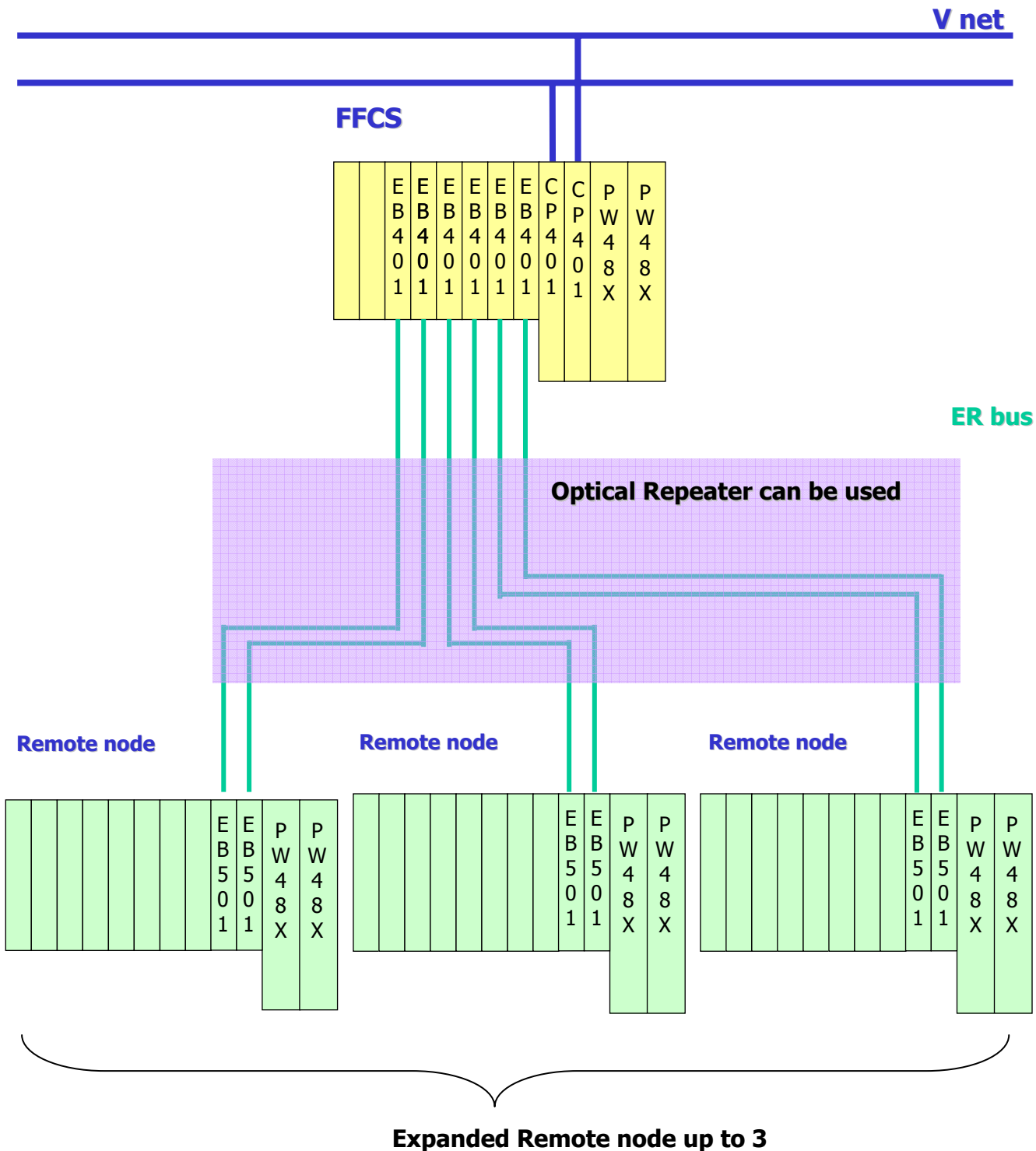


Figure: Hardware Configuration of FFCS-AFF50D

## Details of configuration of the FFCS with remote nodes

### **FFCS supports a maximum of 3 remote nodes.**

- Field inputs and outputs are wired to the IO cards placed in the remote nodes.
- Remote nodes communicate to the main FFCS unit by ER bus.

### **ER bus (Enhanced Remote Bus)**

- It is a communication bus used in connecting the remote nodes with the FCU by means of the ER bus interface module installed on the local node.
- This bus can also be dual-redundant. Using this bus, the nodes can be installed in the same cabinet for FCU or at locations away from the cabinet.
- For ER bus communication, EB401 modules are placed in the main FFCS unit and EB501 modules are placed in the individual remote nodes.
- The communication between the main FFCS unit and individual nodes is done by ER bus.
- The maximum transmission distance is 185 meters using a Ethernet compatible 10 BASE-2 coaxial cable or 500 meters using a 10 BASE-5 coaxial cable, or up to 2 kilometers using general purpose optical bus repeaters.
- Up to 3 remote nodes can be installed on a FFCS.

## 2.6.5 Dual Redundant Configuration of FFCS

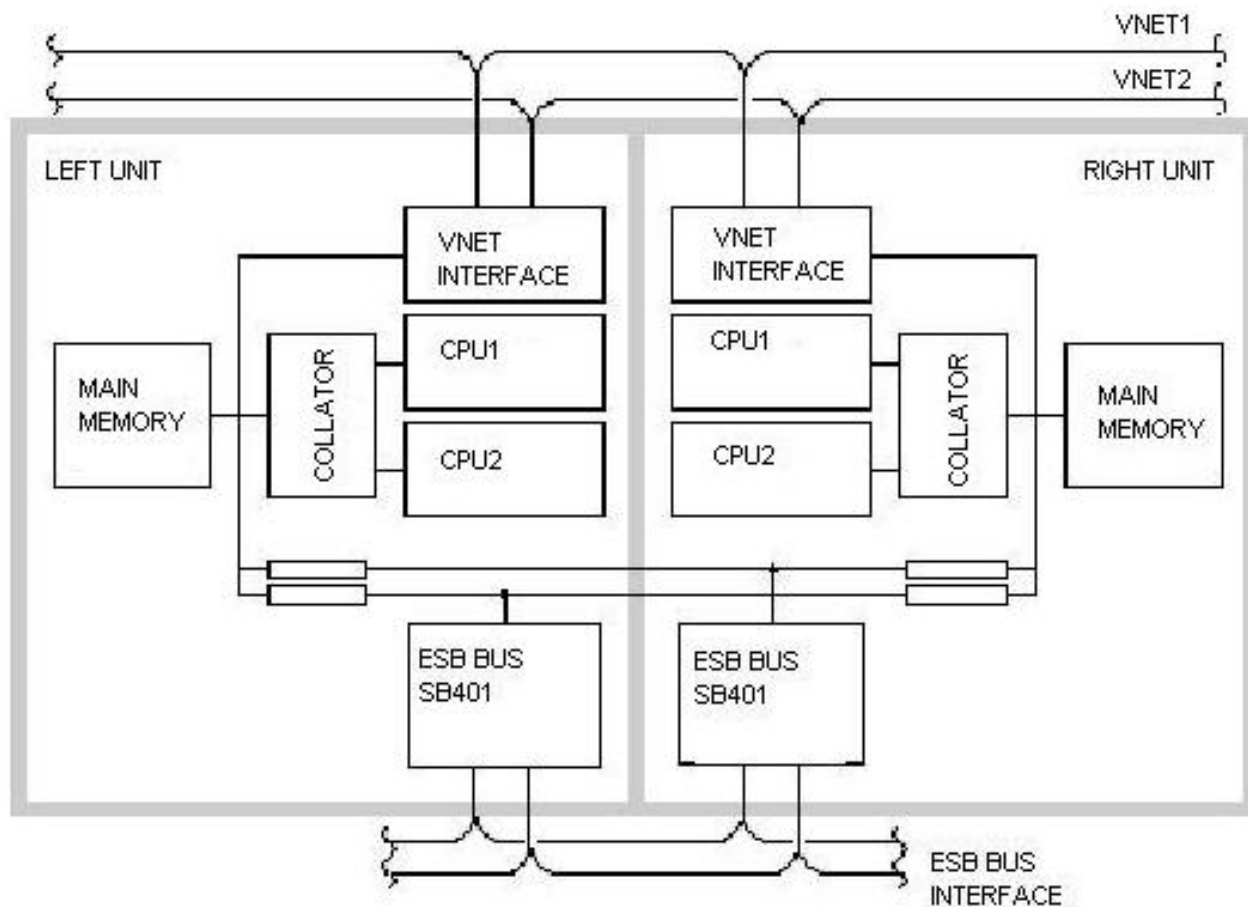


Figure: Dual Redundant Configuration of FFCS-AFF50D

For a compact FCS for FIO, a duplexed FCS is provided. The processor module, V net coupler and power module are all dual-redundant.

If an FIO node unit is added, an ESB coupler module or an ER bus interface module has been installed. Dual-redundant use in either module is also possible.

Here, the ESB bus interface modules need to be dual redundant. Even if one side of the module becomes defective, the control right can be switched without any interruption in control.

---

## CPU

- There are two processors on each processor card. Each CPU performs the same control computations, and the results are compared after each computation.
- If the results agree, then the card is assumed to be normal and the results are transferred to memory and bus interface card.
- The main memory uses ECC (error-correcting code) which can correct transient reversed-bit errors.
- If the results from CPU1 and CPU2 does not agree , then the comparator takes this as “CPU abnormal” and switches to the standby processor card.
- A watch Dog Timer is used to detect if the active processor card is abnormal, which results in a switch from active to standby processor card.
- The standby processor card is performing the same computations as the active card, and when it is switched to active status then the results it has just computed are transferred to the bus interface. There is no interruption in control.
- Id a “CPU abnormal” error is detected in a CPU card, a self-diagnostic check is performed on the card. If the hardware is not abnormal, then the error is treated as a transient error and the card reverts back from “abnormal” to “standby” status.
- The V net and V net interface are dual redundant.

## ESB Bus

- Each processor card incorporates ESB bus interface functions and can be dual redundant. Normally, the ESB bus interface functions on the active CPU side are given the active status and on the other side, the standby status.
- If an abnormality is found in the ESB functions on the active CPU side, the standby CPU side is switched in to use. An active ESB bus interface function, which is an ESB bus master, communicates with node units.
- The dual-redundant ESB buses are used alternately; if an abnormality is detected in one bus then the other is used for communication. The abnormal bus is tested periodically to see if it has returned to normal.

## FIO Nodes

- In nodes, the Node Interface Card and the Node Power Supply can be dual redundant. The I/O module bus from the Node Interface Unit to each I/O unit can also be dual redundant.

## 2.6.6 Application Capacity of FFCS

<b>CPU</b>		<b>R5432 (RISC)</b>
<b>Memory Size</b>		<b>32MB</b>
<b>Power supply</b>		<b>100/220V AC, 24V DC</b>
<b>No. of I/O slot</b>		<b>8</b>
<b>No. of I/O node</b>		<b>total 4 including CPU node</b>
<b>ESB bus I/F</b>		<b>EC401/SB401</b>
<b>Local node for ESB bus</b>		<b>Up to 4</b>
<b>Remote node for ER bus</b>		<b>Up to 3</b>
<b>ER bus I/F</b>		<b>EB401/EB501</b>
<b>Application capacity</b>	<b>AI/AO</b>	<b>480</b>
	<b>DI/DO</b>	<b>1920</b>
	<b>Communication data</b>	<b>4000 words</b>
	<b>Global SW</b>	<b>256</b>
	<b>Common SW</b>	<b>4000</b>
	<b>%ANN</b>	<b>1000</b>
	<b>%PR</b>	<b>1000</b>
	<b>%OP</b>	<b>500</b>
	<b>%RQ</b>	<b>200</b>
	<b>No. of control drawing sheet</b>	<b>200</b>
	<b>No. of function block (total with %ANN)</b>	<b>2500</b>
	<b>Real time trend</b>	<b>256</b>

---

### 2.6.7 System Specifications of FFCS

⇨	<b>Maximum number of stations</b>	<b>: 256/System</b>
⇨	<b>Maximum number of domains</b>	<b>: 16/System</b>
⇨	<b>Numbering of domains</b>	<b>: 1 to 64</b>
⇨	<b>Domain number for CS3000 domain (V-net domain)</b>	<b>: 1 to 16</b>
⇨	<b>Domain number for Virtual Domain (Non V-net domain)</b>	<b>: 17 to 64</b>
⇨	<b>Maximum number of stations per domain</b>	<b>: 64</b>
⇨	<b>Maximum number of HIS per domain</b>	<b>: 16</b>
⇨	<b>Station number for HIS</b>	<b>: 1 to 64 in descending order</b>
⇨	<b>Station number for FCS</b>	<b>: 1 to 64 in ascending order</b>
⇨	<b>Maximum number of Nodes per FFCS</b>	<b>: 3</b>
⇨	<b>Maximum number of Input /Output Modules per FFCS nodes + 6 I/O modules in the main CPU nest)</b>	<b>: 30 (3*8=24 I/O modules in nodes + 6 I/O modules in the main CPU nest)</b>
⇨	<b>Maximum length of V-net</b>	<b>: 500 m</b>
⇨	<b>Maximum length of V-net with optical adapters</b>	<b>: 20 Km</b>

## 2.7 Compact Type FIO – FFCS-L (Vnet/IP FCS)

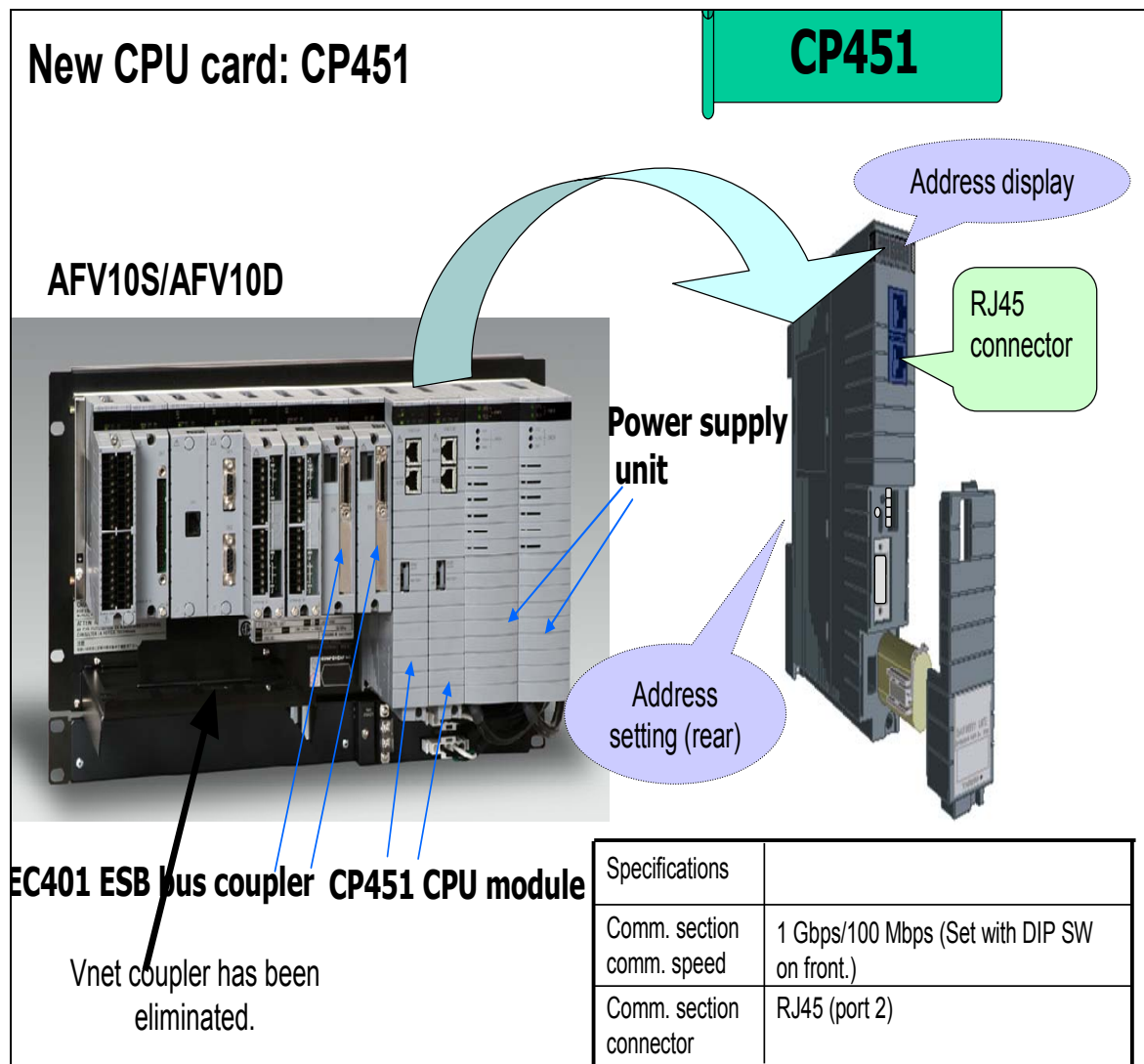


Figure: Field Networked FCS (FFCS – L)

The FCS performs process control and manages communications with subsystems.

FCS consists of the Field Control Unit (FCU), node units and the ESB Bus or the ER bus to connect them.

Two types of FCS are available for Vnet/IP system.

**AFV10S:** Field Control Unit with Single configuration – rack mountable

**AFV10D:** Duplexed Field Control Unit with redundant configuration - rack mountable



**Details:**

The AFV10D has two processor cards CP451, two power supply cards and eight slots for I/O modules.

- Two RJ45 connectors are available on the CPU card for connecting the CAT5e communication cables.
- The address of the FCU is set using the DIP switches available on the rear side of the CPU module.
- Maximum distance between the FCU and the Layer 2 switch is 100m.
- V net couplers are not used in the Vnet/IP type Field control station.
- Back up Battery would hold the main memory contents for 72 hours on power failure. Recharging of battery takes 48 hours.

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## 2.7.1 Vnet/IP FIO Node Overview

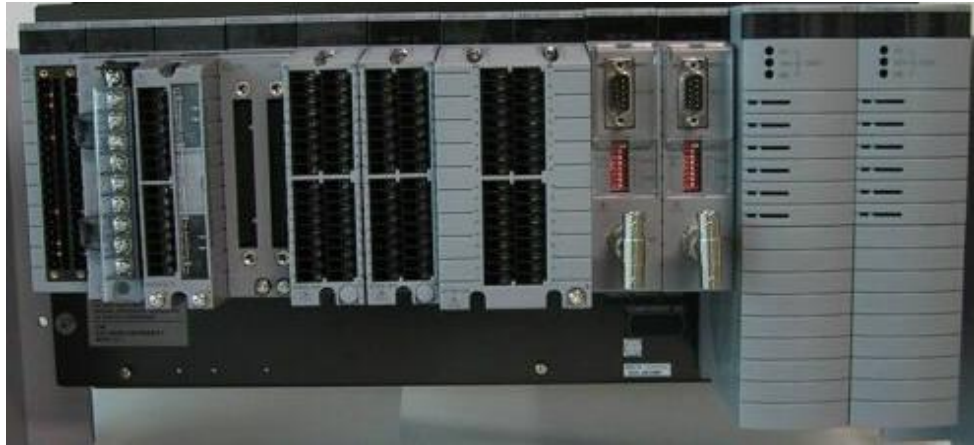


Figure: Node Interface Unit (NIU) – FFCS-L

### Node Unit

- FIO is an I/O system connected to a control station using an ESB Bus. This consists of two types of node units on two types of buses. Node units connected on an ESB bus are referred to as local nodes.
- Those nodes units that are connected on ER bus are referred to as remote nodes. The node units (NU) for FIO are signal processing units which convert and transmit analog or digital process I/O signals received from the field devices to the FCU for FIO.
- Each of these nodes is composed of a base unit, power supply module, bus interface module and input/output modules. Power supply module, bus interface module and input/output modules can be configured redundantly.

The different node types are

**ANB10S:** Node unit for Single ESB Bus

**ANB10D:** Node unit for Dual redundant ESB Bus

**ANR10S:** Node unit for Single ER Bus

**ANR10D:** Node unit for Dual redundant ER Bus

**ESB Slave Interface Module**

This module is installed in the local node to enable communication with the FCU. The module can be duplexed.

**ER Bus Interface Module**

This module has an interface master module, which is installed in the local node and an interface slave module which is installed in the remote node. Both modules can be dual redundant.

**I/O Module**

These modules receive input signals, convert them to appropriate signals required for the CPU and generate output analog and digital field signals.

2.7.2 Vnet/IP Hardware Configuration –Local Nodes

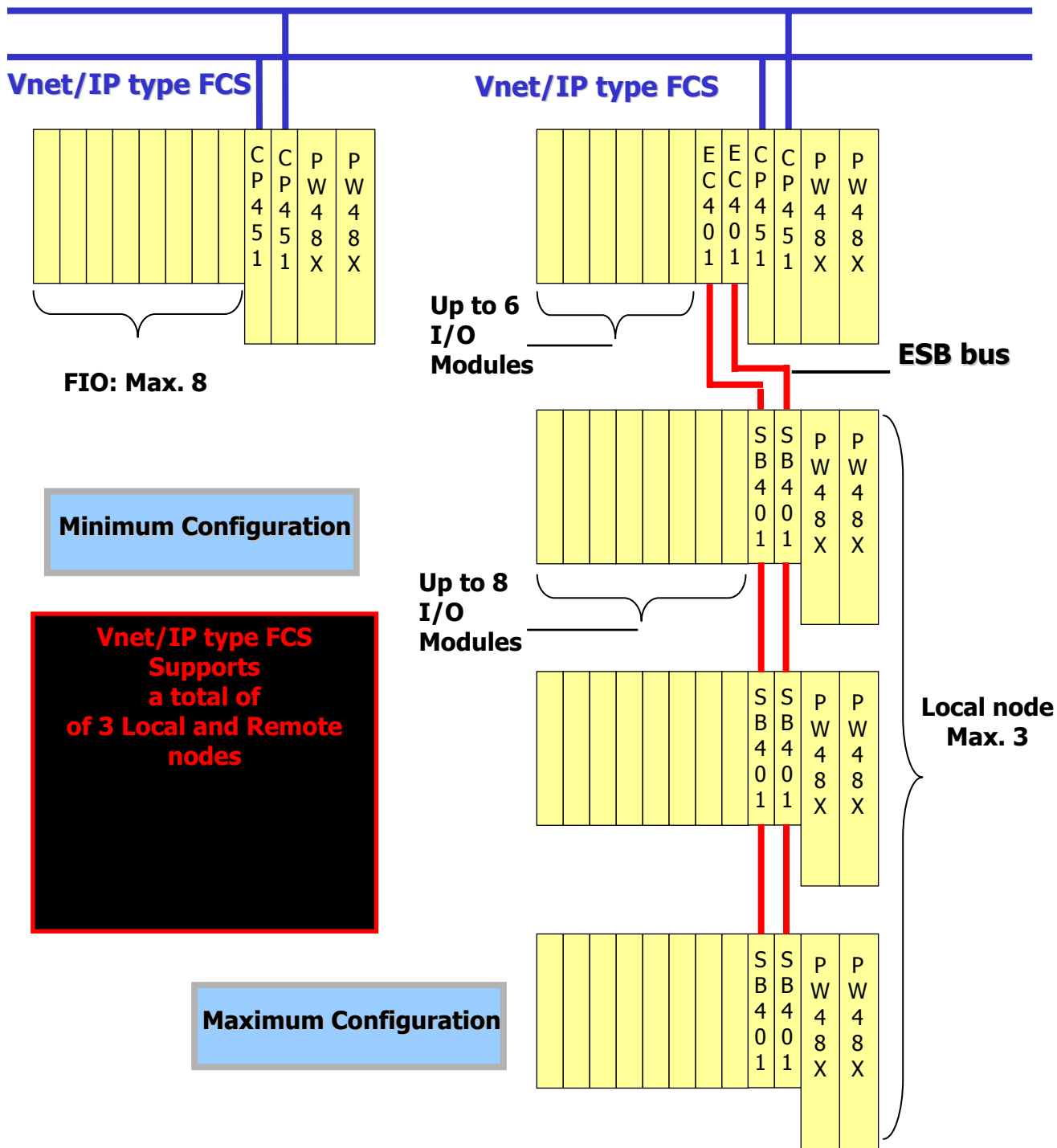


Figure: Hardware Configuration of FFCS-L-AFV10D

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**Details:**

- The minimum and maximum configuration for the V net/IP type FCS
- This type of FCS supports a total of 3 local and 3 remote nodes by default.
- However the total number of local and remote nodes that can be connected to the FCU can be expanded to 14 by using Application Capacity Expansion Package.
- With this expansion package maximum of 9 local nodes can be connected.
- Maximum of 8 I/O modules can be installed in one node.
- Field inputs and outputs are wired to the IO cards placed in the main FFCS unit as well as in the nodes.

**Local Node Connection**

- Local nodes communicate to the main FCU by ESB bus.
- The **ESB (Extended Serial Backboard bus)** is a communication bus used in connecting the local nodes, which are installed in the same cabinet for FCU, with the FCU. This bus can be dual redundant.
- For ESB bus communication, EC401 modules are placed in the main FCU and SB401 modules are placed in the individual nodes.
- The communication between the main FCU and individual nodes is done by ESB bus.
- When connecting a local node to the FCU, ESB Bus Coupler Module EC401 has to be installed in the FCU.
- EC401 must be installed in slot no. 7 and slot no. 8 in redundant configuration.
- In single configuration, EC401 must be installed in slot no.7 and slot no.8 should be left vacant.

2.7.3 Vnet/IP Hardware Configuration – Remote Node

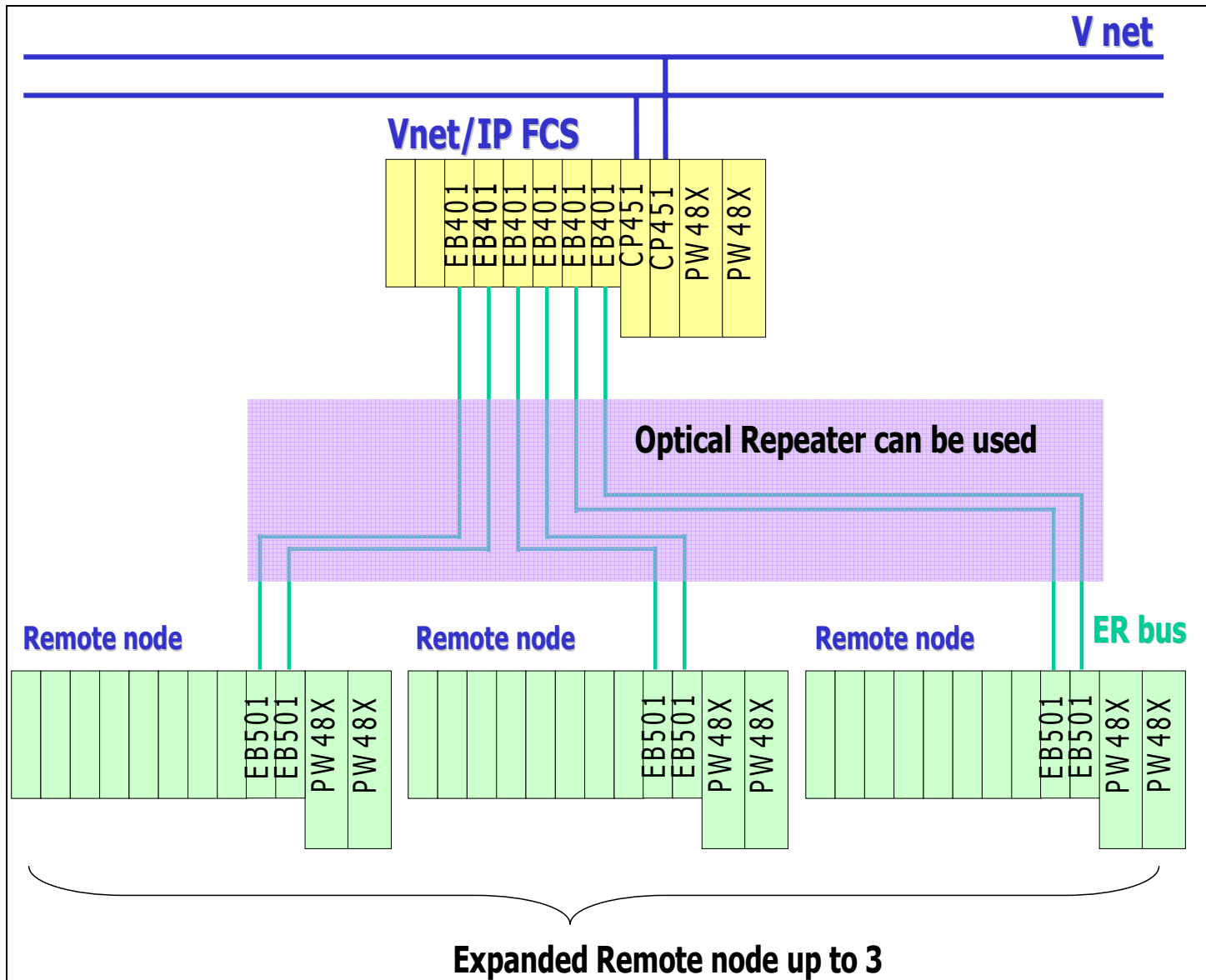


Figure: Configuration of the Vnet/IP type FCS with remote nodes

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## Details

- Vnet/IP type FCS supports a maximum of 3 remote nodes.
- However the total number of local and remote nodes that can be connected to the FCU can be expanded to 14 by using Application Capacity Expansion Package.
- With this expansion package maximum of 14 remote nodes can be connected per FCU. Up to 8 remote nodes can be connected per ER Bus. Maximum 4 ER Bus can be used per FCU.
- Field inputs and outputs are wired to the IO cards placed in the remote nodes.

## Remote Node Connection

- The **ER bus (Enhanced Remote Bus)** is a communication bus used in connecting the remote nodes with the FCU by means of the ER bus interface module installed on the local node.
- This bus can also be dual-redundant. Using this bus, the nodes can be installed in the same cabinet for FCU or at locations away from the cabinet.
- For ER bus communication, EB401 modules are placed in the main FCU and EB501 modules are placed in the individual remote nodes.
- The communication between the main FCU and individual nodes is done by ER bus.
- When connecting a remote node to FCU, ER Bus Interface Master Module EB401 has to be installed in the FCU.
- For single configuration, EB401 should be installed in an odd number slot and the slot to the right of EB401 card should be left vacant.

## 2.7.4 Connection between Vnet/IP Communication Stations

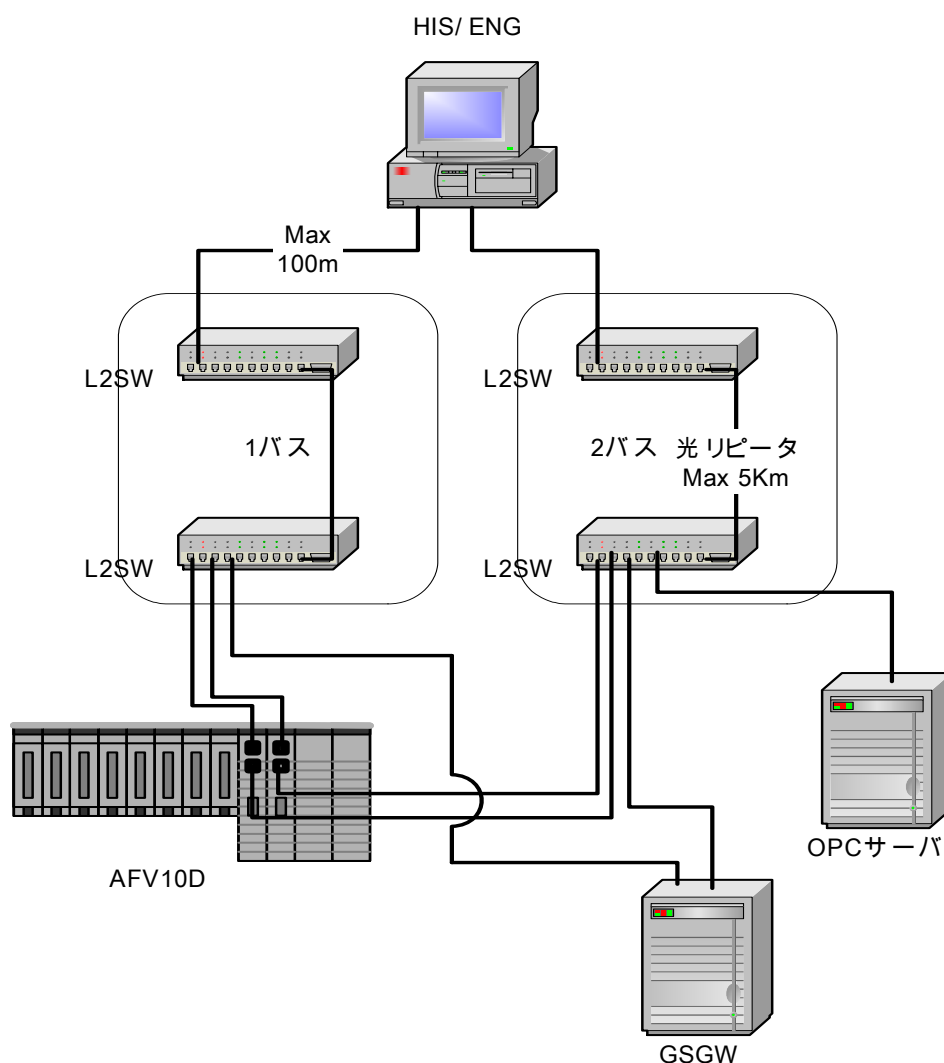


Figure : Connection details of Vnet/IP Communication Stations

### Connection of Devices in a Vnet/IP Domain

Devices within a Vnet/IP domain are connected in the star network using a layer 2 switch of 100 Mbps or 1 Gbps as the central device.

Since, duplexed Vnet/IP buses are separated as independent subnets of each bus, it is necessary to install a layer 2 switch in each bus.



**■ Specification when Connecting Devices in a Vnet/IP Domain**

- **Maximum number of Vnet/IP stations ( including V net router) that can be connected : 64.**
- **Maximum number of other general-purpose Ethernet communication devices (PCs, routers, etc.): 124.**
- **Maximum levels of Layer 2 switches can be connected : 7**
- **Maximum Distance between layer 2 switch and station is: 100 m when UTP (Unshielded Twisted Pair Cable) is used.**
- **Maximum Connection distance between layer 2 switches: 5 km when optical fiber is used.**

## 2.7.5 Layer 2 Switch

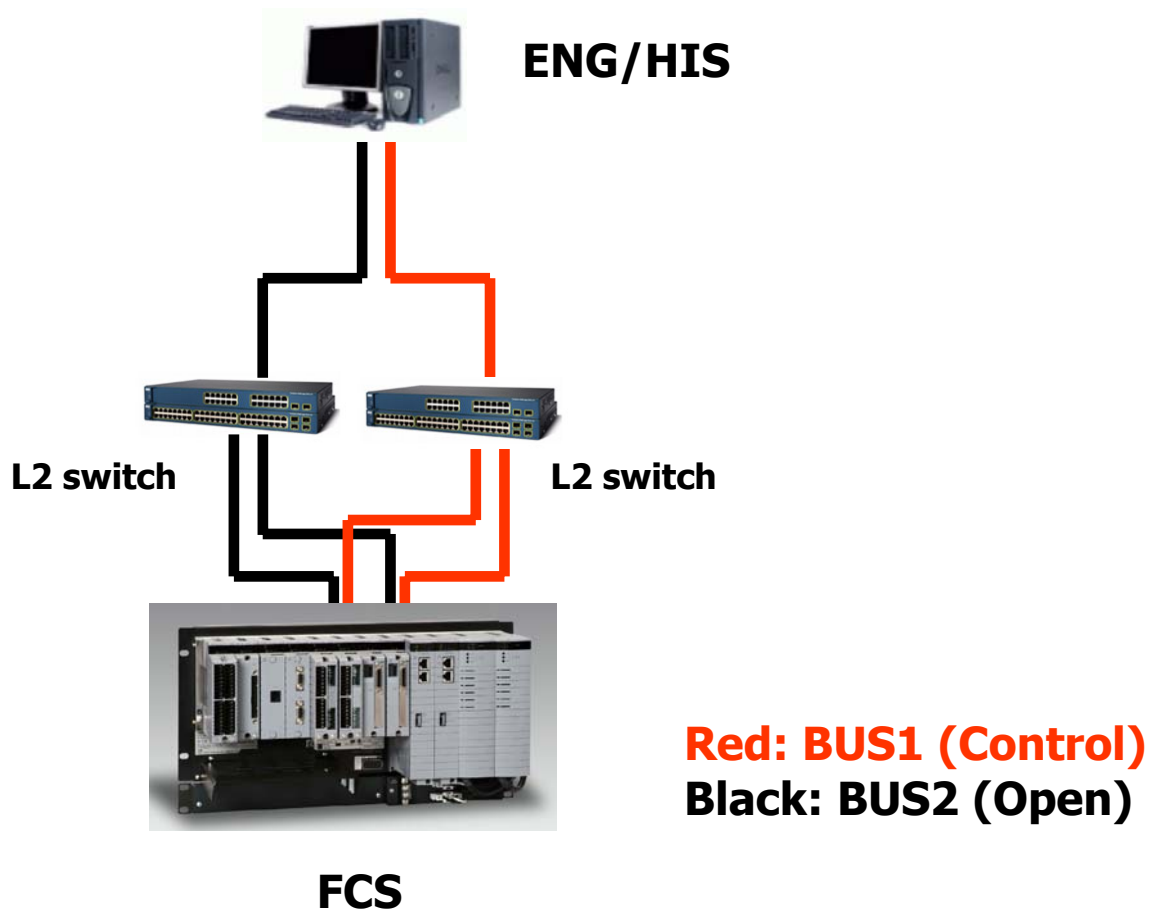


Figure : Layer-2 Switch

- This is a device to connect equipments within the Vnet/IP domain. The layer 2 switch, unlike a HUB, incorporates functions to send data to the destination terminal equipment only.
- It can therefore reduce the traffic within its domain. Commercially available switches can be used for a layer 2 switch. Vnet/IP uses full-duplex communication systems so that no collisions occur.
- The switches used on the Vnet/IP network include an SNMP – managed model which supports SNMP (Simple Network Management Protocol) and an SNMP-unmanaged model.
- Layer 2 managed switches is recommended in complex network configuration or in a case where multiple connections arte used. In the case of larger networks it might be necessary to configure individual ports on the switch.
- For instance, port speed and IP addresses subnets can be configured for individual ports. Hence SNMP –managed model switches are ideally suited for this application.

## 2.7.6 Connections between Vnet/IP Domains

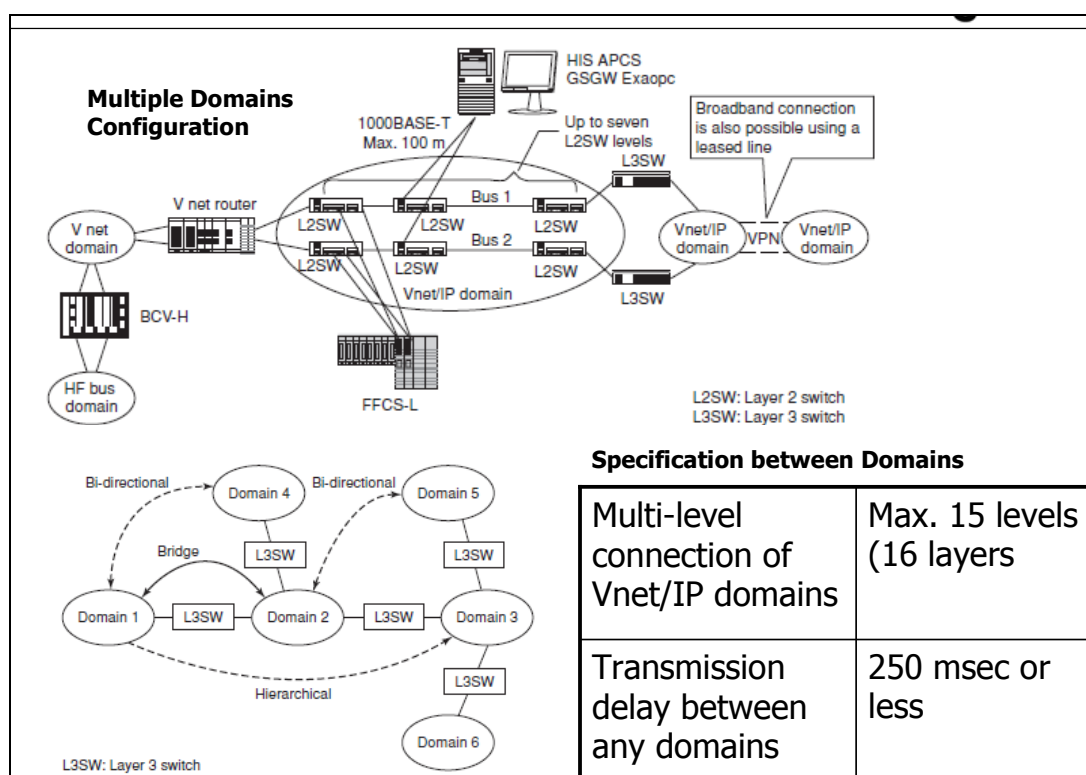


Figure : Connection between Vnet/IP Domains

Vnet/IP domain interconnections are made using commercially available layer 3 switches. Up to 16 domains can be connected.

Connections between domains are generally 1 Gbps. The image shows connection between Vnet/IP domains.

Layer 3 switch has to be installed in each bus of duplexed Vnet/IP buses to connect to other domains.

By using a leased line as the transmission path between domains, broadband connection can be achieved.

Bus convertors are not used in Vnet /IP system.

Domain connections cannot be made, if multiple paths exist between the domains.

## ■ Specification when Connecting between Vnet/IP Domains

- Multi-level connection of Vnet/IP domains: Max. 15 levels (16 layers)
- Transmission delay between any domains: 250 msec or less

## ■ Connections between Vnet/IP Domains

There are three types of connections between any Vnet/IP domains: bi-directional, hierarchical and bridge connections.

It is possible to configure a network with these three types of connections co-existing. Set connection type in Domain Properties for each domain.

### ● Bi-directional Connection

These connections do not use a hierarchical structure. This connection type does not define the upper and lower relationships between Vnet/IP domains.

HIS in both domains can operate and monitor other domain statuses. Both domain stations can accept FCS and HIS messages.

### ● Hierarchical Connection

A hierarchical structure is used between domains. This connection type defines the upper and lower relationships between Vnet/IP domains.

Higher order domains can operate and monitor lower order domains. A higher order domain station can accept FCS or HIS messages occurring in a lower order domain station.

### ● Bridge Connection

This connection type focuses on independence between Vnet/IP domains. For this connection type, Domain Properties are to be set so that each domain will not receive the messages of other domains.

## 2.7.7 Layer 3 Switch

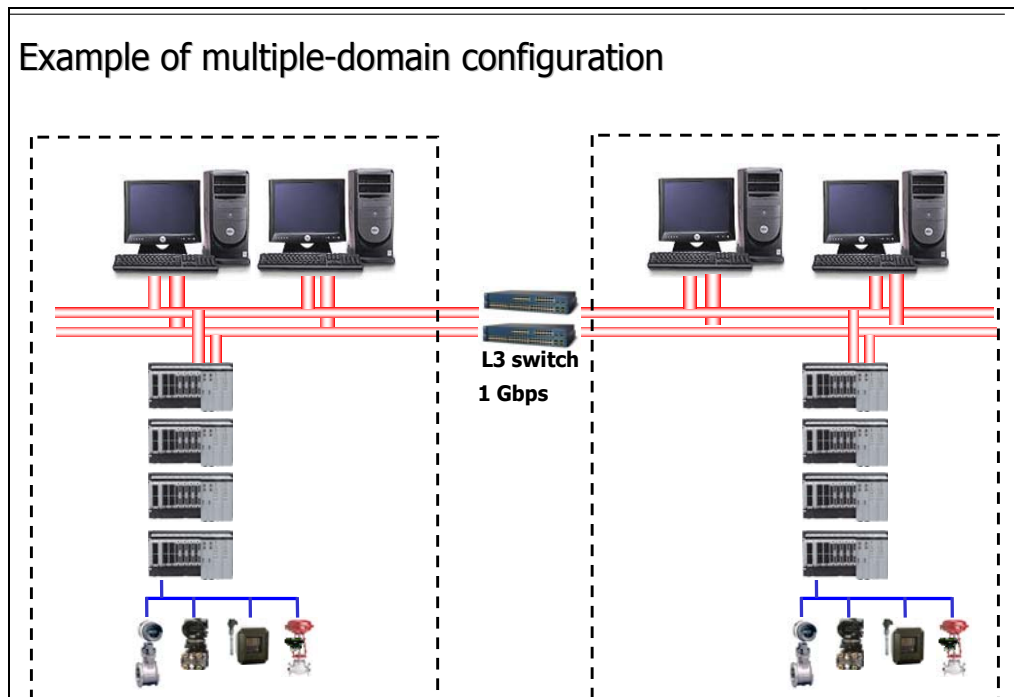


Figure : Layer 3 Switch

- This switch is used to connect two Vnet/IP domains. If the Vnet/IP network consists of multiple domains, the domains are connected via Layer 3 switch.
- This switch has routing functions, allowing a communication frame to be relayed to another domain with IP address route control. The Layer 3 switch also incorporates the function of layer2 switch.
- Therefore, it allows direct connections between Vnet/IP stations and open communications devices. This switch is usually a managed type, having SNMP features.
- Layer 3 switches with high speed communication capabilities are recommended. Commercially available switches can be used for a layer 3 switch.

2.7.8 Connection with Existing Systems

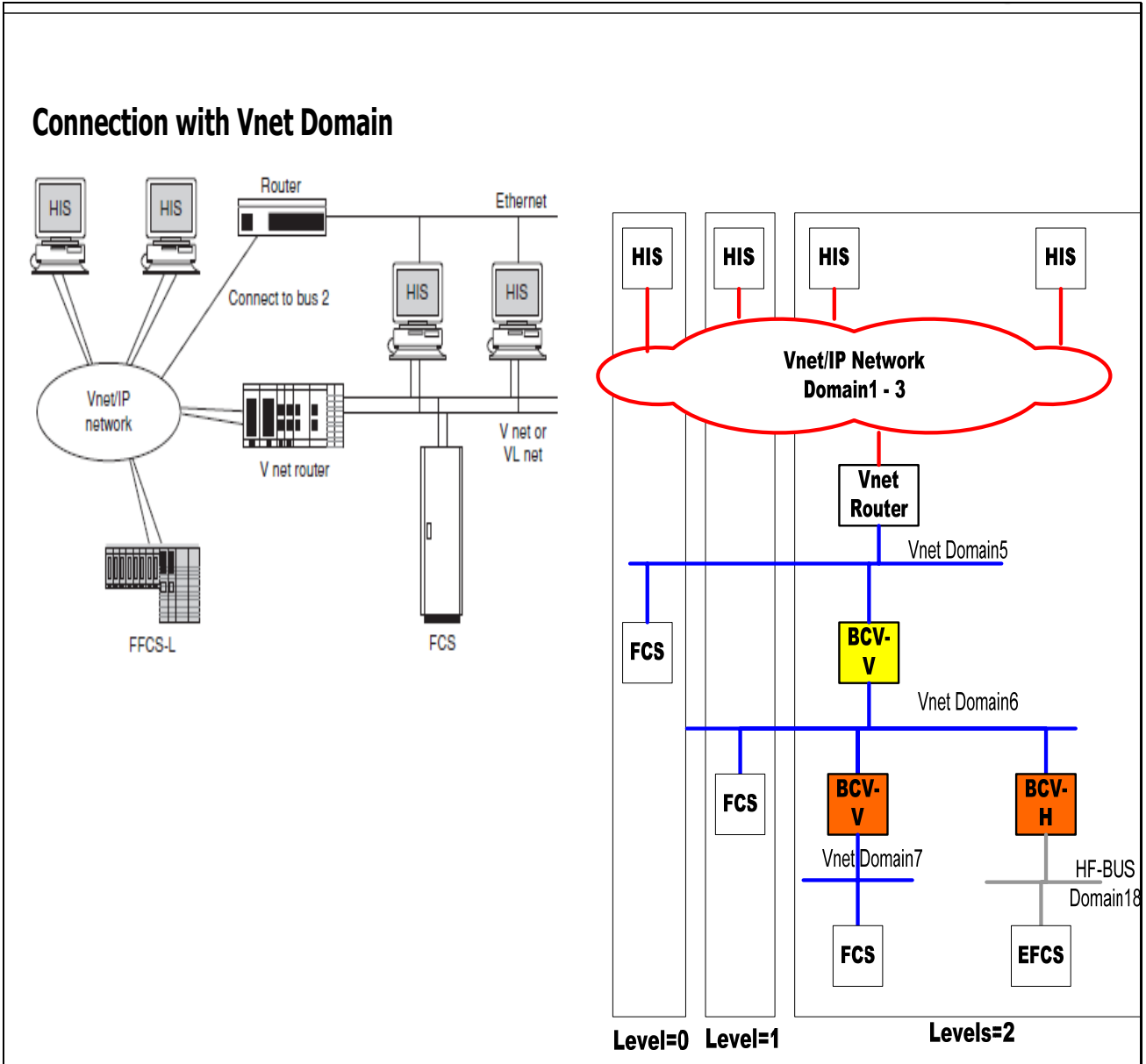


Figure Connection with Existing Systems

A V net router allows the connection of a Vnet/IP domain to a V net domain. A Vnet/IP domain cannot be connected directly to Centum-XL or Micro-XL systems.

When connecting with these systems, a BCV has to be provided in a V net domain, through which connections to those systems can be made.

To connect between a Vnet/IP domain and V net, and between a Vnet/IP domain and a VL net domain, a V net router is used.

---

### ■Connection between Vnet/IP and V net Domains

To connect a Vnet/IP network and V net domains, V net control communication are relayed using a V net router. The engineering of a V net router must be done from the Vnet/IP side.

Because the connection type of a Vnet/IP network and V net domains is bi-directional, it is possible to perform the operation and monitoring of the control stations of other domains. When engineering, it can be handled as one project in which Vnet/IP and V net stations coexist.

It is also possible to handle Vnet/IP and V net as separate projects, and integrate multiple projects using the Multiple Project Connection function. Connect the information bus (Ethernet connection between HISs) using bus 2 of Vnet/IP via a router.

### ■Connection between Vnet/IP and VL net Domains

Similar to the connection with V net, connect a Vnet/IP network and VL net domains using a V net router. In the case of VL net single, the VL net coupler of the V net router will be single.

The CENTUM CS 1000 does not require Ethernet as an information bus; however, it is required when connecting to Vnet/IP. Connect the information bus to bus 2 of Vnet/IP via a router.

Vnet/IP will be a CS 3000 project, and VL net will be a CS 1000 project. They can be integrated using the Multiple Project Connection function. At that time, the project on the Vnet/IP side will always be an upper project.

### ■Connection with HF Bus/RL Bus

The HF bus and RL bus used in control systems prior to the CENTUM CS cannot directly be connected to Vnet/IP.

To connect Vnet/IP with these control buses, it is necessary to configure a network by connecting to a V net domain via a V net router, and further routing through a bus converter (BCV-H, BCV-L).

---

**•Restrictions on Multi-Level Connection of Control Buses**

A station on Vnet/IP network can access a station on the other control bus, up to two hops of bus converters beyond the V net router.

Thus, connection can be established between the Vnet/IP domain and an existing control bus, that is two hops of bus converters away from the V net router.

The method to count the number of levels in multi-level connection of control buses is as follows:

- Do not count the number of levels of Vnet/IP domains on an access path.
- Do not count the number of levels of V net routers.
- Count the number of levels of bus converters that connect other control buses, as usual.



## 2.7.9 Domain Integration with Vnet Domain

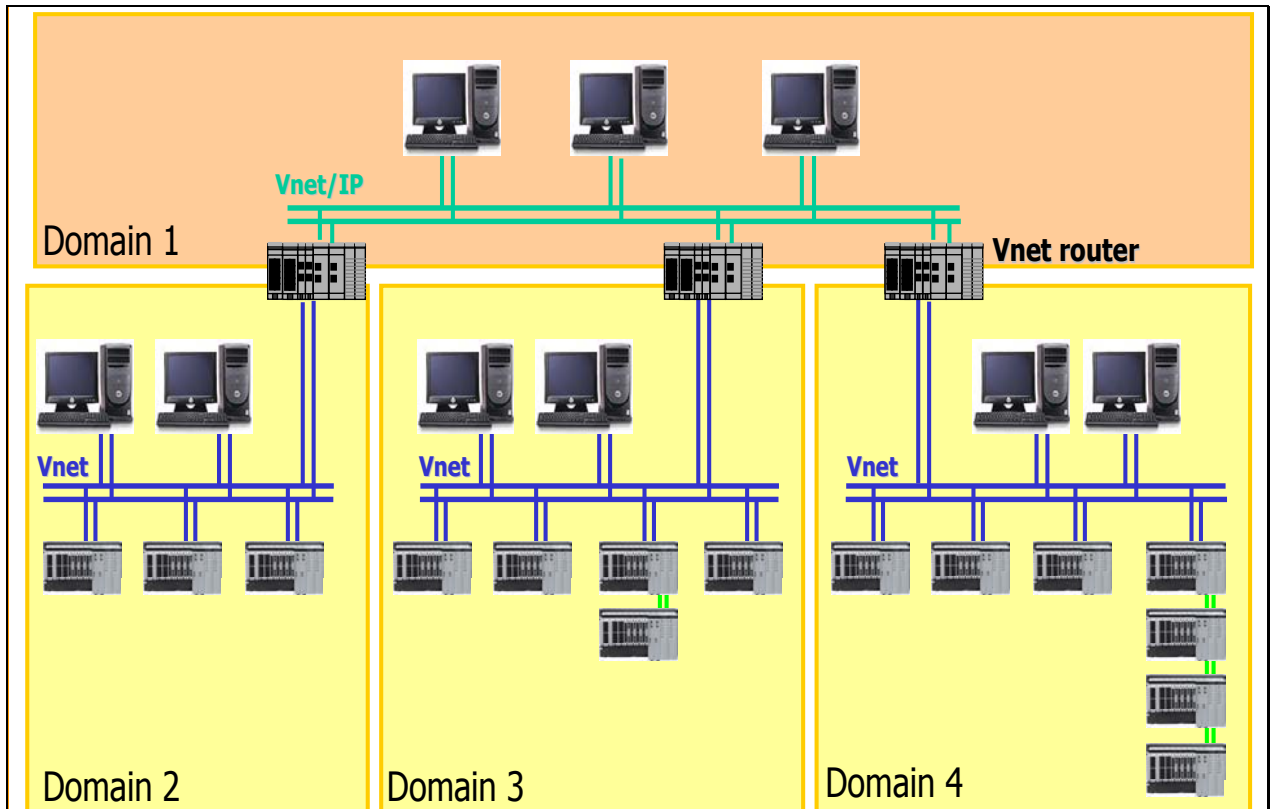


Figure : Domain Integration with Vnet Domain

- ✓ Multiple Vnet domain can be integrated by upper Vnet/IP domain
- ✓ Number of domains that can be hierarchically connected are 16.
- ✓ Number of hierarchical connections through a V-net router is three. (Two levels of bus converters, three levels of control buses)
- ✓ Devices that can be connected for inter-domain communication are V net routers and bus converters.
- ✓ Connections cannot be made via V net from one Vnet/IP to other Vnet/IP domain.
- ✓ Multiple paths for V net systems from Vnet/IP system cannot be configured .

## 2.7.10 Router -AVR10D r

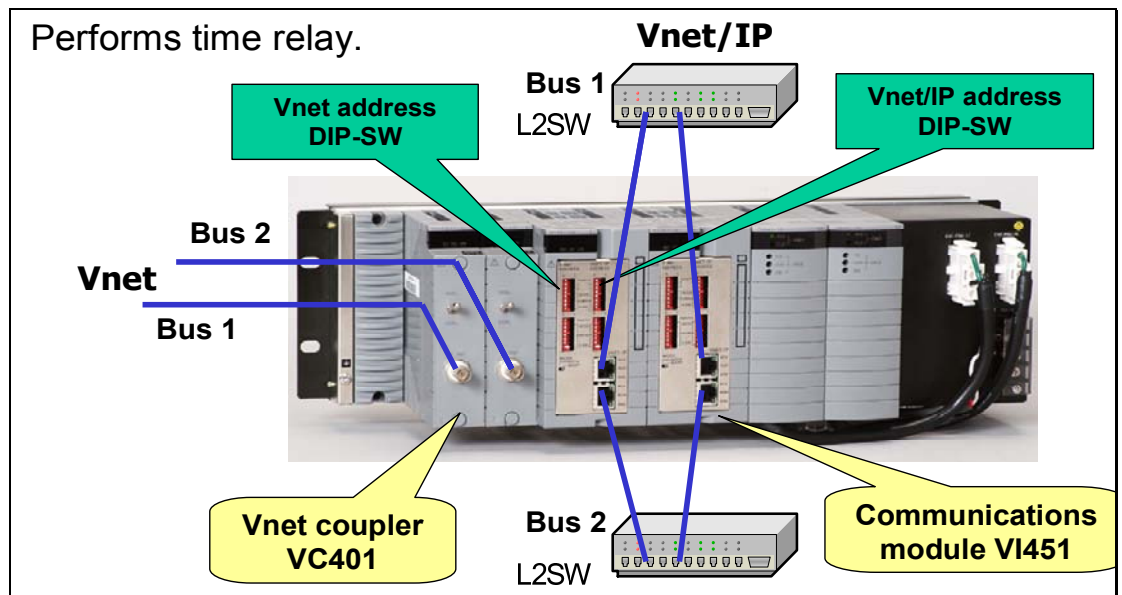


Figure : Router – AVR10D

- ❖ A Vnet Router is a device to connect a Vnet/IP domain and a Vnet domain for relaying control communications.
- ❖ Bidirectional data exchanges are possible between the system on a Vnet/IP side connected by a V net router and the system on a Vnet side.
- ❖ The router realizes operation and monitoring of a control station in one domain from another domain. AVR10D is a Duplexed Vnet Router having redundant communication and power supply modules.
- ❖ The Vnet Router is a bus converter for connecting a Vnet/IP domain to a Vnet domain. There is no direct way of connecting Vnet/IP to micro-XL or other non Vnet systems.
- ❖ To connect, a Vnet Router is required to connect Vnet/IP to a bus Convertor .
- ❖ Both the Vnet and Vnet/IP domains are part of 16 allowable Vnet domains. Configuration of the domains is the same as Vnet domain configuration.
- ❖ AVR10D has two power supply modules, two communications module and two Vnet coupler modules.

### 2.7.11 Cables

Connection	Cable Standard	Transmission rate	Connection distance	Remarks
Between Station & L2SW	100Base-Tx (802.3u) 1000Base-T (802.3ab)	100 Mbps 1 Gbps	Up to 100 m	Station connector: RJ45
Between L2SW	100Base-Tx (802.3u) 1000Base-T (802.3ab)	100 Mbps 1 Gbps	Up to 100 m Up to 100 m	
Between Router & L2SW	10G and optical fiber are also possible.	10 Gbps	Up to 20 km	
Between L2SW and L3SW	1000Base-LX(802.3z)	1 Gbps	Up to 5 km	

Figure : Cables

The interface cable standards and maximum cable distances are shown in the table.

A CAT5e (enhanced category5) or higher UTP (Unshielded Twisted pair) cable is used for 1000Base-T.

Based on the system configuration, either the number of layer 2 switches should be increased or the maximum distances have to be expanded by fiber cabling.

The cable standard can be selected depending upon the transmission rate of the destination devices.

---

## 2.7.12 Network Address Configuration

### Setting Station addresses

Station addresses are used to identify the stations on the control bus.

The station address is composed of a domain number and a station number. Domain numbers are used to identify the domain.

The domain number is set in the range of 1 to 16. The domain number is defined in project property setting menu dialog box. The domain number cannot be changed once it is set.

Station numbers are used to identify the equipments connected in the same domain of the system. The station numbers range from 1 to 64.

- For the FCS, station addresses are set in ascending order from 1 to 64.
- For the HIS, the station numbers are set in descending order from 1 to 64.
- For the Vnet/IP Router, the station numbers are set in ascending order from 1 to 64.

### Control Bus IP Address

The IP addresses on the control bus are used to logically identify the HIS for communication with other HIS on the control network.

The IP address on the control bus is automatically determined from the bus type, domain number and the station number.

The general IP address used are 172.16.domain number.station number.

### Control Bus Subnet Mask

The control bus subnet mask is set to 255.255.0.0.

## **Ethernet IP Address**

Ethernet IP addresses are used to logically identify the HIS or PC connected to the Ethernet.

The Ethernet IP addresses are automatically determined from the bus type, domain number and station number.

The Ethernet IP address normally used are: 172.17.domain number.station number.

However, when connecting to an outside network, the official address issued by the organization managing the IP addresses has to be used.

The Vnet address for the control bus is 172.16.domain number.station number. This is a virtual address for the Vnet application layer.

However, this needs to be connected to the two Ethernet ports.

### 2.7.13 Vnet/IP IP Addresses (Network Address)

<b>Vnet/IP uses Class C Private Addresses : <u>192.168.1.0</u> ~ <u>192.168.255.255</u></b>		
Network Address depends on <b>Domain No.</b> and <b>Bus System</b>		
Bus System	Network Address	
Bus1	192.168.<Domain>.0	
Bus2	192.168.<Domain + 128>.0	
<b>BUS1</b>	<b>192.168.1.xx ~</b>	}
	<b>192.168.33.xx ~</b>	
	<b>192.168.65.xx ~</b>	
	<b>192.168.97.xx ~</b>	
<b>BUS2</b>	<b>192.168.129.xx ~</b>	}
	<b>192.168.161.xx ~</b>	
	<b>192.168.193.xx ~</b>	
	<b>192.168.225.xx ~</b>	
		<b>192.168.1:Domain1</b> <b>192.168.2:Domain2</b> ... <b>192.168.31:Domain31</b>  <b>192.168.129:Domain1</b> <b>192.168.130:Domain2</b> ... <b>192.168.159:domain31</b>

Class C private address is used for setting the IP address for Vnet/IP. Class C private addresses ranging from 192.168.0.0. to 192.168.255.255 are used.

The control bus Subnet mask is set to 255.255.255.0 by default. Duplex control stations use two IP addresses for each subnet for FCS. Up to 64 Vnet/IP stations can be connected in one domain.

In addition, a total of 124 network devices with IP addresses and open based communications devices can be connected per single-sided bus in one domain.

Unmanaged layer 2 switches without SNMP functions are not included in 124. If an IP address is set to use SNMP functions for managed layer 2 switches , they are counted.

### **IP address for Control Communications**

An IP address for control communications can be automatically set, ranging from 1 to 129 from domain and station numbers.

Domain and station numbers are set with a DIP switch for each device. Domain numbers should not overlap in Vnet/IP or a Vnet system.

In addition the time server host address is fixed at 254.

### **IP Address for Open Communications**

IP addresses for open communications in a Vnet/IP station, as well as for general purpose, open based communications devices and network devices, are not automatically set.

Network addresses should be set in conformity with an address system for control communications.

Addresses 1 to 128 and 254 are set aside for control communications. Hence 130 to 253 are used as the host address for open communications.

## 2.7.14 Vnet/IP Address Specifications

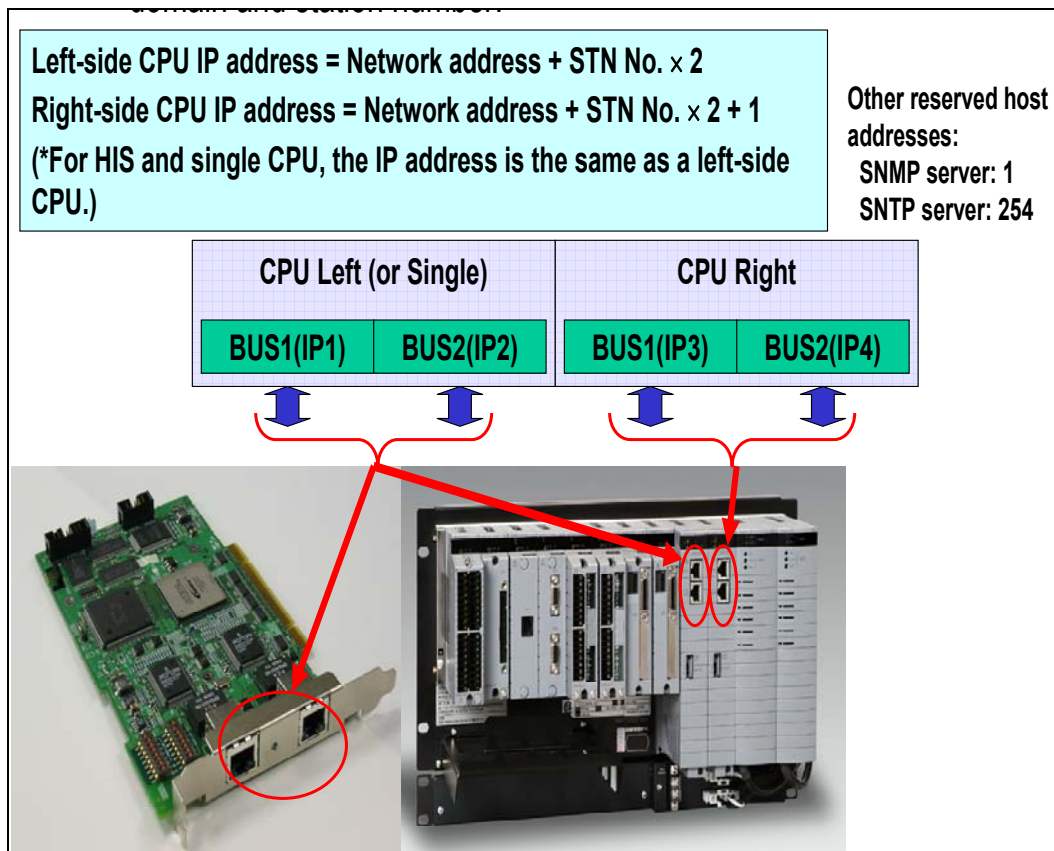


Figure : Address Setting on VI701 Card

### Vnet/IP address specifications

Devices connected to Vnet/IP have control communication and open communications IP addresses.

Bus 1 and bus 2 are separate sub nets, so separate IP addresses are needed for each bus.

Duplexed field control stations and V net routers incorporate IP addresses on a CPU basis.

#### For HIS:

Two IP addresses for control communications one for bus1 and the other for bus 2 and one IP address for open communications are used.

#### For Single FCS:

Two IP addresses one for bus1 and the other for bus 2 are used.



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**For Duplexed FCS:**

- Four IP addresses one each for right side CPU bus 1, right side CPU bus 2, left side CPU bus1 and left side CPU bus 2 is used.
- The Vnet address expands out to two IP addresses for the Ethernet layer, using Class C addressing (192.168.domain number.station number)
- Network addresses are determined by domain number and station number.
  - ✓ For bus1 side, the address is specified as 192.168.domain number.0 and
  - ✓ For bus 2 side the address is specified as 192.168.(domain number +128).0
- In addition, SNMP server uses 192.168.1.1 and SNTP Server uses 192.168.129.254
- User need to set only the Vnet address 172.16.dd.ss. The 192.168.dd.ss addresses are invisible to the user.
- For non Yokogawa devices such as printers, managed switches, the addresses ranging from 192.168.129.194 to 192.168.129.253 are available.

## 2.7.15 Principles of Redundancy

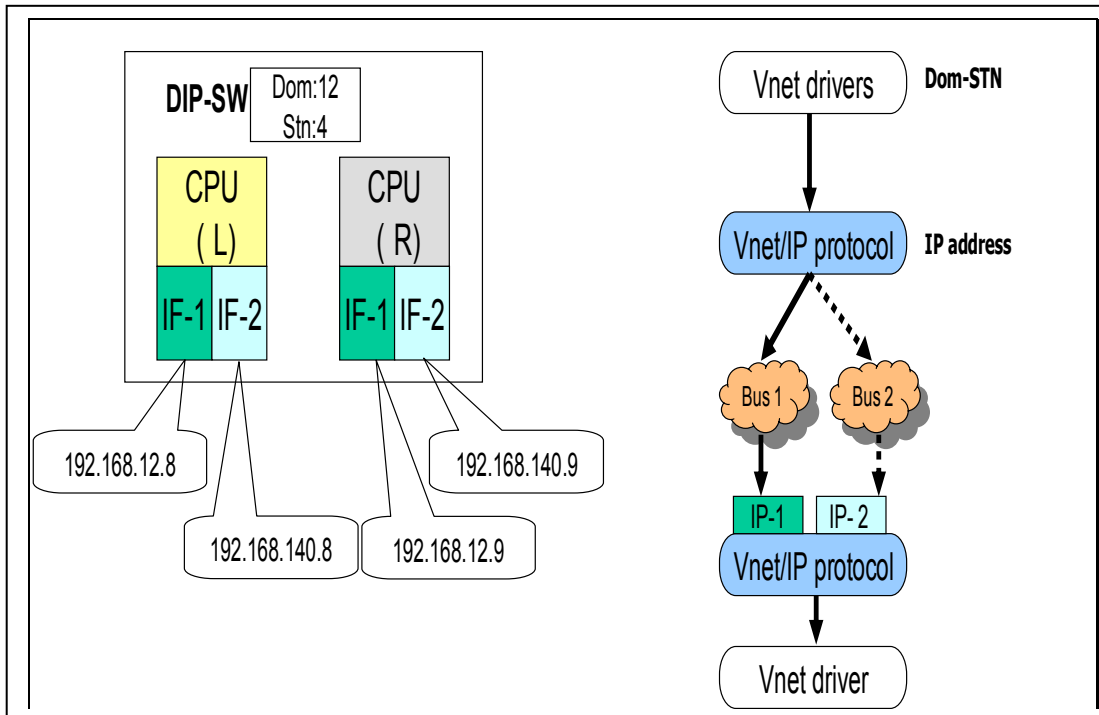


Figure : Principle of Redundancy

- ❖ An independent IP address is assigned to each communications station port.
- ❖ The path information and opposite station's control side are recognized on a fixed cycle.
- ❖ On the sending side, the opposite party's IP address is selected and sending is performed.

## 2.7.16 Open Communications

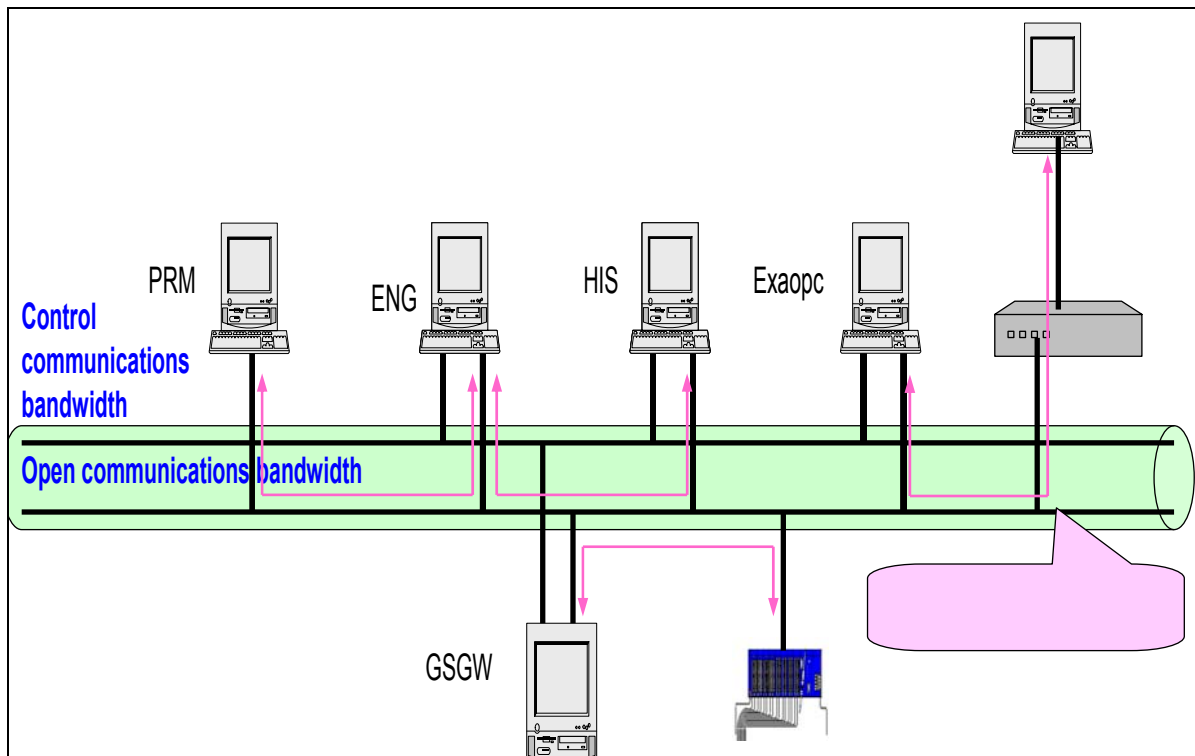


Figure: Open Communications

- ❖ The VI701 bus 2 port is used as the Ethernet port for communication with other devices (other Vnet/IP communications stations, ordinary Ethernet communications stations).
- ❖ Bus 2 is used for both control communications and open communications (when a bus 1 failure occurs).
  - Network bandwidth restricted.
  - Receiving bandwidth ensured.

## 2.7.17 Redundancy Processes

### Path Redundancy

Name	Sending	Receiving	Description of operation
Communication between 2 stations in same domain	One bus	One bus	1 of the dual redundant paths is selected for sending. After 2 retries, the path is switched (bus switching time: 160 ms).
Communication between 2 stations in different domains	One bus	One bus	1 of the dual redundant paths is selected for sending. The transmission serial numbers are verified every 500 ms, and the path is switched if a nonresponding bus is detected.
Message communication	Both buses	One bus	A multicast frame is sent on each of the redundant buses. Reception occurs at the bus where the frame arrives first.
Scan transmission			

### Station Redundancy

Name	Sending	Destination	Description of operation
Communication between 2 stations in same domain	Control side	Control side	The control side of the receiving station is selected according to the path information.
Communication between 2 stations in different domains	Control side	Both sides	At the receiving station, the destination address is judged to be a control destination or a standby destination. The frame is abandoned if it is unnecessary.
Message communication	Control side	Multicast	Receiving occurs at the control side only. Frames at the standby side are abandoned.
Scan transmission	Control side	Multicast	Scan data is received at both sides.

### 2.7.18 Application Capacity

Item		Standard	AP expansion
Tag count	Station common	5800	
	Area	2500	
Process I/O	Node count	4	15
	Analog I/O points	480	1280
	Contact I/O points	1920	4096
	Installable ALF111 boards	30	32
	Installable ALR/ALE/ALP boards	8	16
Comm. I/O	Data volume (words)	4000	
Internal switches	Common switches	4000	
	Global switches	256	
Message output	Annunciator	1000	
	Print messages	1000	
	Operator guide	500	
	Request messages	200	
	Event messages	500	

Item		Standard	AP expansion
Control functions	Control drawing	200	
	Continuous control/operation	500	1280
	Sequence	150	600
	Switch instruments	300	1000
	General-purpose calculations	250	500
	Faceplates	120	200
	Logic operations	80	200
	SFC	20	60
	Units	20	60
	Operation (for CS batch)	150	400
	High-speed trend points	256	256
	ADL points	512	512
	SEBOL interlanguage	210	
	SEBOL user functions	70	
	Recipe area	1 Mbyte	

## 2.7.19 Bandwidth Specification

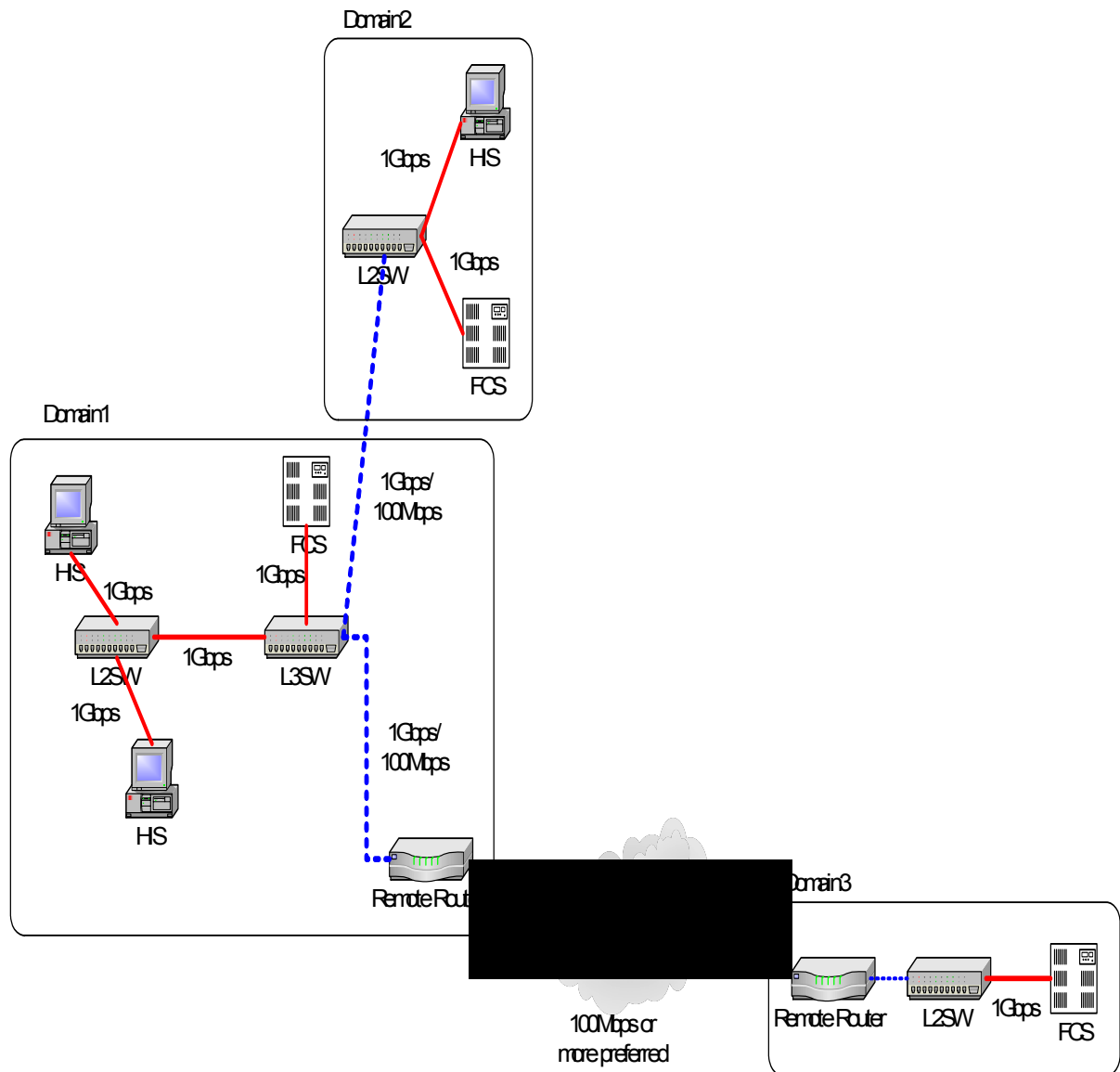


Figure : Bandwidth Specification

- ❖ Within a domain
  - Node – L2SW/L3SW: 1Gbps
  - L2SW – L2SW: 1Gbps or higher
- ❖ Inter domain
  - L3SW – L2SW/L3SW: 1Gbps/100Mbps
- ❖ Narrow Bandwidth between domains:
  - Traffic Analysis and precautions to limit communication Required

## 2.7.20 FCS Redundancy – Pair and Spare CPU

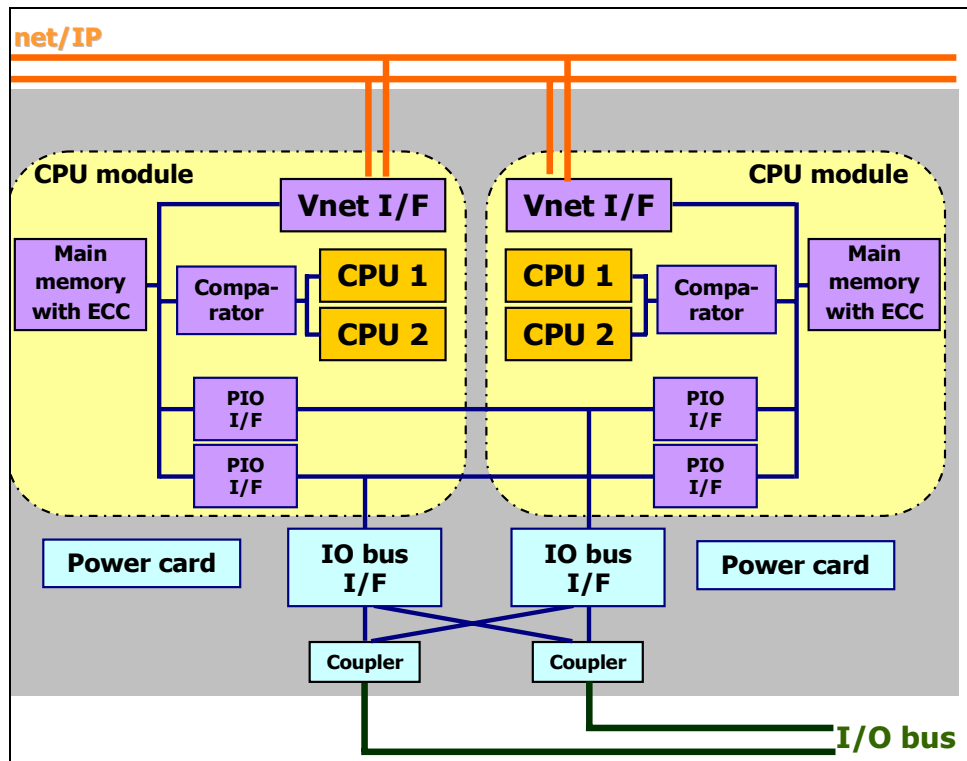


Figure : FCS Redundancy – Pair and Spare CPU

Both CPU modules are processing independently, so CENTUM achieves real bump less switchover.

A Pair of CPU chips are available on each module. Each CPU does processing independently.

Processed results of CPUs are every time compared each other.

If the results are not incongruous, control switch to the stand-by module to avoid the effect of transient error.

2.7.21 Control Bus IP Address and Vnet/IP Open Communication

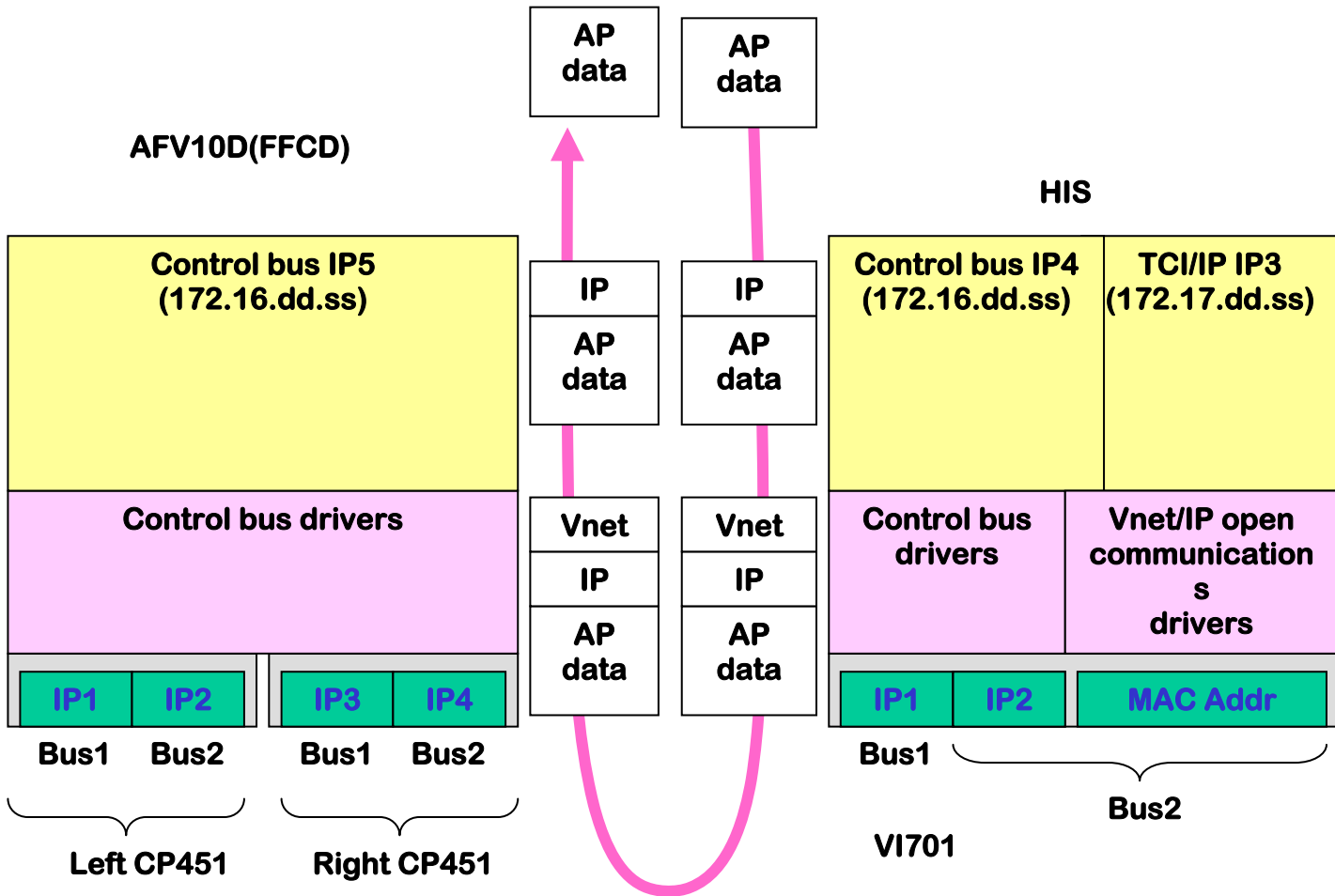


Figure : Control Bus IP Address and Vnet/IP Open Communication

The control bus IP address is the same as before.

TCP/IP communications using a general-purpose PC have been replaced by Vnet/IP open communications.



## 2.7.22 Network Bandwidth Restrictions

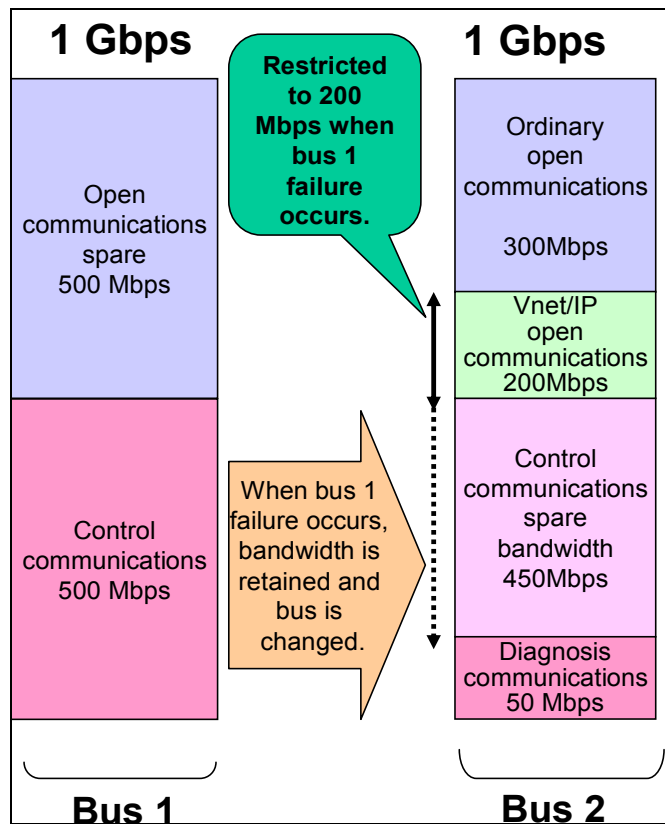


Figure: Network Bandwidth restriction

A minimum of 500 Mbps are secured as bandwidth for control communications.

Control communications: Ordinarily bus 1 is used  
Bus 2 is used when a bus 1 failure occurs.

Open communications: Only bus 2 is used

- Vnet/IP open communications: 200 Mbps
  - Device with Vnet/IP communications card installed
  - When a bus 1 failure occurs, sending is restricted to a maximum of 200 Mbps.
- Ordinary open communications: 300 Mbps
  - Ordinary Ethernet communications devices are connected to bus 2 through a merging hub.
  - The transmission speed is restricted on the merging hub port.

## 2.7.23 Time Synchronization

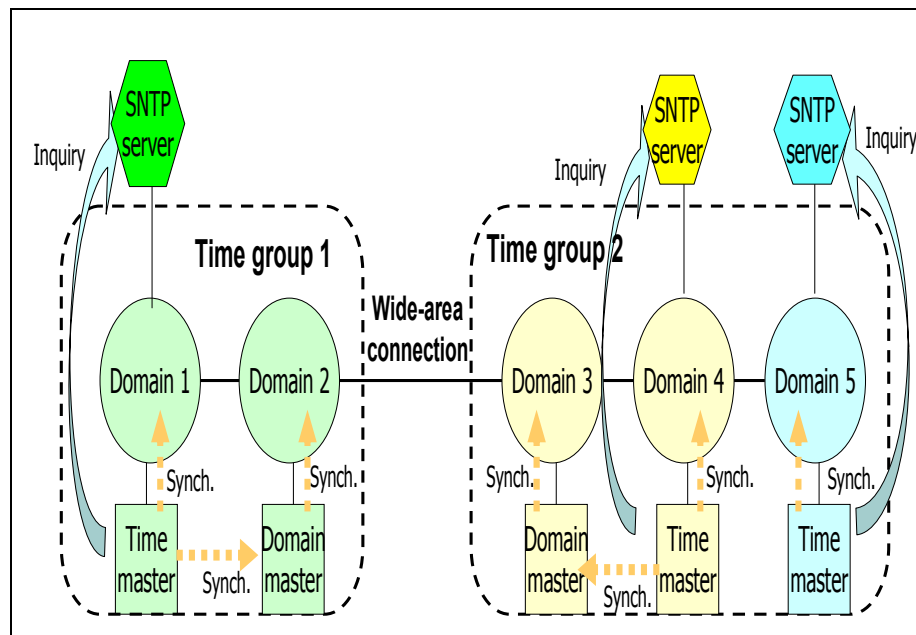


Figure: Time Synchronization

### Features

- Time synchronization within domain (relative accuracy  $< \pm 1$  ms)
- Absolute time is acquired from the SNTP server.
- Time synchronization between domains (relative accuracy  $< \pm 5$  ms)
- Independent time synchronization within a time group (collection of domains) is possible.
- Time required for time synchronization:  $\pm 1$  s or less for synchronization to within 5 s;  $\pm 1$  ms for synchronization to within 5 min or less
- Same as Vnet, supplies tick to CPU, guaranteed cycle  $\pm 5\%$ .

### 2.7.24 Vnet/IP Bus Status

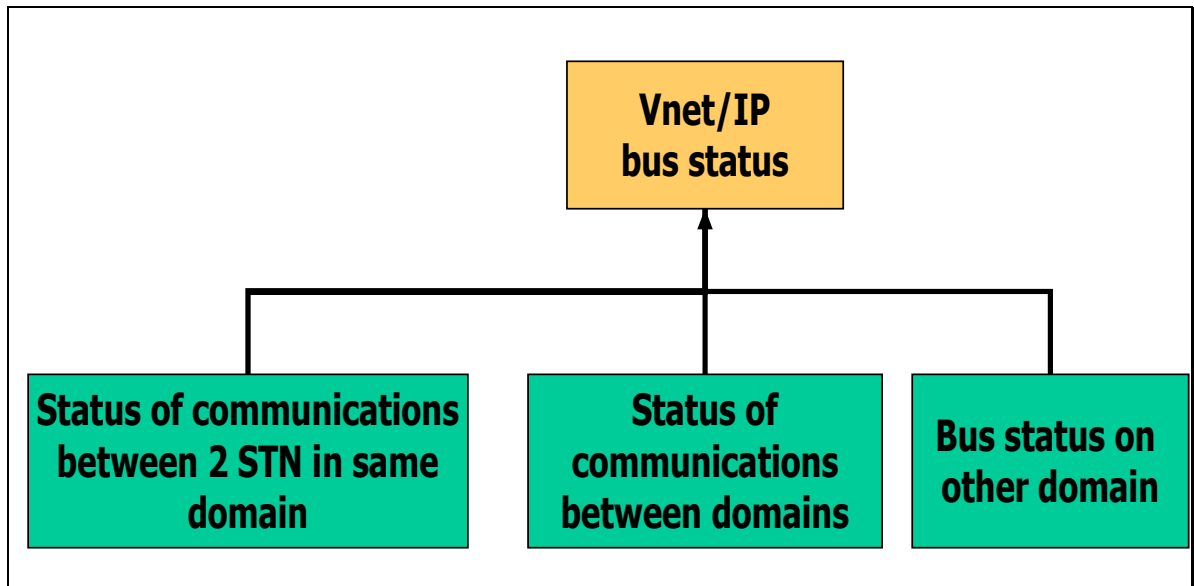


Figure :Vnet/IP Bus Status

- Vnet/IP bus failures are communicated to the entire network.
  - Vnet bus failures affect only within that domain. This is because BCV secures the independence of each domain.
- Communications failures within the network are identified as bus failures within that domain.
  - Communications failures resulting from L3SW faults are also identified as bus failures.
- Handling of multiple bus faults
  - The bus where the failure occurred first is identified as having failed. Simultaneous failure of both buses does not occur.
  - But buses at the same station fail → STN failure

## 2.8 FIO Module Series

The Field Network I/O (FIO) modules are used in the FCS for FIO. They are compact and consist of the line up of abundant variety, such as connector types, the isolation types to provide greater flexibility in field connections.

### Advantages of FIO series IOM

- It supports Variety of Field connections.
- I/O modules are available with different isolation types.
- Supports wide range of Installation environment.
- Redundancy is available.
- Provides Replacement capability for the existing Centum V, Centum XL and Micro-XL systems.

### 2.8.1 Types of Field Connections

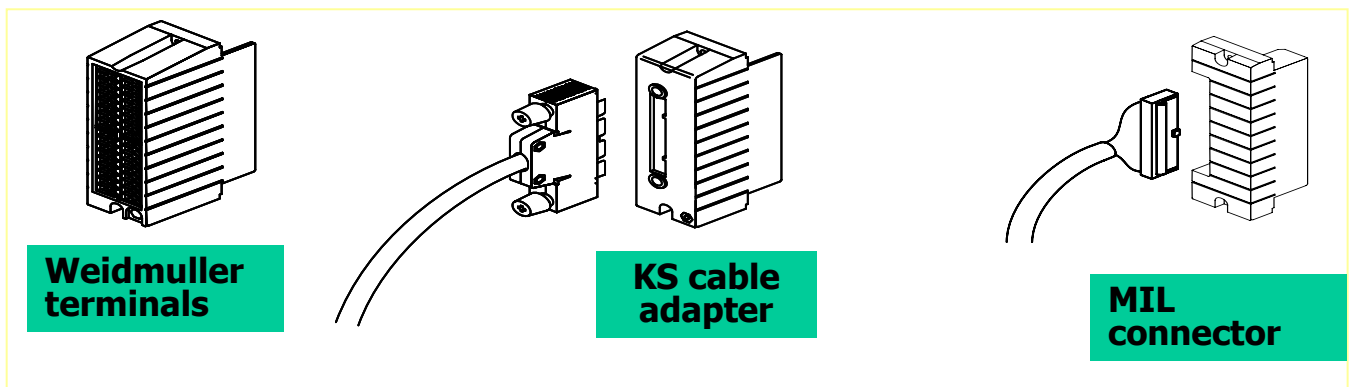


Figure: Types of Field Connections

#### Field Wiring Using Pressure Clamp Terminals (Weidmueller terminals)

- A field signal cable, with its end uncovered, can be connected directly to an analog or digital I/O module equipped with the pressure clamp terminal block. Two to three signal cables can be connected for every I/O channel. It is most popular in Europe.

#### Field Wiring Using KS Cable Interface Adapter

- An analog or digital I/O module equipped with the KS cable interface adapter can be connected with the terminal board using the KS cable and field signal cables are connected to the terminal board with M4 screws. Same as Yokogawa's traditional style

### **Field Wiring Using MIL connector**

MIL cable provided by the user is also available for the connection. This is popular in low cost applications.

#### **2.8.2 I/O Modules Isolation Type: FIO series provides I/O modules with different isolation types**

**a) System-to-signal isolated, channel-to-channel isolated** - This provides high noise immunity.

**b) System-to-signal isolated, channel-to-channel non-isolated** - Equivalent to the present multi-point I/O module; suitable for monitoring points.

**c) Non-isolated** -Low cost solutions for the users

#### **Redundancy of FIO IOMs**

- Duplex configuration of digital module is available.
- Redundant sub-system (serial communication) is available.
- Yokogawa provides world first redundant FOUNDATION Field bus solution.

## 2.8.3 FIO – Remote Nodes

### Remote Node Connection

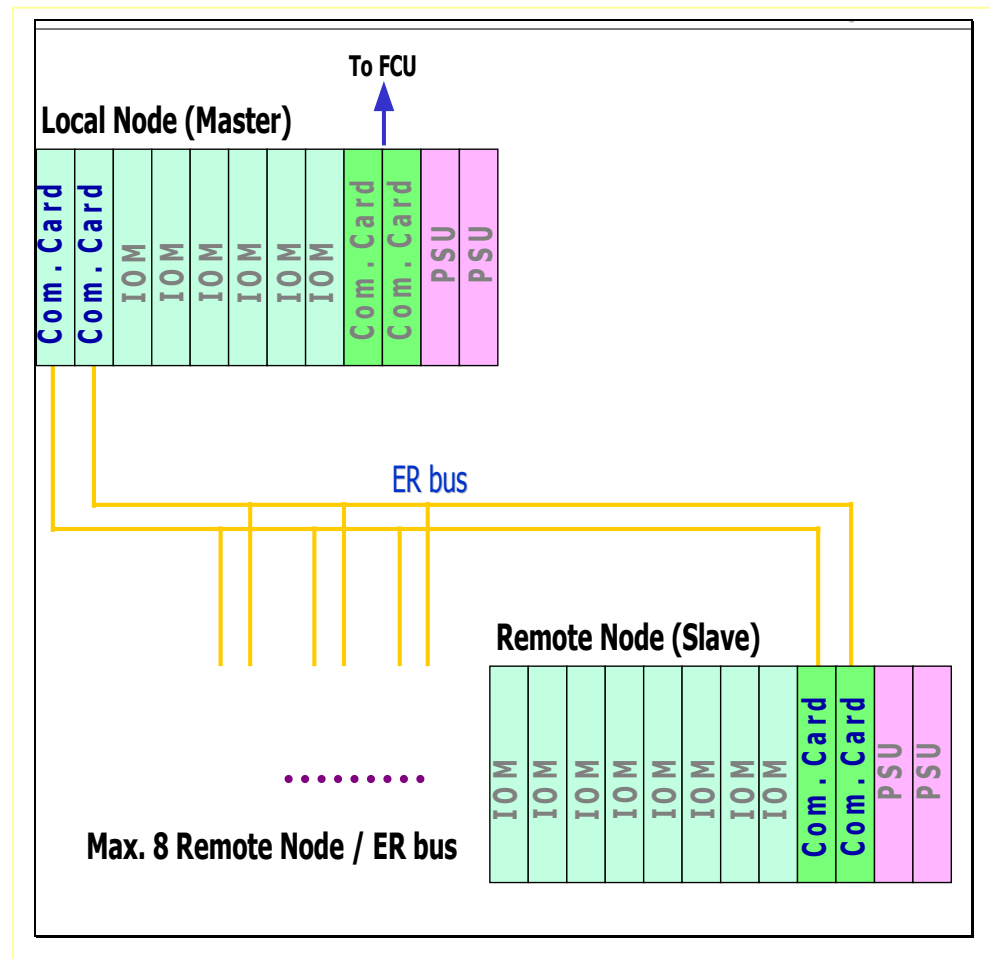


Figure: Remote Node Connection

### ER Bus Specification

- ER bus is based on Ethernet.
- Communication Speed is 10Mbps
- 8 Remote Node can be connected on one ER bus
- ER bus can be extended through fiber optic (Up to 2km)

In Extend FCS database type(32M) can connect 15 node on one FCU, it includes Master node and Remote node. At least one Master node is necessary.

## Remote Node Connection by Fiber

ER bus (10 base 2) can extend by Optical Fiber.

Multi Core type Fiber can extend up to 2km for general specification.

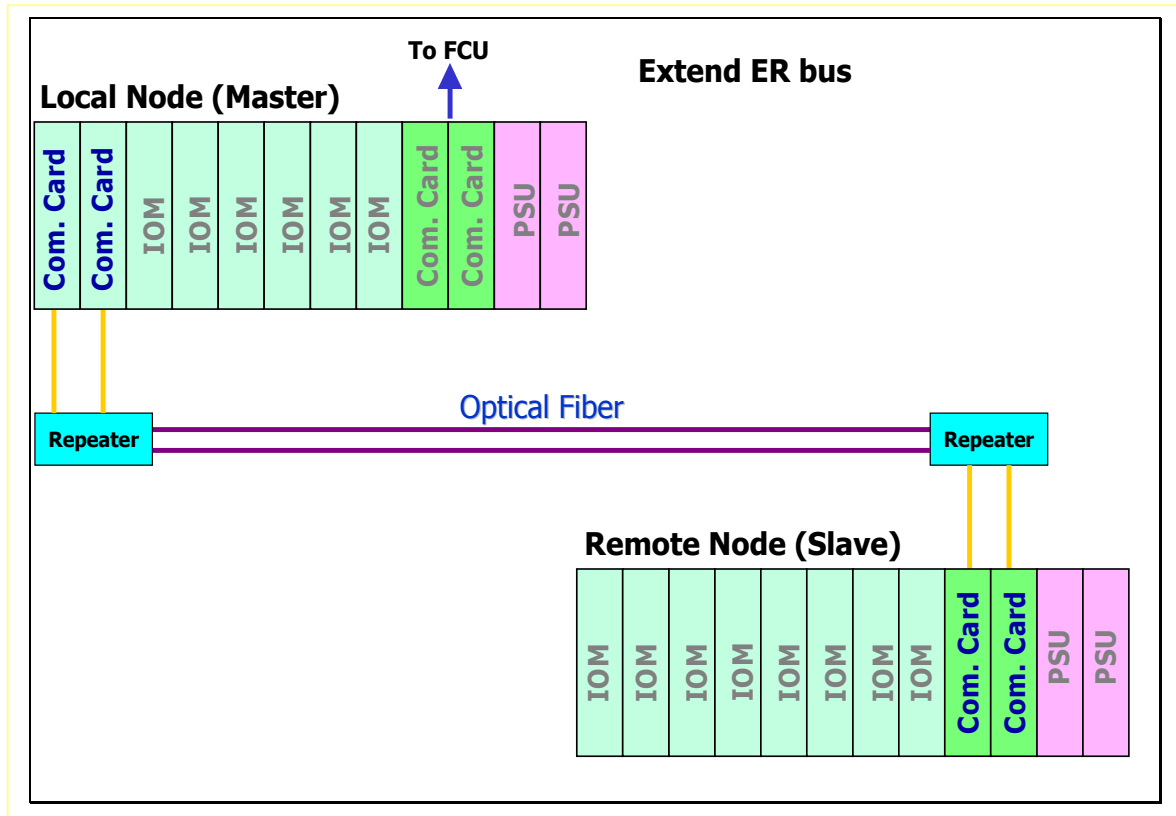


Figure : Remote Node Connection by Optical Fiber

ER bus interface cards support 10 base 2 (EB401:Master) and 10 Base T (EB402:Master) interface.

### Remote Node Connection by Public Line

For Public line, ER bus interface use 10 base T type. EB402 can do tuning the detail communication.

Also, Slave side have to install EB501 (10 base 2) and EB511(10 base T) for ER bus interface card.

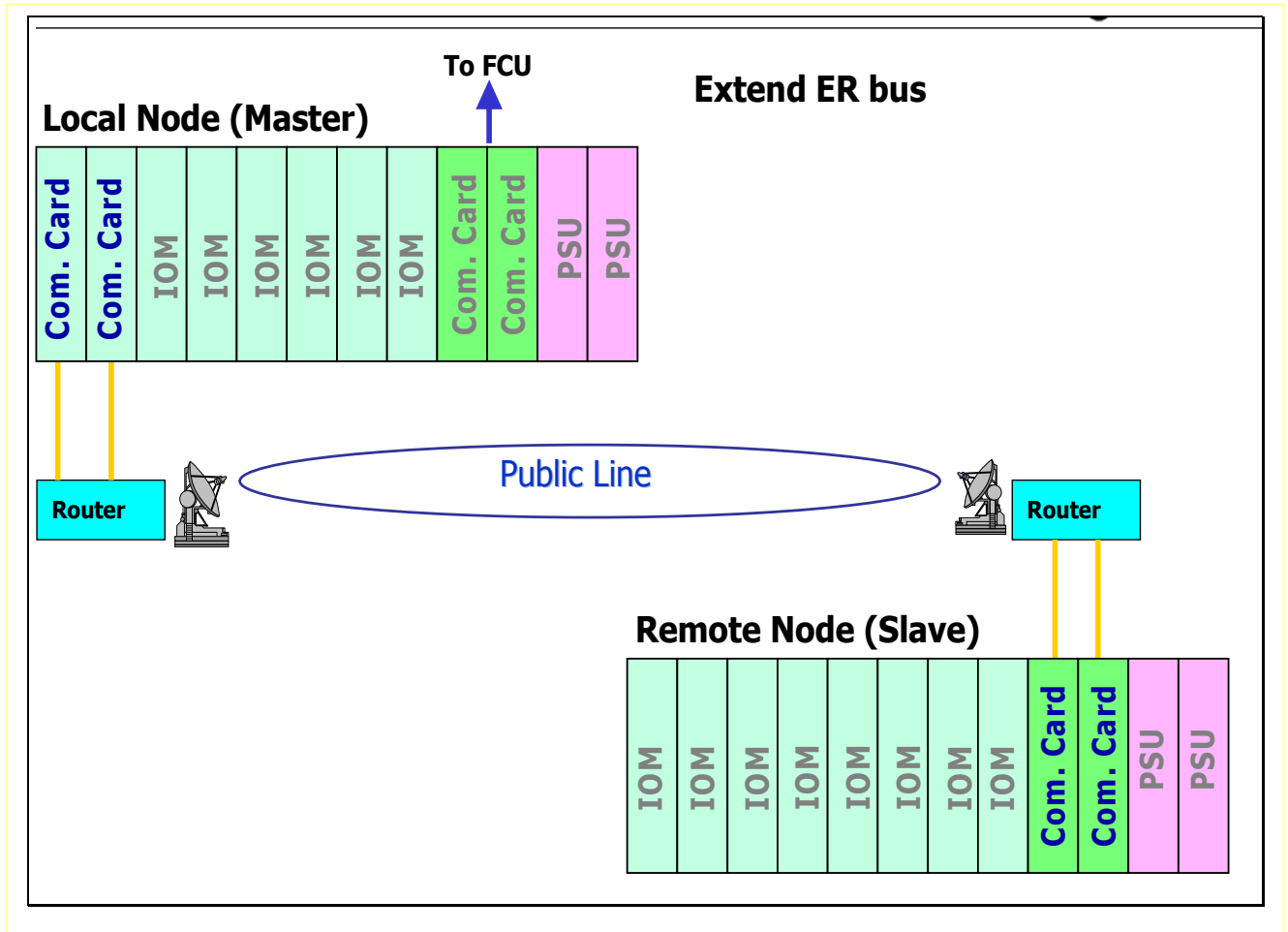


Figure : Remote Node Connection by Public Line



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## 2.8.4 FIO – Series IOMs --- Analog I/O Modules supported by FIO type FCS

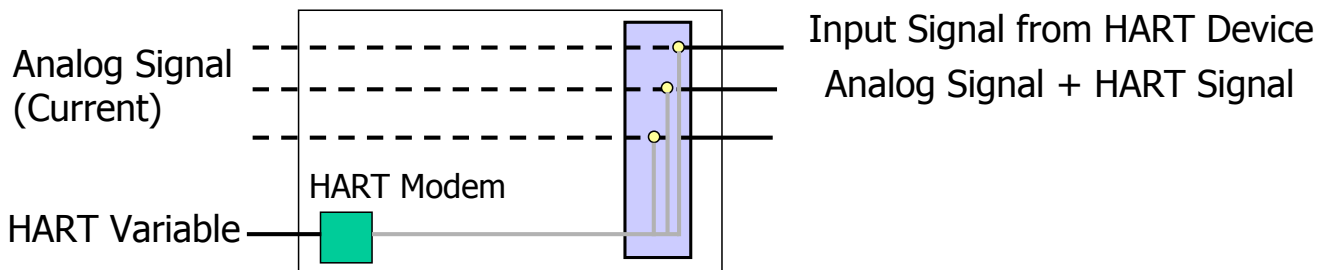
### Non-isolated type

- AAI141 : 16 Channel Current input,4-20mA (Transmitter power supply)
- AAV141 : 16 Channel Voltage input, 1-5V
- AAV142 : 6 Channel Voltage input, -10V to +10V
- AAI841 : 8 Channel Current input/8 Channel Current output, 4-20mA (Transmitter power supply)
- AAB841 : 8 Channel Voltage input/8Channel Current output, 1-5V input/4-20mA output
- AAV542 :16 Channel Voltage output, -10V to +10V
- AAP149 :16 Channel Pulse Count 0 to 6kHz (Pulse Input Module PM1 Compatible)

### Isolated (between system and field)

- AAI143 :16 Channel Current input, 4-20mA (Transmitter power supply)
- AAI543 16 Ch Current output 4-20mA
- AAV144 16Ch Voltage Input -10V to +10V
- AAV544 16Ch Voltage Output -10V to +10V
- AAT141 16Ch mV,TC input JIS R,J,K,E,T,B,S,N / -100 to +150mV
- AAR181 12Ch RTD JIS Pt100 ohm

## 2.8.5 Analog Modules with HART Protocol



### HART I/O Modules

- AAI135-H for 8 input, channel isolated
- AAI835-H for 4 input / 4 output, channel isolated
- AAI141-H for 16 input, non-isolated
- AAI841-H for 8 input / 8 output, non-isolated
- AAI143-H for 16 input, Isolated
- AAI543-H for 16 output, Isolated
- ASI133-H for 8 input, IS module (IS refers to Intrinsic Safety)
- ASI533-H for 8 output, IS module

### Data supported by HART Module

- Analog Data : 4 to 20 mA from Device
- HART device supports maximum four HART Variable
  - PV, Primary Value
  - SV, Secondary Value
  - TV, Third Value
  - FV(4V), Fourth Value
- HART Module supports Max 32 HART Variable data

---

## 2.8.6 Digital I/O Modules supported by FIO type FCS

### Generic type

- ADV151: 32Ch24VDC input module, Common minus side every 16-channel.
- ADV157: 32Ch24VDC input module, Common minus side every 16-channel, Single and Weidmueller only.
- ADV161: 64Ch24VDC input module, Common minus side every 16-channel, MIL type only.
- ADV551:32Ch24VDC,0.1A, module, Common minus side every 16-channel.
- ADV557: 32Ch24VDC,0.1A, module, Common minus side every 16-channel, Single and Weidmueller only.
- ADV561: 64Ch24VDC,0.1A, module, Common minus side every 16-channel, MIL type only.
- ADV851:16ch Input/16ch Output module, 24VDC.

### AC input module

- ADV141,16Ch100VAC input module, Common minus side every 8-channel
- ADV142,16Ch220VAC input module, Common minus side every 8-channel

### Relay output module

- ADR541:16Ch Relay output module, Common minus side every 8-channel, 24-100VDC,100-200VAC,

### CENTUM-ST compatible type

- ADV859: ST2 compatible -16Ch input,16Ch output
- ADV159: ST3 compatible module - 32Ch input
- ADV559: ST4 compatible module - 32Ch output
- ADV869: ST5 compatible module - 32Ch input, 32Ch output
- ADV169: ST6 compatible module - 64Ch input
- ADV569: ST7 compatible module- 64Ch output

---

## 2.8.7 Communication Modules supported by FIO type FCS

### a) Serial Communication Module

- ALR111 module for RS232C communication. It has 2 ports with baud rates from 1200bps to 115.2k bps.
- ALR121 module for RS422/RS485 communication. It also has 2 ports with baud rates from 1200bps to 115.2k bps.

### b) Ethernet Communication Module

- ALE111 module is used for Ethernet Communication -These modules can be installed both in local and remote nodes.

### c) Foundation Field Bus Communication Module

- ALF111 for Field Bus Communication

### d) PROFIBUS-DPV1 Communication Module

- ALP111 for Profibus Communication

## Subsystem Packages List

i) ALR111/ALR121 modules can be used for Serial communication with the following devices.

- ✓ YS Communication
- ✓ YS Directly Communication
- ✓ FA-M3
- ✓ Modbus
- ✓ SLC500/PLC5
- ✓ MELSEC

ii) ALE111 module can be used for Ethernet communication with the following devices.

- ✓ FA-M3
- ✓ Modbus
- ✓ SLC500/PLC5
- ✓ ControlLogix
- ✓ MELSEC

## 2.8.8 Foundation Field bus Module (ALF111)

FF-H1 interface card ALF111 is used for Field Bus communication. It has the following features.

- ❖ Redundancy is available. Yokogawa is the first in the world to provide redundancy in Field Bus communication.
- ❖ Installable both on Local and Remote nodes
- ❖ VCR (Virtual Communications Relationship): 105 per port (one segment)
- ❖ Both pressure clamp and terminal board are available.
- ❖ ALF111 module can be configured as a Link Master.

### Redundant Fieldbus Module (ALF111)

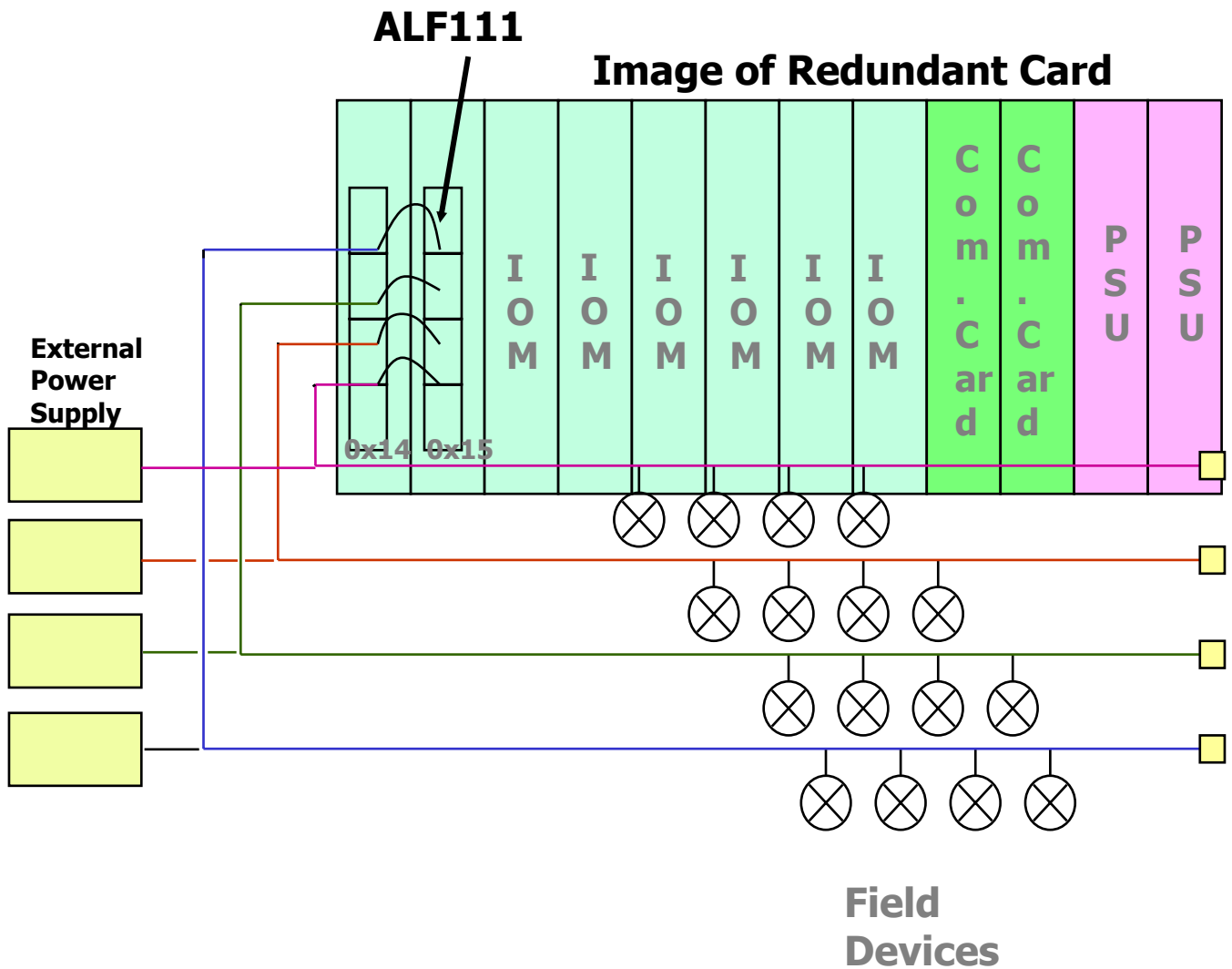


Figure: Redundant Configuration of Field Bus Module

**Field bus has the following features**

- **Field Bus is a bidirectional digital communication protocol for field devices.**
- **Field Bus is a big innovation in process control systems technology and is expected to replace the standard 4-20mA analog communication protocol that most current field devices employ.**
- **A digital transmission protocol is used, ensuring high-accuracy information processing.**
- **High-accuracy information processing enables strict quality control.**
- **Multiplex transmission is supported, so that function block parameters of field devices can be also transmitted.**
- **Communication between field devices allows autonomous distributed control by the field devices.**
- **Interoperability enables devices from different manufacturers to be combined.**
- **A broad choice of devices from many manufacturers allows us to configure the optimum system for our needs.**
- **Various systems such as instrumentation, electrical, Factory Automation (FA), Business Automation (BA) , Office Automation (OA) systems and analyzers can be integrated.**
- **Few adjustments and inspections of field devices can be performed from a remote location.**

## 2.8.9 PROFIBUS DPV1 Interface Module (ALP111)

ALP111 Specifications are as follows.

- -Up to 16 modules can be installed in an KFCS. Up to 8 pairs are available
- -PNO (PROFIBUS Nutzer organization e. V.) standard redundancy is available.
- -ALP111 has both Class1 and Class2 master function
- -ACP71 application compatibility is available. ACP71 is RIO based PROFIBUS DP Interface module

**Class 1:** It is Master Device. The device has to be connected on PROFIBUS-DPV1 all the time. It can Manage Slave Devices.

**Class 2:** Maintenance Master Device

It should be connected on PROFIBUS-DPV1 whenever required. It must not be connected all the time. Online Configuration or Parameter setting for Slave device is possible.

### System Configuration with Profibus Connectivity

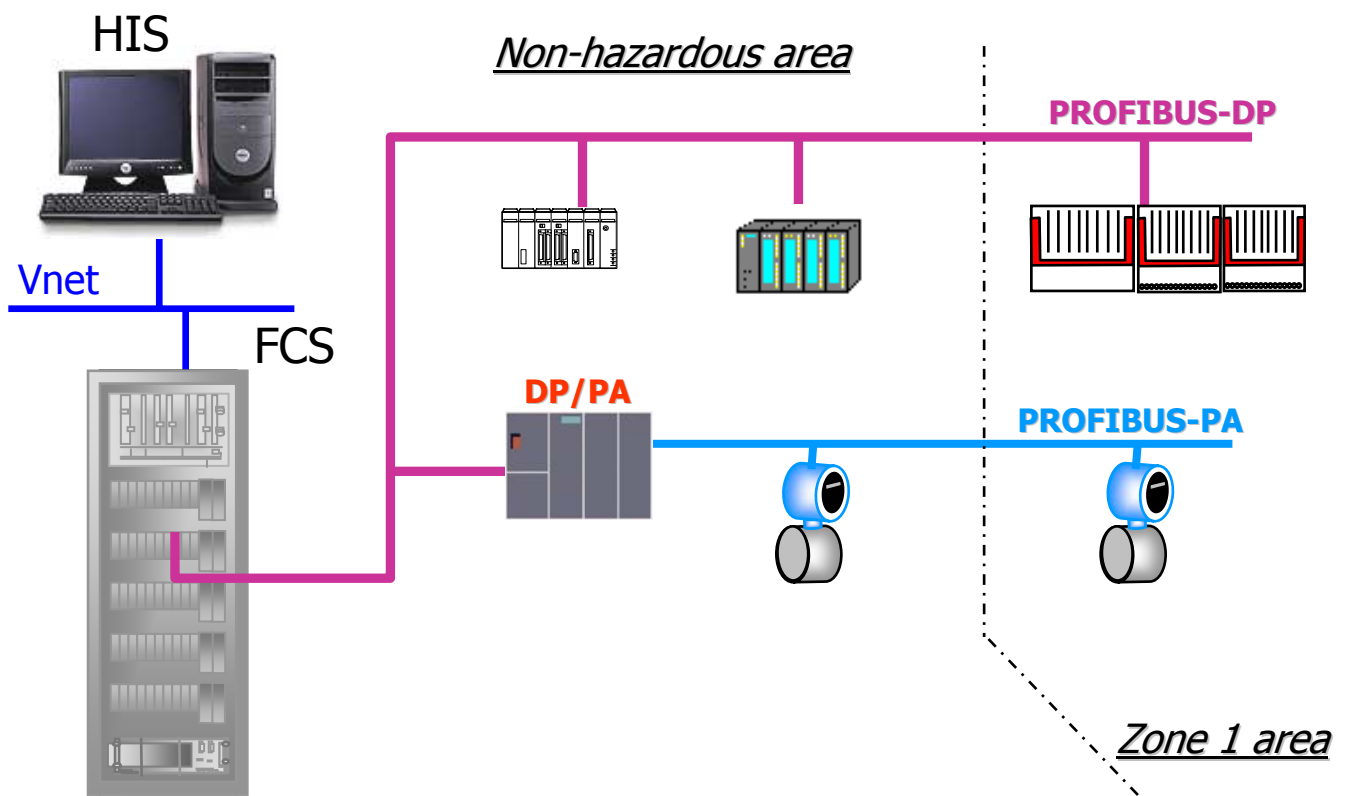
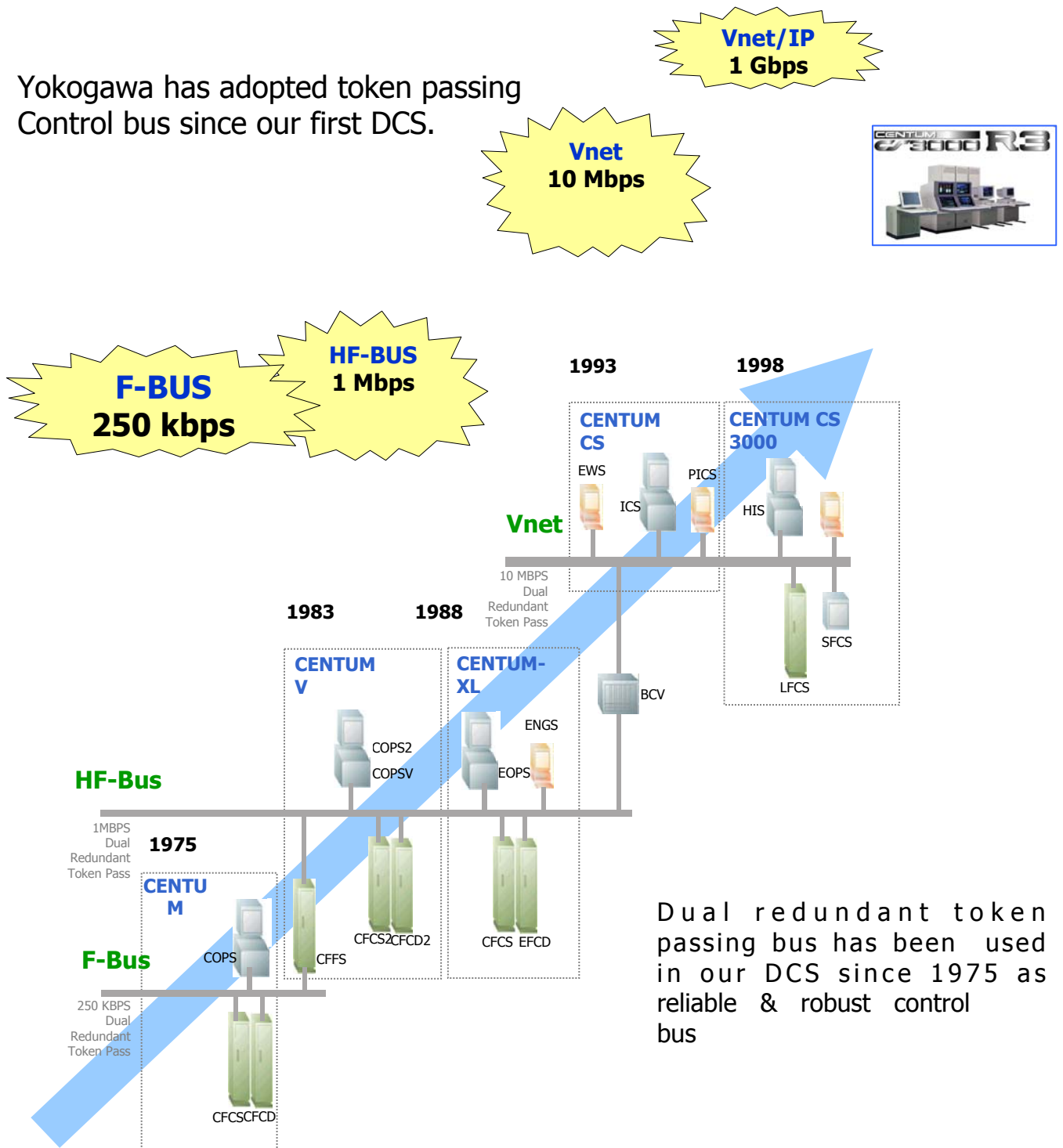


Figure: System Configuration with Profibus Connectivity

## 2.9 Control Network Evolution

Yokogawa has adopted token passing Control bus since our first DCS.



Dual redundant token passing bus has been used in our DCS since 1975 as reliable & robust control bus

Figure: Yokogawa – Control Network Evolution



## Details:

Yokogawa has so far adopted Token Passing Protocol for communicating on the control bus.

V net /IP system has been introduced with changes in communication protocol.

In an V net/IP system, the “Vnet” represents Vnet compatibility and the “IP” indicates an internet protocol for general-purpose communication.

In a Vnet IP system, there are two types of control bus networks available. They are,  
**a) Vnet**                      **b) Vnet /IP**

**Vnet** is a proprietary token passing network using coaxial cable. It has a speed of 10 Mbps.

**Vnet IP** is an Ethernet based 1Gbps network. Although, Ethernet is a collision detection network, a V net Token passing application layer overlays this. It connects HIS to the network as if it is standard Vnet.

### 2.9.1 Communication Network

The FCS and the HIS are connected via a real time control network. This communicates all the parameters to and from the Field Control Station to the Human Interface station.

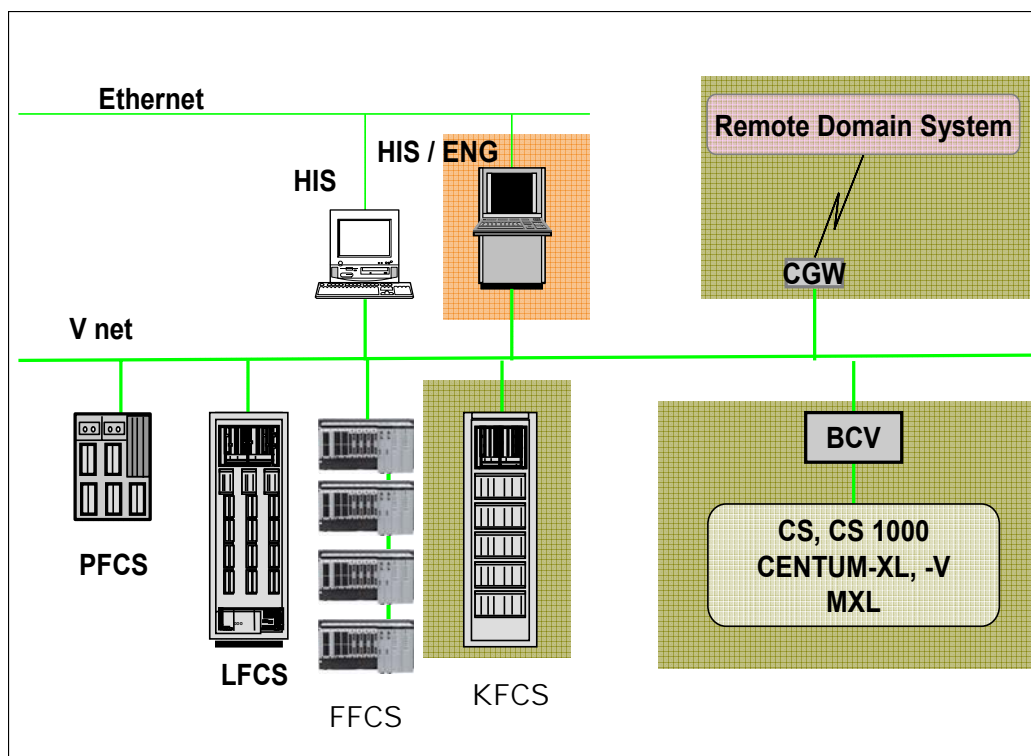


Figure: CS3000 – Communication Networks

## 2.9.2 Vnet/VLnet Communication Network:

CS3000 R3 system uses VL/V net and Ethernet for data communication.

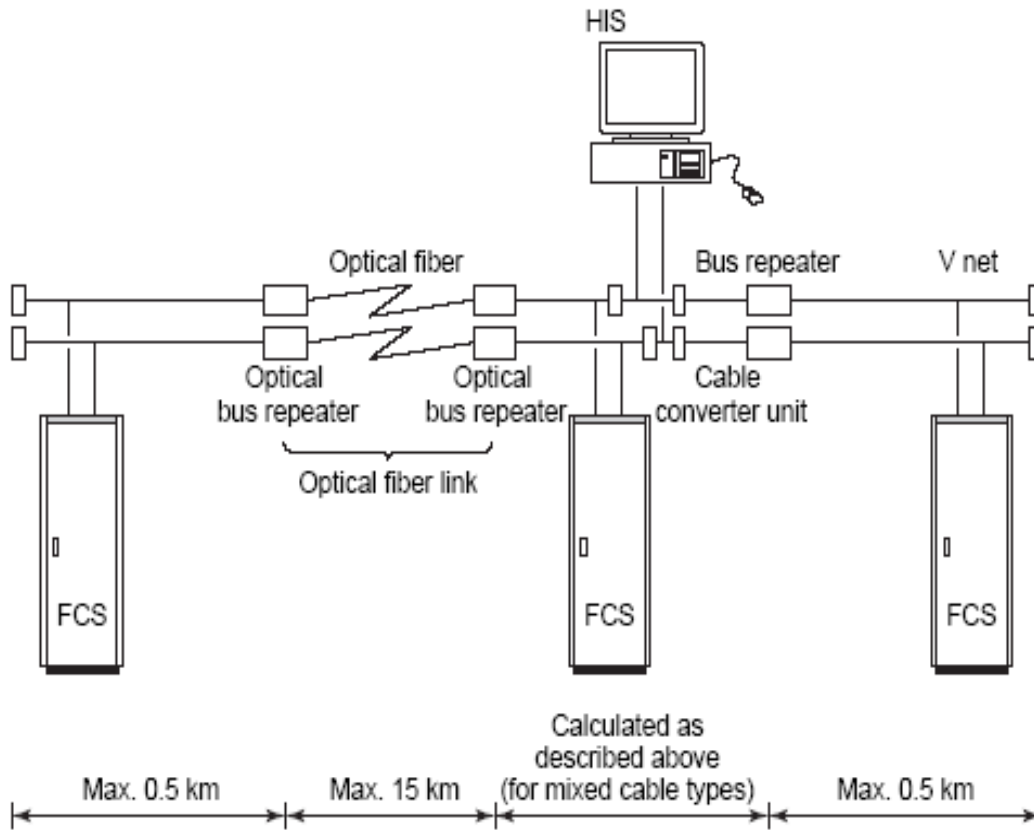


Figure : V net Extension

The Specifications of Vnet and VLnet are given below.

<b>Specification</b>	<b>Vnet Communication</b>	<b>VL net Communication</b>
<b>Cable</b>	<b>10base5</b>	<b>10base2</b>
<b>Protocol</b>	<b>IEEE802.4</b>	<b>IEEE802.4</b>
<b>Access Control</b>	<b>Token Passing</b>	<b>Token Passing</b>
<b>Transmission Speed</b>	<b>10Mbps</b>	<b>10Mbps</b>
<b>Transmission Distance</b>	<b>500m to 20Kms</b>	<b>500m to 20Kms</b>
<b>Medium of Transmission</b>	<b>Coaxial cable /Optical Fibre</b>	<b>Coaxial cable /Optical Fibre</b>
<b>Standard maximum length (without repeaters)</b>	<b>500 meters</b>	<b>185 meters</b>
<b>Maximum length (with optical repeaters)</b>	<b>20 Kms maximum 4 sets</b>	<b>20 Kms maximum 4 sets</b>
<b>Maximum length (with co-axial repeaters)</b>	<b>1.6 Kms maximum 8 sets</b>	<b>1.6 Kms maximum 8 sets</b>
<b>Thickness</b>	<b>5mm</b>	<b>2mm</b>
<b>Color</b>	<b>Blue</b>	<b>Black</b>

Table: Specifications of Vnet/VLnet

---

### 2.9.3 Ethernet Communication: Connects HIS, ENG and supervisory computers.

- **Topology** : Star/Tree topology
- **Transmission speed general** : 1 Gbps for Yokogawa Hardware, 100 Mbps for ethernet equipment
- **Access control** : Full duplex
- **Scale** : 64 stations/domain
- **Bus configuration** : Dual redundant
- **Control communication** : Functionally compatible with V net
- **Open communication** : TCP/IP
- **Network equipment** : Commercially available switching hubs and routers
- **Cables optic** : CAT5e or higher UTP cables or single-mode fiber cables

## 2.9.4 Vnet/IP - Overview

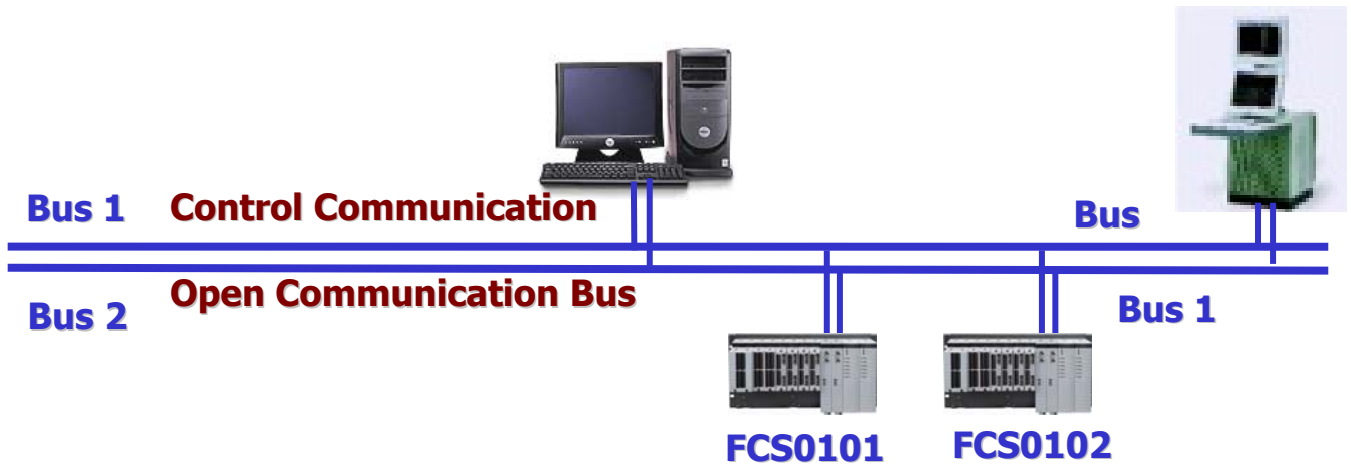


Figure : Vnet/IP - Overview

- Vnet/IP is a new control network which maintains the reliability and real-time capability of Vnet, while adding open performance for links with information systems.
- Vnet/IP is a control network which connects pieces of equipment configuring a Centum CS3000 system and exchanges control data between equipments.
- Vnet/IP uses a dual redundant configuration and dual-redundant buses 1 and 2. Vnet/IP allows control communication as well as communication with Ethernet based standard protocols within predetermined bandwidths referred to as open communication.
- Control communication is effected by bus 1. On its bus 2, control communications and open communications with various Ethernet Standard Protocols are provided.
- Vnet/IP is a control bus conforming to the IEEE802.3 standard. Line speed is 1Gbps. The Vnet/IP bus 2 can realize TCP/IP protocol-based communications such as data access, through an Exaopc OPC interface.
- In addition, Vnet/IP uses a V net router, allowing connection to V-net systems as a control bus.

## 2.9.5 Coexistence of control communications and open communications

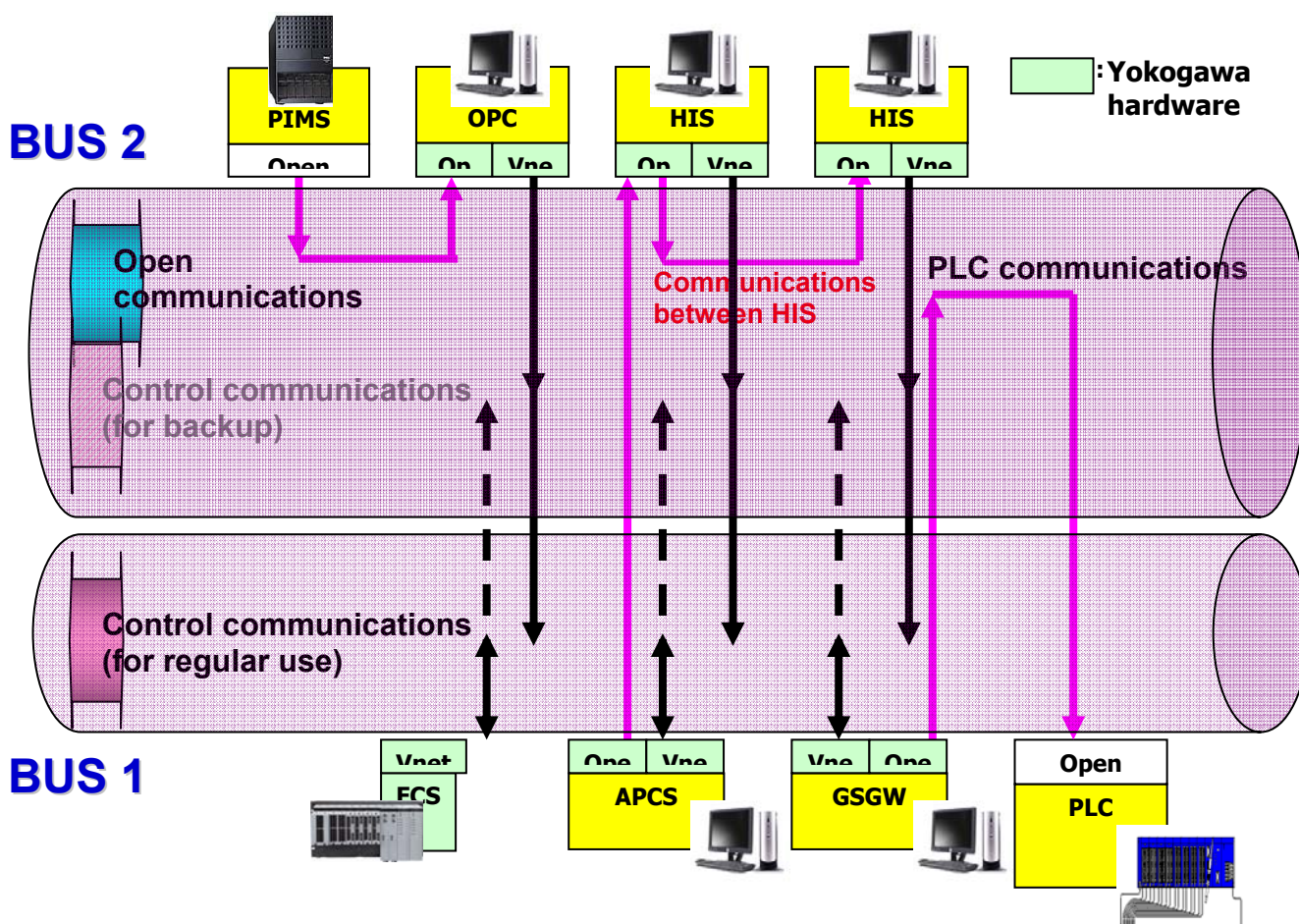


Figure: Coexistence of control communications and open communications

Control and open communications coexist in a Vnet/IP network.

The bus-1 side is used for control communications only while the bus-2 side is usually used for open communications.

If any failure occurs on the bus-1 side, control communications are backed up by the bus-2 side.

Though control communications switches to the bus-2 side, sufficient bandwidths are assured for control and open communications, thereby having no effect on either communications.

## 2.9.6 CS3000 Vnet/IP System Concept

### Vnet/IP Hardware Configuration

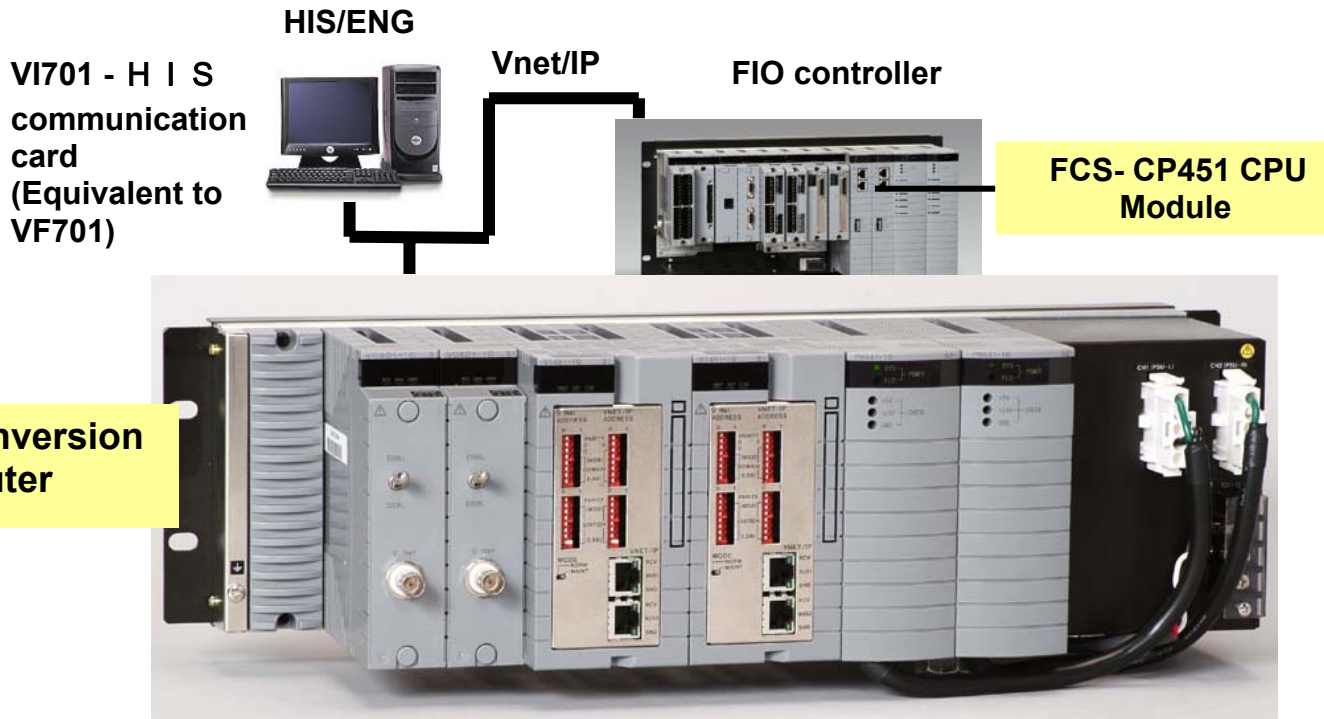


Figure: System connection topology using V net/IP network.

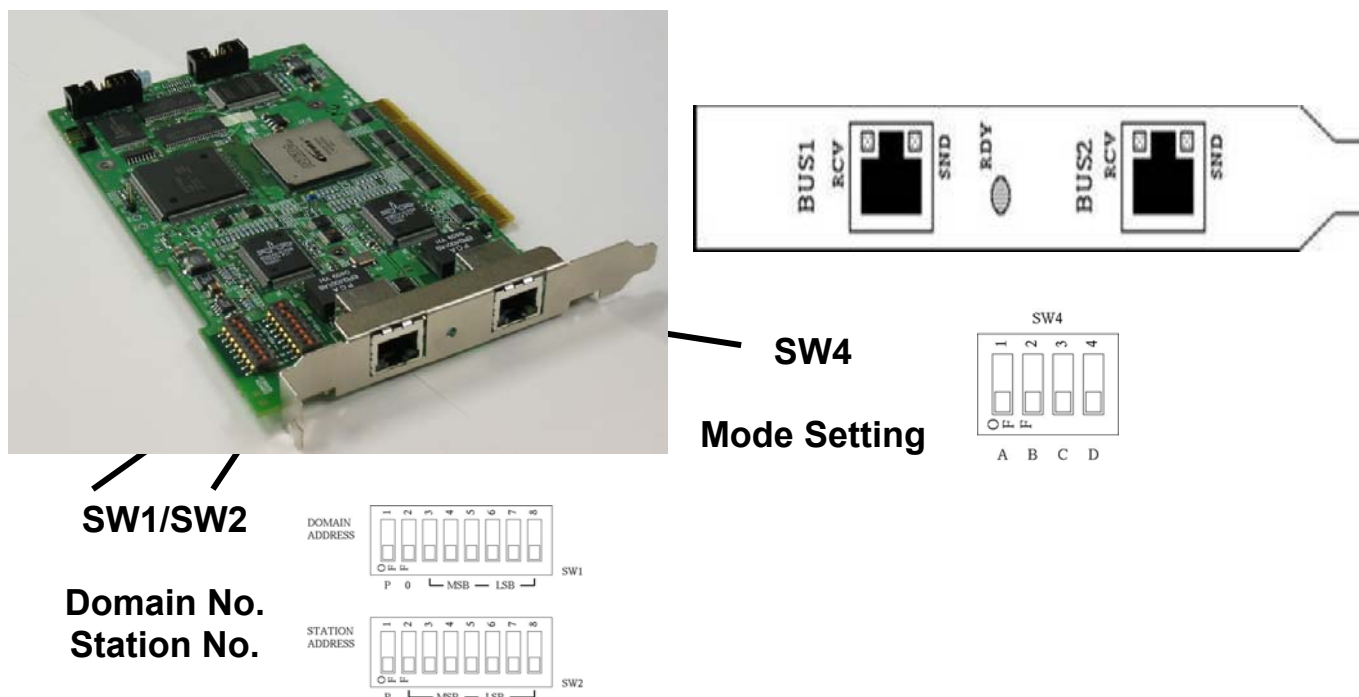
- In a V net/IP network, an area without communicating through relaying devices in an IP layer, such as router , a layer 3 switch etc... is called a domain. Up to 64 Vnet/IP stations can be connected in one Vnet/IP domain.
- If more than 64 Vnet/IP stations are connected, multiple domains are configured. In a Centum CS3000 system, up to 16 domains can be defined in combinations of Vnet/IP domains, Vnet domains and VL net domains.
- Vnet/IP connection topology takes tree formation. Devices within domains are connected using layer 2 switches.
- In is a dual-redundant Vnet/IP configuration, buses 1 and 2 are independent subnets. Two independent communication routes exists in each bus.
- Layer 3 switches are used for communicating between two Vnet/IP domains. Routers are used to communicate between Vnet/IP domains and Vnet domains.

- Vnet /IP can use network devices that are commercially available for network connections. Devices on a Vnet/IP are connected using commercially available cables, switches and the like.
- An HIS serves as a human interface station for operation, monitoring and engineering. VI701 Control Bus interface card is used to connect the HIS to the Vnet/IP network.
- FIO type Field Control station AFV10S/D is used for controlling the process. Layer2 and Layer3 switches are used for communication between stations within a domain.
- A Vnet Router is used to connect Vnet /IP domain to Vnet domains.

### 2.9.7 VI 701 Control Interface Bus Card:

This card is used to connect HIS to the Vnet /IP network. The VI701 card has two RJ45 Ethernet connectors for connection to Vnet/IP.

The domain and station numbers are set using the dip switches on the network card.





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**2.9.8 Communication Gateway Unit (CGW):** This is used to communicate with supervisory computers. This links the V net control system bus to an Ethernet bus (to a supervisory computer system or general purpose personal computer).

CGW wide area communication function is used to link two CENTUM CS 3000 V nets in different places using a dedicated telephone line.

**2.9.9 Bus Converter (BCV):** This links the V net system bus to another CENTUM CS 3000 domain or to an existing CENTUM or  $\mu$ XL system. Different types of Bus Convertors are

- V net to V net Bus Converter : this is used to connect CS3000 or Centum CS to CS3000 system.
- HF Bus to V net Converter: this is used to connect Centum V or Centum-XL to CS3000 system or Centum CS to CS3000 system.
- RL Bus to V net Converter: This is used to connect Micro-XL to CS3000 system.

## 2.10 Domain Concept:

Domain is the group of stations connected on one V-net cable. Maximum 64 stations can be connected per domain. Bus Convertor (BCV) is used to link two domains.

Multiple Domains are used

- when there are more than 64 stations to be connected
- when there are multiple sections in a plant
- To reduce the load on the V net.

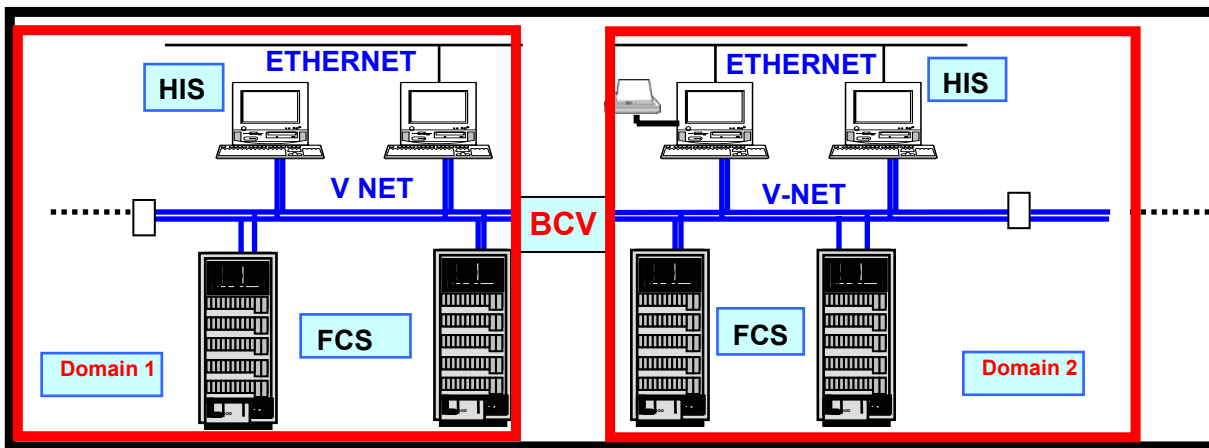


Figure : BCV – Linking two domains

### 2.10.1 System Specification:

CENTUM CS 3000 is a flexible system that can handle everything from small to quite large systems.

- ✓ Maximum number of stations : 256/System
- ✓ Maximum number of domains : 16/System
- ✓ Numbering of domains : 1 to 64
- ✓ Domain number for CS3000 domain(V-net domain) : 1 to 16
- ✓ Domain number for Virtual Domain (Non V-net domain) : 17 to 64
- ✓ Maximum number of stations per domain : 64
- ✓ Maximum number of HIS per domain : 16
- ✓ Station number for HIS : 1 to 64 in descending order.
- ✓ Station number for FCS : 1 to 64 in ascending order

## 2.10.2 Address Setting for FCS and HIS

**Field Control Station:** The domain and station number setting for the FCS is done using the DIP switches present on the CP card of the FCS.

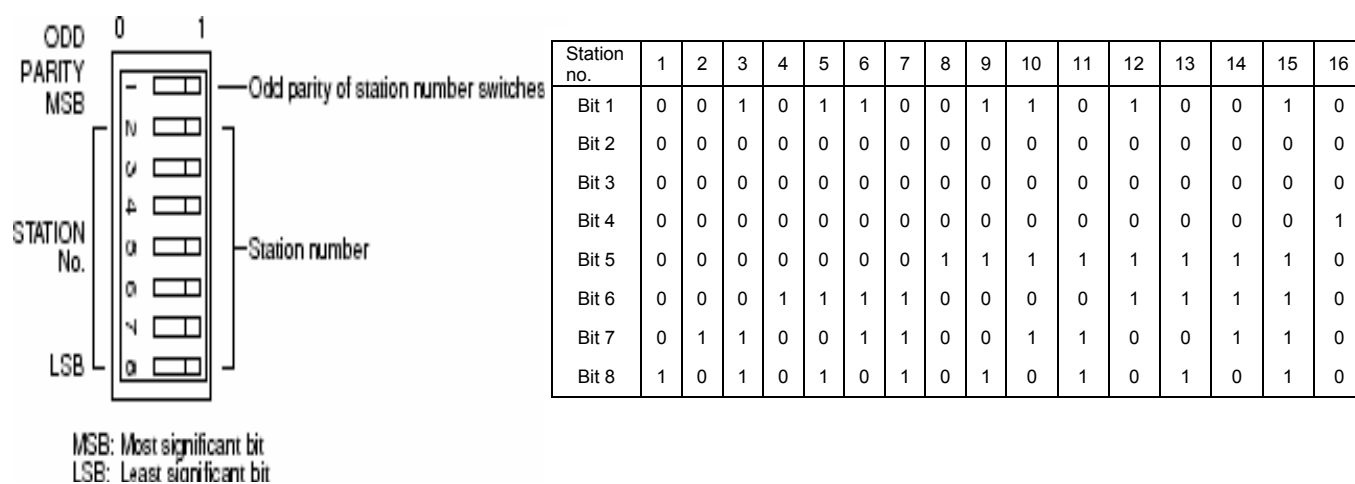


Figure : Station Number setting for FCS

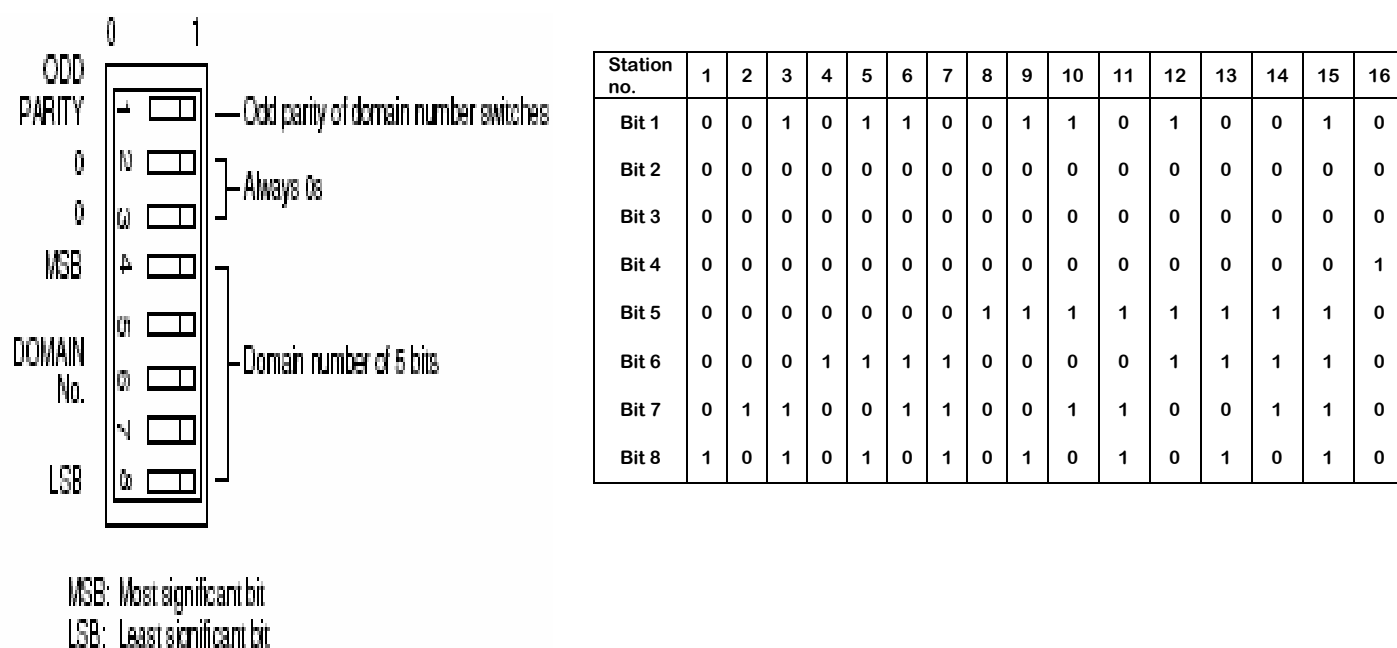
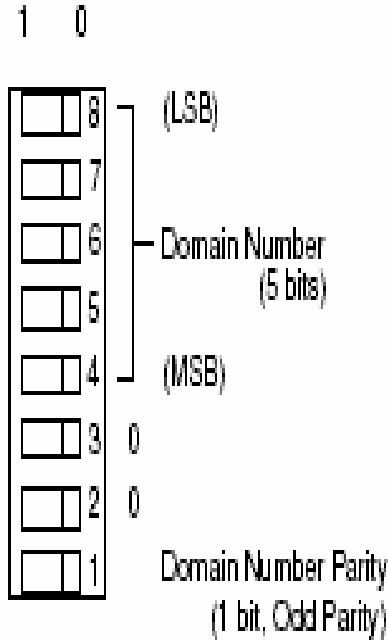


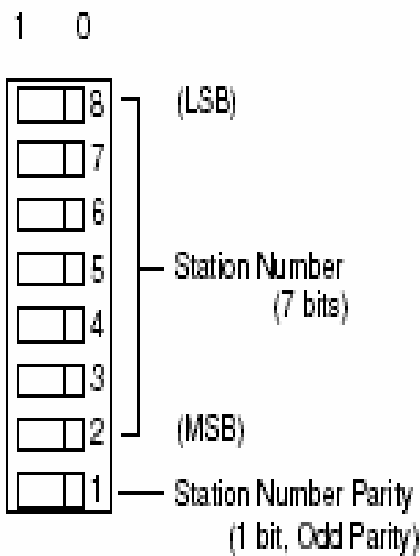
Figure : Domain Number setting for FCS

**Human Interface Station:** The domain and station number setting for the HIS is done using the DIP switches present on the VF701 / VI701 card of the HIS installed in the PCI slot of the PC.



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

**Figure : Domain Number setting for HIS**



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 :Station Number setting for HIS**

# **3.CS 3000-OPERATOR KEYBOARD**

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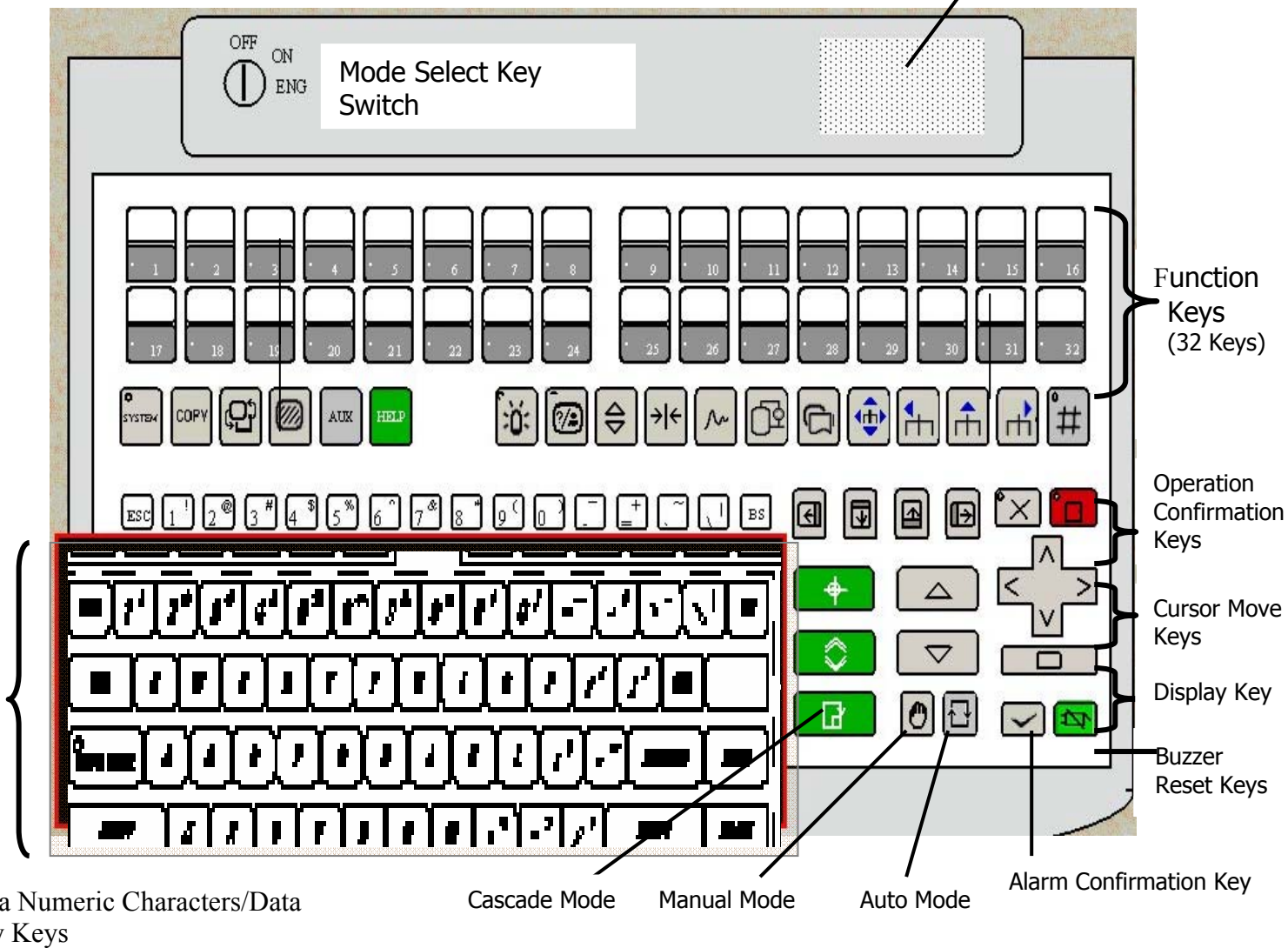
<b>Table of contents</b>	<b>Page Number</b>
3.1 Operator Keyboard of CS3000	142
3.2 Parts of the Operator Keyboard	143
3.2.1 Window Call Keys	144
3.2.2 Operation Control Keys	147
2.2.3 The Other Keys	148

**Objective :** This chapter deals with Operator Keyboard and its functionalities

### 3.1 Operator Keyboard of CS3000

The snapshot of the operator keyboard shows following details

Built in Speaker (Electronic Buzzer)



**Figure: Physical Appearance CS3000 Operator Keyboard**

## 3.2 Parts of Operator Keyboard

### ◆ Function Keys

Function keys are used for one-touch operations only. These keys can be used to call windows, start application programs, and other purposes. An LED lamp and a space for writing the assigned service function name are provided on each key. A total of 32 keys are provided.

◆ **Adjustment Keys:** These keys are used for changing the set values for feedback control, manipulated output value and block mode.

◆ **Data Entry Keys :** These keys are used for specifying tag names and entering data.

◆ **Mode Select Key Switch:** This key switch is located at the top left of the keyboard and used for specifying the operation range of the keyboard.



Figure : Mode Select Keys

- **MODE-OFF :** Only the operation and monitoring functions specified in the system generation are allowed.
- **MODE-ON :** In addition to the functions above, modifying the control parameters and other operations are allowed.
- **MODE-ENG:** All functions including operations for the system maintenance functions are allowed.



Figure : Mode Key Selection Range

When the operation key is used  
ENG position cannot be selected.

When the engineering key is used,  
all the key positions are selectable.



◆ **Operation Confirmation Keys:** These keys are used for verifying operations.

[Verify Operation] key: Used for confirming and executing an operation.

[Cancel Operation] key: Used for canceling an operation.

◆ **Cursor Move Keys:** These keys are used for moving the cursor horizontally and vertically.

◆ **Display Key:** This key is used to display the selected item.

◆ **Alarm Confirmation Key:** This key is used for confirming an alarm when it occurs.

◆ **Buzzer Reset Key:** This key is used for stopping the buzzer sound when an alarm occurs.

◆ **Scroll Keys:** These keys are used for scrolling the displayed screen.

**3.2.1 Window Call Keys:** These keys are used for calling various windows.



Figure: Window Calling Keys

Function of each window calling key is as described below.



This displays the System Status Overview window, to allow confirmation of the system operation status. It indicates the system alarm message generation state by its LED status.

◆ **Flashing in Red :**A system alarm message has occurred but the contents remain unacknowledged.

◆ **Steady in Red:** A system alarm message has occurred but all of the contents have been acknowledged.

◆ **No Color:** A system alarm message has not occurred.



This Prints the image of the entire screen.



This toggles between the top and bottom positions of the operation and monitoring window group and windows general application window group.



This closes all of the operation and monitoring windows except for the System Message window.



This Displays the User-In dialog, window switching menu, operation menu and reset menu all at once.

AUX menu can be called up by pressing down the following keys:

ALT][CTRL][F12].

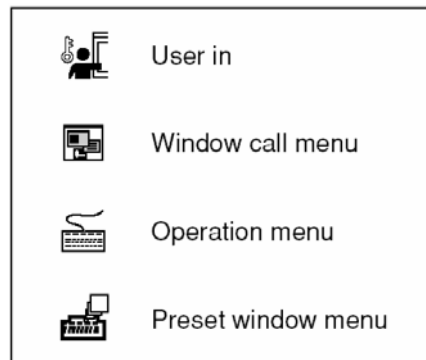


Figure: AUX Menu



This displays the Help dialog box displaying help related to the active window.



This displays the Process Alarm window to allow confirmation of the alarm content.

Indicates the process alarm occurrence state by its LED lamp.

- ◆ **Flashing in Red:** A process alarm message has occurred but the contents remain unacknowledged.
- ◆ **Steady in Red:** A process alarm message has occurred but all of the contents have been acknowledged.
- ◆ **No Color:** A process alarm message has not occurred.



This displays the Operator Guide window or Operator Guide Acknowledge window. Indicates the operator guide message generation state by its LED lamp.

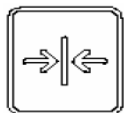
◆ **Flashing in green** :An operator guide message has occurred but the contents remain unacknowledged.

◆ **Lit in green** :An operator guide message has occurred but all of the contents have been acknowledged.

◆ **No Color** :An operator guide message has not occurred.



This displays the Graphic window with control attribute.



This displays the Tuning window.



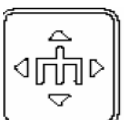
This displays the Trend window.



This displays the Graphic window with graphic attribute.



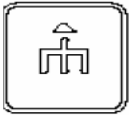
This displays the Process Report window.



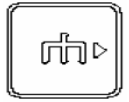
Displays the Navigator window.



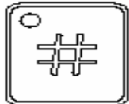
Displays the hierarchy windows of the active window in ascending order of the sequence defined in the window hierarchy.



Displays the upper windows in the hierarchy of the active window.



Displays the hierarchy windows of the active window in a descending order based on the window hierarchy definition.



Displays the Graphic window with overview attribute.

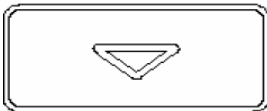
### 3.2.2 Operation Control Keys :Used to operate the instrument faceplate.



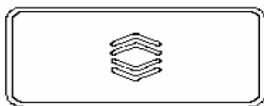
Switches the action target data in the manual mode (MAN) from the manipulated output value to the set point value.



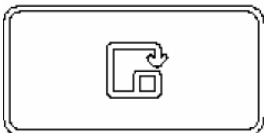
Increases the target data. While the INC key is being operated, the data increases by 1 % of the full scale every 0.2 second. The full stroke of the index can be changed every after 20 seconds.



Decreases the target data. While the DEC key is being operated, the data decreases by 1 % of the full scale every 0.2 second. The full stroke of the index can be changed after 20 seconds.



Pressing this key with the INC key or DEC key quadruples the analog data increase/decrease speed during INC/DEC operation.



Changes the block mode to the cascade mode (CAS) or semiautomatic mode(SEMI). Pressing the AUT key with this key held down changes to the cascade mode. Pressing the MAN key with this key held down changes to the semiautomatic mode.

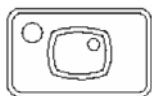


Changes the block mode to manual mode (MAN).

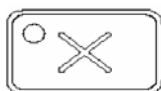


Changes the block mode to automatic mode (AUT).

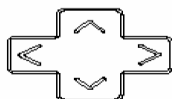
### 3.2.3 The Other Keys



Confirms and executes the operation.



Cancels the operation.



Used to move the cursor up and down or to right and left.



Used to display the selected item.



Used to stop the buzzer sound generated by alarm output.



Used to acknowledge the alarm.



Used to scroll the content of the active window.



Reverse paging key.



Sequential paging key



Used to change the data item of action target.



Calls up the name input dialog box.



Used to erase dialog boxes, etc. Triggers the same action as when the ESC key is pressed.

# **4. CS 3000 OPERATION & MONITORING WINDOWS**

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**Objective:** This chapter provides

- Introduction to different operation and monitoring windows
- Introduction to System Message Area
- Details on face plate operation and tuning window operation

## 4.0 Operation and Monitoring Windows

Information regarding the process is gathered as well as monitored by the Standard Operation windows on the HIS.

There are two types of Operation and monitoring windows provided by the HIS. They are

- i) System Windows:** These windows are inbuilt in the system. These includes,
  - System Message Window
  - Instrument Faceplate Window
  - Tuning Window
  - Process Report Window
  - Historical Report Window
  - Navigator Window
  - System Alarm Window
  - Process Alarm Window
- ii) User-Defined Windows:** These windows are defined by the user based on the applications and display contents of the operation and monitoring.

These includes,

- Control Group Window
- Trend Window
- Graphic Window
- Overview Window



## 4.1 Methods of Calling Windows

- All operation windows can be called from the **System Message Area** icons.
- The windows can be called by using **NAME** icon on the system Message Area.

Ex. To call any window, select the **NAME** icon and type the **WINDOW** name. Select **OK**.

The window will be displayed on the HIS.

- The windows can also be called by selecting the respective keys on the **Operator Keyboard** connected to the HIS.
- To call Large size windows type **WINDOWSNAME-SL**
- To call Medium size windows type **WINDOWSNAME-SM**

## 4.2 System Message Area

This window is displayed on the top of the operator screen.

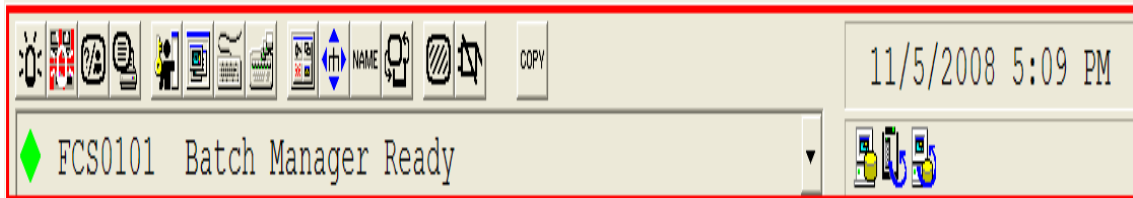


Figure: Snap shot of System Message Area Window

System message window appears as the operation and monitoring function is started.

It is a fixed window, which does not clear even when the clear screen key is pressed.

The Blinking of the Process and System alarm icons prompts the operator when either of the alarm occurs.

The details that are displayed in the system message area are, current date & time, the icons show whether there are any Process alarms,

System alarms or Operator guide messages in the plant to access different types of functional windows on the HIS.

The Different icons of System Message Windows are:















	Process Alarm		Tool Bar
	System Alarm		Navigator Window
	Operator Guide		Window Name
	Message Monitor		Circulate
	User Login		Clear Screen
	Window Call Menu		Buzzer Rest
	Operation Menu		Hard Copy
	Preset Menu		

Figure: Different Icons of System Message Area

---

## 4.3 Instrument Faceplate Operations

- ✓ The instrument faceplate displays the status and data of a function block, an instrument or contact I/O graphically on a window.
- ✓ When an instrument is created in the engineering builder, the instrument faceplate window automatically gets created depending on the type of the instrument.
- ✓ To call an instrument faceplate window, select the **NAME** icon and type the **TAGNAME** of the instrument and select **OK**. The faceplate window appears.

The faceplates of the function blocks are classified into the following display types. The display types are grouped according to their display characteristics, shown as below.

- **Analog type:** This includes,

PID controller block family

Three-Pole Three-Position Selector Switch Block (SW-33) etc.

- **Discrete type:** This include,

Two-Position Motor Control Block (MC-2)

Switch Instrument Block with 1 Output (SO-1) etc.

- **Data display type:** This Include,

Sequence Table Block (ST16).

### 4.3.1 Components of Instrument Faceplate

The instrument faceplate consists of the following components:

- ◆ Comment display area
- ◆ Status display area
- ◆ Parameter display area
- ◆ Instrument display area
- ◆ Operation mark
- ◆ Data input dialog box call button

The following figure show the instrument faceplate with the name of each item indicated.

The Controller instrument faceplate consists of the following components.

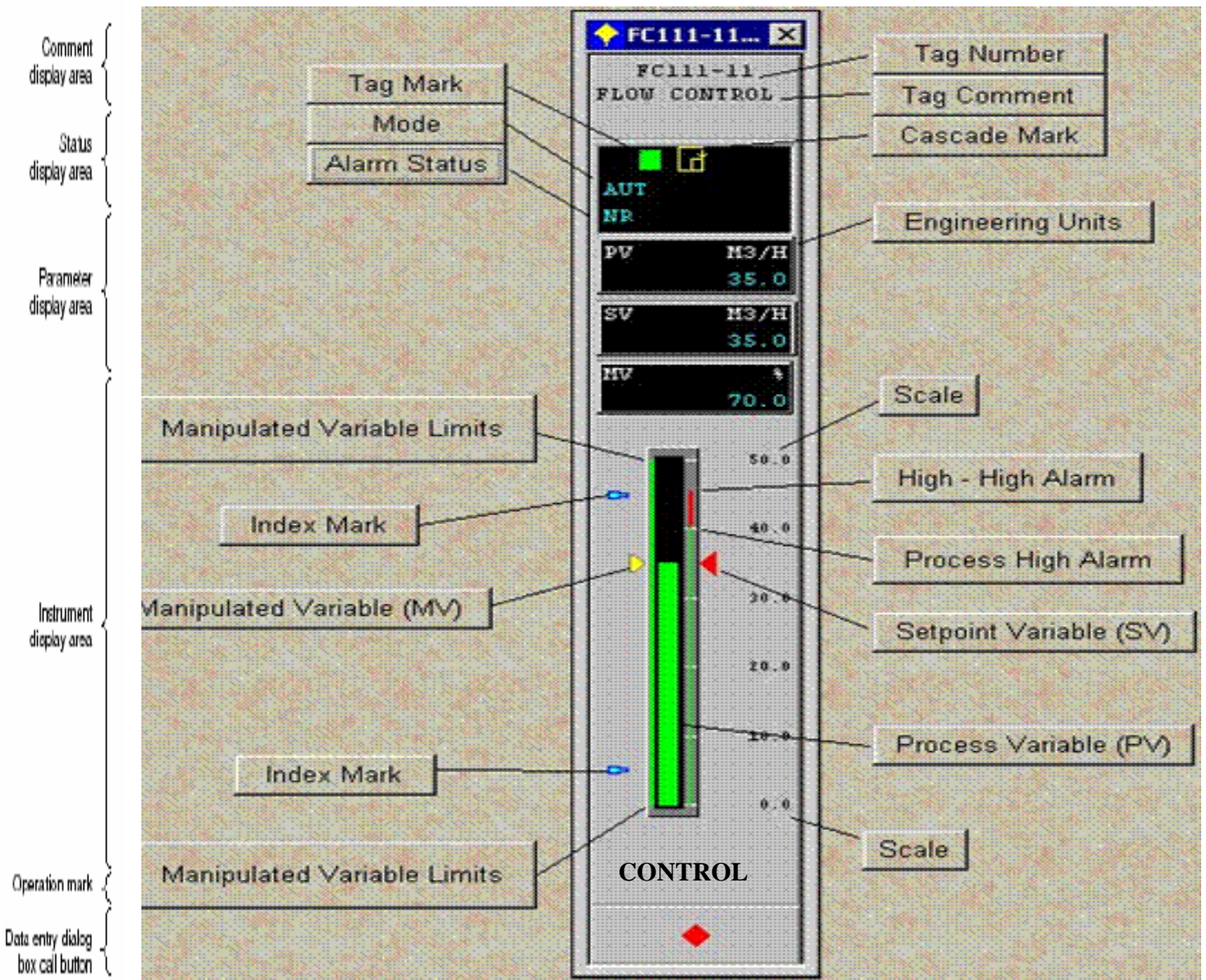


Figure: Instrument Faceplate

---

## Comment Display Area

- ◆ **Tag Name** - The tag name assigned to the function block is displayed on the instrument faceplate.
- ◆ **Tag Comment** -The tag comment assigned to the function block is displayed on the instrument faceplate. The user can specify a desired tag comment.

## Status Display Area

- ◆ **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.
  - The user can specify whether the priority for each tag mark should be acknowledged or not.
  - The display color of the tag mark indicates the alarm status of the function block.
  - The occurrence of process alarm and the annunciator message can be indicated by the status of Tag Mark.
    - **Flashing red:** Alarm message has been initiated but not been acknowledged.
    - **Flashing green:** Alarm recovery message has been initiated but not been acknowledged.
    - **Constant red or green:** Alarm message or Alarm recovery message has been initiated and acknowledged.

- ◆ **Cascade Mark** - This mark indicates that the instrument is receiving its set point from another instrument. This instrument is to be in cascade status during normal operation.

- ◆ **Block Mode** -The block mode and block status of the function block is displayed on the instrument faceplate.

- ◆ **Block Status** –This indicates the mode of operation of the instrument. The different modes are AUT/MAN, CAS/PRD.

- ◆ **Alarm Status** - The current alarm status of the function block is displayed on the instrument Faceplate.

The alarm status could be HH/LL/HI/LO based on the ranges set in the tuning window of that instrument.

---

◆ **Calibration Status** - The calibration status of the function block is displayed on the instrument faceplate.

When the displayed function block is in the calibration mode, [CAL] is displayed in cyan.

The Instrument automatically comes to MAN mode. The actual transmitter input is bypassed. PV of the instrument can be changed.

All the alarms checking on the instrument are bypassed. [CAL] disappears when the block is not in the calibration mode.

◆ **Alarm ON/OFF Status** - The alarm ON/OFF status of the function block is displayed on the instrument faceplate.

When the block is in the alarm OFF state, [AOF] is displayed in blue. [AOF] disappears when the block is in the alarm ON state.

### **Parameter Display Area**

◆ **Data Item Name** - The name of the data items (PV, SV, MV, etc.) defined to the function block are displayed.

◆ **Process Data** - The process data of the data items (PV, SV, MV, etc.) are displayed.

◆ **Open/Close Mark** - This mark indicates the open/close status of a device in response to manipulated output. "OPN" indicates the open status and "CLS" indicates the close status. Other pre-defined marks can also be specified in the System Generation function.

◆ **Instrument Faceplate Scale** - This is a display scale used for bar graphs and pointers. The high/low limits, reverse scale display, and the number of divisions of scale can be set on the Function Block Details Builder.

### **◆ Scale High/Low Limits**

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. 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.

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

◆ **Index** - This mark indicates the referenced output value of a controller block. Show/Hide the index can be specified on the Function Block Details Builder.

---

### 4.3.2 Modes of Operation of Instrument Faceplate

The various modes of operation are

- MAN -Manual mode
- AUT - Auto mode
- CAS – cascade mode
- PRD – primary direct mode

#### MANUAL MODE - MAN

In manual mode, the MV pointer appears in red color and the SV pointer appears in yellow color. MV of the instrument can be changed by increment/decrement keys or through data entry box.

The SV of the instrument can be changed either by set point change key or selecting the ITEM and entering the data value in the data entry box.

#### AUTO MODE - AUT

In auto mode, the SV pointer appears in red color and the MV pointer appears in yellow color. SV of the instrument can be changed by increment/decrement keys or through data entry box.

**The MV of the instrument cannot be changed by any method.**

#### CASCADE MODE - CAS

In a cascade loop the output of the primary controller (MV1) goes as set point of the secondary controller (SV2). The output of the secondary controller (MV2) goes to the final control element.

For a cascade loop, the primary controller can be in AUT or MAN mode, but the secondary controller has to be in CAS mode. In cascade mode both the SV and MV pointers appear in yellow color. The SV and MV of the instrument cannot be changed.

#### PRIMARY DIRECT MODE - PRD

In PRD mode the output of the primary controller (MV1) directly goes to the final control element. The secondary controller is bypassed and cannot be operated.

**To select PRD mode:**

1. Go to the tuning window of the Secondary controller.
2. Select PRD icon. Confirm.

**To select CASCADE mode:**

**Change the mode status of the secondary controller to CAS. Confirm.**

---

**MODE SUB STATUS:****IMAN (INITIALIZATION MANUAL)**

In a cascade loop, if the cascade is broken by taking the secondary controller from CAS to either AUT or MAN mode, IMAN appears as the mode sub status of the primary controller.

IMAN indicates that

- ◆ Cascade loop is broken
- ◆ Primary controller is bypassed
- ◆ Primary controller cannot be operated due to SV tracking.

**SV tracking:**

The output of the primary controller (MV1) automatically tracks the set point of the secondary controller (SV2) to have bump less transfer to CAS mode.

**To bring the primary controller out of IMAN mode**

Change the mode status of the secondary controller to CAS. The primary controller will automatically come out of IMAN mode.



### 4.3.3 Face plate operation

#### Data Entry Operation:

- To change any parameter from the faceplate window, select the control soft key below the instrument. The data entry box will be displayed.
- To change the displayed parameter value, type the new data value. Select Enter key. The new data value will be displayed.

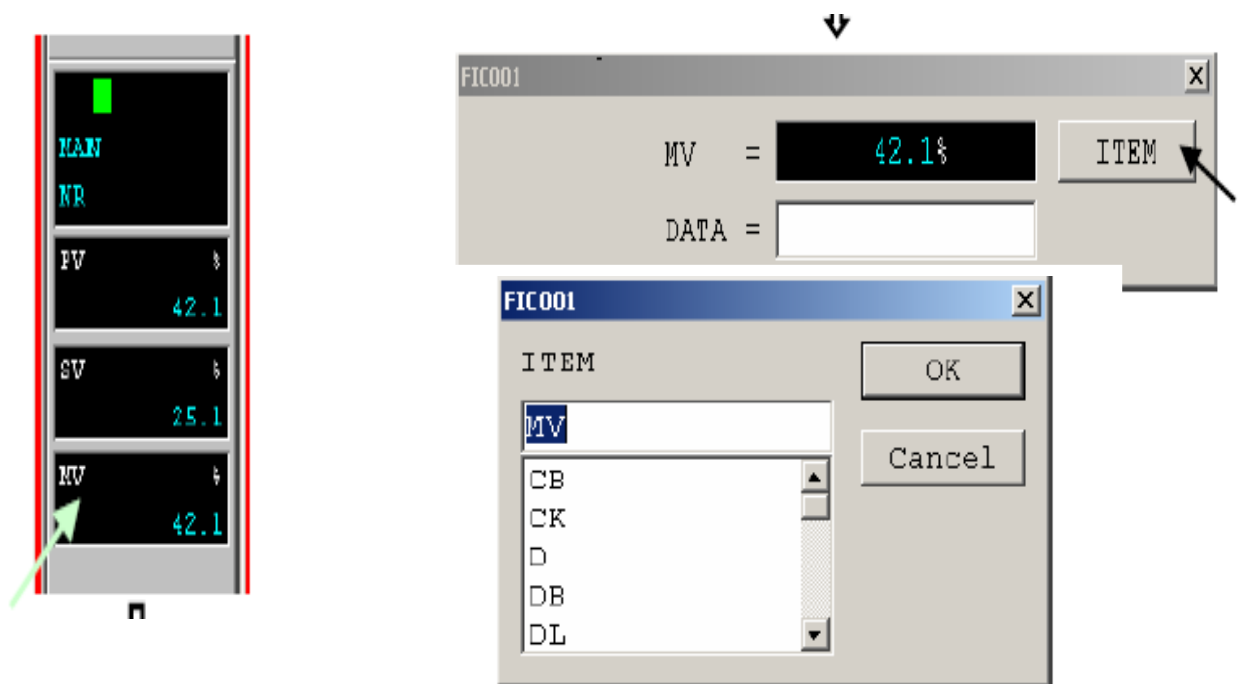


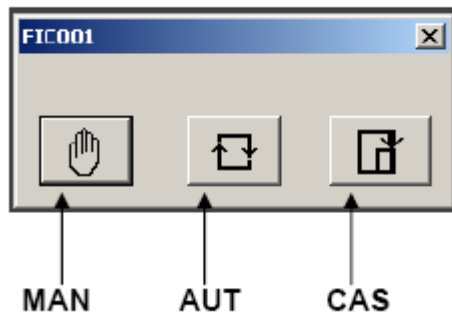
Figure: Data Entry Operation in Faceplate.

- In case you want to change the parameter other than the one that is displayed in the data entry box, select ITEM icon.
- Type the parameter (Viz. HH/PH/LL/PL/MV etc...) to be changed. The current value of the parameter will be displayed in the data entry box.
- Type the new data value. Select Enter key. The new data value will be displayed.

---

**Block Mode Change Operation:**

Clicking the block mode display area with the mouse will display the block mode change operation dialog box to change the block mode.



These are the three basic block modes of a PID controller

**MAN** : Manual Mode

**AUT** : Automatic Mode

**CAS** : Cascade Mode.

The block mode may be changed by operating this dialog box. The buttons on the dialog box have the same functions as the buttons with same symbols on the operation keyboard.

## 4.4 Tuning Window

This window displays the process data status of the function blocks in detail.

This window is used not only for monitoring but also to change the setting of parameters.

Tuning window being a system-defined window is automatically created when the Function block is created during system generation.

Every Function block created has a Tuning window and the parameters displayed in each of these tuning windows depend on the Function block.

The Tuning Window is used to set up the alarm setting as well as the loop tuning parameters.

Only the tuning parameters indicated with a "=" in the tuning window can be changed.

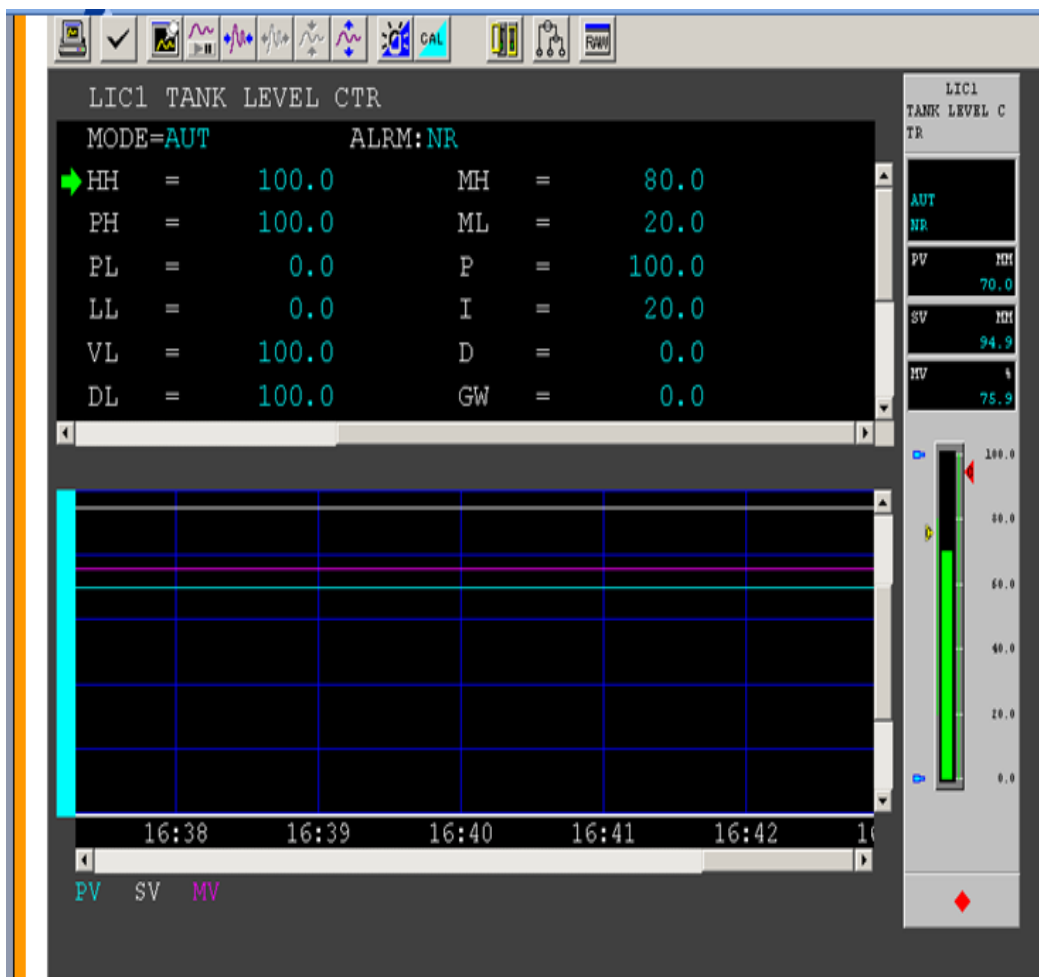


Figure: Tuning Window of a PID Controller

#### 4.4.1 Method to Call the Tuning Window

- The tuning window can be called from the **System Message Area** icons.
- The windows can be called by using **NAME** icon on the system Message Area.

Ex. To call the tuning window, select the **NAME** icon and type the **TAGNAME TUN** Select **OK**. The window will be displayed on the HIS.

- The windows can also be called by selecting the respective keys on the **Operator Keyboard** connected to the HIS.
- Double Click on the Tag's name on a 'Control Group Window' and the faceplate window will appear. Select the 'Tuning Window' icon from the tool box.

#### 4.4.2 Components of Tuning Window

The components of tuning window are



This button outputs the image of the Tuning window currently displayed.



This button acknowledges the alarm generated in the function block that is displayed.



When this button is clicked, the tuning trend graph is reduced or enlarged in the direction of the time axis (horizontal direction), with the right edge (latest time) of the graph as the reference point. This button can be used when the tuning trend is displayed.



When this button is clicked while the tuning trend graph is displayed in an analog format, the data axis display scale can be reduced or enlarged with respect to the displayed trend graph. This button can be used when the tuning trend is displayed.

Figure: Components of Tuning Window



Clicking this button may change the function block to the primary direct block mode. When this button is clicked, a dialog box appears to prompt for the operator's confirmation. To return to the original mode, double-click the mode display string in the parameter display area to call up the Data Input dialog box, then enter the mode name. This button is displayed when the Tuning window is for a function block that supports the primary direct mode.



Clicking this button may change the function block mode to the AOF mode to suppress alarms. When this button is clicked, a dialog box appears to prompt for the operator's confirmation. To return to the original state, click this button again. This button is displayed when the Tuning window is for a function block that supports the AOF mode.



Clicking this button may change the data status to calibration status. When this button is clicked, a dialog box appears to prompt for the operator's confirmation. To return to the original state, click this button again. This button is displayed when the Tuning window is for a function block that supports the calibration mode. When the faceplate is in CAL mode, no alarm processing is carried out.



Clicking this button calls up a Control Drawing window.



This button calls up a dialog box to display RAW data. This button is displayed for a function block with a data item "RAW." Note that "\*" (a communication error) is displayed if a function block input is not a process input.

**When an Instrument goes to IOP condition, the RAW value is checked to find out the actual signal from the transmitter.**

**Figure: Components of Tuning Window (Contd)**



This button calls up the Operation Mark Assignment dialog box. In the Operation Mark Assignment dialog box, the operation marks for the instrument faceplate displayed in the Tuning window can be defined. The figure below shows an example of an Operation Mark Assignment dialog box.

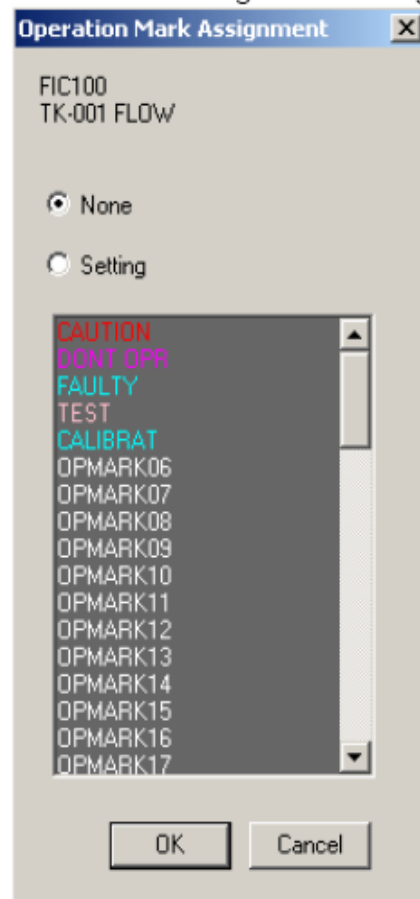


Figure: Operation Mark Assignment Window

### Using the Operation Mark Assignment dialog box

When assigning an operation mark, select the operation mark to be assigned to the instrument faceplate and click the [OK] button. Also, to remove an operation mark that has already been assigned, select [None.]

### Security in the Operation Mark Assignment dialog box

In the Operation Mark Assignment dialog, a security is set for each operation mark. The security for the operation mark is determined by the function security level that has been defined by the builders.

The operation marks for which the operator is not authorized to operate will not be displayed in the Operation Mark Assignment dialog.

#### 4.4.3 To Change any parameters in the Tuning Window

- To change any parameter from the Tuning Window, select the Parameter to be changed by mouse or cursor in the operator keyboard.
- The Data entry window appears. Type the data value. Select Enter key. The new data value will be displayed.
- In case you want to change the parameter other than the one that is displayed in the data entry box, select ITEM icon.
- Type the parameter (Viz. HH/PH/LL/PL/MV etc...) to be changed.
- The current value of the parameter will be displayed in the data entry box. Type the new data value. Select Enter key. The new data value will be displayed.

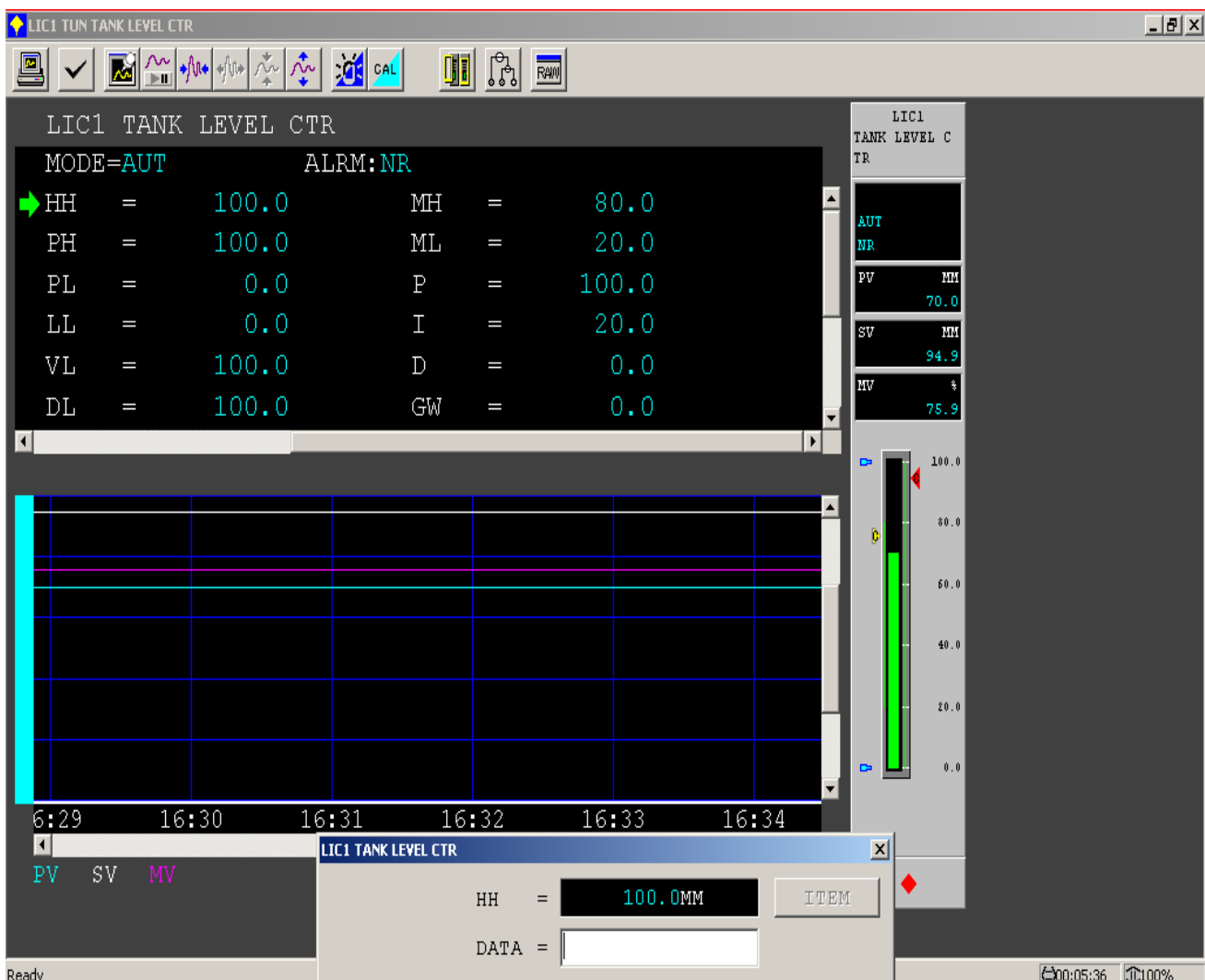


Figure: Example of Tuning Window

## 4.5 Process Alarms in CS3000

Alarm Status	Process Status	Alarm Settings	Item to be Set in the Tuning Panel	PV Bar Color	Tag Mark Color	Remarks
NR	PROCESS NORMAL	-----	-----	GREEN	GREEN	-----
HH	PV VERY HIGH	PV > HH	HH	RED	RED	-----
HI	PV HIGH	PV > PH	PH	RED	RED	-----
LL	PV VERY LOW	PV < LL	LL	RED	RED	-----
LO	PV LOW	PV < PL	PL	RED	RED	-----
DV+	DEVIATION ALARM	DV > DL DV = PV - SV	DL DEVIATIO N LIMIT	YELLO W	YELLOW	-----
VEL+	VELOCITY ALARM	VEL > VL VEL= PV/ T	VL VELOCITY LIMIT	YELLO W	YELLOW	-----
IOP+	INPUT OPEN	INPUT OUT OF RANGE SENSOR/TR. FAILURE	-----	RED	RED	-----
OOP	OUTPUT OPEN	OUTPUT LINE OPEN	-----	RED	RED	-----
MHI	MV HIGH	MV > MH	MH	YELLO W	YELLOW	OCCURS ONLY IN CAS/ AUTO MODE
MLO	MV LOW	MV < ML	ML	YELLO W	YELLOW	OCCURS ONLY IN CAS/ AUTO MODE

Table: Different Process Alarms in CS 3000



### 4.5.1 Alarm Priority

1. Input Open – IOP ; Output Open - OOP
2. High High – HH ; Low-Low -LL
3. High High – HI; Low Low - LO
4. Deviation - DV+ or DV- ; Velocity - VEL+ or VEL-
5. MV High – MHI; MV Low - MLO

ALARM STATUS	PV BAR COLOUR	TAG MARK COLOUR
NR	GREEN	GREEN
HH/HI/LL/LO/IOP/OOP	RED	RED
DV+/VEL+/MHI/MLO	YELLOW	YELLOW
AOF	NO CHANGE	DARK BLUE
TAGS WITHOUT ALARM	-----	WHITE

### 4.5.2 Alarm Sub Status: AOF (Alarm Output Off)

Normally when an alarm occurs:

- The tag mark changes color depending on the type of the alarm.
- Audible alarm is heard.
- The alarm status (HI/LO/HH/LL etc...) is displayed on the process alarm window.

In AOF mode:

- The tag mark changes to dark blue color irrespective of the alarm.
- Audible alarm is put off.
- The alarm status is displayed only on the instrument faceplate.
- All the alarms status except IOP & OOP on the instrument are not displayed on the process alarm window.

To put the instrument to AOF mode:

1. Go to the tuning window of the instrument.
2. Select AOF icon. Confirm.

To bring the instrument back to normal mode:

1. Go to the tuning window of the instrument.
2. Select AOF icon once again. Confirm.

## **5. USER DEFINED WINDOWS**

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**Objective:** This chapter deals with

- Introduction to User Defined Windows
- Control Group window
- Trend Window
- Graphics Window
- Overview Window

## **5.0 User Defined Window**

There are four types of User defined windows used for Operation and Monitoring.

- ✓ Control Group Window
- ✓ Trend Window
- ✓ Graphics Window
- ✓ Overview Window.

# HIS Window

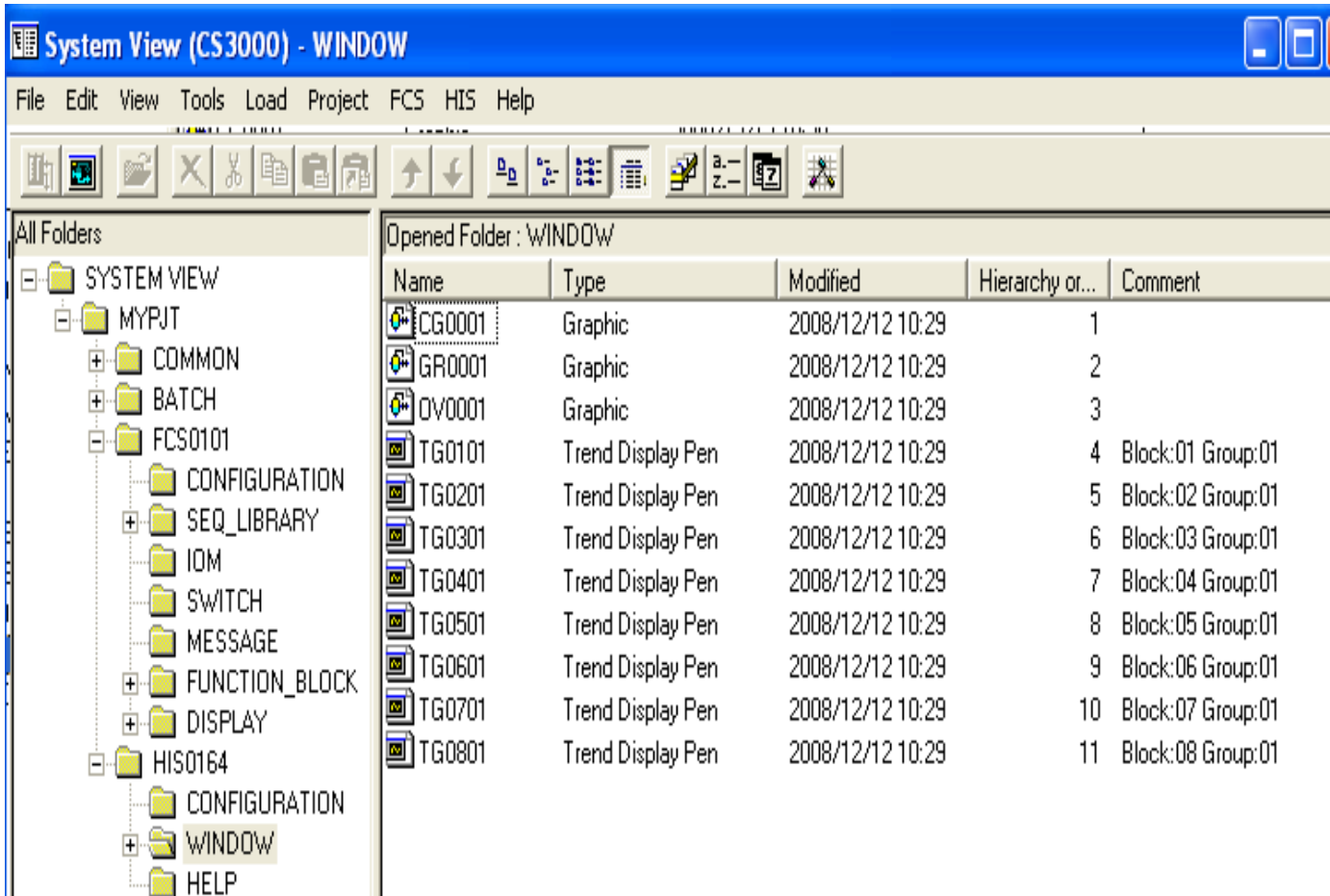


Figure: Snap Shot of HIS Window

In CS3000, the user defined windows are generated by the user. However, the system generates one default user defined windows.

- ie. **CG0001** – Control Group Window
- GR0001** – Graphics window
- TR0001** – TR0008 – Trend Window
- OV0001** – Overview Window

---

## 5.1 Control Group

- Control group windows are used to display multiple instrument faceplates.
- Maximum 8 or 16 instrument faceplates can be displayed in one Control Group window
- Normally the instruments are monitored and operated from this window.

### 5.1.1 Methods to call the Control Group Window

**Method 1)** To call a control group window on the HIS, select the **TOOL BOX** icon in the system message area. Select the **Control Group** icon from the tool box.



Control Group Icon

**Method 2)** The windows can be called by using **NAME** icon on the system Message Area.

Ex. To call the Control Group Window, select the **NAME** icon and type the **Control Group Window Name** Select **OK**

The window will be displayed on the HIS.

**Method 3)** The windows can also be called by selecting the respective keys on the **Operator Keyboard** connected to the HIS.

### 5.1.2 Control Group Window

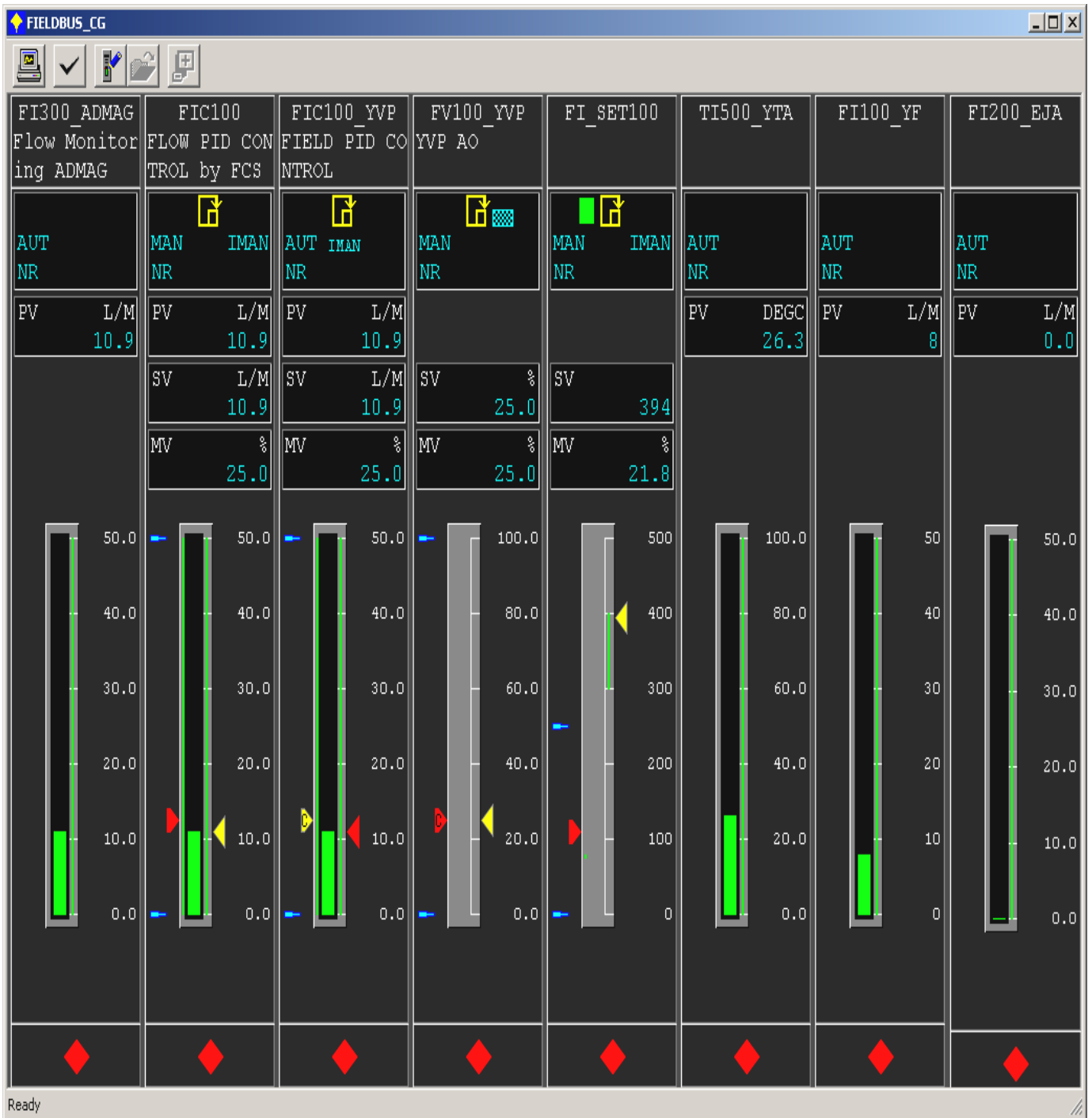


Figure: Control Group Window ( 8 – Instrument Face Plates)

- To operate instruments from a 8 instrument Control Group window, Double click on the instrument **TAGNAME**.
- To assign an instrument in a Control Group Window, Select the **INSTRUMENT ASSIGNMENT** icon. Enter the **TAGNUMBER** of the instrument. Select **OK**. These are temporary assignments.
- They will be retained till the HIS is not powered Off. Once the HIS is powered Off and On again, the instruments that were assigned in the engineering builder will be displayed.

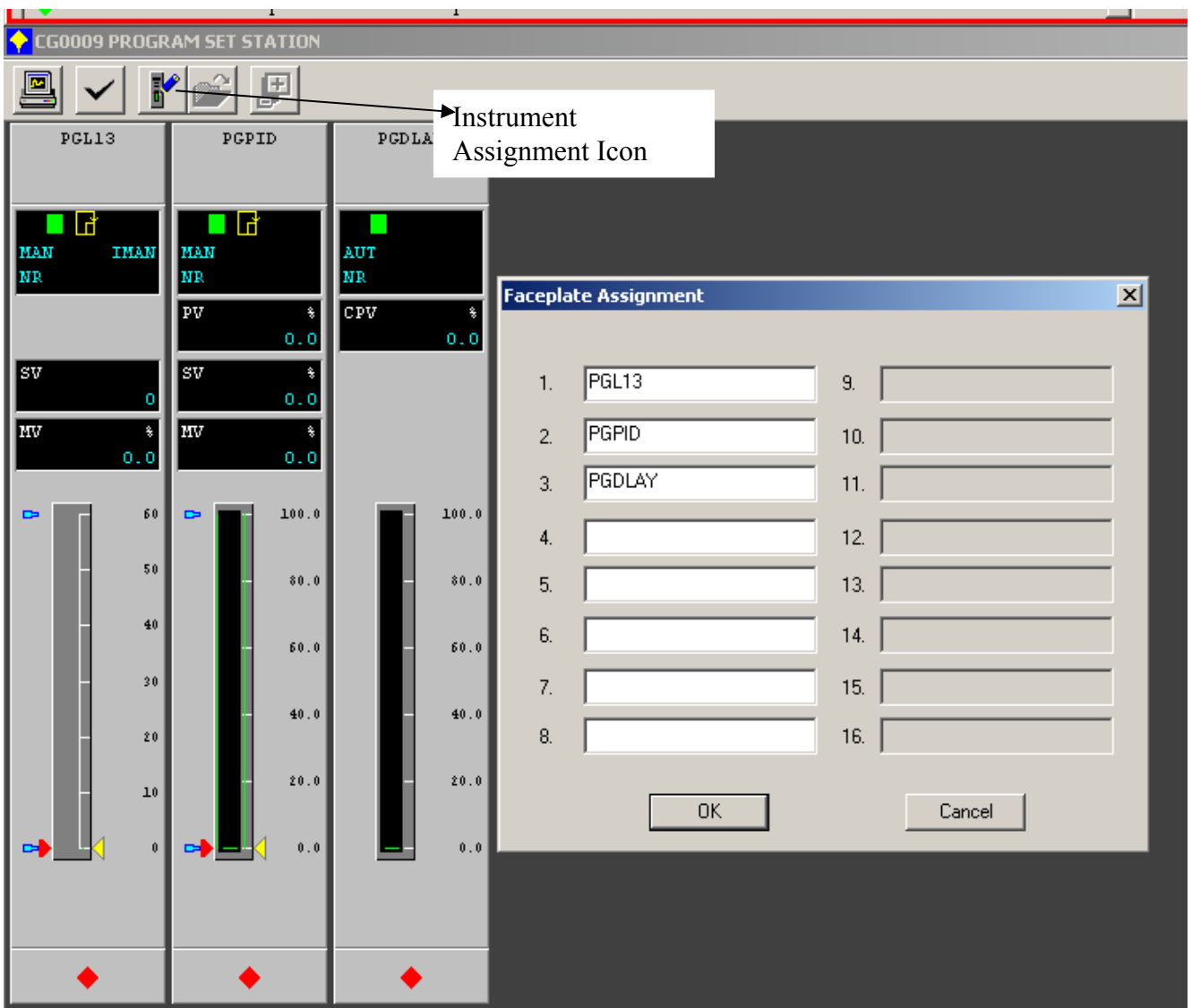


Figure : Instrument Assignment in Control Group Window



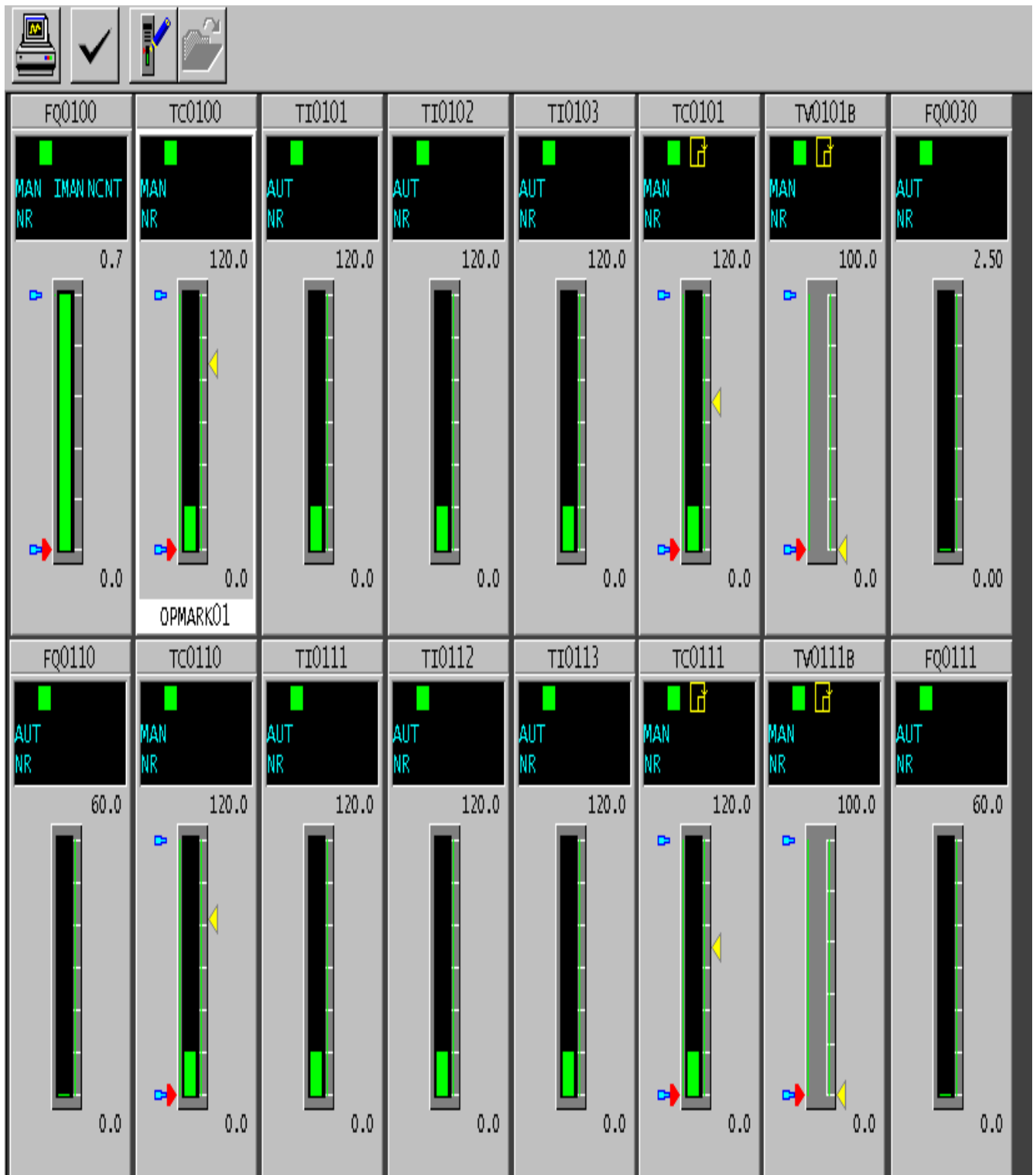


Figure: Control Group Window ( 16 – Instrument Face Plate)

To operate instruments from a 16 instrument Control Group window, Double click on the instrument TAGNAME to display the faceplate window of the instrument.

---

## 5.2 Overview Window

The Overview window acts as an index page to access all the other windows or faceplates used in CS 3000.

It has 32 operation push buttons or overview tabs which can be configured to call faceplates and windows.

The Overview tab and Function tab are used to assign a function to the operation push button.

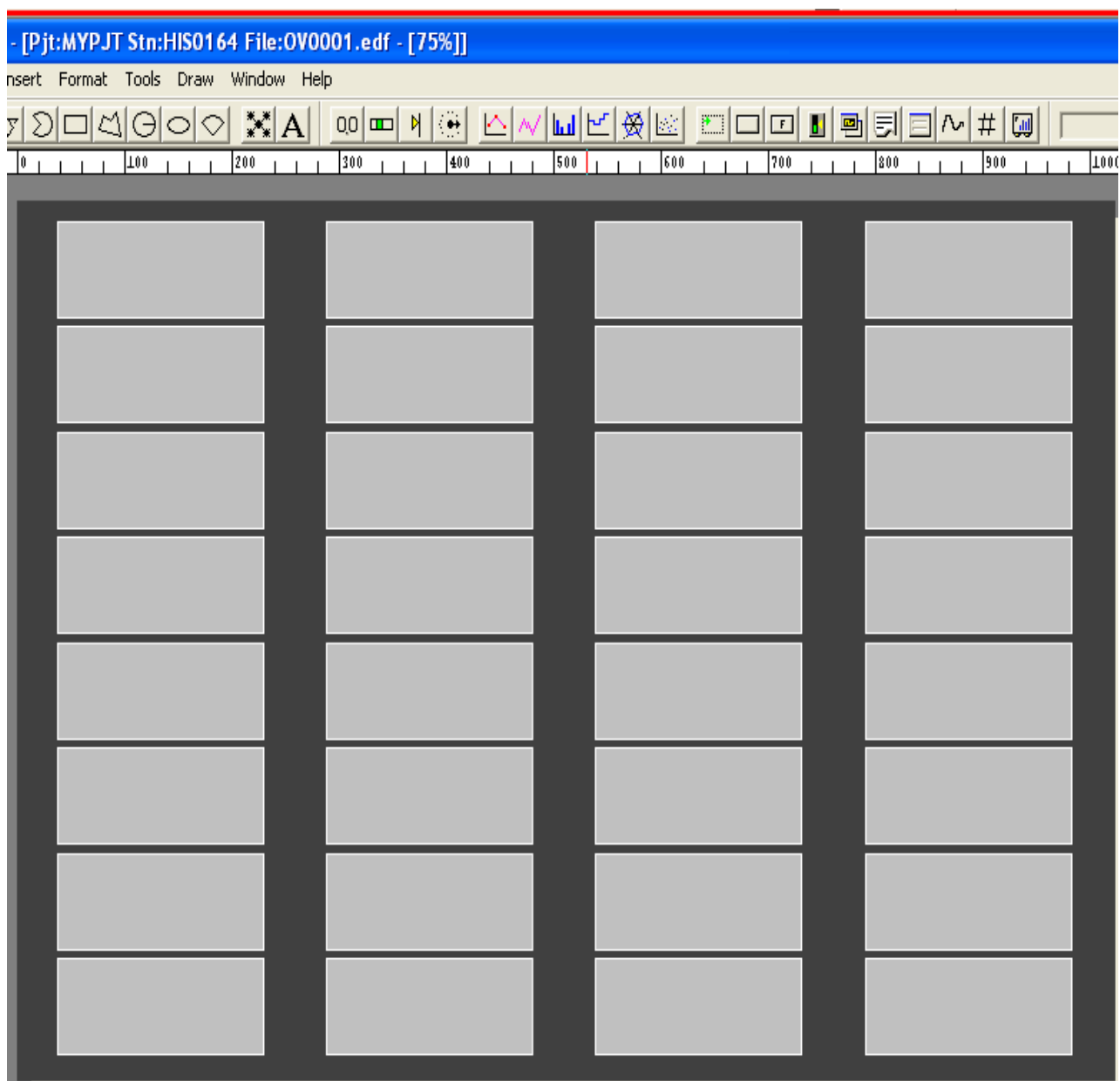


Figure: Default Overview Window –OV0001

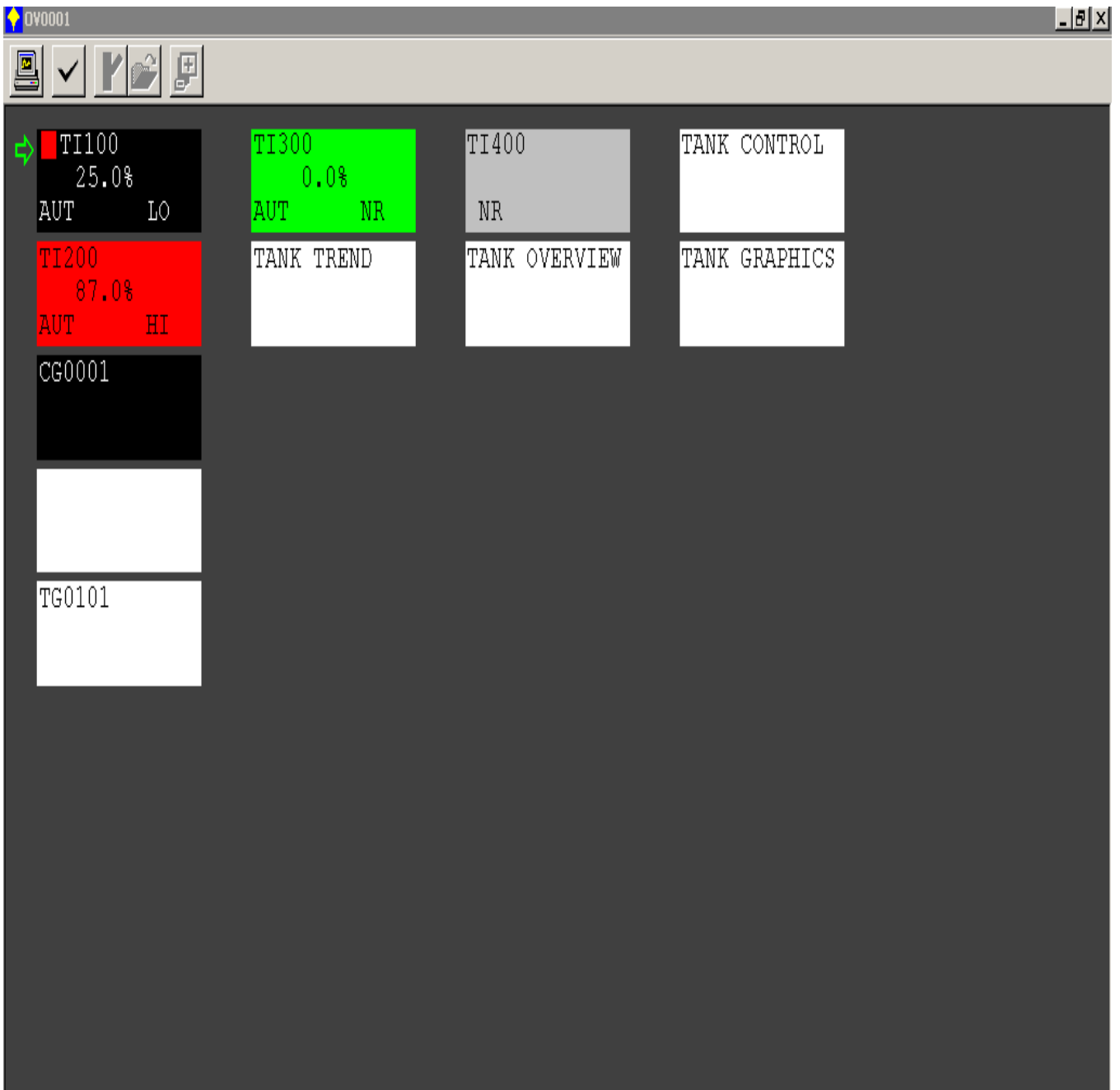


Figure: Example of Overview Window

- 
- In the Overview window, three types of Display Blocks can be configured. They are
- Single Tag Block – Includes Faceplate, Tuning window etc.
  - Window Display Block - Control Group, Graphics, System Alarm, Process Alarm, Reports, Station Status etc.
  - Comment Block
- Types of Assigning Functions

Each block of the overview window can be assigned with different types of functions. They are,

- Call window
- Execute the system function key
- Start/Stop/Restart Trend
- Flash/Light/Turn OFF the LED
- Execute the Program by File Name
- Instrument Command Operation
- Call Data Input Dialog
- Call Menu Dialog
- Data-Item Dependent Menu Dialog
- Execute the Multimedia Function
- Report Printout
- Call Panel set
- Others

Functions such as system function key function and Graphic window specific function can be assigned.

---

### 5.1.1 Methods to call the Overview Window

**Method 1)** To call a control group window on the HIS, select the **TOOL BOX** icon in the system message area. Select the **Overview icon** from the tool box.



Overview Icon

**Method 2)** The windows can be called by using **NAME** icon on the system Message Area.

Ex. To call the Control Group Window, select the **NAME** icon and type the **Overview Window Name** Select **OK**

The window will be displayed on the HIS.

**Method 3)** The windows can also be called by selecting the respective keys on the **Operator Keyboard** connected to the HIS.

## 5.3 Trend Window

Trend recording function of HIS acquires data from the field controls station (FCS) and displays changes of the acquired data in a graphical format of parameter variation versus time.

### 5.3.1 Trend Structure

Trend recording function has a three-layered structure.

- ◆ Trend Block
- ◆ Trend Group/Window
- ◆ Trend Point / Pen Window

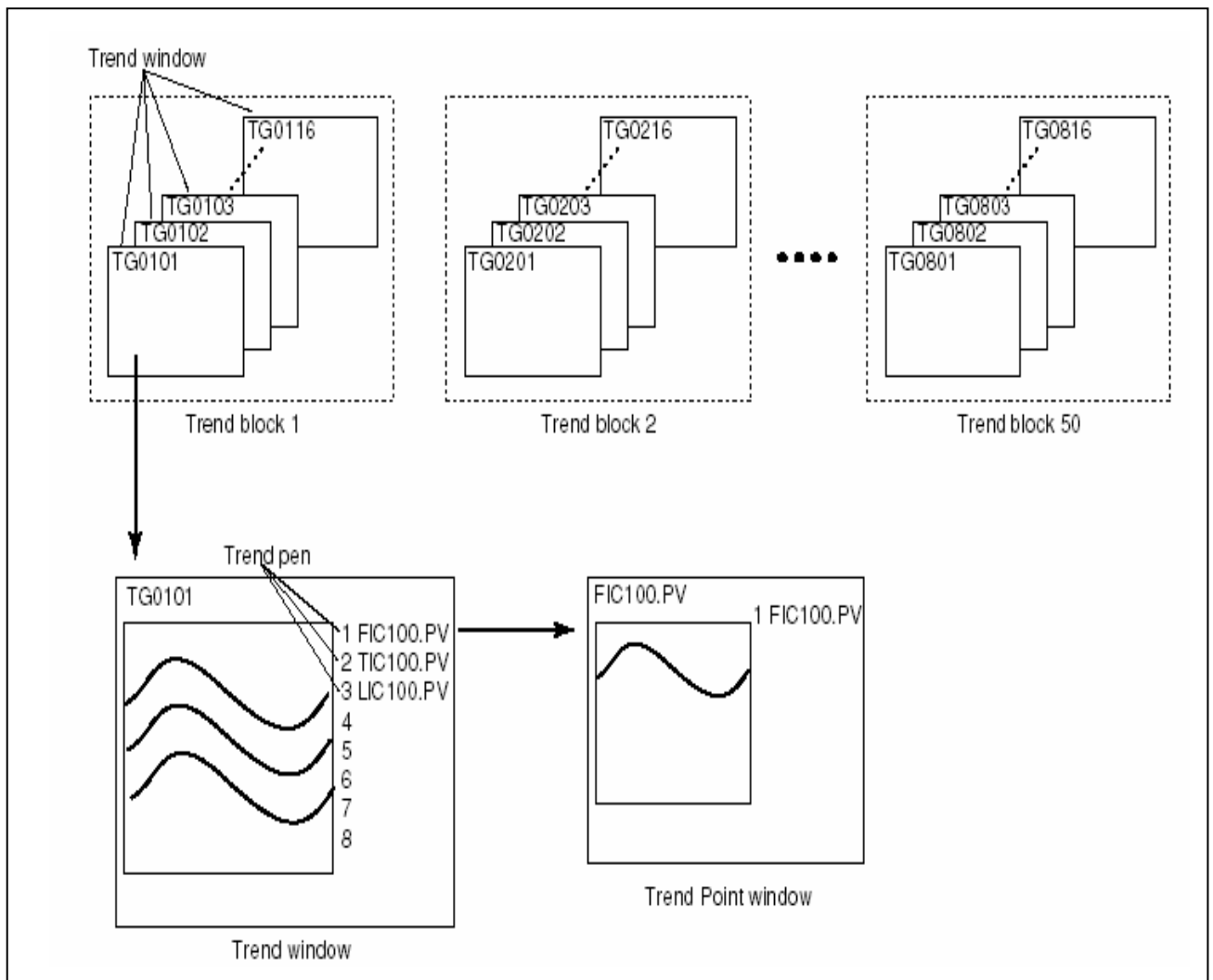
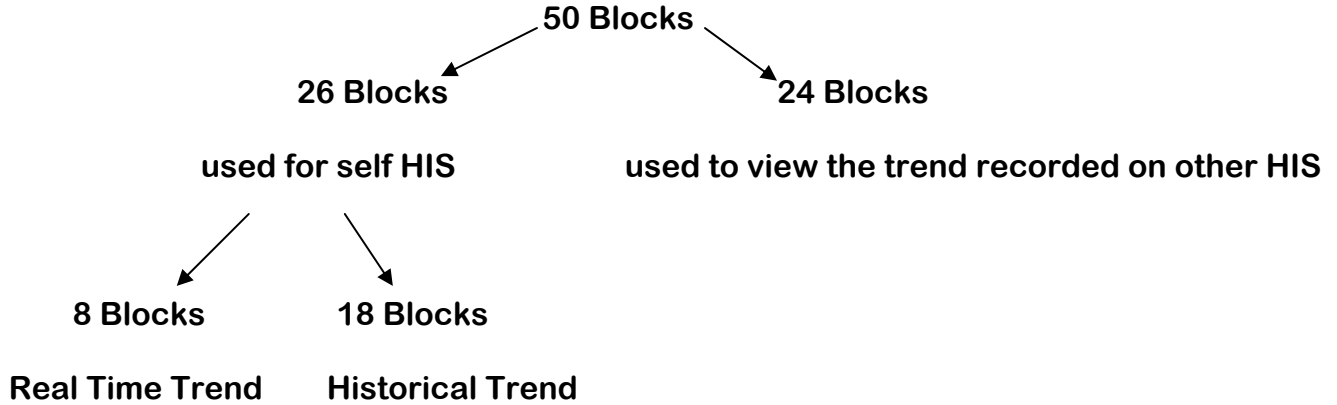


Figure: Trend Structure

## Trend Blocks:

There are 50 Trend Blocks are available per HIS. These 50 trend blocks are divided as follows.



**Trend Window:** Each trend block consists of 16 trend groups/ windows. There are 800 trend windows per HIS.

**Trend Point / Pen Window:** Each trend group is divided into 8 trend recording points or Pen window. Each of these pens can be assigned to a Tag Parameter like PV, SV, MV etc. There are 6,400 Trend Point windows per HIS

## To Configure Trend Windows

CS 3000 provides 8 blocks of Trend by default.

A Trend window can be configured in any of the Trend blocks available under the **CONFIGURATION** folder of the HIS. Select a block and select the Properties option to configure the block.

---

## Trend Properties

### a) Trend Recording Format

There are two types of trend recording format

**Continuous Rotary Type:** Rotary trend is used for a continuous process. By this mode, process data are acquired constantly. The trend is recorded continuously, once the pens are assigned.

Data acquisition starts automatically after starting the HIS. Data acquisition stops when the HIS stops. Acquired data will not be erased after the HIS stop.

When the storage capacity becomes full, the oldest data are deleted and replaced by new data.

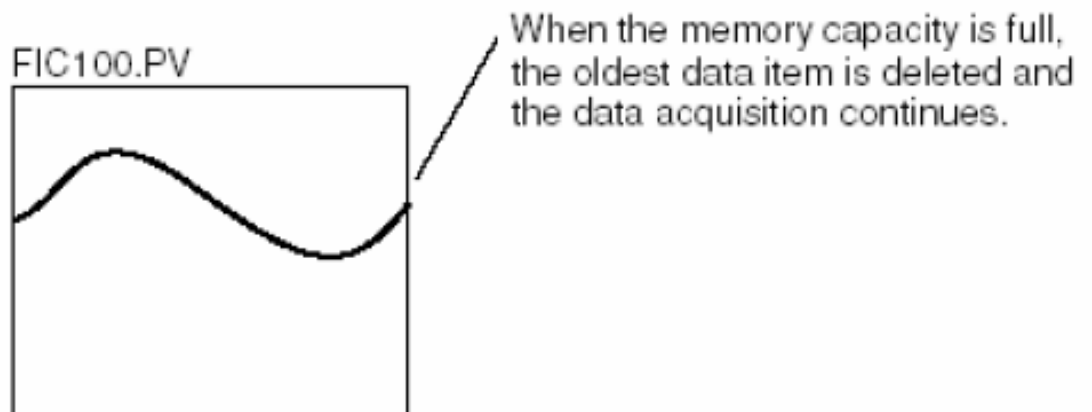


Figure: Continuous Rotary Trend Recording



---

**Batch Type:** Batch type trend is used for a Batch Process.

In case of batch trend, the trend has to be started and stopped whenever required, through an external command.

When ever start command is given, it erases the old recorded trend completely and starts recording the new trend.

There are two types of Batch Trend Recording Format. They are

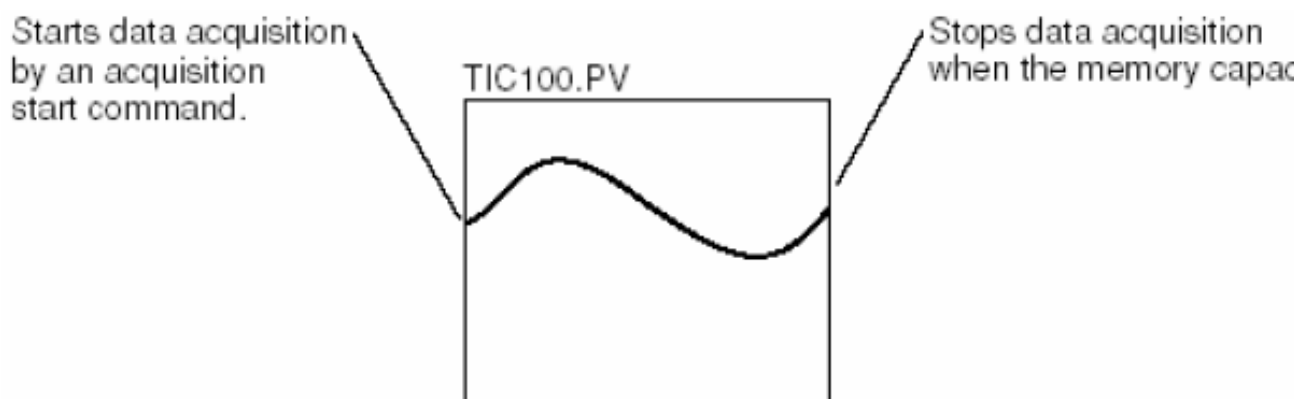
### **Batch-Stop Type**

By this type, data acquisition starts and stops according to the received command.

If no stop instruction is given, data acquisition will stop automatically when the storage capacity becomes full.

The acquisition start and stop commands may be sent from:

- Button on the toolbar of the Trend windows
- Graphic window or function key
- Sequence Messages Request



**Figure: Batch-Stop Acquisition Type**

---

### ◆ Batch-Rotary Type

By this type, data acquisition starts and stops according to the received command.

If no stop instruction is given, data acquisition will continue until the storage capacity becomes full.

Once it is full, the oldest data are deleted and replaced by new data.

The acquisition start and stop commands may be sent from:

- Button on the toolbar of the Trend window
- Graphic window or function key
- Sequence Messages Request

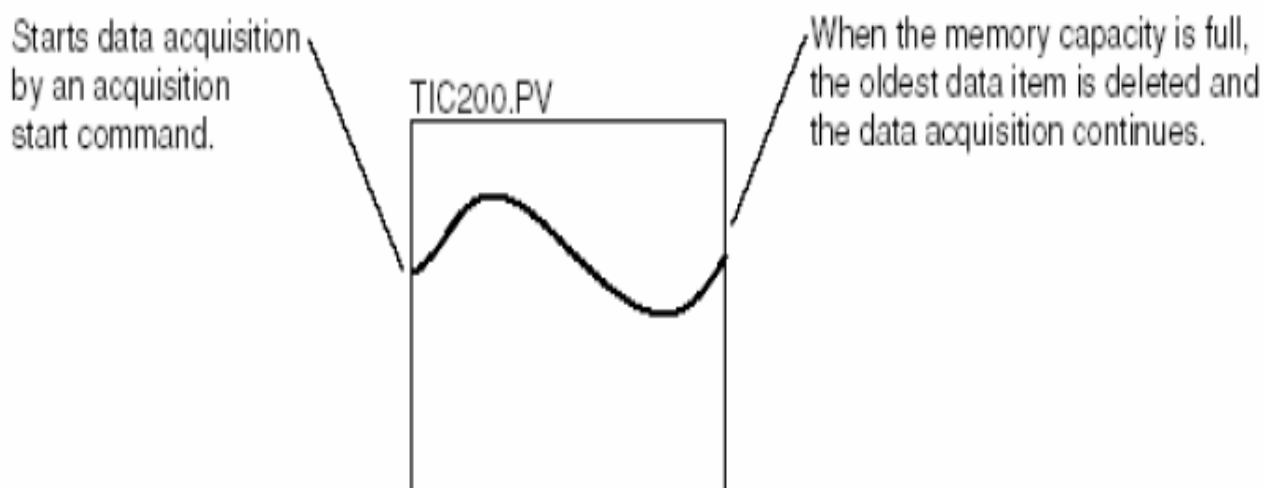


Figure: Batch-Rotary acquisition type.

## Trend Acquired by other HIS

This type of trend data acquired by other HIS may be referenced in blocks. On the Trend Acquisition Pen Assignment Builder, define the name of other HIS and the number of trend block to be acquired.

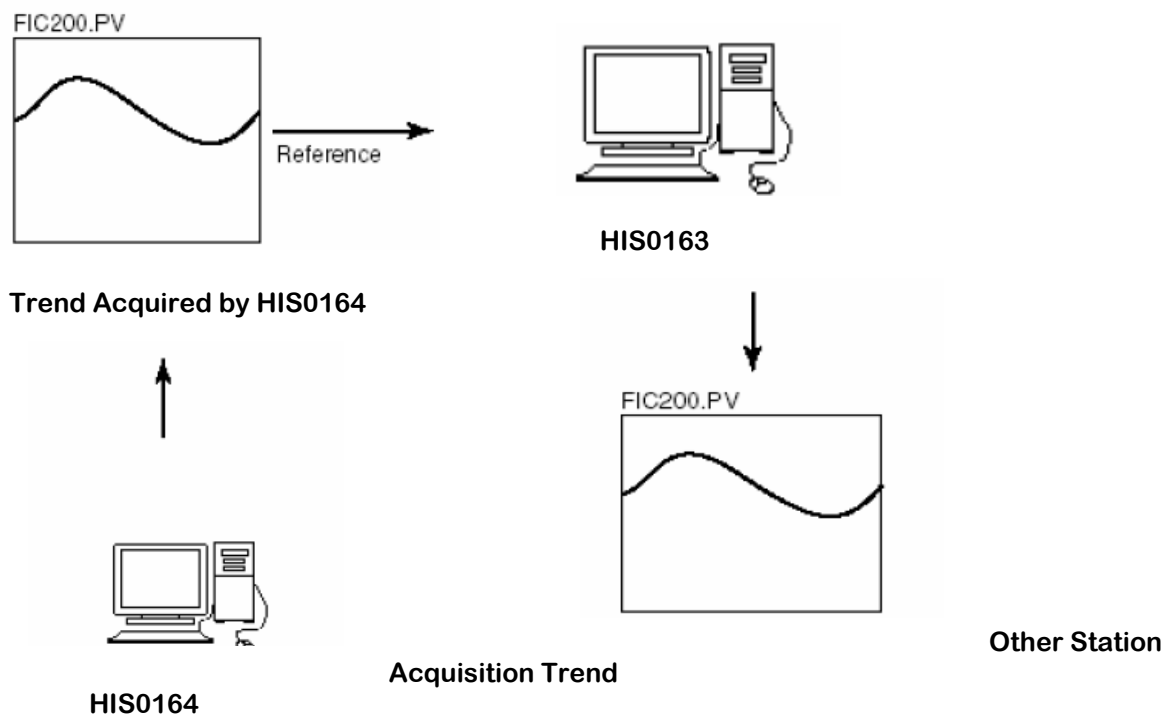


Figure: Trend Acquired by other HIS.

Trend Format and Sampling Period needs to be set. If the trend data needs to be saved, a Long-term Data Save can also be specified.

**b) Sampling Period:** This is the time difference between two consecutive samples recorded.

total trend recording period in a trend window depends on the sampling period and number of samples collected per pen.

Maximum number of samples/pen is 2880.

### TREND RECORDING SPAN

Maximum samples /pen - 2880 Samples/Pen	
Sampling Period	Total Recording Time
1 sec.	48 mins.
10 secs.	480 mins. (8 hours )
1 min.	48 hours (2 days)
2 mins.	96 hours (4 days)
5 mins.	240 hours (10 days)
10 mins.	480 hours (20 days)

Trend recording span

**c) Long Term Data Save:** The Long term data save option in the Trend window stores the trend for longer duration. The separate memory allocation is provided by the system.

### 5.3.2 Trend Saving

When a new trend block is created a download to HIS is required. Select the HIS and from the Load option, select Download to HIS. Once the download is completed, the trend windows of the new block created can be called.

The trend recorded on one HIS can be viewed on other HIS if both the HIS are connected using the Ethernet cable.

---

### 5.3.3 Methods to call the Trend Window

Method i) Each trend window is called by the trend block number followed by trend group number.

The windows can be called by using **NAME** icon on the system Message Area.

select the **NAME** icon and type TGbbgg Select **OK**

where bb-Trend Block number, gg – Trend Group number

Ex : TG0101 represents Trend Block 01 and Trend Group 01

The window will be displayed on the HIS.

Method ii) To call the current Trend window from the System Message Area



Click on the icon to call the trend window

### 5.3.4 Other Station Acquisition Trend

Trend created in other HIS can be viewed from the current HIS, using the other station acquisition trend option.

In the properties of a trend block, select the trend format as Other Station Acquisition Trend.

The sampling period option is automatically disabled. The sampling period set in the other HIS is automatically accepted.

The station whose trend needs to be viewed is specified in the Other Station Name.

The trend block to be viewed is specified as the Reference Block Number.

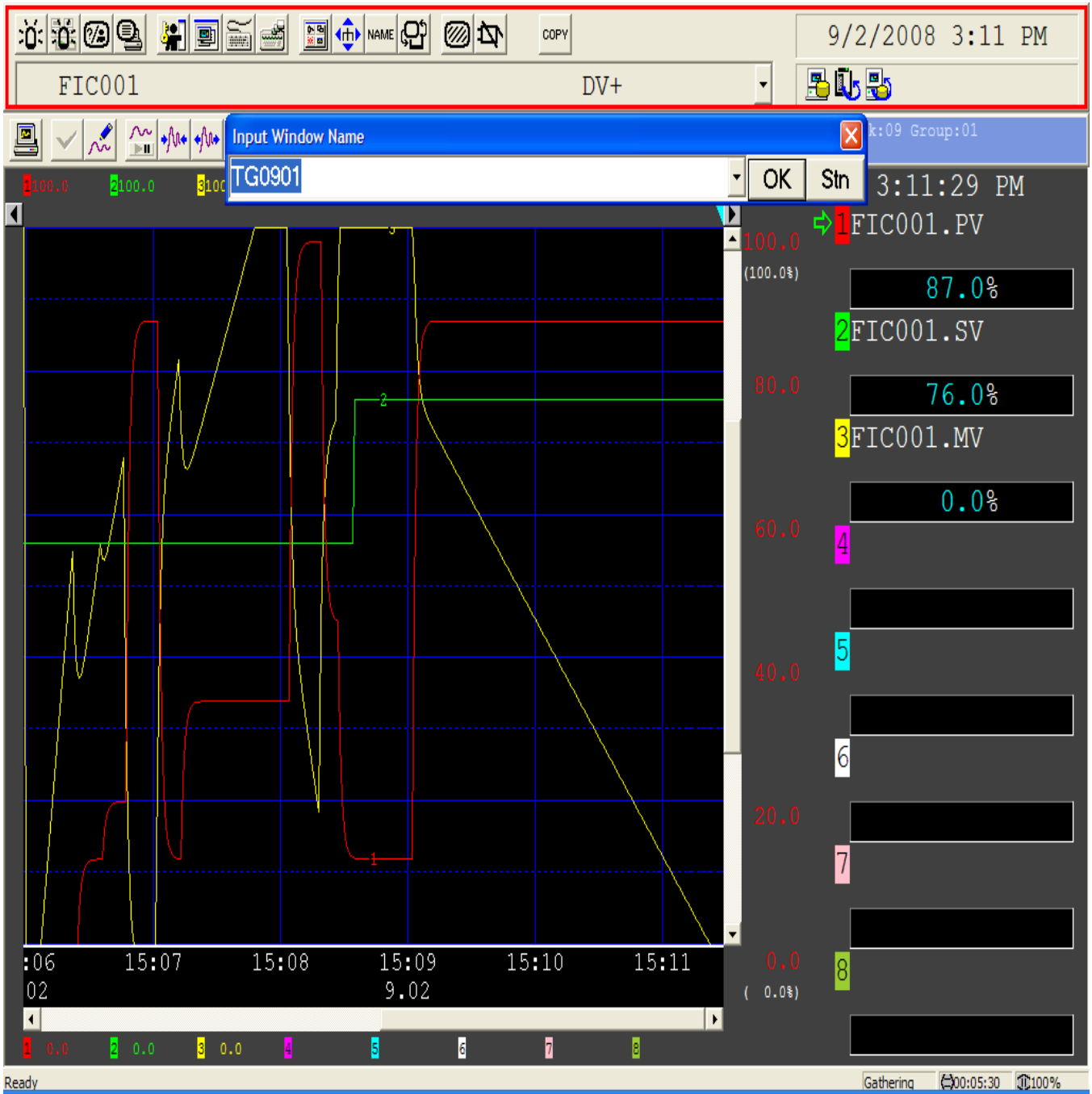


Figure: Example of Trend Window

### 5.3.5 Components of Trend Window

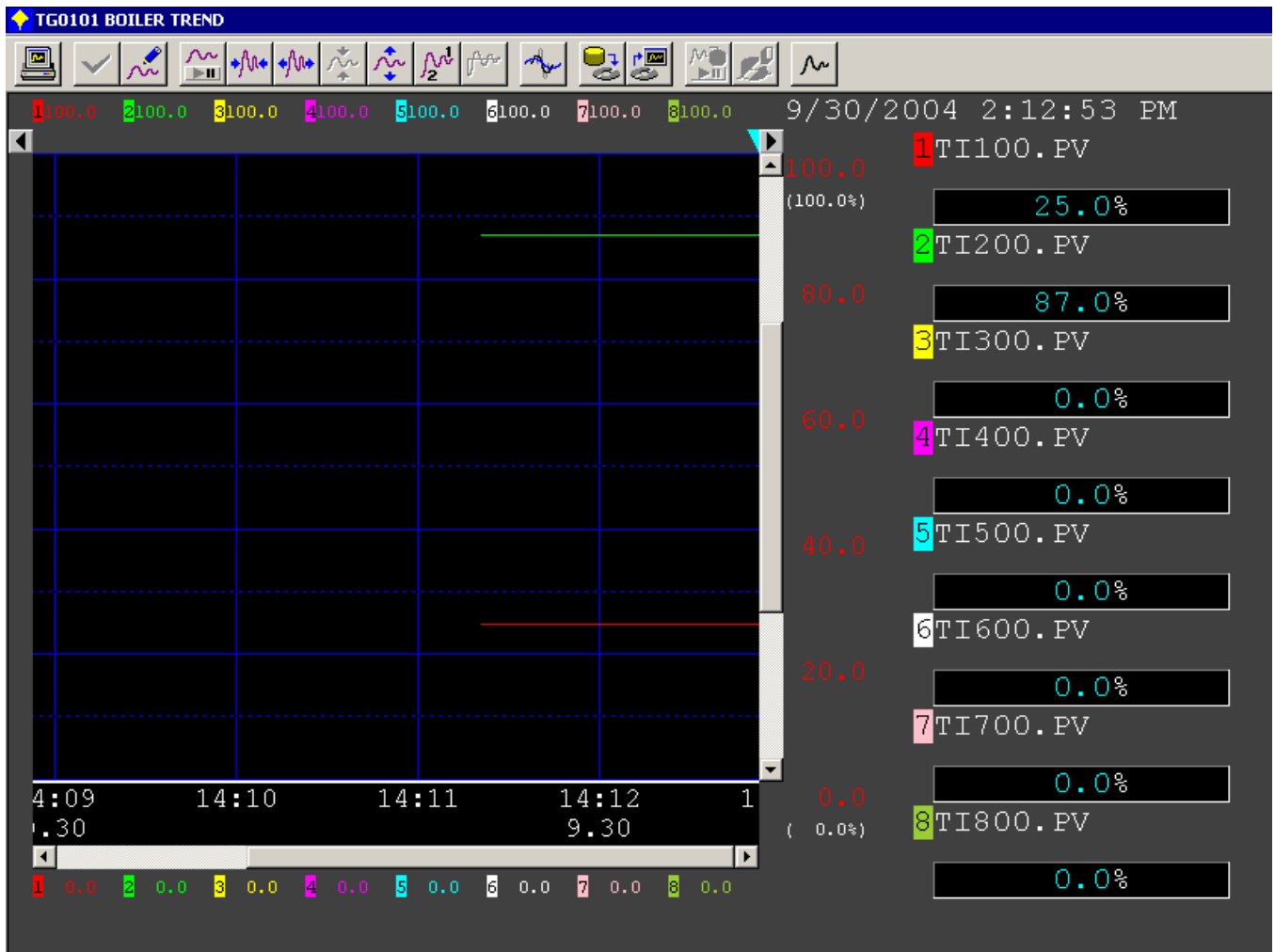


Figure: Components of Trend Window



Hard Copy

This will output the current trend window to the color hard copy unit.



Acknowledge

This function is disabled, as it is not possible to acknowledge the alarms from the Trend window



## Pen Assignment

The assignment of trend pens being displayed in the trend window can be changed using this button.

	Collected	Set Upper/ Lower Limit	Lower	Upper	Display
1	<input type="checkbox"/>	<input type="checkbox"/>	0.0	100.0	<input checked="" type="checkbox"/>
2	<input type="checkbox"/>	<input type="checkbox"/>	0.0	100.0	<input checked="" type="checkbox"/>
3	<input type="checkbox"/>	<input type="checkbox"/>	0.0	100.0	<input checked="" type="checkbox"/>
4	<input type="checkbox"/>	<input type="checkbox"/>	0.0	100.0	<input checked="" type="checkbox"/>
5	<input type="checkbox"/>	<input type="checkbox"/>	0.0	100.0	<input checked="" type="checkbox"/>
6	<input type="checkbox"/>	<input type="checkbox"/>	0.0	100.0	<input checked="" type="checkbox"/>
7	<input type="checkbox"/>	<input type="checkbox"/>	0.0	100.0	<input checked="" type="checkbox"/>
8	<input type="checkbox"/>	<input type="checkbox"/>	0.0	100.0	<input checked="" type="checkbox"/>

Figure: Pen Assignment Window

This function is very useful for the operator to compare two or more parameter variation against time simultaneously though it is not assigned to that trend window page.

Hence while the trend pens are assigned to a block, it is necessary to gather all the relevant process parameters to be assigned for trend in one block.

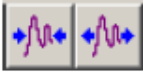
For a block defined as “batch stop” or “batch rotary”, an additional tab is available. It is then possible to compare the current trend with one that has previously been saved.





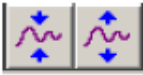
### Stop/Resume Display

This is to pause and then resume the trending function. The trend data gathering continues even during the temporary suspension.



### Reduce / Enlarge time axis

To perform a zoom-out / zoom-in of the time axis.



### Reduce / Enlarge data axis

To perform a zoom-out / zoom-in of the data axis.



### Pen number

This displays the pen number along with the trend graphs. This is useful to identify the parameters in the graphs when a monochrome printout of the trend window is taken.



### Display/Delete reference

Displays or hides the reference pen.



### Display initialization

This restores all the data and time magnifications back to the default settings.



### Save Data

Saves the current trend as a .trf file in the hard disk. The default directory being – C:/CS3000/his/save/trend.



### Read Data

Retrieves the saved data and displays it in the trend window.



### Stop/resume collection

Stops or continues the trending data collection. Applicable only for batch trend acquisition blocks.



**Start collection**

Start the batch trend collection. Applicable only for batch trend acquisition blocks.



**Previous long term data**

This button displays the data of previously archived file against the currently displayed file. If the previous file does not exist, it returns to real time data display. While displaying the real time data, clicking this button may display the most recently archived data. This button is displayed when the long-term data archive package is installed.



**Next long term data**

This button displays the data of the next long term data archived file against the currently displayed file.



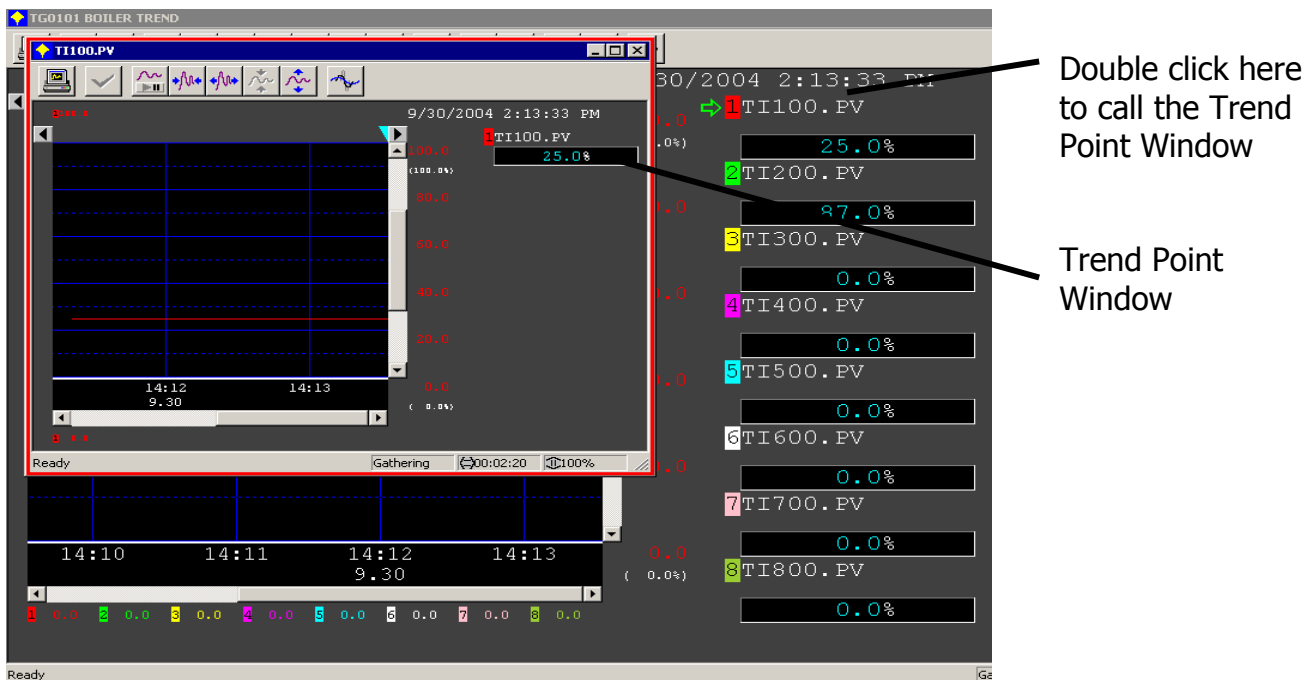
**Read long-term data**

Calls up the dialog box for selecting the archived files. This button is displayed when long-term data archived package is installed.



**Re-display**

When the archived long term trend data are being displayed or when the trend data save by toolbar button are being displayed, clicking this button changes the display to real time data display.



**Figure: Trend Point Window**

---

## 5.4 Graphics Window

The Graphic Window displays the graphical representation of the process with dynamic process values, color changes etc.. The graphic window is completely configurable by the user as per the requirement.

Graphics window uses graphic objects to provide an overall view of the plant.

Graphics window can display graphic objects, control objects, overview objects, or a combination of these types of objects.

Graphic objects display a graphical representation of the plant status, providing operation and monitoring environment.

One can also call up various windows from a graphic window.

### Features of Graphics Window

- The size and color of the Graphics page can be changed.
- A background image can also be set if required. Any bitmap image can be selected and set as the background.
- The grid option of a graphic builder page can be used for alignment of graphic objects. This is an optional feature.
- Different objects can be built in the graphics window. The Parts window of a graphic page consists of various preset images. The required image can be dragged on to the graphic sheet.
- The image can then be modified as per the user requirement.

### Example of Objects: Tanks, Pipes, Valves, Joints, Motors etc.

- If the images available in the Parts window are insufficient or do not meet the requirements, new images can be created using a combination of the geometrical shapes like Circle, Ellipse, Rectangle.
- The color of the objects can be chosen.

- 
- All the graphic objects are labeled and the graphic page is given a heading. Hence, text can be inserted in the Graphics sheet by selecting text icon present in the builder.  
The text font, color and size can be set.
  - The process value can be displayed on the graphic builder page for the convenience of the end user. This is possible using the process data character display tool.  
The desired font size and color can be set.
  - Along with process data character, a process data bar can also be used. This is normally used to indicate level changes in tank. The desired color of the bar can be chosen
  - A color change can be provided to text or process data or to the graphic objects based on alarm conditions occurring in tags.
  - The color change during specific conditions can be set under the Graphic Modify tab. eight conditions can be added to a single graphic object.
  - The System defined or user defined windows can be called from the Graphics page using either Touch target or Push Button.
  - The touch target is an object that executes assigned functions, such as window calling.
  - Another useful object in the graphic builder is the Soft key. Soft keys are used to call other windows used in the project. They cannot be seen on the builder page but can be viewed on the run file.
  - Each graphic page can accommodate 8 soft keys. The position of the soft keys is fixed at the bottom of the page. All the 8 soft keys can be assigned from a single window.



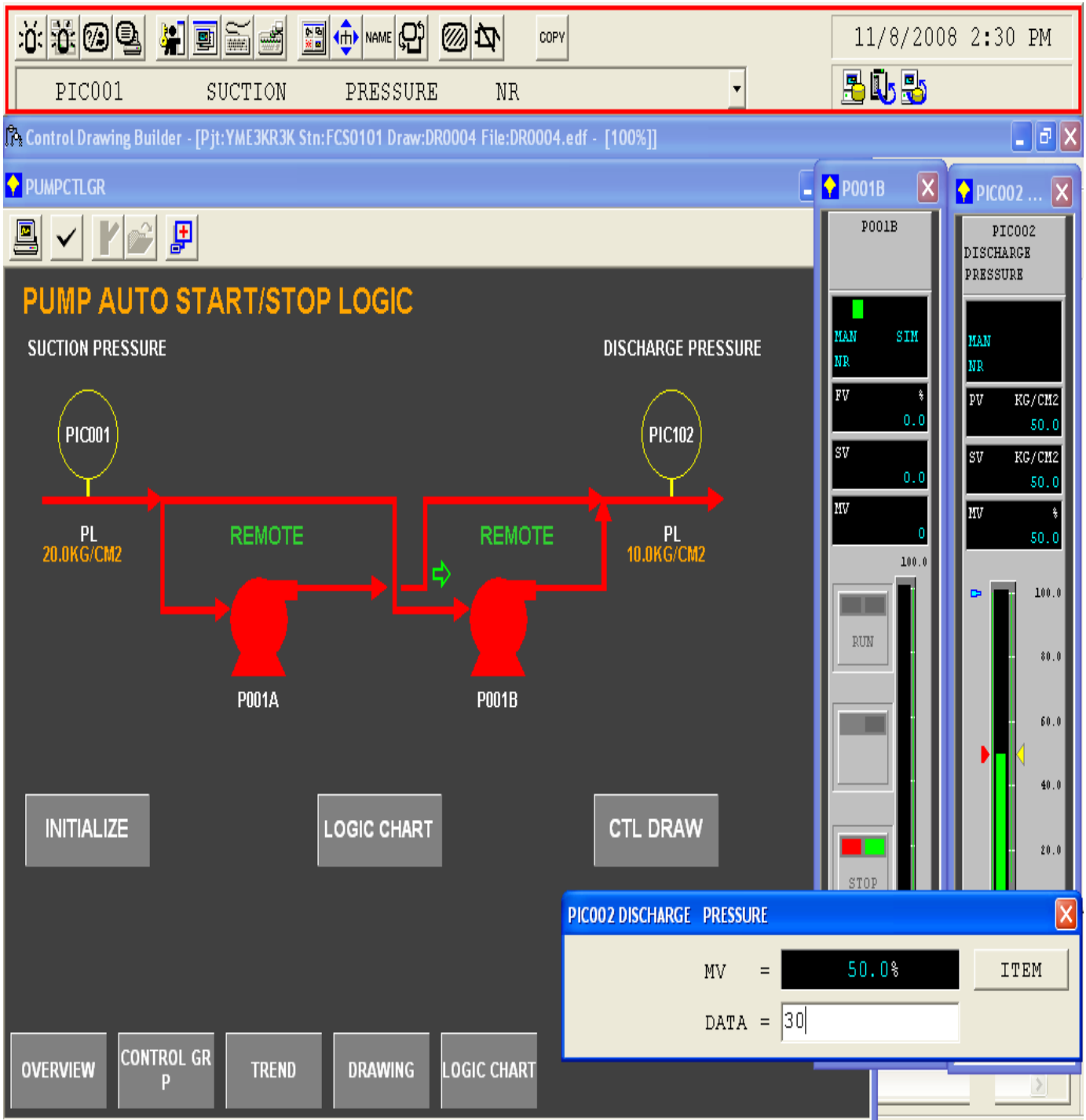


Figure: Example of Graphics Window – Pump Auto Start/Stop Logic

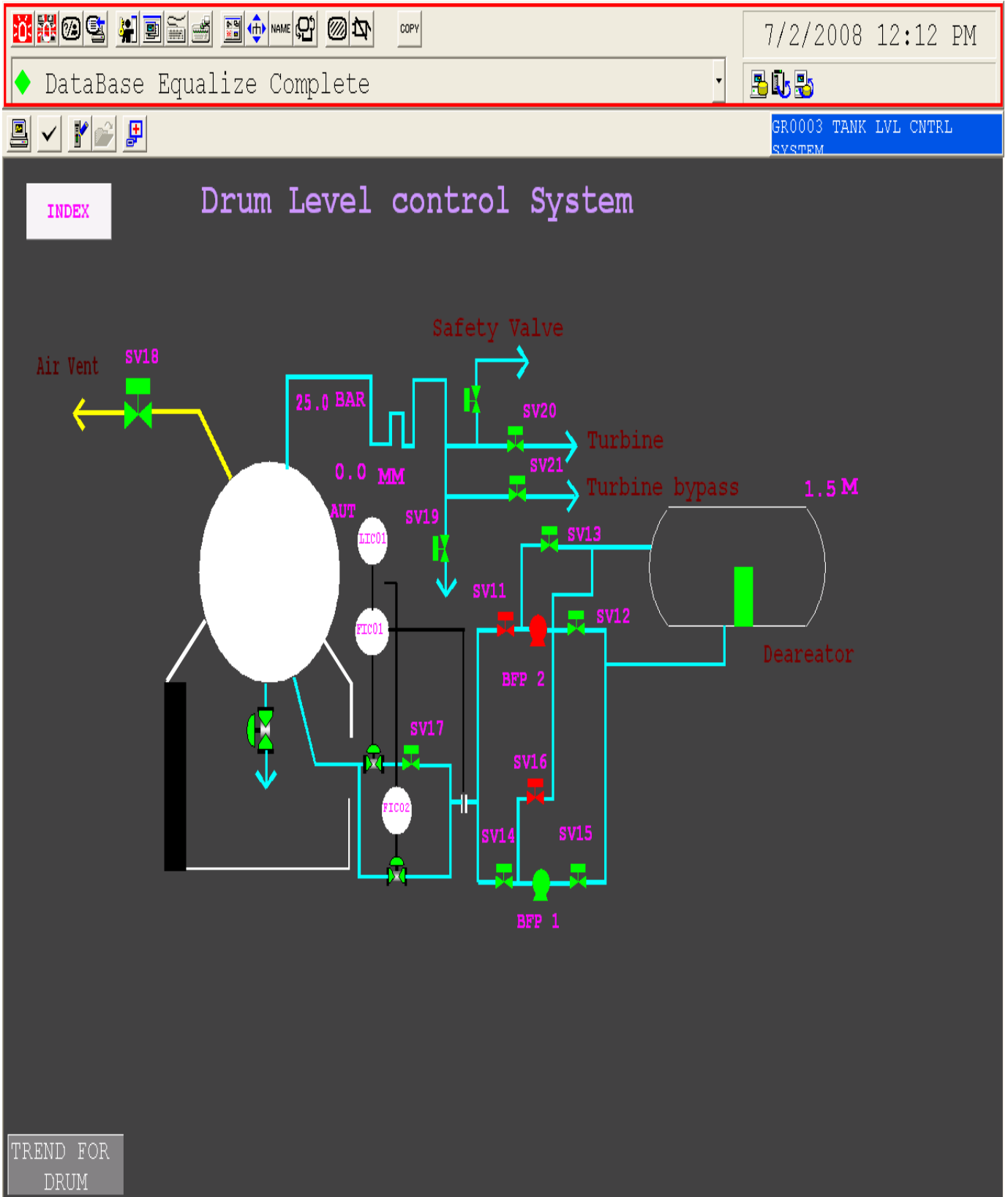


Figure: Example of Graphics Window – Drum Level Control System

## **6. SYSTEM MESSAGE AREA**



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**Objective:** This chapter deals with

- Details of System Message Icons

## 6.0 System Message Icons

The System Message icons are as shown in the figure.

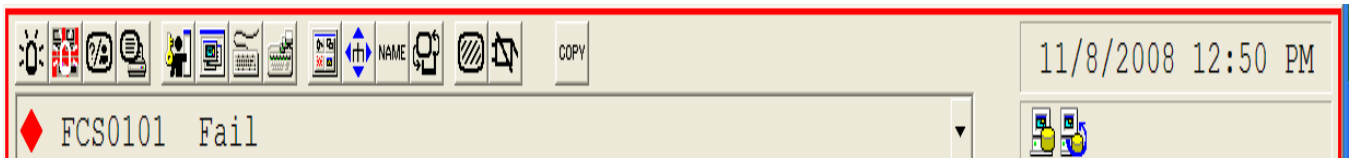


Figure: System Message Icons

**Details of the System Message Area Window**

### 6.1 Process Alarm



This is the first icon of system message window. This record all the alarms related to the process in the plant.

- Process alarm messages occurred are displayed in the order from the latest messages first, in the message display area of the process alarm window.
- A maximum of 200 alarm messages can be held.
- If the number of alarm messages occurred exceeds 200, the messages will be deleted starting from the oldest ones that have been acknowledged.
- When there are no acknowledged alarm messages, the oldest unacknowledged messages are deleted first.

## 6.1.1 Process Alarm Message Format

The diagram shows a table representing the Process Alarm Window. Labels with arrows point to specific fields in the table:

- Date/Time alarm message occurred:** Points to the date and time columns (e.g., 12/12 10:18:15).
- Tag name:** Points to the tag name column (e.g., FIC005).
- Annunciator message:** Points to the first part of the tag comment (e.g., Flowrate 5).
- Tag comment:** Points to the second part of the tag comment (e.g., NR).
- Alarm status:** Points to the alarm status column (e.g., NR, LO).
- Present process variable:** Points to the present process variable column (e.g., 33.0M3H).
- Engineering unit symbol:** Points to the engineering unit symbol column (e.g., NR).
- Present alarm status:** Points to the present alarm status column (e.g., DV+, HH).
- Display sequence number:** Points to the first column (1-10).
- Tag mark:** Points to the square icons in the second column.

1	■	12/12 10:18:15	FIC005	Flowrate 5	NR	33.0M3H	NR
2	□	12/12 10:18:15	FIC005	Flowrate 5	LO	33.0M3H	NR
3	■	12/12 10:18:05	Tank level error		NR		
4	■	12/12 10:17:45	FIC005	Flowrate 5	LO		
5	■	12/12 10:17:45	Tank level error		ALM		
6	■	12/12 10:17:45	Tank temp error		ALM		
7	□	12/12 10:17:15	Pump fail		NR		
8	□	12/12 10:17:15	Pump fail		ALM		
9	■	12/12 10:17:05	FIC004	Flowrate 4	DV+	50.0M3H	DV+
10	■	12/12 10:16:45	FIC003	Flowrate 3	HH	12.0M3H	HH

Figure: Process Alarm Window

◆ **Display sequence number** - Number 1 through 200 is displayed.

◆ **Tag Mark** - The assigned tag mark whether it is an important tag, general tag or a auxiliary tag based on the assignment in the function block builder appears. This mark has a dynamic color change based on the alarm status. The color changes will be based on the alarm priority and the colors assigned. Generally the color significance is as below.

**Red Flashing** - A process alarm or an annunciator message notifying that an alarm related to that tag has occurred, and the alarm is unacknowledged.

**Flashing green** - A process alarm message or annunciator message notifying that the alarm status has reverted to normal, and the alarm remain unacknowledged.

**Steady** - A process alarm message or annunciator message has occurred, and the contents of the alarm have been acknowledged.

◆ **Date and Time display**- Displays the date and time of alarm occurrence.

## 6.1.2 Soft key Functions



Prints out all process alarm messages and annunciator messages occurred.



This button acknowledges the process alarm messages and annunciator messages. **'Global acknowledgment'** or **'Individual acknowledgment'** can be used to acknowledge the alarm messages.

When the global acknowledgment is used, all the unacknowledged alarm messages can be acknowledged by clicking this button.

For the individual acknowledgment, click this button after selecting the function block alarm message to be acknowledged.

When all the process alarms are acknowledged, the Process Alarm window call button will change from flashing to lit.

When all the alarms are deleted, the color of the button will return to the normal display color.



Views only the high /Medium/Low priority alarms. All the alarms are displayed when the button is released.



Display current PV of the analog data with the engineering unit. At this point the alarm status is also displayed.

The current PV values disappear when this button is released.



The alarm message display is retained (or paused) for 5 seconds with display update.

Click this button to restart the display update. When the display is paused, the alarm gathering continues but only the display is not updated.



In the filter dialog, the filter conditions of the process alarm window, such as displaying the alarms of a specific control station or function block, can be specified.

The specified filter conditions are displayed in the status bar of the process alarm window.

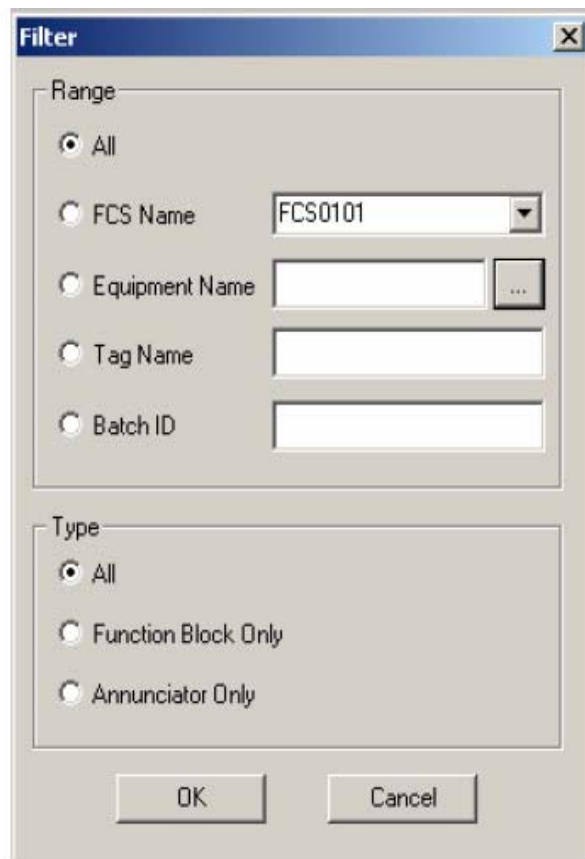
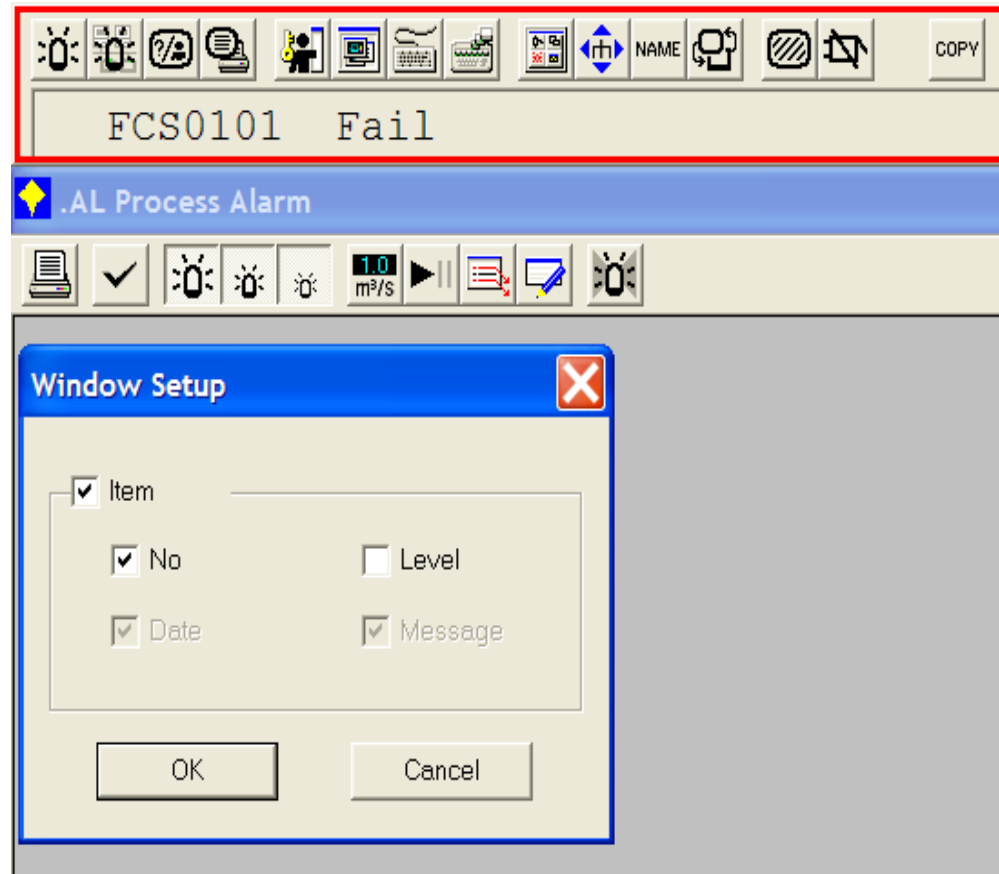


Figure: Filter dialog of Process Alarm



**Window setup:** This window provides the list of items that can be displayed in the process alarm window.



**Figure: Window Setup**



**SCS Alarm Occurrence Notification:** When the Safety Control Station alarm occurs, it is notified in this window.

---

### 6.1.3 When an Alarm occurs

- ❖ The tag mark changes color depending on the alarm and starts flashing.
- ❖ The Process alarm window icon starts flashing in the System Message Area.
- ❖ Audible alarm is activated.
- ❖ The LED on the Process Alarm Window Key on the Operator Keyboard starts flashing.
- ❖ The alarm status is displayed on the instrument faceplate as well as on the Process Alarm Window.
- ❖ The alarm is printed on the printer connected to the HIS.
- ❖ The alarm is also stored in the History.

### 6.1.4 Actions to be taken by the operator

- Select the Process Alarm Window icon in the System Message Area or Select the Process Alarm Window key on the Operator Keyboard.
- Acknowledge the alarm by the Alarm Acknowledge key. The instrument tag mark stops flashing.
- Reset the audible alarm using Buzzer Reset Key.
- Double click the process alarm in the Process Alarm Window for which action needs to be initiated.
- Take corrective action to reset the alarm.
- The alarm disappears from the Process Alarm window once it is reset.



## 6.2 System Alarm



This is the second icon of System Message. This record all the system related events.

- The system alarm messages occurred is displayed in the order from the latest to the earliest in the system alarm window message display area.
- Maximum of 100 alarm messages are saved.
- The messages will be deleted starting from the oldest system alarm message that has been acknowledged if the number exceeds 100.
- When there are no acknowledged system alarm messages, the oldest messages that are unacknowledged are deleted first.

Display sequence number	System alarm mark	Time the alarm occurred	System alarm message
1	◆	0823 01/14 03:20:01	Printer EPSON MJ-930C Offline
2	◆	0602 01/14 02:31:02	DataBase Equalize Complete
3	◆	0510 01/14 02:30:57	Data Base Download from YOKOGAWA File = ClsDef.odt
4	◆	0510 01/14 02:30:57	Data Base Download from YOKOGAWA File = TrDspAssign.odt
5	◆	0510 01/14 02:30:57	Data Base Download from YOKOGAWA File = TrAssign.odt
6	◆	0502 01/14 02:29:33	DataBase Equalize Complete
7	◆	0510 01/14 02:29:23	Data Base Download from YOKOGAWA File = ClsMng.odt

System alarm message number

Figure: System Alarm Window

---

### 6.2.1 System Alarm Message Format

◆ Display sequence number - Numbers 1 through 100 are displayed.

◆ **System alarm Mark** - This mark is specific to the system and indicates that the generated alarm is a system alarm message. This mark has a dynamic color change based on the alarm status.

**Flashing red** - A System error has occurred and the contents of the alarm remain unacknowledged.

**Flashing green** - A system alarm message has occurred and the contents of the alarm have been acknowledged.

**Steady** - A system alarm message has occurred and the contents of the alarm have been acknowledged.

◆ **System alarm message number** - The system alarm message number is a registration number to identify the alarm message.

The system alarm message number cannot be defined while the same is assigned by the system.

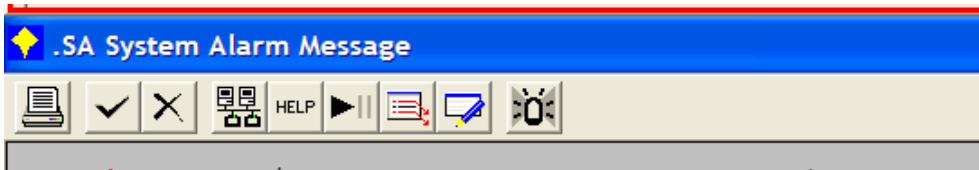
This message number will enable the maintenance personnel to refer to the message and maintenance manual for more details on troubleshooting the system error.

◆ **Time stamp of the alarm message** - The date and time of the system alarm occurrence is displayed.

◆ **System alarm message**- The system error is notified in brief by the system.

These are system defined message and for more details on the error the messages and maintenance manual can be referred.

## 6.2.2 Soft Keys Function



Prints out all the system alarm messages occurred.



The system alarm messages are acknowledged with this button. When all the system messages are acknowledged, the system alarm window call button will change from flashing to steady.

When all the alarms are deleted, the color of the button will return to the normal display color.



Acknowledged system alarm messages are deleted with this button. This is a privilege of ENG user.



This button calls up the system status overview display window.



This button calls up the help dialog box, which explains the system alarm message. Click this button after selecting a displayed system alarm message.

If this button is pressed without selecting any system alarm message, a help dialog, which explains the system alarm window, appears.



The alarm message display is retained (or paused) for 5 seconds with display update. Click this button to restart the display update.

When the display is paused, the alarm gathering continues but only the display is not updated.

This button calls up the filter dialog box.



In the filter dialog, filter conditions for the system alarm windows, such as displaying system alarm messages of a specific control station, can be specified.

Specified filter conditions are displayed on the status bar of the system alarm window.



Figure: Filter dialog of System Alarm Window.

Window set up: This window provides the list of items that can be displayed in the process alarm window.

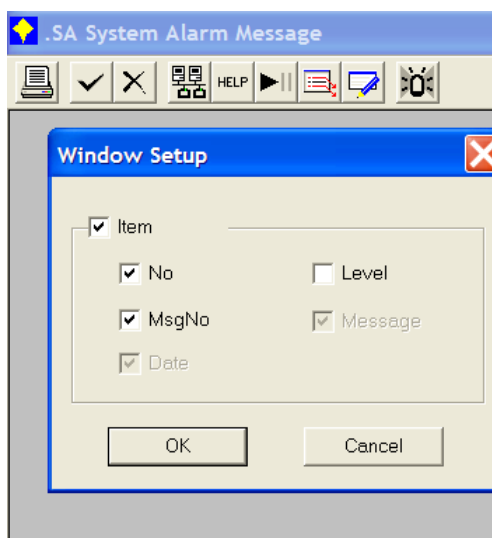


Figure: Window Setup- System Alarm



**SCS Alarm Occurrence Notification: When the Safety Control Station alarm occurs, it is notified in this window.**

The screenshot shows a window titled ".SA System Alarm Message" with a toolbar containing icons for print, check, close, help, and a bell. The main area displays a list of alarm events:

Seq	Time	Date	Time	Station	Description
1	0303	11/8	12:06:48 PM	FCS0101	Fail
2	0480	11/7	5:45:57 PM	FCS0101	Too Heavy Load
3	0490	11/7	5:24:43 PM	FCS0101	Batch Manager Ready
4	0451	11/7	5:24:43 PM	FCS0101	RIGHT Control
5	0001	11/7	5:24:43 PM	FCS0101	RIGHT Manual Reset Start
6	0011	11/7	5:24:43 PM	FCS0101	RIGHT Fail (SW STOP Code= 0000 0000 0000 0000)
7	0304	11/7	5:24:39 PM	FCS0101	Recover
8	0303	11/7	5:23:47 PM	HIS0163	Fail
9	0303	11/7	5:23:47 PM	FCS0104	Fail
10	0303	11/7	5:23:47 PM	FCS0103	Fail
11	0303	11/7	5:23:47 PM	FCS0102	Fail
12	0303	11/7	5:23:47 PM	FCS0101	Fail
13	0238	11/7	5:23:47 PM	HIS	Start ( Virtual )

**Figure: Example of System Alarm Window**

---

### 6.2.3 When an Alarm occurs

- ❖ The tag mark changes color depending on the alarm and starts flashing.
- ❖ The System alarm window icon starts flashing in the System Message Area.
- ❖ Audible alarm is activated.
- ❖ The LED on the System Alarm Window Key on the Operator Keyboard starts flashing.
- ❖ The alarm is printed on the printer connected to the HIS.
- ❖ The alarm is also stored in the History.

### 6.2.4 Actions to be taken by the operator

- Select the System Alarm Window icon in the System Message Area or Select the System Alarm Window key on the Operator Keyboard.
- Acknowledge the alarm by the Alarm Acknowledge key. The instrument tag mark stops flashing.
- Reset the audible alarm using Buzzer Reset Key.
- Double click the process alarm in the System Alarm Window for which action needs to be initiated.
- Take corrective action to reset the alarm.
- The alarm disappears from the Process Alarm window once it is reset.

## 6.3 Operator Guide Window



This window displays the predefined messages to guide the operator regarding the current process status and /or the actions to be taken.

- OG messages can be acknowledged either as a **Group** or as **Individual** message.
- The operator guide messages that have occurred are displayed in the order from the latest messages, in the operator guide window. Maximum of 40 operator guide messages are saved.
- If the number of operator guide messages occurred exceeds 40, messages will be deleted starting from the oldest one that has been acknowledged.
- The Operator guide messages are generated based on the configuration of the process events during system generation.
- This message guides the operator to carryout a specific operation or indicates the status/completion of an event.
- For example when a batch cycle is completed, an operator guide message can be generated that that the specific batch is completed or halted due to the pre engineered reasons.

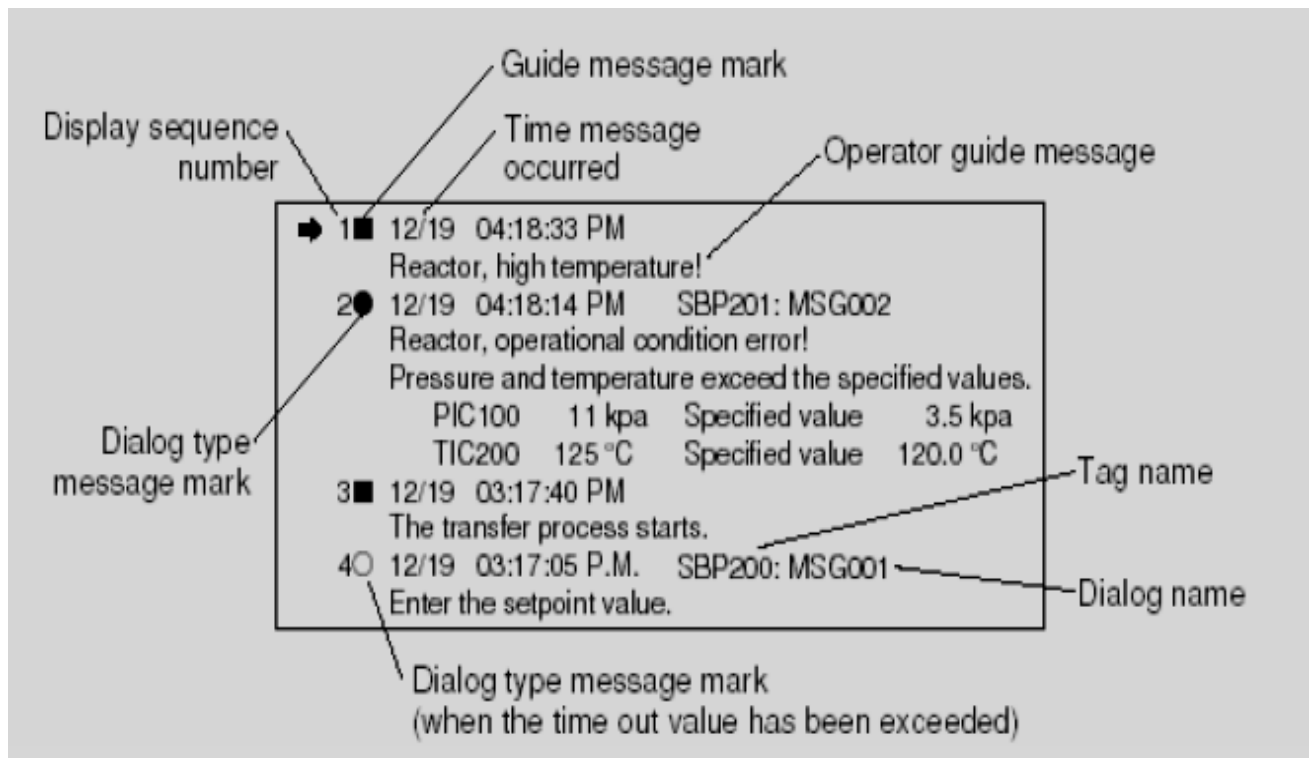


Figure: Operator Guide Message Window.

---

### 6.3.1 Operator Guide Message Format

◆ **Sequence Number** - Numbers 1 through 40 are displayed.

◆ **Operator guide message mark** -This mark indicated whether the operator guide message is a guide message or a dialog message.

When the time-up value (a period of time specified for the time between message initiation and operator acknowledgement) is reached and the dialog message is cancelled from the control station, the dialog type message mark automatically changes the color.

Also, flashing status of the mark indicated if the operator guide message has been acknowledged or not.

◆ **Message occurrence Date/time stamp**- Displays the date/time when the message occurred.

◆ **Operator guide message**-Displays the operator guide message defined by the operator guide definition builder.

◆ **Tag Name** - For a dialog message, the tag name of the function block, origin of the operator guide message is displayed.

◆ **Dialog name**-For a dialog message, the dialog name attached for identifying the operator guide message is displayed.

### 6.3.2 Soft Keys Function



Prints out all operator guide messages occurred.



This button acknowledges the operator guide messages.



This button deletes the guide messages that have been already acknowledged from the operator guide messages



Select a dialog type message then click this button to call up an operator guide individual acknowledgement window, which prompts for the operator's confirmation.

When operation of this window is completed, the message mark of the corresponding operator guide message that appears in the operator guide window stops flashing.





Click this button to halt updating the operator guide message display for 5 seconds. Click this button again to restart display update.



In the filter dialog, the filter conditions of the Operator guide message window, such as displaying the alarms of a specific control station can be specified. The specified filter conditions are displayed in the status bar of the Operator guide message window.



Figure: Filter dialog of Operator Guide Message Window.

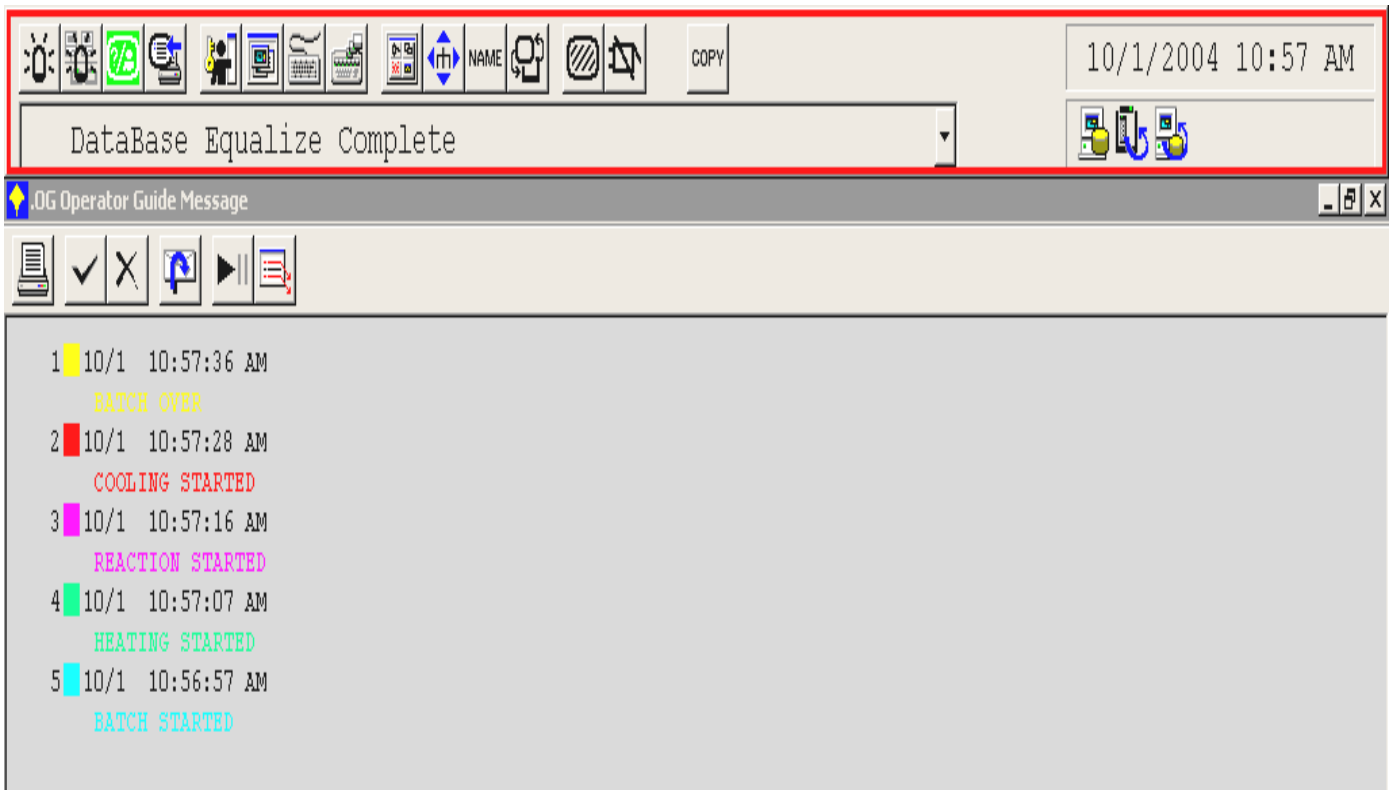


Figure: Example of operator Guide Message Window

---

### 6.3.3 When an Operator Guide Message occurs

- ❖ The Operator Guide Message icon in the System Message Area as well as the LED in the
- ❖ Operator Guide Message key on the Operator Keyboard starts flashing.
- ❖ The operator guide message is displayed in the OG window.
- ❖ Audible alarm is activated.
- ❖ The OG message is printed on the printer connected to the HIS if it configured for printing.
- ❖ The OG message is also stored in the History.

### 6.3.4 Actions to be taken by the operator

- Select the OG Message icon in the System Message Area or Select the OG key on the Operator Keyboard.
- Acknowledge the message by the Alarm Acknowledge key. The head mark on the OG message stops flashing.
- Reset the audible alarm using Buzzer Reset Key.
- Double click the OG message on the OG Window for which action needs to be initiated. The related window will appear as per the setting done in the HIS Setup menu.
- Take the necessary action.
- Delete the OG message by the Delete key in the OG window. OG messages cannot be deleted if they are not acknowledged.

## 6.4 Message Monitor Window



This window displays the latest 100 messages as configured in the Message Registration Window.

- Messages can also be filtered using the filter option.
- Specific colors can be chosen for each type of message.
- Only specified messages are acquired and displayed in the message monitor window for real time acknowledgement of the occurrence of these messages.

Mark for a new message	Display number	Message number	Message occurrence date/time	Message
●	1	3001	2001/04/20 17:10:14	FCS01 FB RI01 NODE 01 UNIT 01 SLOT 01 Device Error
	2	3002	2001/04/20 15:03:22	FCS01 FB RI01 NODE 01 UNIT 02 SLOT 01 Device Recover

Figure: Message display area of Message monitor window.

### 6.4.1 Message Format

- ◆ **Mark for a new message** -This mark is added to an unacknowledged message. The mark goes off upon acknowledgement of the message in the message monitor window.
- ◆ **Display Number** -The numbers are displayed in the ascending order starting with 1.
- ◆ **Message number**-This number is used to identify the message, which is pre-defined by the system.
- ◆ **Message occurrence date/time**-The date and time when the message occurred is displayed.
- ◆ **Message**-A message is displayed in colors specified and registered by the user.

## 6.4.2 Soft keys Function



Prints out all displayed messages.



This button acknowledges all unread messages displayed at one time. Note that equalization with other HIS will not take place as this is specific to the HIS.



This button maintains a displayed message for five seconds without updating it. Click this button again to update the displayed message.



This button calls up the Filter dialog box. The Filter dialog box is used to specify the filter conditions for displaying a message for a specific control station or an arbitrary message in the Message Monitor window. The specified filter conditions are displayed on the status bar in the Message Monitor window.

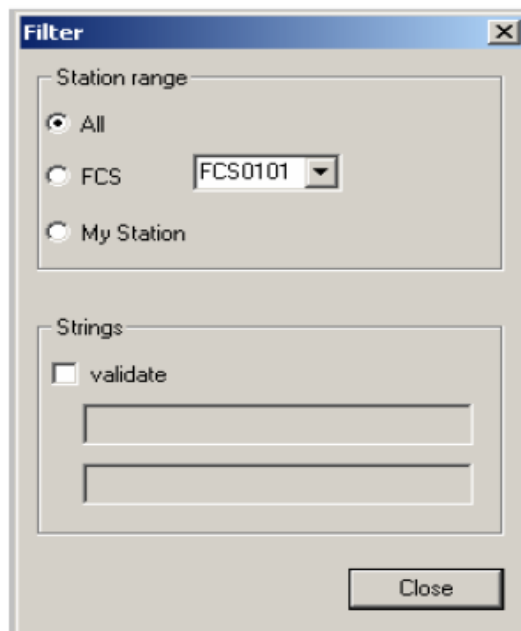


Figure: Filter Dialog Box



The Message Registration dialog box is used to register the type of a message to be displayed in the Message Monitor window and the number of messages to be stored.

	First Category	Second	Third Category	Color
1				white
2				white
3				white
4				white
5				white
6				white
7				white
8				white

Figure: Message Registration in Message Monitor Window

## Details of Message Registration Window

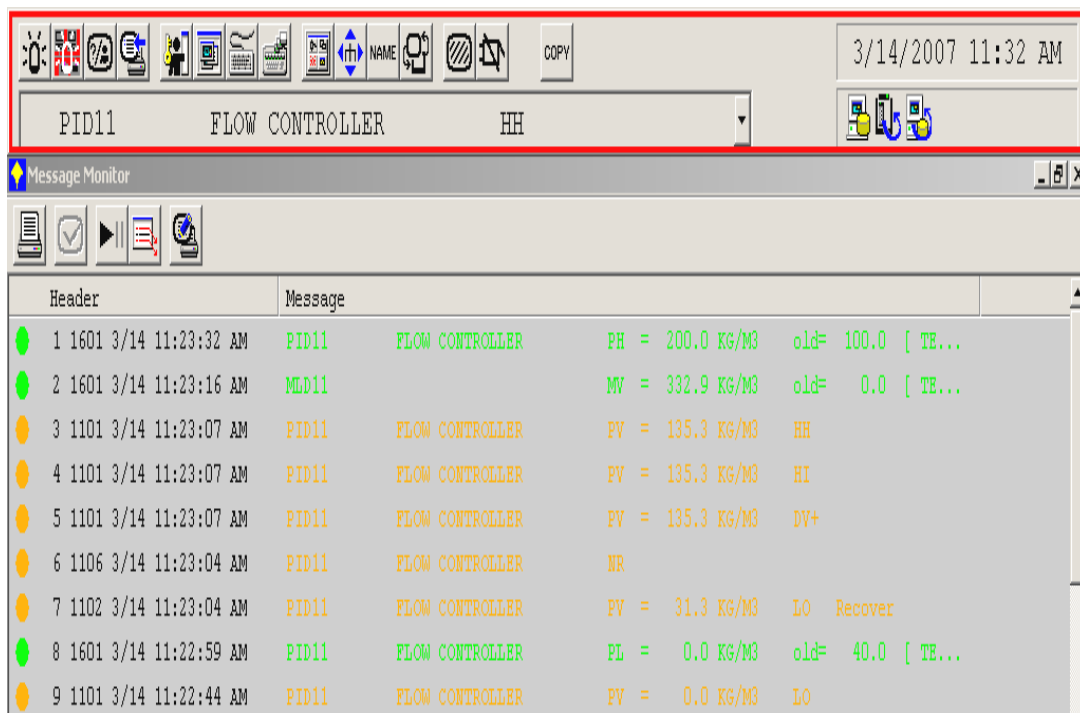
◆ **Maximum Number of Line** - The number of messages to be stored in the Message Monitor window is specified. Up to 200 messages can be stored, with the default setting being 100.

◆ **Message Types and Color** -The message types and colors to be displayed in the Message Monitor window are specified. A display color for each type of a message can be specified.

Of messages stored in the historical message save file, the following types of messages can be displayed in the Message Monitor window.

Note that selecting all types of messages takes up the entire buffer. It is recommended not to select all types of messages during normal operation.

- **Sequence Messages** -Messages for the sequence control such as operation guide messages, print messages, etc are displayed.
- **Operation Messages** –Messages related to process and batch operation records are displayed.
- **Field Bus Messages** -Messages related to the field bus are displayed.
- **All Messages** -All messages that have occurred are displayed.
- **Details** -In [Details], messages are classified into the First, Second, and Third categories. Sequence messages can be classified into these categories.



The screenshot shows the Message Monitor window with a toolbar at the top containing various icons and a 'COPY' button. The window title is 'Message Monitor'. Below the toolbar, there is a dropdown menu showing 'PID11 FLOW CONTROLLER HH'. The main area displays a list of messages in a table format.

Header	Message
1 1601 3/14 11:23:32 AM	PID11 FLOW CONTROLLER PH = 200.0 KG/M3 old= 100.0 [ TE...
2 1601 3/14 11:23:16 AM	MLD11 MW = 332.9 KG/M3 old= 0.0 [ TE...
3 1101 3/14 11:23:07 AM	PID11 FLOW CONTROLLER PV = 135.3 KG/M3 HH
4 1101 3/14 11:23:07 AM	PID11 FLOW CONTROLLER PV = 135.3 KG/M3 HI
5 1101 3/14 11:23:07 AM	PID11 FLOW CONTROLLER PV = 135.3 KG/M3 DV+
6 1106 3/14 11:23:04 AM	PID11 FLOW CONTROLLER NR
7 1102 3/14 11:23:04 AM	PID11 FLOW CONTROLLER PV = 31.3 KG/M3 LO Recover
8 1601 3/14 11:22:59 AM	PID11 FLOW CONTROLLER PL = 0.0 KG/M3 old= 40.0 [ TE...
9 1101 3/14 11:22:44 AM	PID11 FLOW CONTROLLER PV = 0.0 KG/M3 LO

Figure: Example of Message Monitor Window

## 6.5 USER LOGIN



This button calls up the User-In dialog box.

From the User-In dialog box registering or changing passwords, switching users (user-in), users log-out, and shutting down Windows can be done.

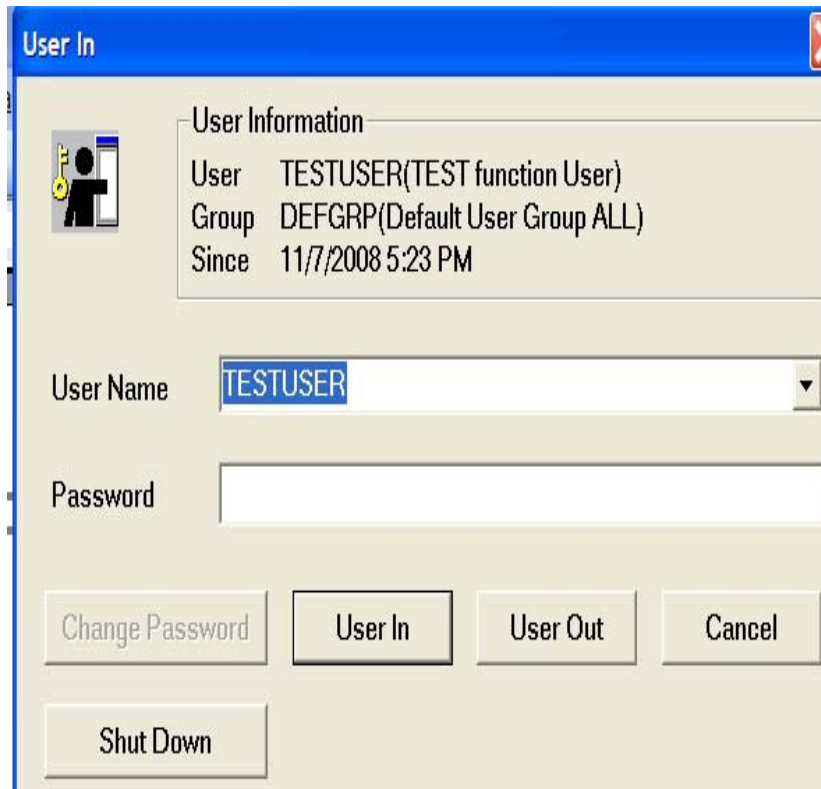


Figure: User-In-Dialog Box

The figure above shows an example of the User-In dialog box. The details of this window are,

- ◆ **User information** - The user name, user group, and the time when the user currently performing operation and monitoring logged in are displayed.
- ◆ **Change Password** -This is used when changing a password. Up to 32 single-byte alphanumeric characters may be entered as a password.
- ◆ **User In** -A user logs in with the user name entered in the User-In dialog box.
- ◆ **User Out**-The user with the user name entered in the User-In dialog box logs out.
- ◆ **Shut Down** -This is used to shut down Windows. This button is displayed when the user has logged in with the privilege level S3 (ENG User).

---

**6.5.1 Different Types of Users:** There are three users created when the Operation and Monitoring function is loaded. They are,

- i) OFF USER
- ii) ON USER
- iii) ENG USER.
- iv) TEST USER – When the virtual test function is started, the user is test user.

These users are categorized in the order of their privileges; the OFF USER has the least privilege while the ENG USER has all the privileges.

The default user when the operation and monitoring function starts or when any user logs out is the OFF USER.



### 6.5.2 Security Levels

Security level is assigned to an instrument when it is created in the engineering builder. There are 8 security levels.

Tuning Parameters are displayed with = or: depending on the security level.

Parameters displayed with = can be changed in the current key position.

Parameters displayed with: cannot be changed in the current key position.

The table explains the permissions that are associated with different security levels.

KEY POSITION/ ACCESS LEVEL	MONITORING FACEPLATE DISPLAY			OPERATION FACEPLATE OPERATIONS, PROCESS DATA INPUT OPERATIONS		
	OFF	ON	ENG	OFF	ON	ENG
1	O	O	O	O	O	O
2	O	O	O	*1	O	O
3	O	O	O	*2	O	O
4	O	O	O	X	O	O
5	O	O	O	X	X	X
6	X	O	O	X	X	O
7	X	X	O	X	X	X
8	X	X	X	X	X	X

O : Can be executed

X : Cannot be executed

\*1 : Only the PV alarm settings, SV, MV and block mode can be changed

\* 2 : Only the SV, MV and block mode can be changed

Figure: Different Security Levels

#### Details of Security Levels

The three columns under the Monitoring / Faceplate display indicate whether the instrument can be monitored with respect to each security level and user login.

The next three columns under the operations display indicates the extent to which the instrument parameters can be changed with respect to the security level and user login.

### 6.5.3 Importance Levels

The tag mark signifies the importance of an instrument to the Operator.

Importance level is assigned to an instrument when it is created in the engineering builder.

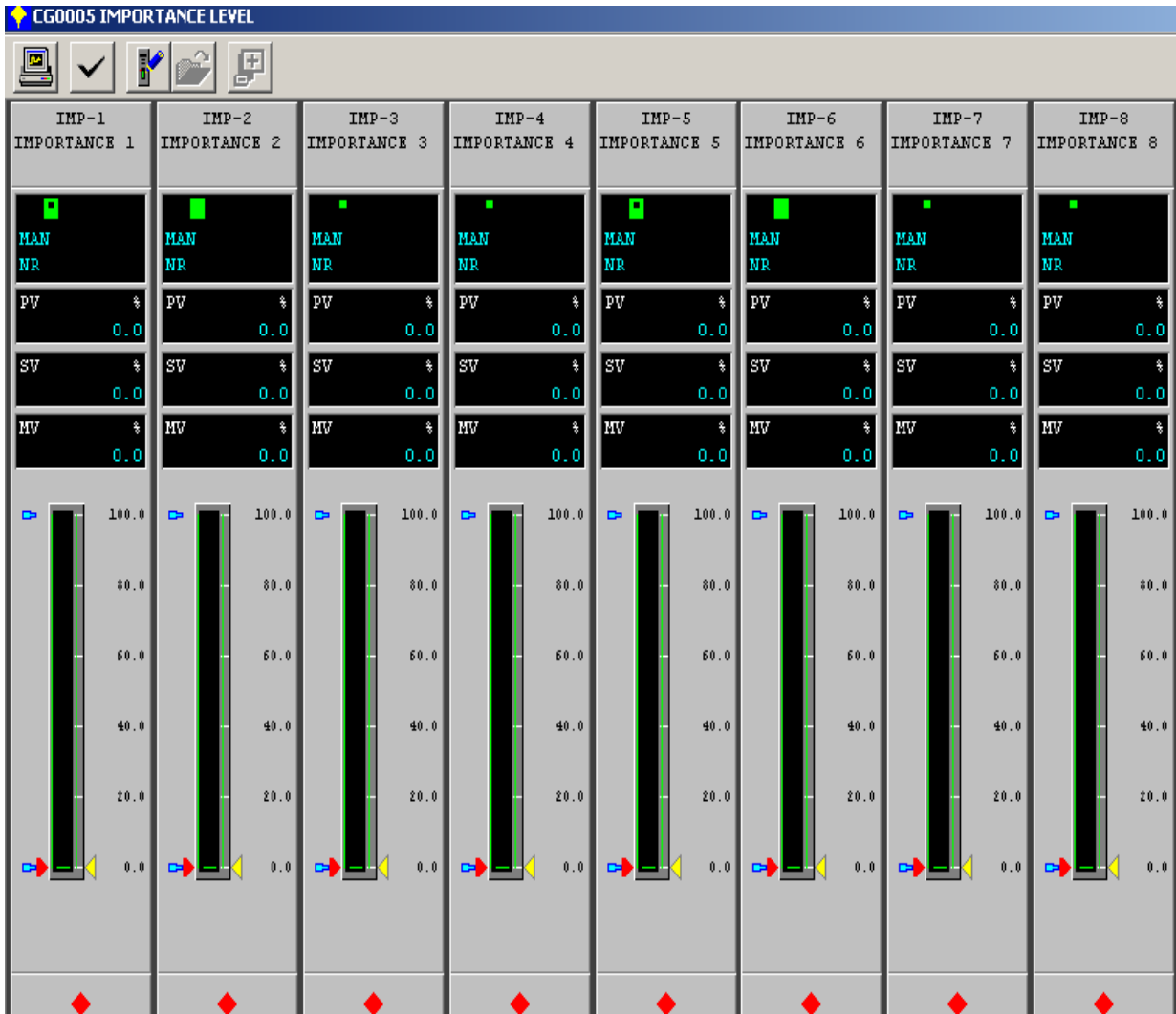
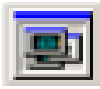


Figure: Example of Importance Levels

There are 8 important levels.

- |   |  |
|---|--|
| 1 – Important tag <b>with</b> confirmation        | 5 – Important tag <b>without</b> confirmation  |
| 2 - General tag <b>without</b> confirmation       | 6 - General tag <b>with</b> confirmation       |
| 3 - Auxillary tag –I <b>without</b> Confirmation  | 7 - Auxillary tag –I <b>with</b> Confirmation  |
| 4 - Auxillary tag –II <b>without</b> Confirmation | 8 - Auxillary tag –II <b>with</b> Confirmation |

## 6.6 Window Call Menu



This window is used to call windows on the HIS.

This is the short cut menu for any type of the windows present.

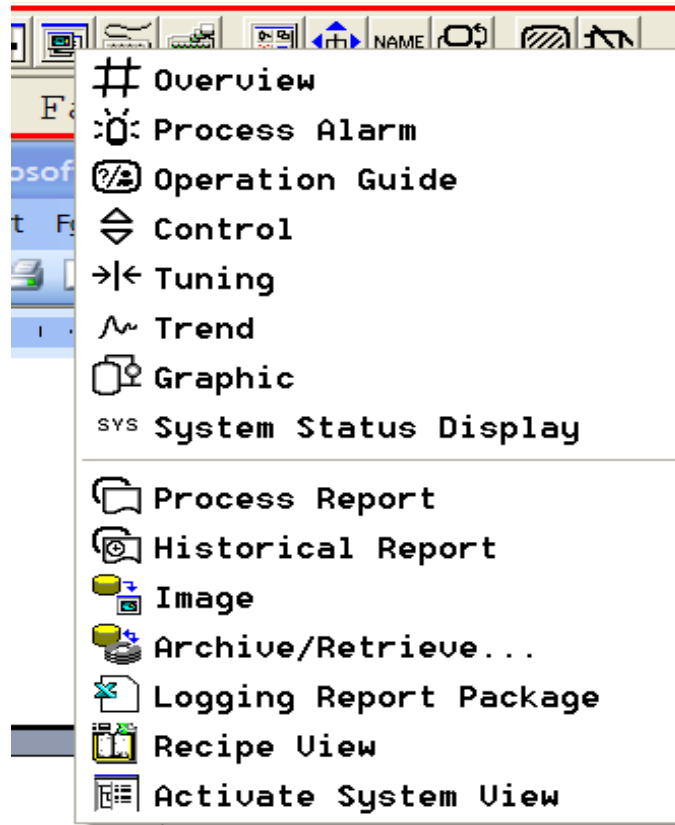


Figure: Window Call Menu

## 6.7 Operation Menu Key



This window is to call Left window, Right Window, Upper Window, Recall windows back wards and Recall windows forward.

NAME input window can also be called from this window.

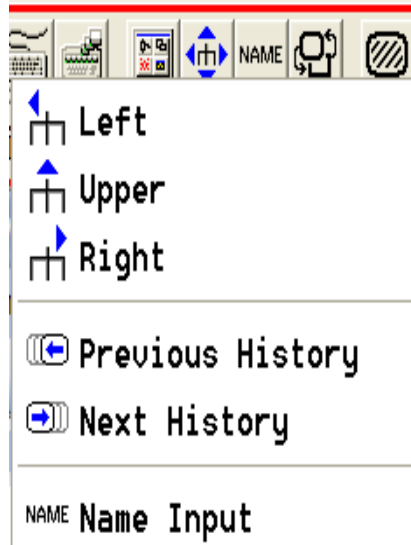








Figure: Operation Call Menu

### 6.7.1 Description of the Items of the Operation Menu Window

Item	Description
	Call up hierarchy windows of the active window in ascending order and in the order specified in the window hierarchy definition.
	Call up the upper window of the active window.
	Call up hierarchy windows of the active window in descending order and in the order specified in the window hierarchy definition.
	<p>Display the previously displayed windows one at a time. The windows are displayed going backward starting with the current window, in the reverse order they were called up. Up to 30 of the previously displayed windows can be displayed.</p> <p>In full screen mode, only primary windows can be retrieved. In windows mode, all windows can be retrieved. Pushing this button when the latest called window is being displayed, it returns to display the window right before the current window is called.</p>
	Display the previously displayed windows one at a time. The windows are displayed going forward starting with a previously displayed window, in the order they were called up. Up to 30 of the previously displayed windows can be displayed.
	Call up the Name Input dialog.

## 6.8 Preset Menu



This window can be used to carry out various functions that are defined in the Preset Menu option in the HIS Setup menu.

- In the preset menu, the user can register the windows to be called up as predefined windows.
- To register the preset windows, HIS set-up window in the system maintenance is used.
- This is a useful to display the most common displayed windows by the operator. A maximum of 16 preset windows can be registered.
- The figure below shows an example of a pull-down preset window menu.

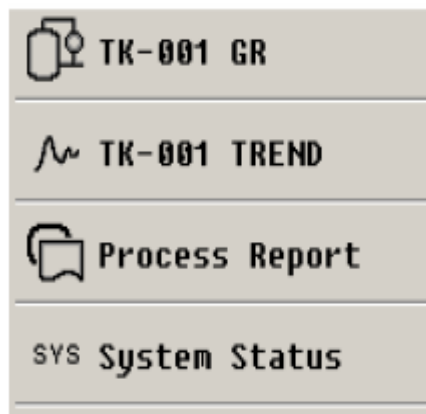


Figure: Example of Preset Menu

## 6.9 Circulate



This window is to switch between engineering windows and the operation windows on the HIS if they are opened simultaneously.

## 6.10 Clear Screen



This command when enabled clears all the windows that are opened except system view and any engineering builders.

---

## 6.11 Buzzer Reset



This command resets the alarms sound when any alarms occur.

## 6.12 Hard Copy



This command when enabled saves the screen in the specified location defined by the user.

## 6.13 Window Name Input



This button calls up the name input dialog. In the name input dialog, the desired window can be called up by entering the window name or tag name and specify the FCS Station, where the tag is from.

### 6.13.1 Input Format in the Name Input Dialog Box

The following is the input format used when calling up windows from the name input dialog box:

**Window name { $\Delta$ Function type} { $\Delta$ Display size} { $\Delta$ =Display position}**

The brackets must be omitted.

$\Delta$  Indicates a space.

Click [OK] button after entry, the window corresponding to the name entered displays.

◆ **Function Type** - The function type such as TUN, TABLE, LOGIC, DRAW etc. can be specified to display the tuning window, sequence table, logic chart and control drawing respectively of the specified tag name.

♦ **Display Size** -The display size that can be specified are: -SL is large size, -SM is medium size, -SC is special size.

♦ **Format of the Display Position** -The display position of the called window can be specified beforehand.

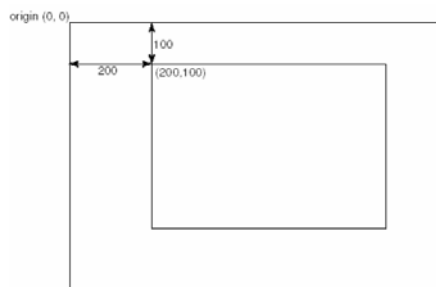
The display position is specified using X and Y coordinate. The specification range falls within 0 to 32767. The window display position is specified in the format given below.

=+X coordinate +Y coordinate

**X coordinate of the display position:** The X coordinates of the window when the left edge of the screen is set as the origin.

**Y coordinates of the display position:** The Y coordinates of the window when the upper edge of the screen is set as the origin.

For instance, when “=+200+100” is specified, the display position of the window will be as shown in the fig.



## Display Sizes of Windows

In the full-screen mode and window mode, the display size of the operation and monitoring window is indicated as a ratio to the display as shown below.

The sizes are not affected by the resolution of the display.

### Full-Screen Mode

When the large (-SL) size is specified: 100% (display as the primary window)

When the medium (-SM) size is specified: 50% (displayed as an auxiliary window)

When the special size (-SC) size is specified: Varies with the design of objects in the window (displayed as an auxiliary window).'



---

## Window Mode

When the large (-SL) size is specified: 80%

When the medium (-SM) size is specified: 50%

When the special (-SC) size is specified: Varies with the design of objects in the window.

### 6.13.2 Summary of Using Name Input dialog Box

#### NAME INPUT:

<b>TAGNUMBER</b>	: Displays the instrument faceplate window
<b>TAGNUMBER TUN</b>	: Displays the Tuning window of the instrument
<b>TAGNUMBER TUN -SM</b> instrument	: Displays the Medium size Tuning window of the instrument
<b>TAGNUMBER DRAW</b>	: Displays the control drawing of the instrument
<b>TAGNUMBER DRAW -SM</b> the instrument	: Displays the medium size control drawing window of the instrument
<b>TAGNUMBER TABLE</b> (The instrument should be of model ST16)	: Displays the sequence table window
<b>TAGNUMBER TABLE -SM</b>	: Displays the medium size sequence table window
<b>TAGNUMBER LOGIC</b> (The instrument should be of model LC64)	: Displays the logic chart window
<b>TAGNUMBER LOGIC -SM</b>	: Displays the medium size logic chart window
<b>WINDOWNAME -SL</b>	: Displays the large size window
<b>WINDOWNAME - SM</b>	: Displays the medium size window

## 6.14 Navigator Window



In the operation and monitoring function, the window configuration can be displayed hierarchically by predefining it in the system builder. This is done in the navigator window.

- The user can grasp the architecture of the windows used in the system at a glance in the navigator window. This is a system-defined window and is automatically generated as the window hierarchy configured in the system builder.
- Each of the various operation and monitoring windows can be called up by selecting one of the window names displayed in the navigator window.
- The figure below shows an example of a navigator window.

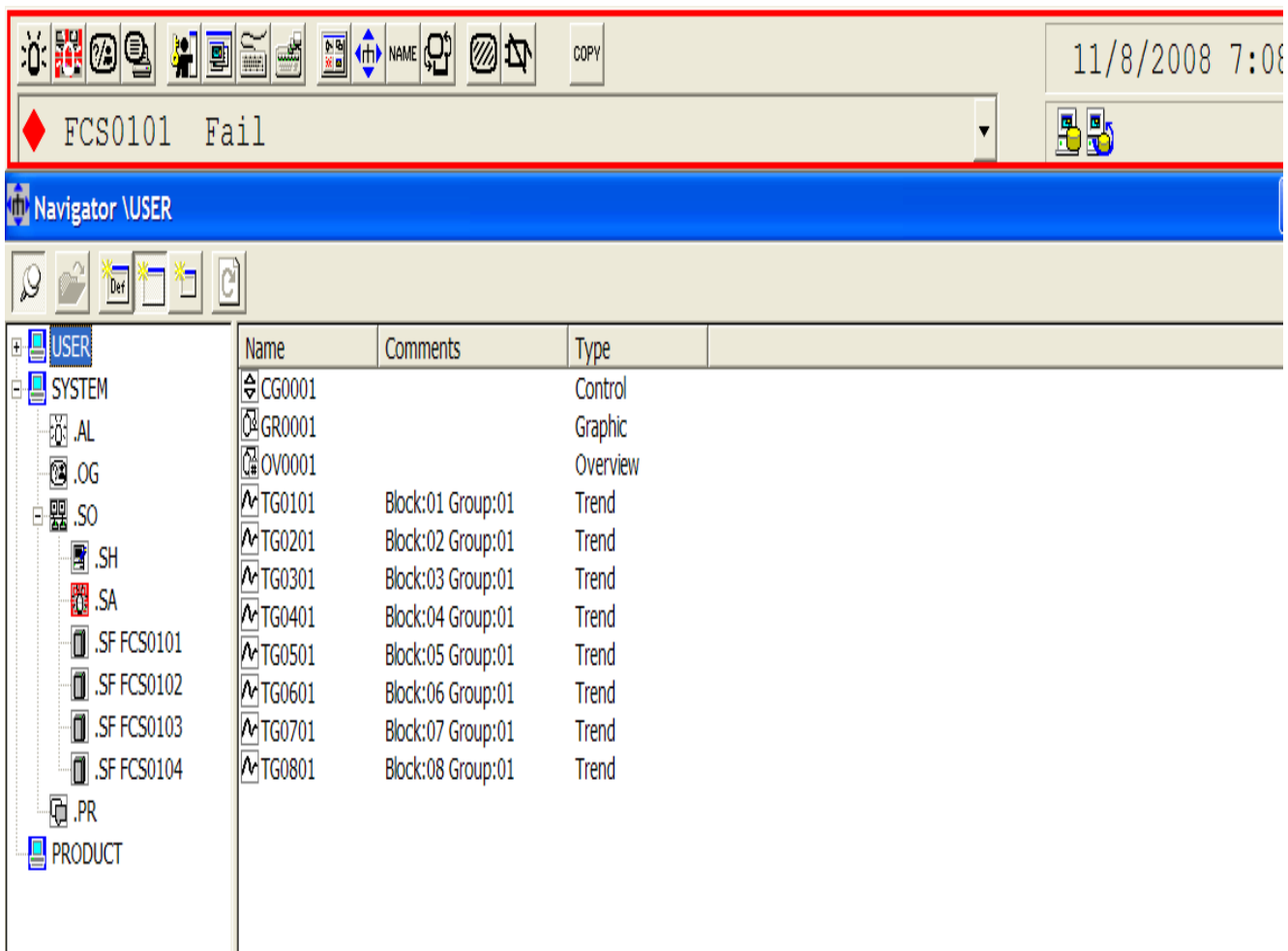
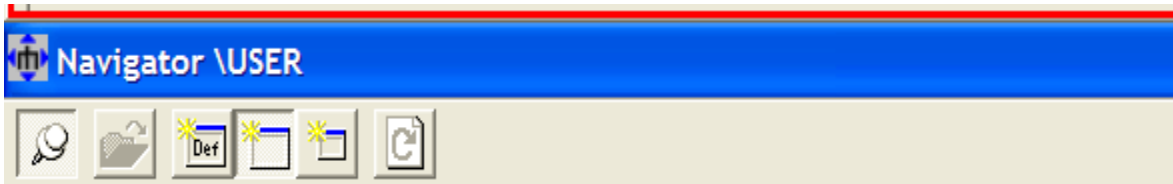


Figure: Typical Navigator Window

### 6.14.1 Components of Navigator Window



This button specifies to display or hide the Navigator window.

- ◆ When the pin is erected  
The Navigator window is always visible. The Navigator window does not close when other windows called up.
- ◆ When the pin is lying down  
The Navigator window closes automatically when another window is called up.



This button calls up the window that has been selected in the window hierarchy display area. This button cannot be operated unless a window is selected.



When this button is pressed down, the window called up from the Navigator window is displayed in its default size (normally this is a large size, or the saved window size if the size was saved). When a window saved as a part of a window set is called up, the window set is displayed.



When this button is pressed down, the window called up from the Navigator window is displayed in large size. Even if the called window is saved as a part of a window set, only the selected window is displayed.



When this button is pressed down, the window called up from the Navigator window is displayed in medium size. Even if the called window is saved as a part of a window set, only the selected window will be displayed.



This button displays the window hierarchy with the currently active window being the reference window.

---

## 6.15 Tool Box















This button calls up the toolbox.

The toolbox is a window that contains the buttons for calling up various operation and monitoring windows. It is always displayed in the front of the system message window.













Figure: Tool Box

### 6.15.1 Table describing various Items of the Tool Box

Button	Description
 	Specifies whether to display or hide the Toolbox. <ul style="list-style-type: none"> <li>• When the pin is active The Toolbox is always visible. The Toolbox does not close without closing operation.</li> <li>• When the pin is not active The Toolbox closes after a single button operation.</li> </ul>
	Calls up the System Status Overview window.
	Calls up the Help dialog for the active operation and monitoring window.
	Calls up the Process Alarm window.
	Calls up the Operation Guide window.
	Calls up the Graphic window with control attributes.
	Calls up the Tuning window.
	Calls up the Trend window.
	Calls up the Graphic window with graphic attributes.
	Calls up the Process Report window.
	Calls up the Historical Message Report window.

**Table describing various Items of the Tool Box**

Button	Description
	Calls up the hierarchy window of the active window in ascending order and in the order specified in the window hierarchy definition.
	Calls up the upper windows of the active window.
	Calls up the hierarchy window of the active window in descending order and in the order specified in the window hierarchy definition.
	Calls up the Graphic window that has the process overview attribute.
	Saves the currently displayed operation and monitoring window group as a dynamic window set. An "M" follows the name of the operation and monitoring windows saved as a window set if it is a primary window and "S" follows if it is an auxiliary window.
	Deletes the currently set dynamic window set.
	Calls up the image window.
	Switches the active window in sequence, when multiple operation and monitoring windows are displayed.
	Calls up the active operation and monitoring window in a large size window.
	Calls up the active operation and monitoring window in a medium size window.

**7. PROCESS REPORT  
HISTORICAL REPORT  
&  
SYSTEM STATUS OVERVIEW**

---

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**Objective:** This Chapter handles

- Process and Historical Report Windows
- System Status Overview

## 7.0 Process and Historical Report Windows

The HIS is provided with the following two windows for confirming the present and historical process status.

- ◆ **Process Report Window:** In the process report window, the current status of the function blocks, Digital inputs and outputs are displayed
- ◆ **Historical Report Window:** In the historical message report window, alarm, messages and operation record logged in the hard disk are displayed.

### 7.1 Process Report Window

Process report window displays an overview of the control station process status. The process report is to collect information on the system operating status and displays it in a window or prints to a printer depending on the user's request. The current status will be displayed or printed.

The following two types of reports are available in the Process Report window.

- ◆ Tag report
- ◆ I/O report

The Process status window can be displayed using the toolbox.



Click To view Process Report Window

Figure: To call a Process Report Window

### 7.1.1 Components of Process Report Window

Using the toolbar of the Process Report window, the user can switch the display between the tag report and the I/O report, or print out the most recent status of the reports that are displayed.

Both the tag report and I/O report come with their own search dialogs, in which the search conditions such as the station name or the element type can be entered

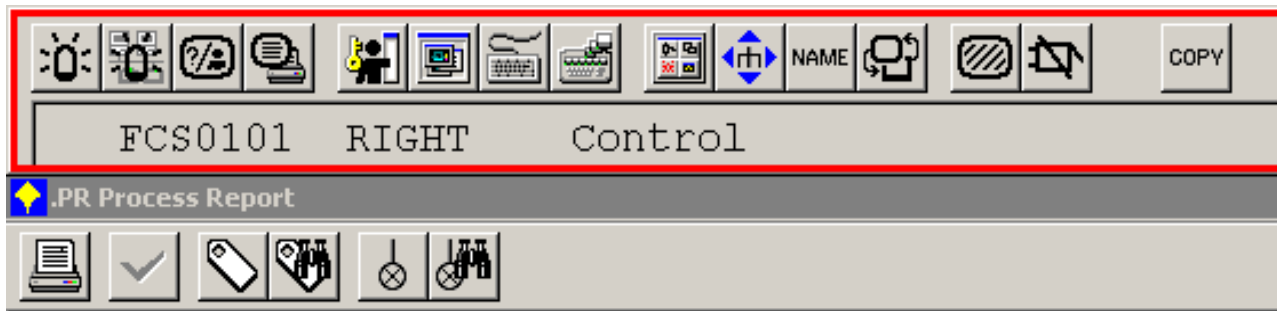


Figure: Components of Process Report Window



**Print:** This button prints out the most recent status of the report that is displayed.



**Acknowledge:** This function is disabled in the Process report window.



**Tag Search:** This button displays the tag reports that meet the search conditions set in the tag report search dialog box.

The tab strip selected in the tag report search dialog box will be the object of the SEARCH.

The status and values displayed are at the requested time and does not dynamically update. Clicking the button again, the tag report displays the updated report with the same conditions.



**Tag search dialog:** This button calls up the tag report search dialog box.

**Figure: Tag report search dialog of Process report window**

There are five search tab strips in tag report search dialog box. Once the search conditions are set, it will not be erased.

Therefore, it is convenient to set frequently used search conditions.

If the sheet is not selected, default search conditions are searched for.

The search conditions such as “range”, “element type” , “state” etc are considered AND conditions and the search is performed based on the same.

## 7.1.2 I/O Report Search and Display

In the I/O report, the I/O status is displayed as a digital value for each element. An I/O report can be searched by station name or element type.

The following elements can be the objects of an I/O report:

- ◆ Annunciator (%AN)
- ◆ Common switch (%SW)
- ◆ Communication I/O (%WB)
- ◆ Process I/O (%Z)

The I/O report search is done using the I/O Report Search dialog box.



### Report Search Dialog Box

- The station name or element type of the control station can be set as the search conditions for the I/O report in the I/O Report Search dialog box.
- Click the [OK] button after setting search conditions to start the search. The results of the search will be displayed in the Process Report window.
- Also, the search conditions set at the time the I/O Report Search dialog box is closed with the [OK] button will be used for the search conditions the next time the I/O report is displayed.

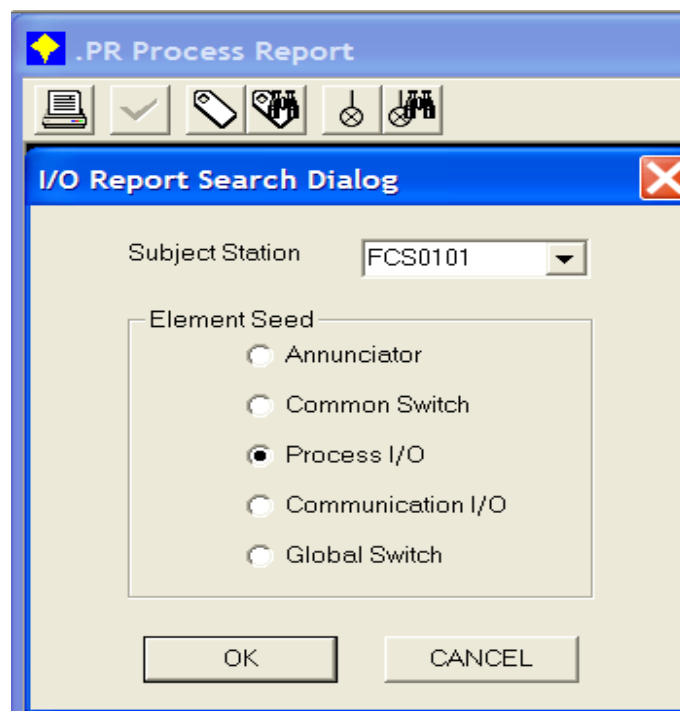


Figure: I/O Report Search Dialog



## I/O Report Display

The results of the search in the I/O Report Search dialog box are displayed in the Process Report window (I/O report). When the data is ON, “1” is displayed.

When the data is OFF, “.” (Period) is displayed. Data is periodically refreshed in the I/O report display.

Tag Name	Tag Comment	Alarm	Current Value	Mode	Operatio...	System Tag Name
SW			0			.SW0201s0101
TT100		NR		MAN		.BL0321s010101
TI100		NR	0.0 %	AUT		.BL0322s010101
TT200		NR		MAN		.BL0323s010101
TT300		NR		MAN		.BL0324s010101
TT400		NR		MAN		.BL0325s010101
TT500		NR		MAN		.BL0326s010101
TT600		NR		MAN		.BL0327s010101
TT700		NR		MAN		.BL0328s010101
TT800		NR		MAN		.BL0329s010101
TI200		NR	0.0 %	AUT		.BL0330s010101
TI300		NR	0.0 %	AUT		.BL0331s010101
TI400		NR	0.0 %	AUT		.BL0332s010101
TI500		NR	0.0 %	AUT		.BL0333s010101
TI600		NR	0.0 %	AUT		.BL0334s010101
TI700		NR	0.0 %	AUT		.BL0335s010101
TI800		NR	0.0 %	AUT		.BL0336s010101
LC100		NR	0.0 %	MAN		.BL0337s010101

Figure: Example of Process Report Window

## 7.2 Historical Message Report Window

- The Historical Message Report window displays an overview of historical messages such as the history of each alarm message type or the operator's operation history.
- All the events and operations done on the system are recorded in the History. Historical Message Report stores the Process Alarms, Annunciator Messages, and Operator Guide Messages Operation Record.
- The historical message report can retrieve process alarms or the operation history stored within the HIS and display or print messages related to all types of events related to the system or a process that occurred in the past.
- A historical message can be retrieved and displayed by specifying message type, station name and tag name.



Click to View Historical Report

### 7.2.1 Components of Historical Message Report Window

The Historical Message Report window consists of a menu bar, toolbar, report display area and status bar.

**Menu Bar in the Historical Message Report Window :** The menu bar of the Historical Message Report window consists of the same menu items as toolbar buttons and the ones that modify printer settings and window display style.

---

## Toolbar of the Historical Message Report Window

Operating the toolbar of the Historical Message Report window, the user can specify filter conditions for the historical message to be displayed and print out the current report.



Figure: Toolbar of Historical Message Report Window



This button calls up the File Select dialog box. This is the same as [Open] in the File menu. Historical messages are saved separately according to the message type.

In the file selection dialog box, the user can select the type of historical message to display, a folder name can be specified when saving a historical message file into a folder other than the standard folder.

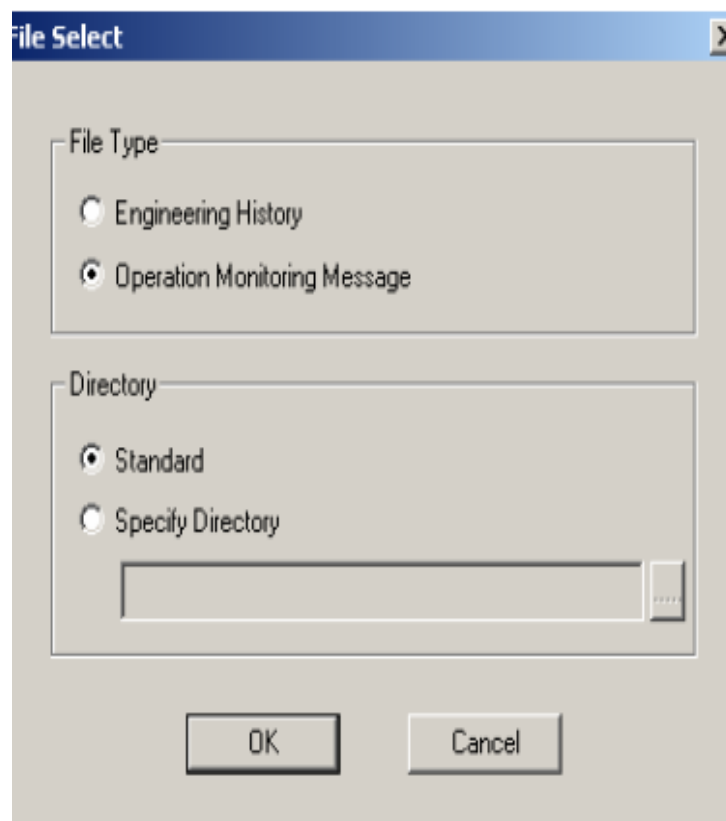


Figure: File select dialog of Historical Message Window.



This button prints out all historical messages retrieved. It is the same as [Print] in the File menu.



This button refreshes the displayed historical messages to the latest status. It is the same as [Redraw] in the View menu.



This button calls up the search dialog box for setting the search conditions. It is the same as [Find] in the Edit menu.



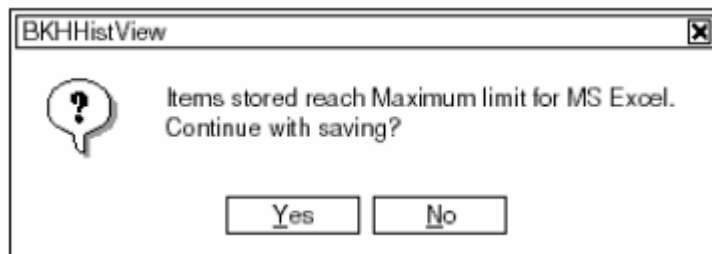
This button aborts the historical message search being executed. This button can be used after the search is begun. It is the same function as [Pause] in the Edit menu.



This button outputs the currently displayed historical message to a file. It is the same as [Save] in the File menu.

Clicking this button calls up the following dialog box. Specify a file name and a storage location, and then click the [Save] button to output the historical message to the specified text file in the CSV format.

If the total number of the messages exceeds 65,536 when output to a file in the CSV format, MS Excel cannot read them. The following dialog box is called up at the point the total number of the messages exceeds 65,536 when output:



Selecting [Yes] continues on to output all messages to the specified file.

Selecting [No] outputs up to 65,536 messages to the specified file.

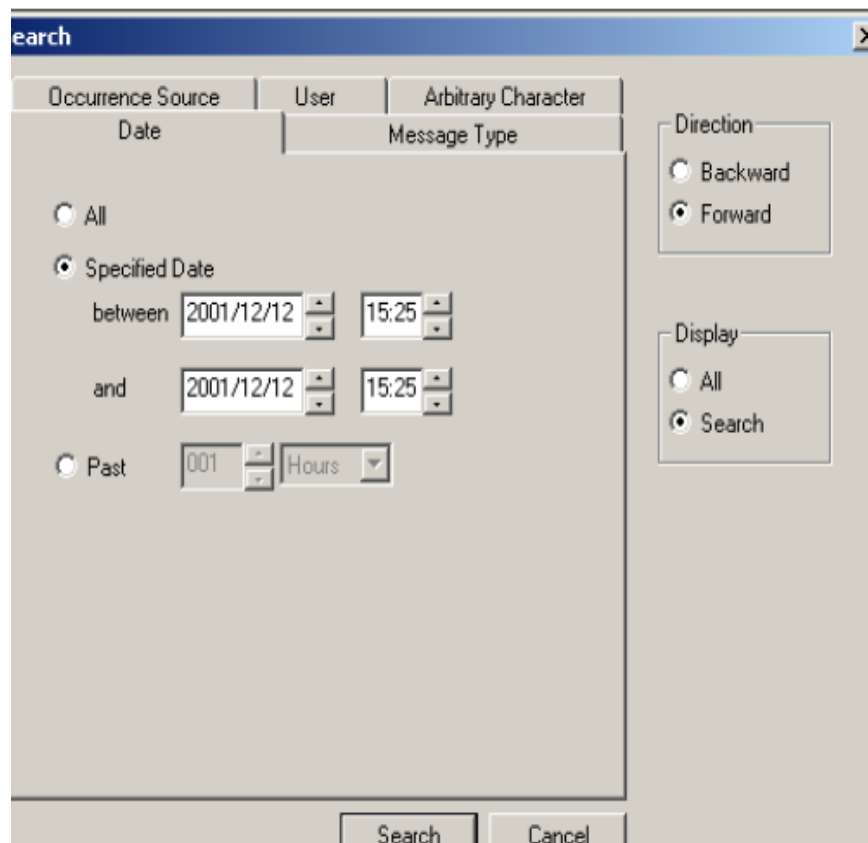


## 7.2.2 Searching For a Historical Message

Use the Search dialog box to set the historical message search conditions. The items shown below can be used as keywords for a search in the HIS historical message report.

- ◆ Specifying a time interval using date and time
- ◆ Specifying message type
- ◆ Specifying message origin
- ◆ Specifying user name
- ◆ Specifying arbitrary character

Each of the search conditions is set in the Search dialog box. In the Report Search dialog box, there are five tabs to set up search conditions. Select the tab to set for each search item.



The screenshot shows a dialog box titled "earch" with a close button (X) in the top right corner. The dialog is divided into several sections:

- Occurrence Source**: A tabbed interface with "Date" selected.
- User**: A tabbed interface with "Message Type" selected.
- Arbitrary Character**: A tabbed interface.
- Direction**: Radio buttons for "Backward" and "Forward". "Forward" is selected.
- Display**: Radio buttons for "All" and "Search". "Search" is selected.
- Search Conditions**:
  - All
  - Specified Date
    - between: 2001/12/12 (date) and 15:25 (time)
    - and: 2001/12/12 (date) and 15:25 (time)
  - Past: 001 (value) and Hours (unit)
- Buttons**: "Search" and "Cancel" buttons at the bottom.

Figure: Search dialog to search Historical Messages

Message No	Date	Message Text
1101	8/3/2004 10:28:00 AM	LIC-111 PV = 20.0 % LO
1106	8/3/2004 10:27:02 AM	LIC-111 NR
1102	8/3/2004 10:27:02 AM	LIC-111 PV = 20.0 % LO Recover
1101	8/3/2004 10:26:54 AM	LIC-111 PV = 20.0 % LO
1106	8/3/2004 10:25:19 AM	LIC-111 NR
1102	8/3/2004 10:25:19 AM	LIC-111 PV = 20.0 % LO Recover
1101	8/3/2004 10:23:25 AM	LIC-111 PV = 20.0 % LO
1106	8/3/2004 10:23:06 AM	LIC-111 NR
1102	8/3/2004 10:23:06 AM	LIC-111 PV = 20.0 % LO Recover
1101	8/3/2004 10:22:48 AM	LIC-111 PV = 20.0 % LO
1106	8/3/2004 10:22:25 AM	LIC-111 NR
1104	8/3/2004 10:22:25 AM	LIC-111 MV = 100.0 % MHI Recover
1102	8/3/2004 10:22:14 AM	LIC-111 PV = 20.0 % DV- Recover
1102	8/3/2004 10:22:07 AM	LIC-111 PV = 20.0 % LO Recover
1101	8/3/2004 10:16:53 AM	FIC-111 PV = 55.0 % HI
1101	8/3/2004 10:11:13 AM	LIC-111 PV = 20.0 % LO
1103	8/2/2004 3:25:58 PM	LIC-111 MV = 80.0 % MHI
1104	8/2/2004 3:24:50 PM	LIC-111 MV = 22.1 % MLO Recover
1103	8/2/2004 3:23:53 PM	LIC-111 MV = 13.6 % MLO
1101	8/2/2004 3:22:09 PM	LIC-111 PV = 55.0 % DV-
1102	8/2/2004 3:22:09 PM	LIC-111 PV = 55.0 % DV+ Recover
1101	8/2/2004 3:21:51 PM	LIC-111 PV = 55.0 % DV+

Figure: Example of Historical Report

## 7.3 System Status Overview Window

- The System Status Overview window displays an overview of the system status of the control buses in the domain.
- The System Status Overview window displays the status of all stations and the communication buses in the V/VL net comprising the system. The status of the connected stations and the V/VL net may be visually confirmed by icon displays.
- Also, other system maintenance windows may be called up from this window.

The figure below shows an example of the System Status Overview window.

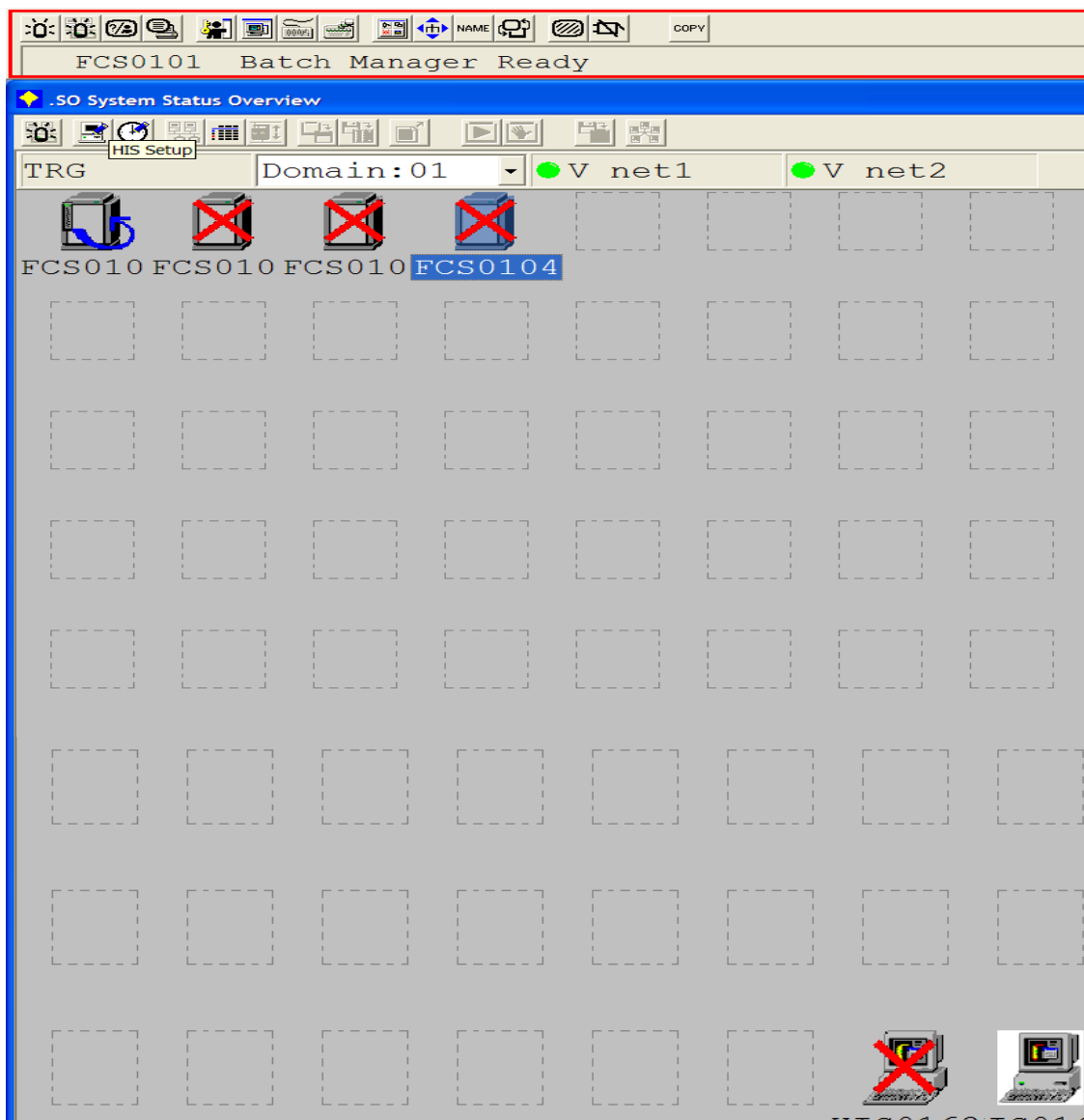


Figure: System Status Overview Window

### 7.3.1 Components of System Status Overview Window

The System Status Overview window consists of a toolbar and a status display area.

#### Toolbar of the System Status Overview Window

Using the toolbar of the System Status Overview window, the user can call up windows from the other system maintenance windows or change the display format of the system status overview.

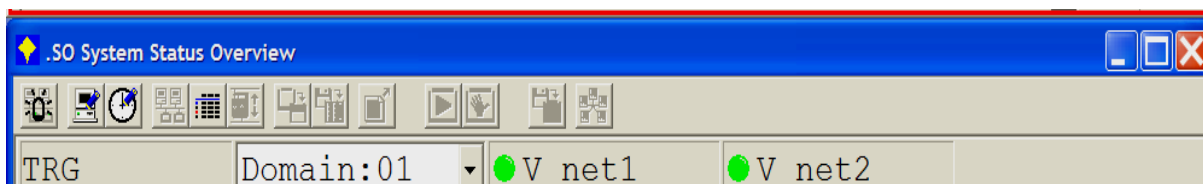


Figure: Toolbar of System status Overview Window



This button calls up the System Alarm window, in which the contents of alarms can be acknowledged. The button status indicates the status of system alarm message occurrence.

- ◆ Flash in red:  
System alarm messages have occurred whose contents have not been acknowledged yet.
- ◆ Constant red:  
System alarm messages have occurred whose contents have already been acknowledged.
- ◆ Normal color:  
No system alarm messages.



This button calls up the HIS Setup window.



This button calls up the Time adjust window.



This button cannot be used in the System Status Overview Display window.



When this button is pressed down, the system status overview is shown in a List (text format). To return to the icon display, set the button to the original state.



This button calls up System Overview window of the bus converter connected destination.



This button cannot be used in the System Status Overview Display window.



This button cannot be used in the System Status Overview Display window.



This button calls up the System Report dialog, which displays the system information. The contents of the dialog display can be printed or output to a file.



This button cannot be used in the System Status Overview Display window.



This button cannot be used in the System Status Overview Display window.



This button cannot be used in the System Status Overview Display window.



This button calls up the Touch Target Maintenance dialog box.  
This button is displayed on the console type HIS.



This button calls up the V net Setup dialog box.  
This button is displayed on the console type HIS.



This button calls up the HIS Status Display window for the current station.  
This button is displayed on the console type HIS.

11/15/2008 7:25 PM

◆ FCS0101 Batch Manager Ready

◆ .SF FCS0101 Station Status Display

TRG
Domain:01
● V net1

FCS0101

Station No: 1

Type :AFF50D

Revision :R3.08.00

Generation:

9/14/2008 12:37 PM

CPU Idle Time: 0sec

Comm Load Ave: 0%

Cur: 0%

Test Mode :ON

ControlStatus:RUN

Comm I/O :

MAN

△				
C	C	P	P	
P	P	S	S	
U	U	U	U	

01

PSU	PSU
-----	-----

- ✗ Not Ready
- △ Stand-By
- Control
- Hard Ready
- Maintenance

Figure: FCS Status Display Window

The display shows the status of card in a Field Control Station. Select each node to display the status of individual cards placed in the respective node. The card color coding is also indicated on the screen.

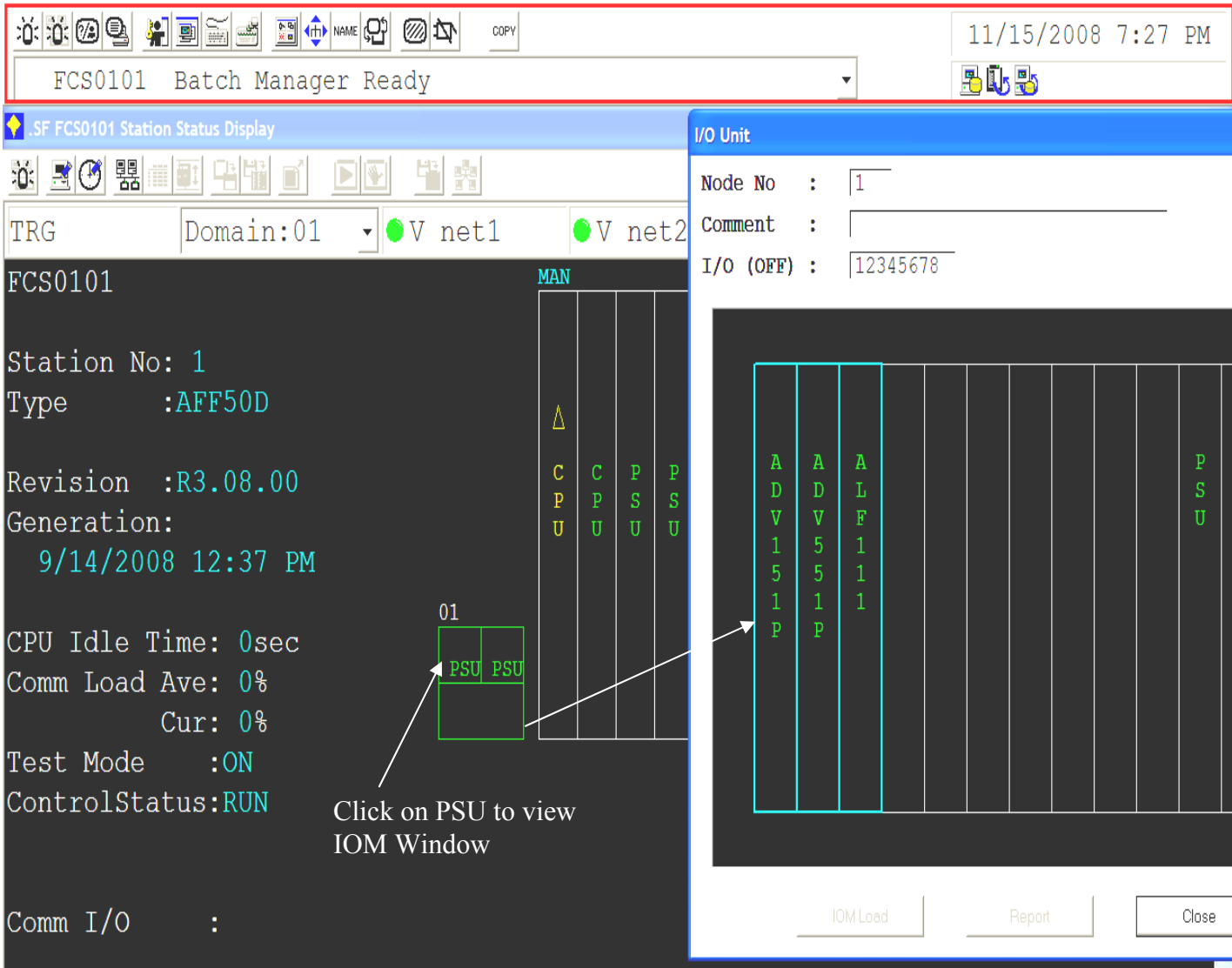


Figure: FCS Status Display Window with IOM Status



## **8. HIS SETUP**

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## 8.0 HIS SETUP

The HIS Setup window displays station information and operating environment for the HIS. The operating window allows user to set window size, printer settings, screen mode setting, and operation/monitoring function specific settings. All the HIS related settings can be performed using this HIS setup window.

The different methods of logging into the HIS SETUP window are from

- i) Soft keys of Graphics Window
- ii) Panel Set
- iii) Name Input Dialog Box (Name  $\longrightarrow$  .SH  $\longrightarrow$  OK)

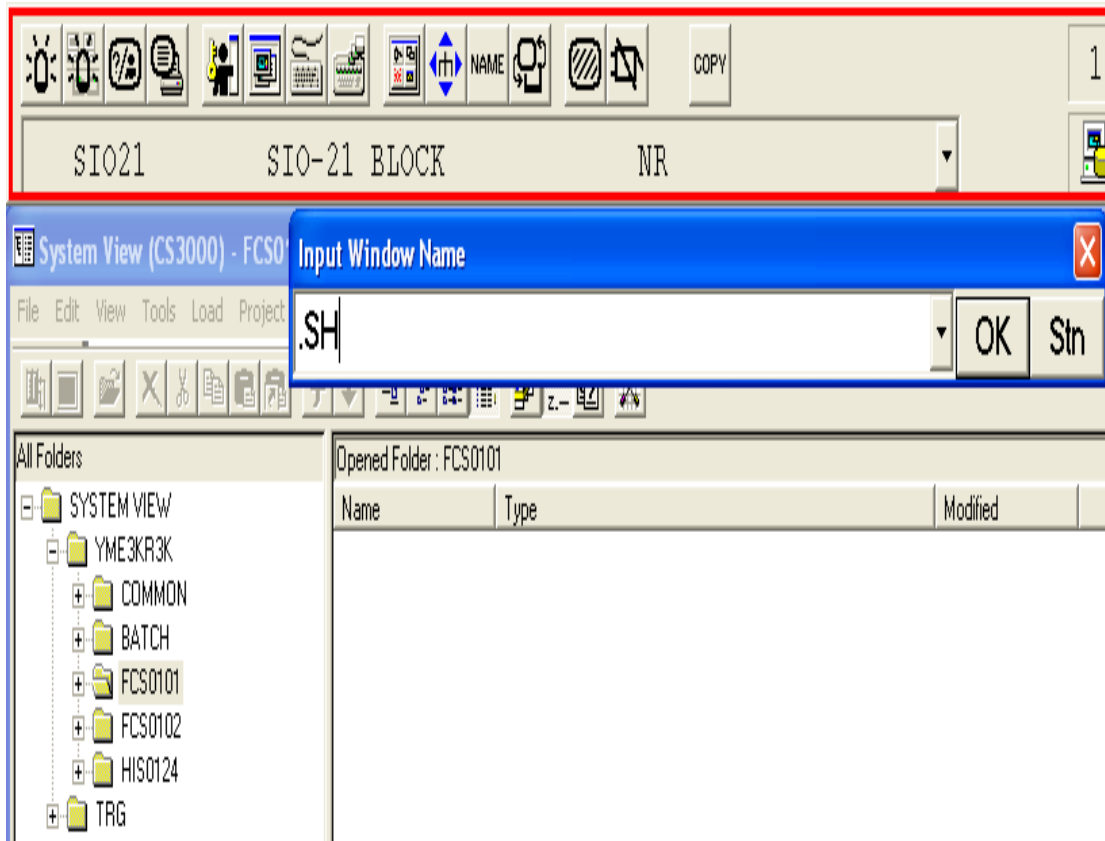
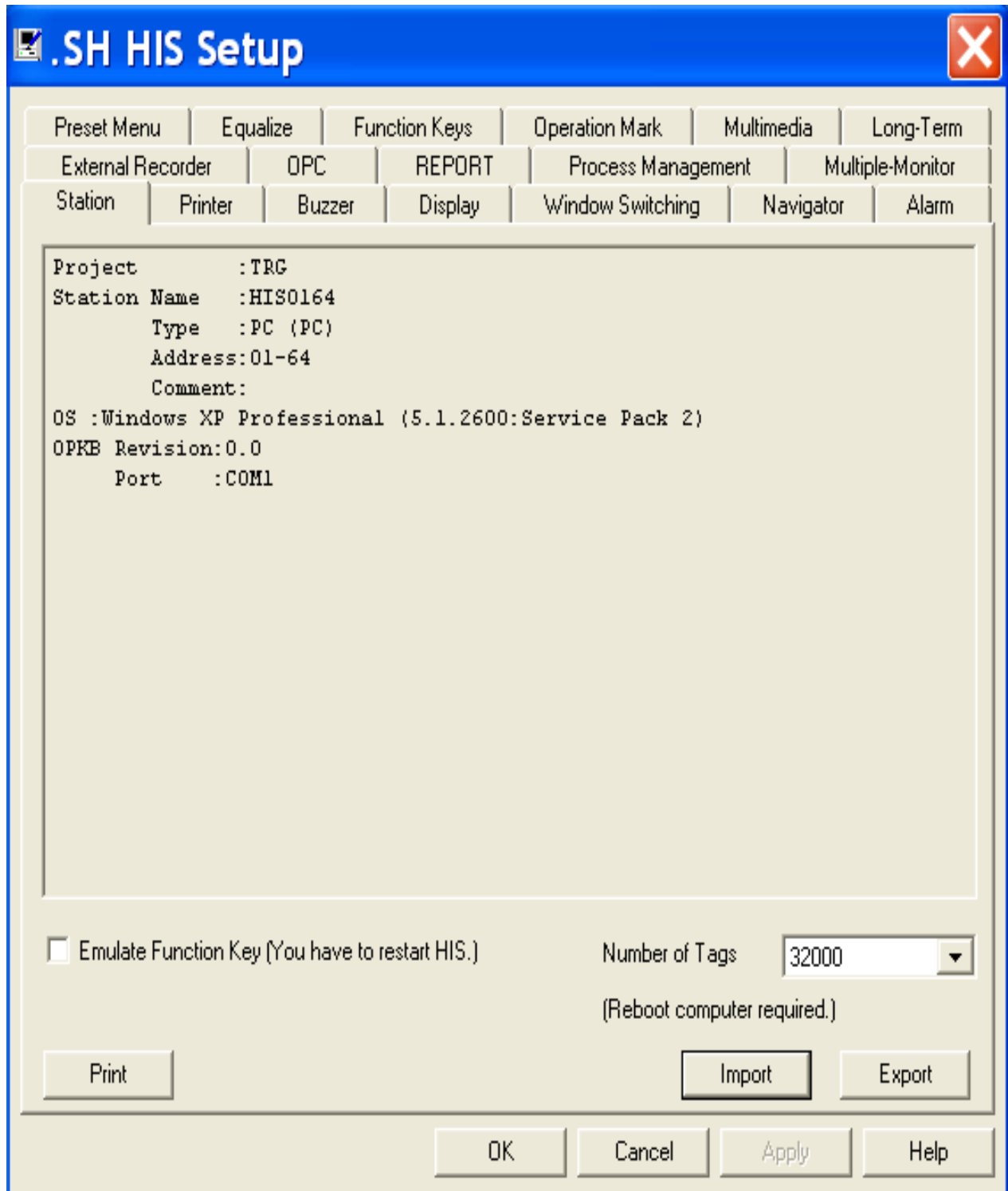


Figure: HIS SETUP Window from Name Input Dialog Box

**HIS SETUP Window**

**.SH HIS Setup**

Preset Menu	Equalize	Function Keys	Operation Mark	Multimedia	Long-Term	
External Recorder	OPC	REPORT	Process Management	Multiple-Monitor		
Station	Printer	Buzzer	Display	Window Switching	Navigator	Alarm

Project : TRG  
Station Name : HIS0164  
Type : PC (PC)  
Address: 01-64  
Comment:  
OS : Windows XP Professional (5.1.2600:Service Pack 2)  
OPKB Revision: 0.0  
Port : COM1

Emulate Function Key (You have to restart HIS.)

Number of Tags: 32000

(Reboot computer required.)

Print Import Export

OK Cancel Apply Help

**Figure : HIS SETUP Window**

## Details of HIS SETUP

# 8.1 Station

The station Name, Station Address, HIS Software Revisions are displayed in the station tab

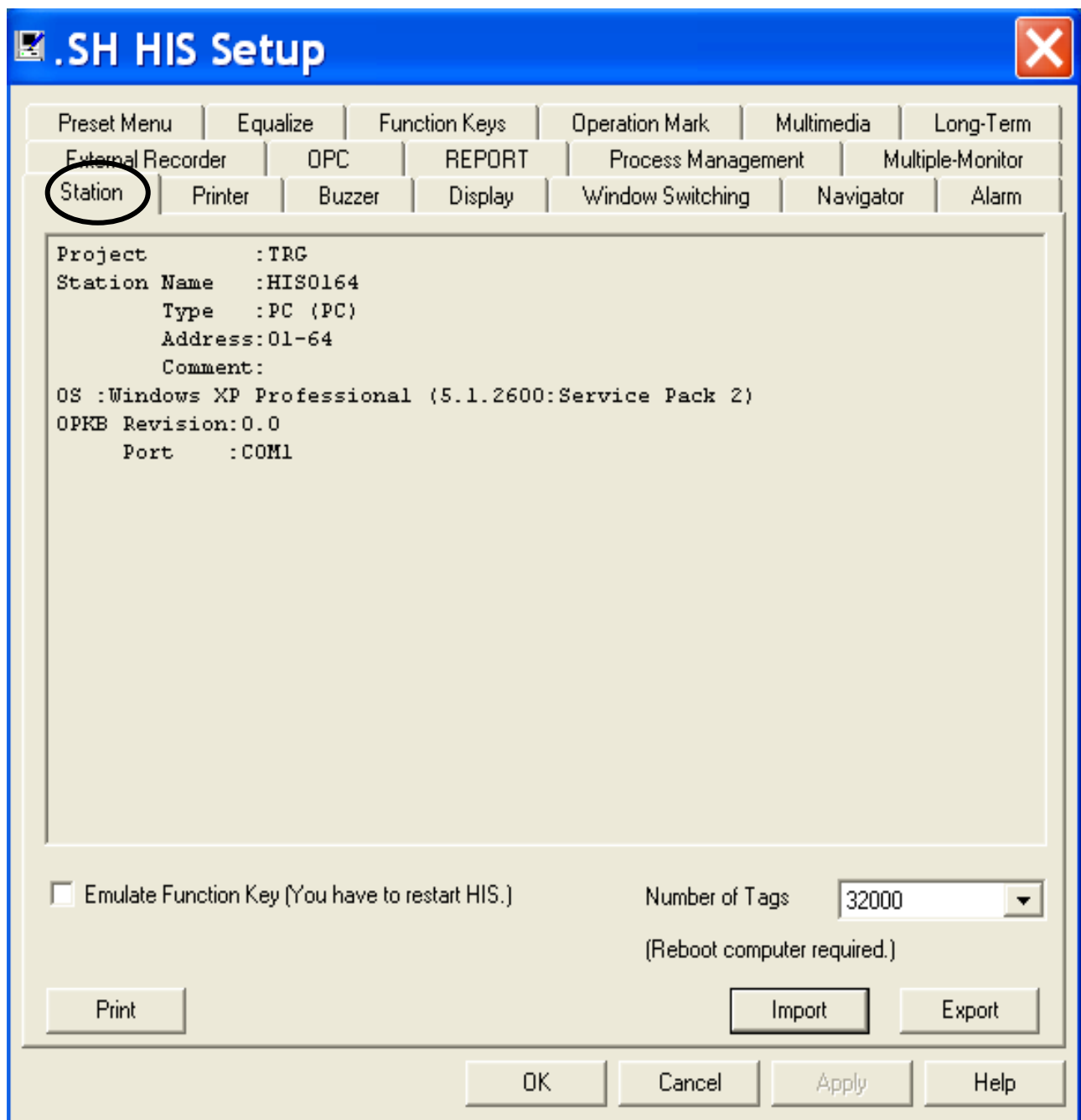


Figure: Station Tab of HIS SETUP

---

## Emulate Function Key

The functions for the 64 function keys of the HIS operation keyboard are executable from the designated shortcut keys on the standard keyboard of PC.

In order to use shortcut keys, these functions must be assigned to the corresponding function keys on the HIS operation keyboard and the option for enabling the shortcut keys are checked on the Station tab of HIS Setup window.

When changing the option for enabling the shortcut keys, it is necessary to restart HIS console to enable the new settings. To restart the HIS console, log-out Windows and logon again is required.

## Number of Tag

The user can select the number of user-defined tags and windows to be monitored according to the scale of the project.

When the expansion package for operation and monitoring is applied, one million or 500 thousands can be chosen as the number of tags to be handled.

## Print

The following contents may be printed out from the Station tab. The properties can be set on the dialog box displayed after clicking [Print] button.

- Function key assignment
- Operation Mark
- Trend display assignment
- Graphic window with control attributes
- Multimedia
- External recorder settings

The above contents are output via the printer defined as [PRT] on HIS setup printer tab.

## Import Button

This button is used when incorporating items set in HIS Setup windows for other HIS.

When importing HIS settings, select the file in which the data to be extracted is stored in the dialog called up by clicking on the [Import] button in the Station tab.

## HIS Settings Export Button

This button is used to save the items set in the HIS Setting window to a file. Click on the [Export] button in the Station tab to display a dialog box, and specify the name of the saved file. The items saved by this operation can be imported by other HIS.

## 8.2 Printer

In the Printer tab, the printer for printing messages and settings related to output of screen images are selected.

When there is a printer error, the printer can be switched directly using the HIS without starting up the builders.

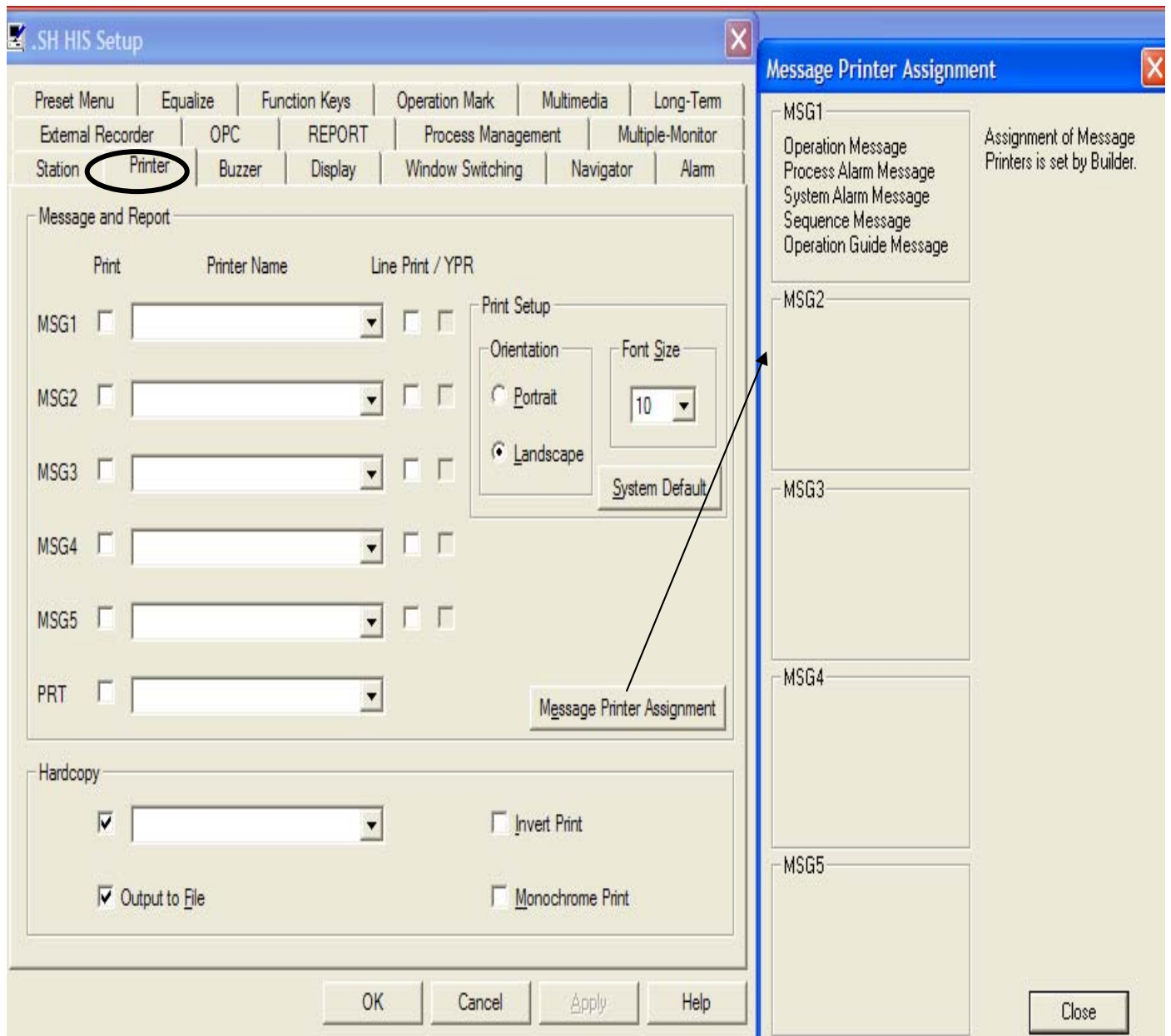


Figure : Printer Tab of HIS SETUP

## Message Report

To print messages and reports, check [Print] for each message assignment and select the output printer from the pull-down menu.

The print orientation and font size can also be selected.

With the [message and report] default setting, messages and reports are printed out when data equivalent of one page is accumulated.

Printing at periodic intervals can also be done by specifying a print wait interval for the message using the HIS Constants Builder.

## MSG 1 to 5

The type of message to be assigned to MSG1 - MSG5 is pre-defined in the HIS Constants Builder.

The printer that the assigned message is printed to is selected in the Printer tab.

The name of the printer assignable to MSG1 to MSG5 must be up to 63 bytes long. If the printer name length exceeds this, change the name so that it will fit into 63 bytes.

The total length of the printer and PC names must be up to 63 bytes in remote operation.

## Line Print

Select this for printing one message at a time on a serial printer.

With this unselected, data is printed by the page. This function is displayed with the line output printer package installed in the HIS.

## Print Orientation

Select the orientation of the paper. Note that this setting will be invalid with 1 line print selected.

With 1 line print selected, the only valid print orientation is [Landscape]. Select the font size to be printed on paper.

## System Default

This is used when resetting the print orientation and font size back to the default settings.



## **Message Printer Assignment**

The messages defined in MSG1 to 5 are displayed. The type of message to be printed cannot be changed here. Change the message type assignment in the HIS Constants Builder.

## **PRT**

Select the printer to which the alarm message, process report and historical message report are output.

## **Hardcopy**

To print the screen image, check [Print] and select the output printer from the pull-down menu. To print with black and white reversed or monochrome printing, check the items respectively.

## **Invert**

Prints the screen image to a color printer with only the black and white colors inverted. Other colors (other than black or white) are printed out as they are.

## **Monochrome print**

The screen image is printed out in black and white.

## **Output file**

Check this to output the screen image to a file. If [Output file] is checked, a bitmap file (.bmp) is created and stored. This file can be called up and printed out from the image window.

## 8.3 Buzzer

With the HIS, a sound can be generated to inform the operator that a message has occurred or there is an operation error. Also, the tone and type of sound can be set so that the type of message generated can be distinguished by the sound.

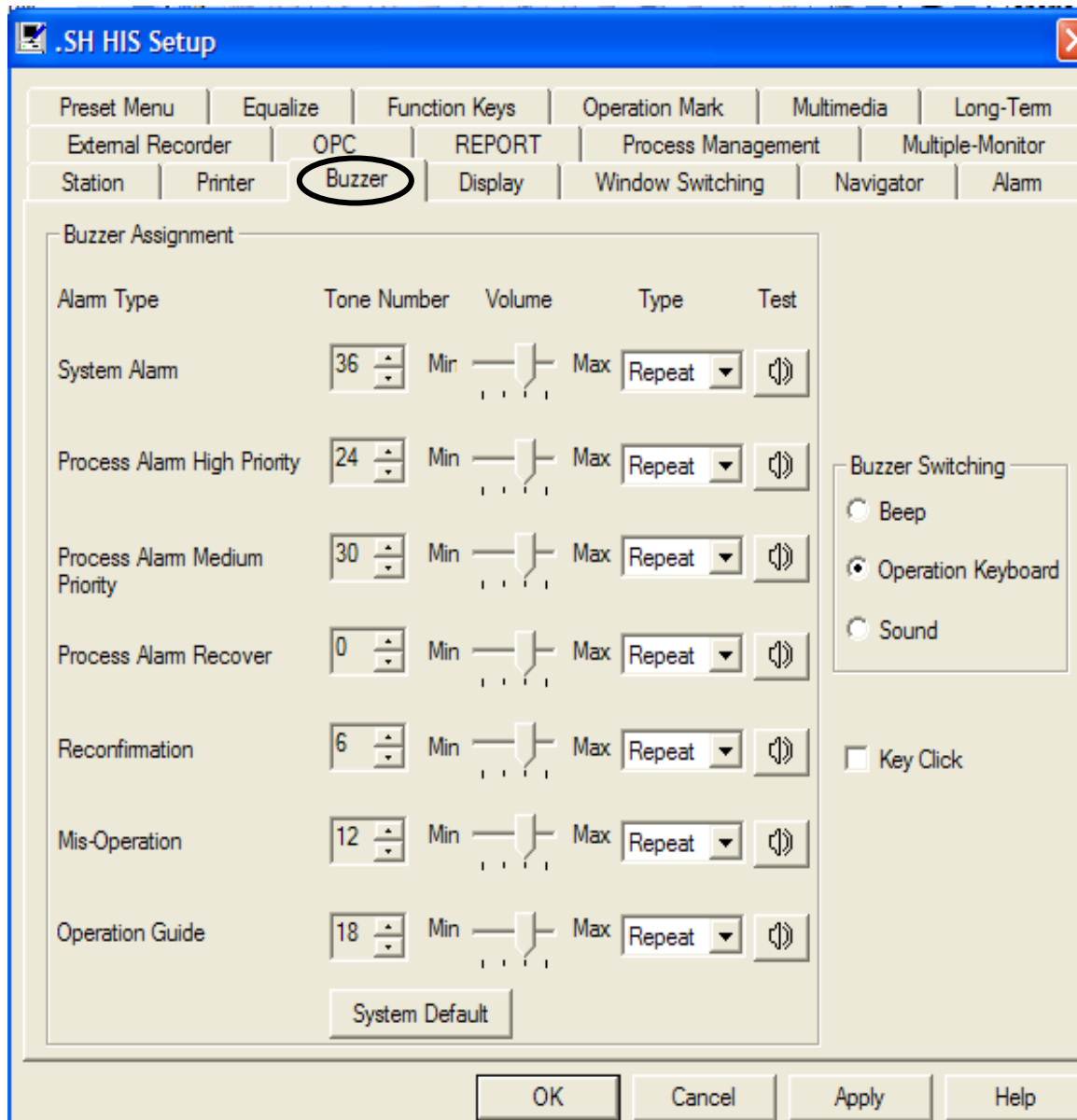


Figure : Buzzer Tab of HIS Set up

## Buzzer Assignment

The tone and volume of the sound generated when an alarm occurs or during an operation error can be set for each type of alarm.

- **Tone number:** The tone output is designated by a number. This is valid when [Operation Keyboard] is selected at [Buzzer Switching].
- **Volume:** This is used when adjusting the volume of the buzzer sound output. No buzzer sound will be output if the volume is minimized.
- When [Beep] or [Sound] is selected at [Buzzer Switching], tuning the volume can only be set the buzzer either on or off.
- **Type:** Select either repeat sound or notification sound.
- **Test:** This is used to test what kind of sound is output. Click the test button again to stop the test.

## System default

This is used when returning the tone number to the default setting.

## Buzzer Switching

Select the device to output the buzzer. This is fixed to the operation keyboard on the console type HIS.

- **Beep:** The buzzer sound is generated from the HIS.
- **Operation keyboard:** The buzzer sound is generated from the keyboard.
- **Sound:** The buzzer sound is generated from the sound board.
- **Key Click:** Sets whether key/mouse click sound is active or not when the operation keyboard or the mouse is operated.

## 8.4 Display

Settings such as the operation screen mode and toolbar button size are displayed in the Display tab. The contents of the settings can also be changed.

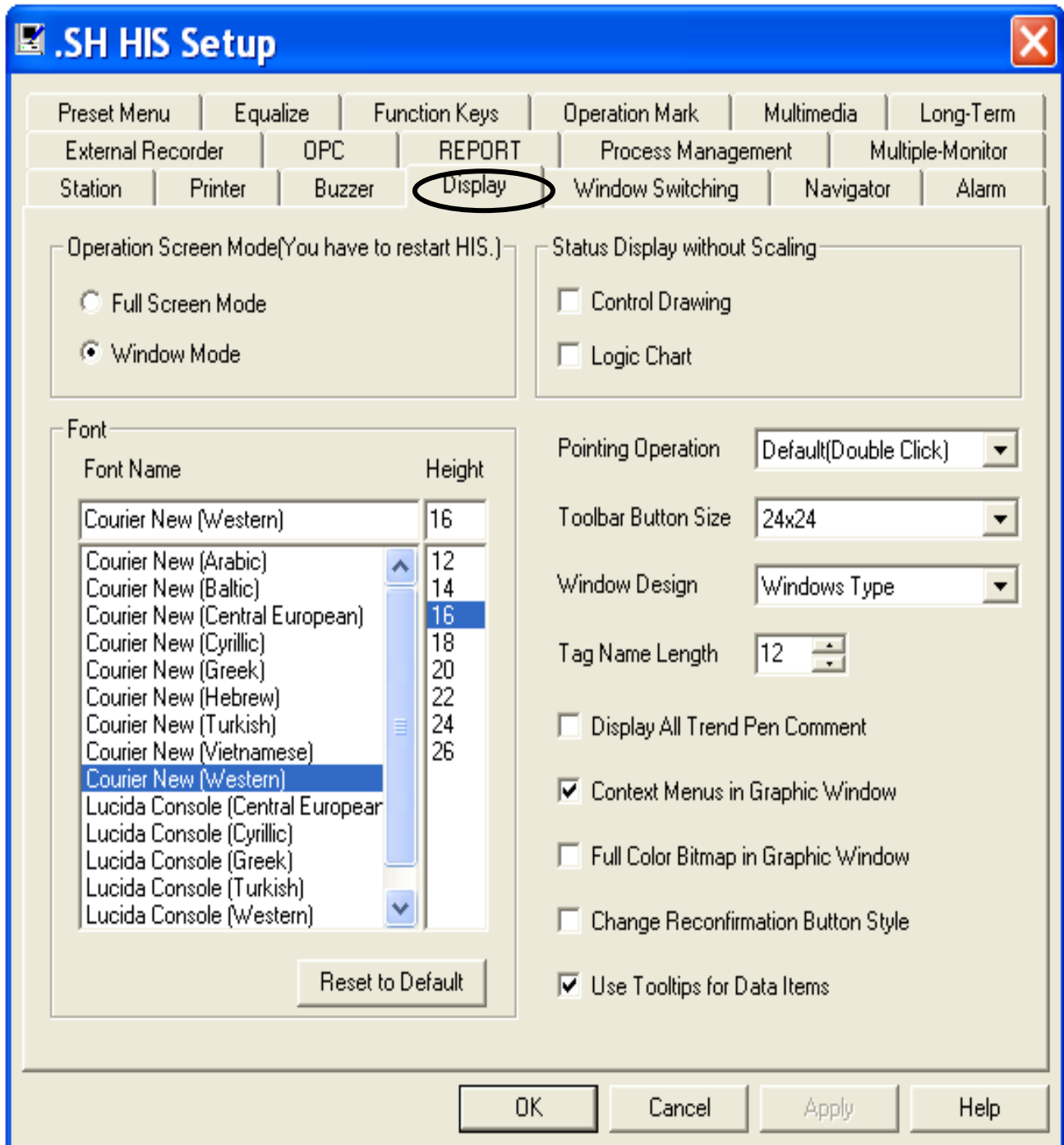


Figure : Display Tab of HIS SETUP

### **Operation Screen Mode**

Select the operation screen mode when monitoring.

- **Full Screen Mode:** When this option is checked, the operation windows will be displayed in full screen mode.
  
- **Window Mode:** When this option is checked, the operation windows will be displayed as overlapped windows.

When changing the operation screen mode, it is necessary to restart HIS console to enable the new settings. To restart the HIS console, log-out Windows and logon again is required.

### **Font**

Select the font for displays in the windows. The fonts displayed here are TrueType fonts of fixed width. Clicking [System Default] button may return to system default settings.

### **Pointing Operation**

Select the pointing operation method for using the Operation and Monitoring to select a touch target and operate a window.

- Default (Double Click)
- Single Click on the Graphic Touch Target
- Single Click

### **Status Display without Scaling**

Scaling for control drawing windows or logic chart windows can be enabled or disabled. When the option "Status Display without Scaling" is checked, the scaling is disabled.

### **Toolbar Button Size**

Select the size of the toolbar buttons. The contents set here will be enabled in the toolbars of all windows in HIS.

---

## Window Design

The designs of the Operator Guide window, Process Alarm window, System Alarm window, System Status Overview window, and instrument faceplates can be changed by selecting their background color, character color, etc.

The available window designs are the following.

- Windows Type (default)
- Traditional
- No specification

## Tag Name Length

Select the number of display digits for a name displayed in the operation and monitoring window.

## Display All Trend Pen Comment

The size of the tag comment allowed for display in the trend window can be selected. Checking this box, up to 12 double-byte characters or 24 single-byte characters can be displayed.

Otherwise, only 8 double-byte characters or 16 single-byte characters can be displayed.

## Context Menus in Graphic Window

When the mouse cursor is moved into a graphic window, right clicking the mouse can pop up a context menu.

This context menu is a menu that we referred to as the Context Menus in Graphic Window. Moving the mouse cursor may choose a menu item from this context menu.

In order to activate the context menu, this option needs to be checked on the Display tab of HIS Setup window.

## Graphic Full Color Bitmap

When inserting a bitmap image into a graphic window, full color bitmap or reduced color bitmap is selectable.

Here, full-color bitmap means the bitmap contains all the color information of the originally created bitmap image while the reduced-color bitmap contains less color information.

### **Change Reconfirmation Button Style**

The style of reconfirmation buttons can be changed.

Changing the reconfirmation button style can be valid only when the option is enabled.

### **Use Tooltips for Data Items**

On the tuning window, whether to pop up the tips of the data items in the parameter area can be selected. Checking this option, the tips of the data items will popup.

## 8.5 Window Switching

In the Window Switching tab, the display size of the operation and monitoring windows called up from the System Message window can be selected.

Automatic window switching can be enabled when a process alarm or operator guide message is generated etc, The setup items can also be changed.

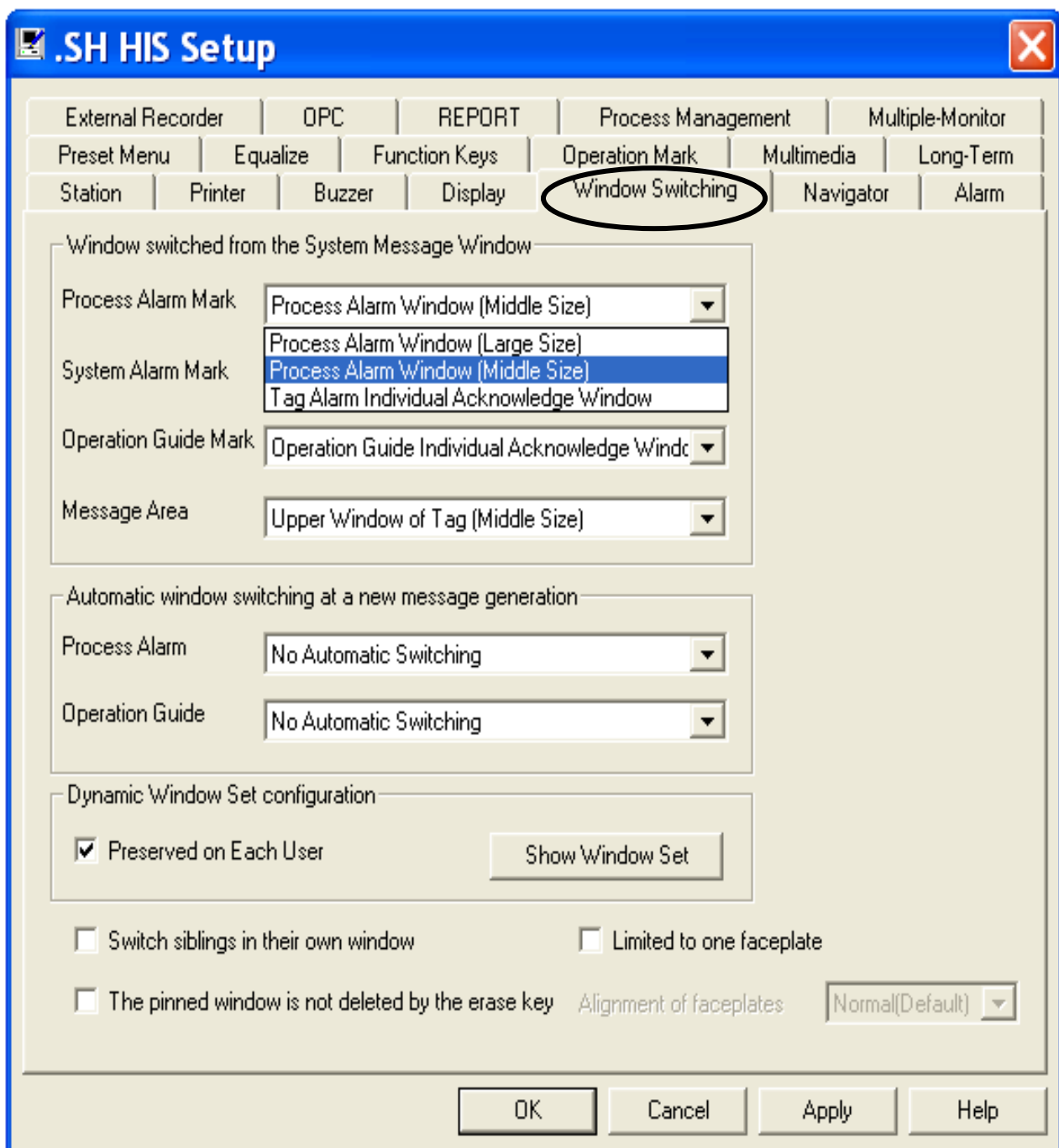


Figure: Window Switching tab of HIS Setup



### **Process Alarm Mark, System Alarm Mark and Operator Guide Mark**

Select the size for the windows called up from the buttons for "Process Alarm Window," "System Alarm Window" or "Operator Guide Window" respectively.

### **Message area**

Select the window to be called up when the message displayed in the message display area of the System Message window is clicked.

### **Dynamic Window Set Configuration**

#### **Show Window Set**

Clicking this button may display a dialog box to show all the current dynamic window sets. The window sets are displayed in the order they were saved.

When the dynamic window sets are specified for each user, the dynamic window set saved for the user who has currently logged on is displayed.

#### **Preserved on Each User**

Checking this check box may preserve the dynamic window set for each user that saved the window set.

#### **Switch Siblings in their Own Window**

Pressing the left or right hierarchy button on the operation menu, calls up a hierarchy window.

Checking this check box replaces the contents of the active window with those of a hierarchy window without calling up a new window.

Selecting this function changes the sibling window call-up operation for all windows with the sibling window call-up function.

#### **The Pinned Window is Not Deleted by the Erase Key**

Check this check box to prevent the closing of a pinned window by operating the clear-all button (or the clear-all key).

**Limited to one faceplate**

This is an option to allow only one faceplate to be displayed on the screen.

When open a new faceplate, the new faceplate is displayed in the same position to replace the old one. By default, this option is not checked.

**Alignment of faceplates**

The display alignment of the faceplates can be specified. However, this setting is valid only for the console-type HIS that supports simultaneous manipulation of the eight control loops.

The opened faceplates are aligned from left side of the screen regardless the window types (active windows).

## 8.6 Navigator

The settings regarding to icons blinking can be set on Navigator tab. Only the user with ENGUSER (S3) privilege can change these settings.

When the settings are changed, the new settings will become valid only after the Navigator window is re-opened.

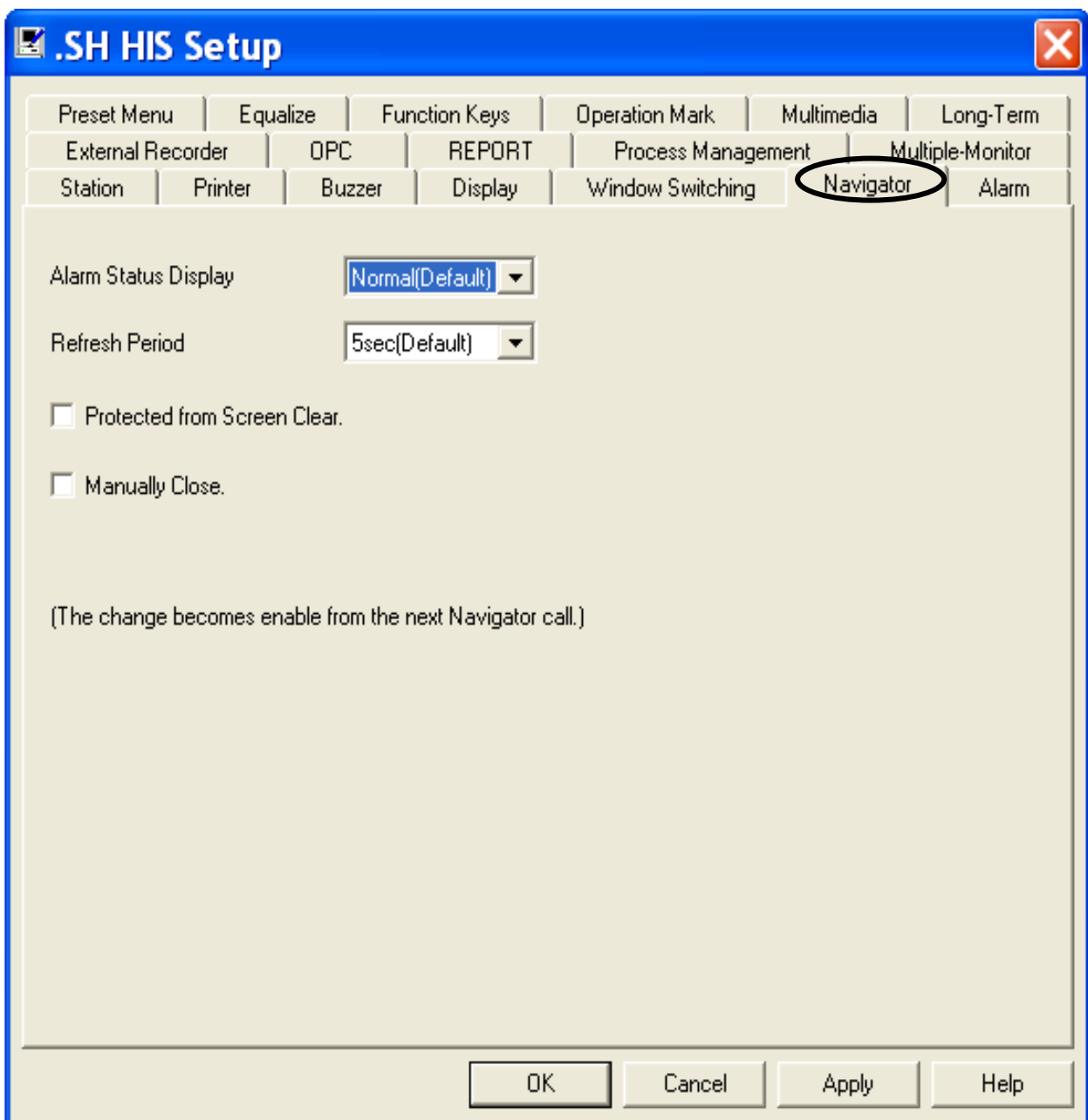


Figure: Navigator tab of HIS Setup

---

## **Alarm Status Display**

The alarms in the windows can be displayed in the following manners.

**Normal:** The unacknowledged alarms are display in green or red without blinking.

**Blinking:** The unacknowledged alarms are display in green or red and blinking.

## **Refresh Period**

The messages status in the window can be set to refresh in the period of 5 seconds, 3 seconds, 2 seconds or 1 second.

## **Protected from Screen Clear**

When [Protected from Screen Clear] option is checked, the Navigator window will not be cleared from the screen by Screen Clear key or by user login and logout. And the Display Always pin on the toolbar becomes irrelevant.

This option becomes valid only after the Navigator window is closed and re-opened.

## **Manually Close**

When [Manually Close] option is checked, the Navigator window will not automatically disappear from the screen even though the Display Always pin is in the OFF status.

## 8.7 Alarm

The process alarm display level and the alarm message acknowledgment method are displayed in the Alarm tab. The setup items can also be changed.

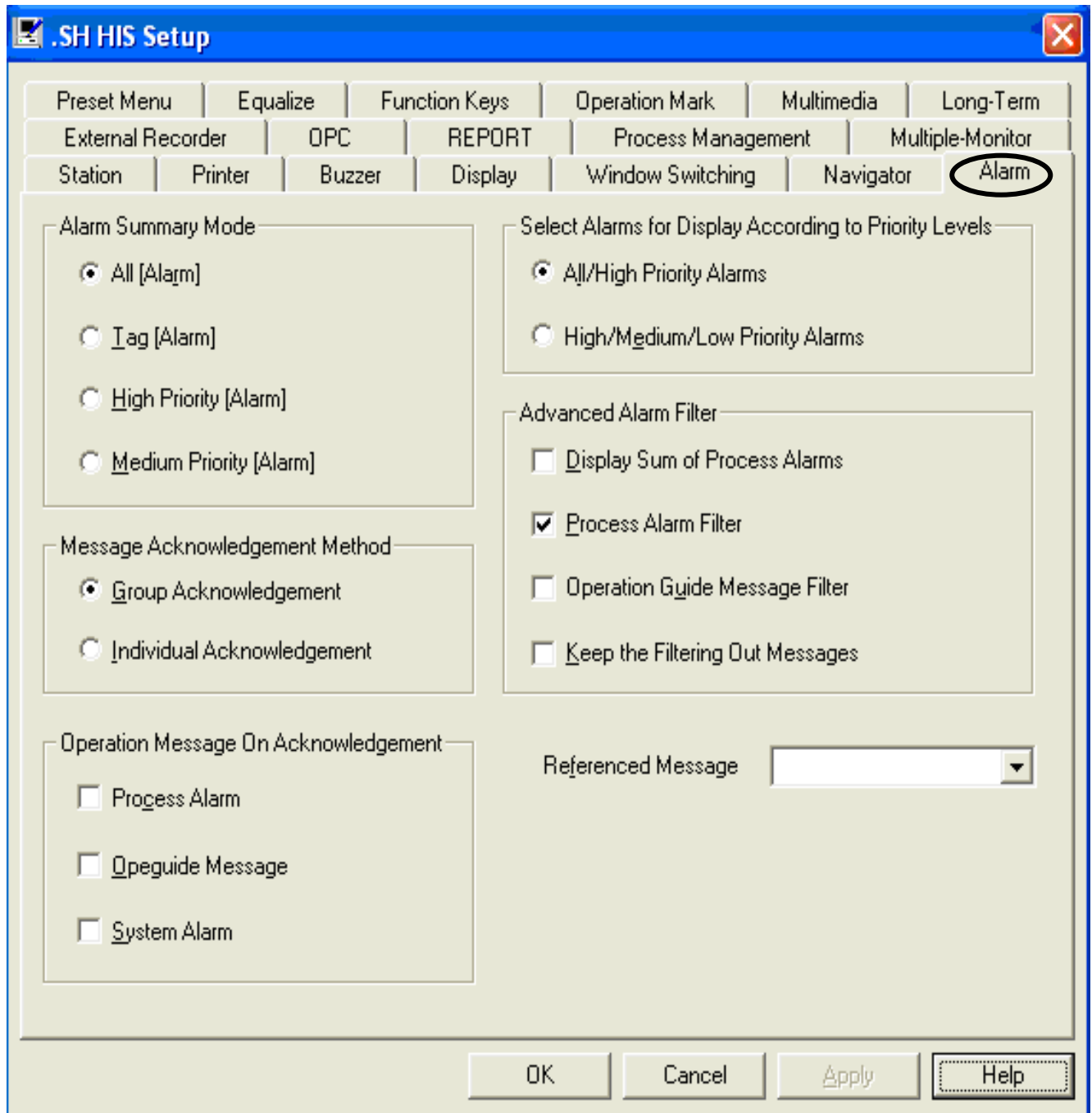


Figure: Alarm tab of HIS Setup

## Alarm Summary Mode

Among the process alarms activated, only the process alarms in the selected range are displayed in the operation and monitoring window.

**All alarms:** All process alarms activated are displayed.

**Tag alarm:** If multiple process alarms are activated for a single function block, the highest priority alarm is displayed.

**High Priority alarm:** Among all process alarms activated, only emergency alarms are displayed.

**Medium Priority alarm:** Among all process alarms activated, only emergency and high priority alarms are displayed.

## Message Acknowledgment Method

Select the alarm message acknowledgment method. The method selected here is valid for operator guide messages, process alarm messages and system alarm messages.

In the group acknowledgment mode, the generated messages are acknowledged globally for each message type.

In the individual acknowledgment mode, the generated messages are individually selected and then acknowledged.

## Operation Message on Acknowledgment

If this option is checked, when acknowledging a process alarm message, an operator guide message or a system alarm message, the acknowledging operation itself is recorded and sent to historical message report window as an operation message.

## Select Alarm for Display According to Alarm Priority Levels

The following two options can be chosen.

**ALL/High Priority Alarms:** If this option is checked, clicking the button on the process alarm window toolbar can switch from displaying all alarms to only displaying high priority alarms.

**High/Medium/Low Priority Alarms:** If this option is checked, clicking the button on the process alarm window toolbar can switch among displaying high/medium/low priority alarms respectively.

### Advanced Alarm Filtering (Optional)

After installing Advanced Alarm Filter package, this option becomes available.

---

### **Display Sum of Process Alarm**

Check the [Display Sum of Process Alarm] check box to display the number of unconfirmed process alarms (flickers) and the total number of process alarms in the System Message window.

### **Process Alarm Filter**

Check the [Process Alarm Filter] check box to enable the filtering of process alarm messages so that process alarms are filtered according to the settings of the specified advanced alarm filter.

### **Operation Guide Message Filter**

Check the [Operation Guide Message Filter] check box to enable the filtering of operator guide messages so that operator guide messages are filtered according to the setting of the specified advanced alarm filter.

### **Keep the Filtering Out Messages**

Check the [Keep the Filtering Out Messages] check box to store on the HIS messages suppressed by the specific filter.

There is a maximum number of messages that can be stored, and messages are stored until the maximum is reached. Up to 200 process alarms and 40 operator guide messages are stored.

As a general rule, older messages are deleted first when the maximum number is exceeded, although the confirmation status of the messages is taken into consideration.

Any messages that have been suppressed will be displayed if the filtering is canceled.

### **Referenced Message**

The HIS may display the alarms occurred after HIS starts up.

Furthermore, the HIS may copy the history of the message from other operation and monitoring consoles so that the alarm messages, the alarm messages in the past may be displayed on the Process Alarm window.

Thus, specify the HIS name, the source of the message history to be copied, to this field.

## 8.8 Preset Menu

In the HIS, there is a function that allows frequently used functions to be called up easily.

By presetting the functions to be called in the Preset Menu tab, they can be called up from the System Message window. Up to 32 functions can be set.

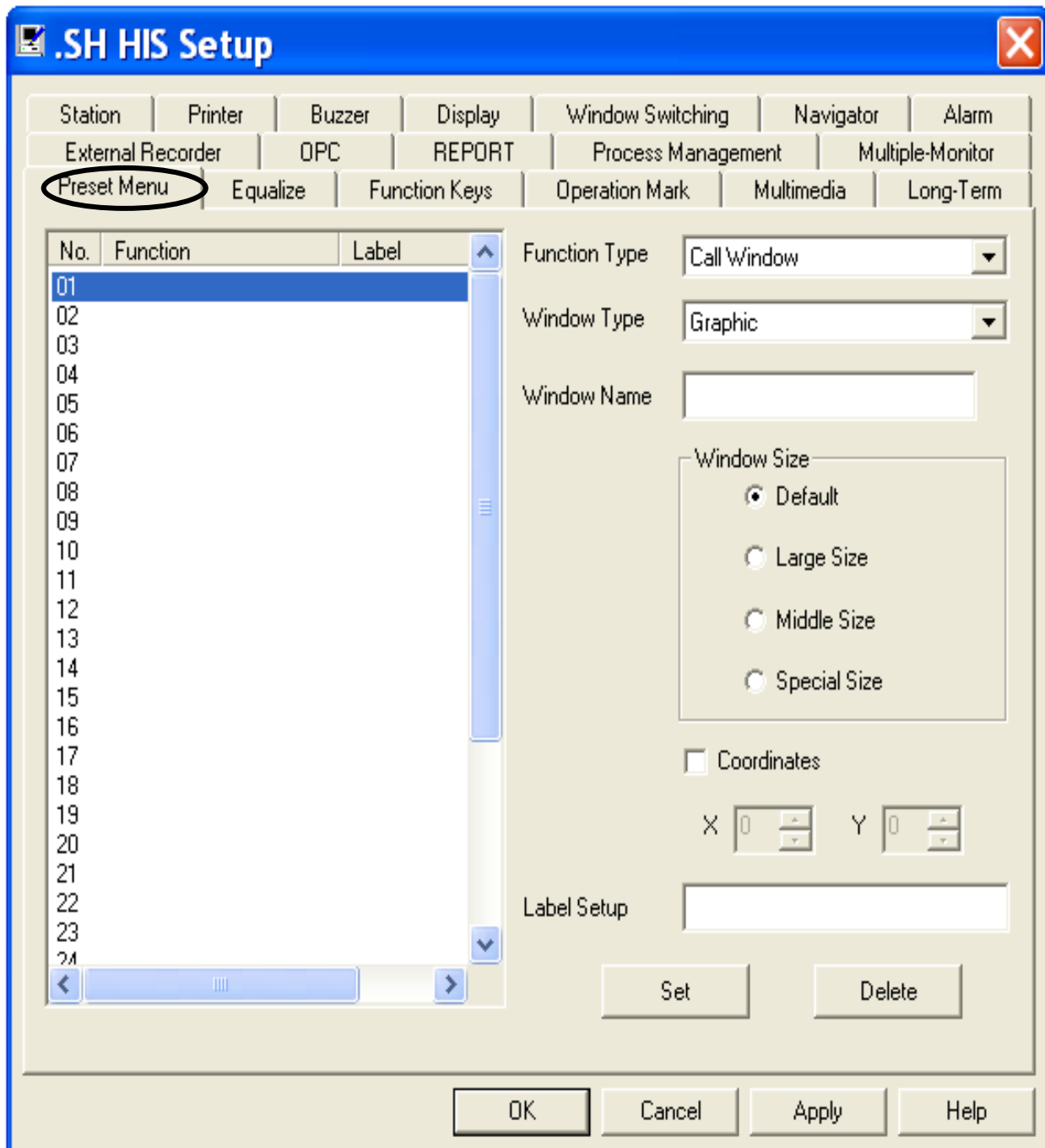


Figure: Preset Tab of HIS Set up



### **Label Setup**

Enter up to 32 double-byte or 64 single-byte characters for a string to be displayed on the preset menu. With this setup omitted, a string assigned for [Function] is displayed.

### **Window Size**

To set the size of the windows opened using the Preset Menu

### **Delete**

To delete the assigned Menu in the Preset Menu.

### **Creation of Preset Menu**

Step i) To create a preset menu the position is first selected as shown in the figure below

Step ii) Select the function from the “**Function Type**” option. Then “**Window Type**” and the “**Window Name**” has to be specified.

Ex. “**Window Type**” is set as “**Graphics**” and the “**window Name**” is set as “**GR0003**”.

The “**Label Setup**” is set as “**GRAPHICS**”. This Label Setup appears on the preset menu listed.

Once the function is assigned the “**Set**” option is given to set the function.

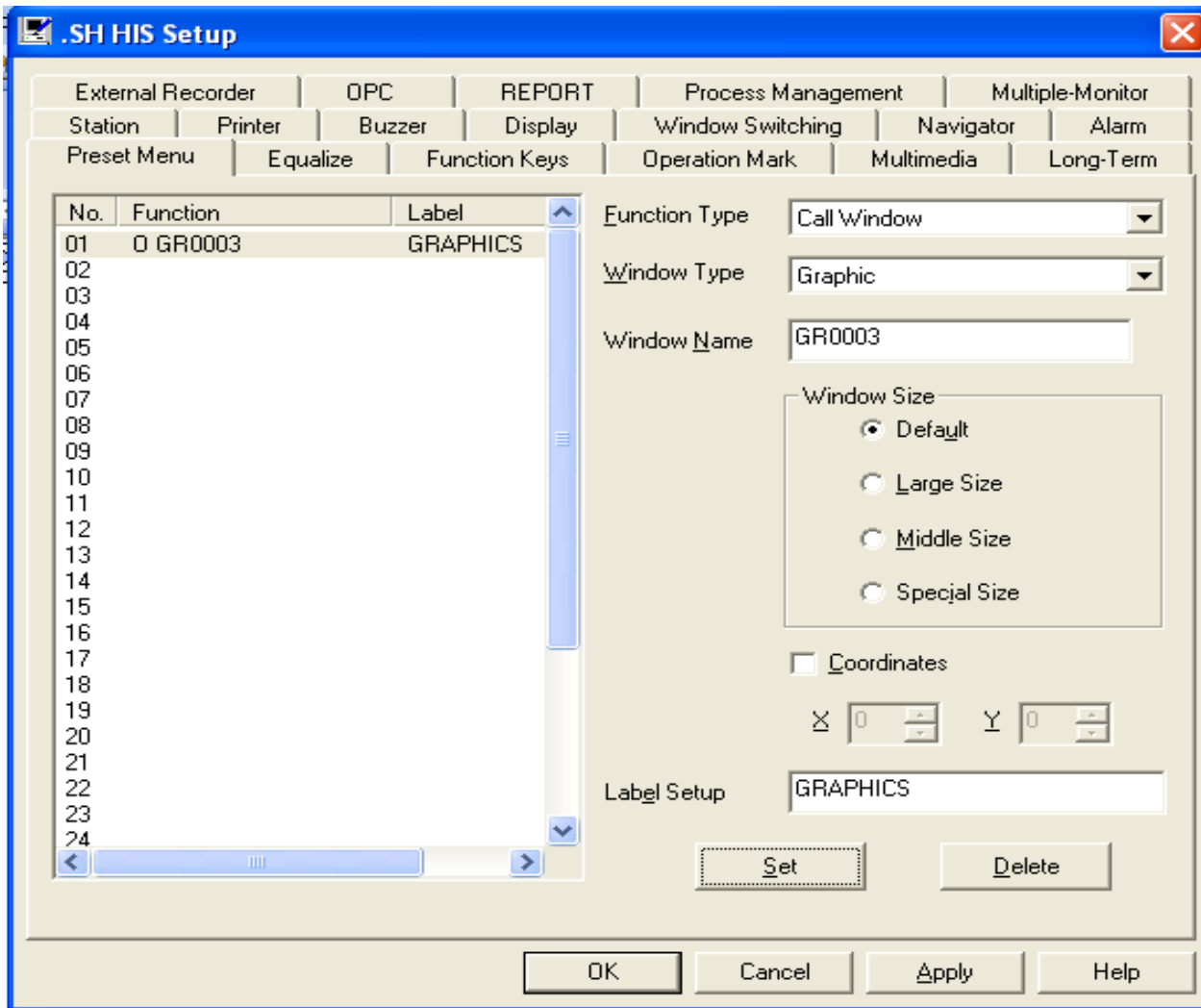


Figure: Assignment of Windows in Preset Menu

## 8.9 Equalize

The database information regarding the equalization is displayed in the Equalization tab. Equalization can also be executed.

Equalization is a process to equalize the items defined by builders and the database in the current station.

The creation dates of the database in the control station or builders and of the database of the current station are compared at the time HIS is activated.

If there is an inconsistency, the equalization request dialog is displayed in the System Message window. In this case, perform the equalization in the Equalization tab.

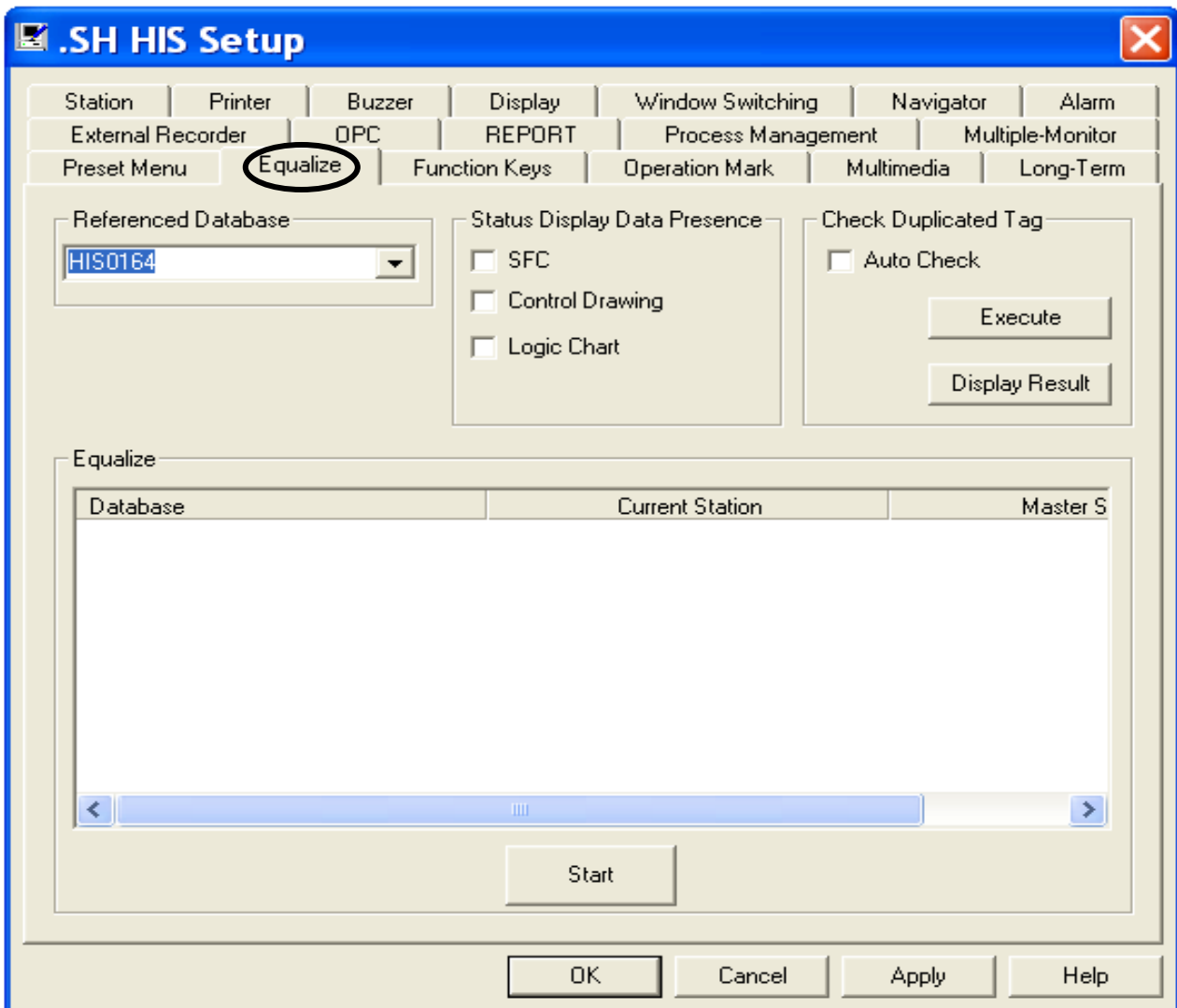


Figure: Equalize tab of HIS Setup

**Referenced Database**

This is used to select the station which has the database to be referenced for equalization (i.e., station which has the master database).

The station name displayed here is the station name defined by builders.

**Status Display Data Presence**

The item displayed here can specify whether to perform equalization for each item. Place a check mark by the item that is not to be equalized.

**Check Duplicated Tag**

This is used to check for any duplication in all of the FCS tag lists to be operated and monitored on HIS, and in operation and monitoring window names.

The check results are output in a text file for display on HIS. With the Multiple Project Connection Package installed, function blocks in all projects will be checked.

**Auto Check**

Any duplicated tags are automatically checked for upon startup of the HIS console or upon loading of tag lists.

**Execute**

Click this to manually check for any duplicated tags. The HIS Setup window cannot be operated during the tag duplication check.

Upon successful completion of the check, the results are automatically displayed.

**Display Result**

Click this to display the results of the previous check without performing any further check.

**Equalize**

When the database in the current station and the master station do not match, the creation dates of the database in the current station and the master station are displayed for each database file.

**Start Button**

Equalization is executed with this button. Upon completion of equalization, the equalization list displays items completed successfully in green and those completed unsuccessfully in red.

## 8.10 Function Keys

The function key assignments defined in the Function Key Assignment Builder are displayed in the Function Keys tab. Also, the function key assignment can be defined temporarily.

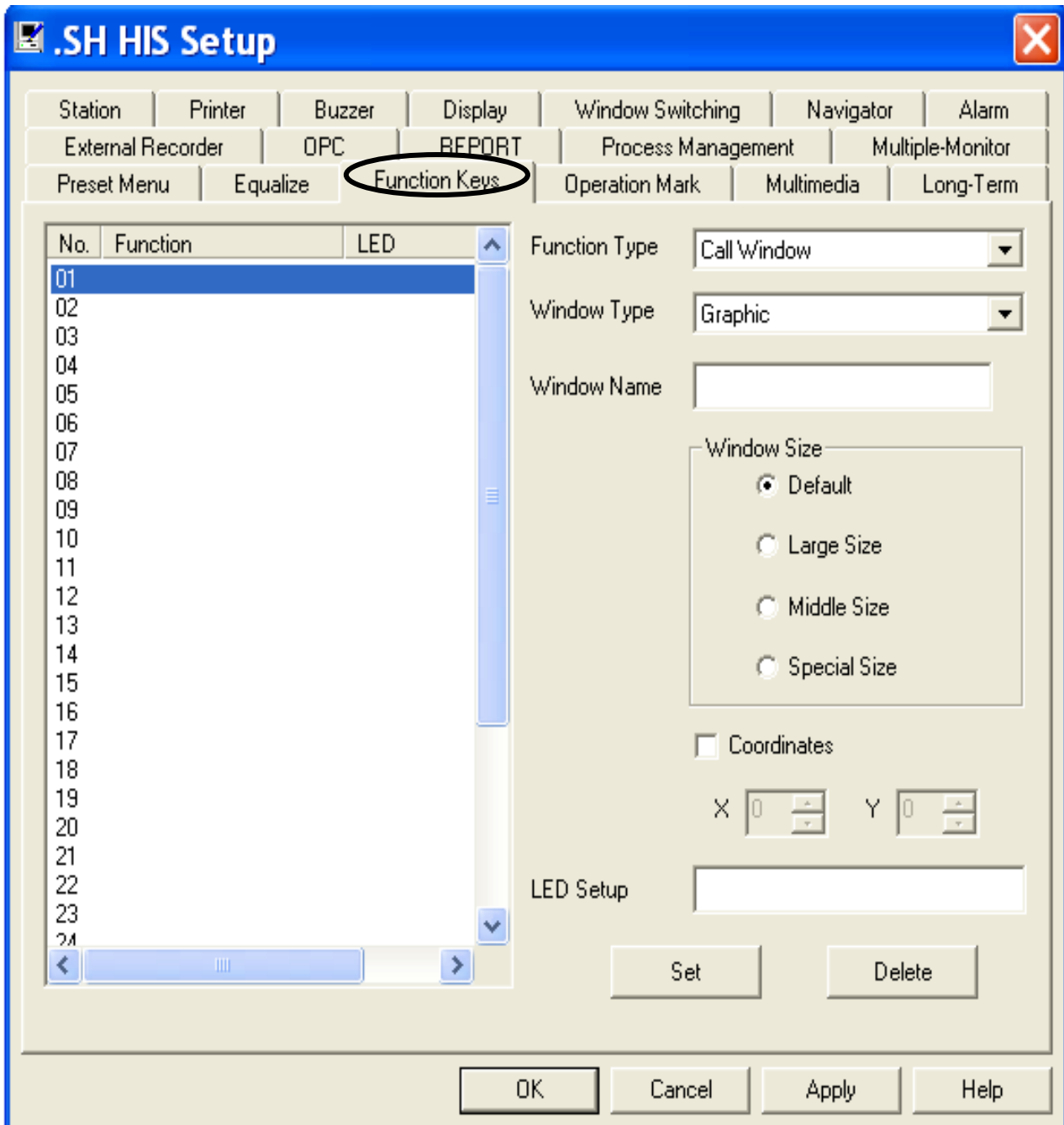


Figure: Function Key tab of HIS Setup

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## Precautions when Using the Function Keys Tab

A security code can be set for each function key in the Function Key tab using the builders.

Function keys that the user has no authority to change cannot be defined in this tab. Also, function key assignments can be defined in both the Function Key Assignment Builder and the HIS Setup window.

When both are used to define the same function key, the contents of the definition downloaded later takes effect

## Window Size

To set the size of the windows opened using the Function Key.

## Delete

To delete the assigned Menu in the Function Key.

## Function Key Assignment

The assignment of the function keys is just the same as the creation of preset menu. The options available in preset menu and the function key assignment are same.

To assign the Function key the position is first selected as shown in the figure.

Select the function from the “Function Type” option. Then the “Window Type” and the “Window Name” has to be specified.

Ex: “Function Type” is set as “Call Window”,  
“Window Type” is set as “Graphics”  
“Window Name” is set as “GR0003”.

The “Label Setup” is set as “GRAPHICS.

Once, the function is assigned the “Set” option is given to set the function.

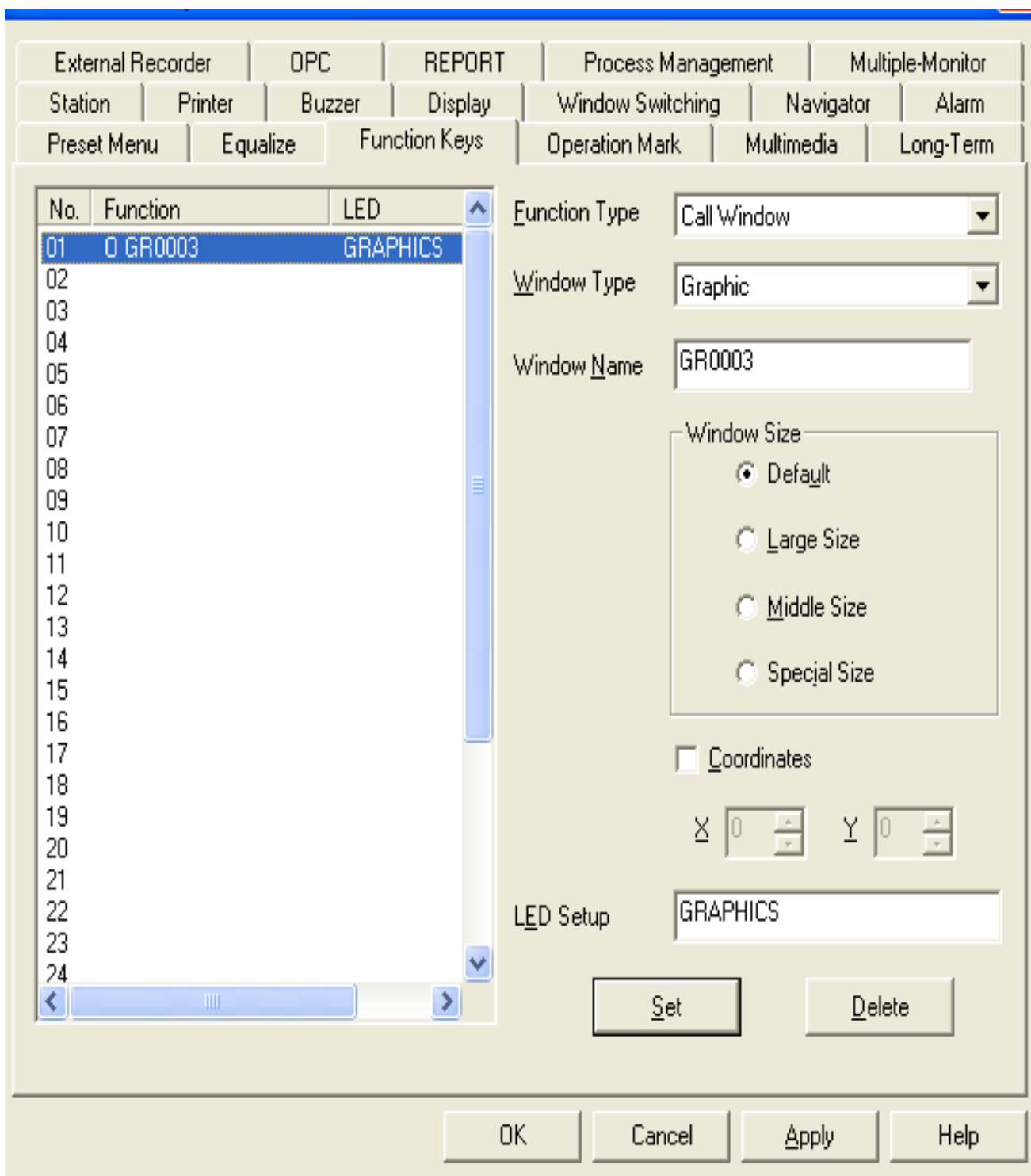


Figure: Function Key assignment in HIS Setup

## 8.11 Operation Mark

The operation marks which are defined in the Operation Mark Builder are displayed in the Operation Mark tab. Also, the label comment color of the operation mark may be defined temporarily, as well.

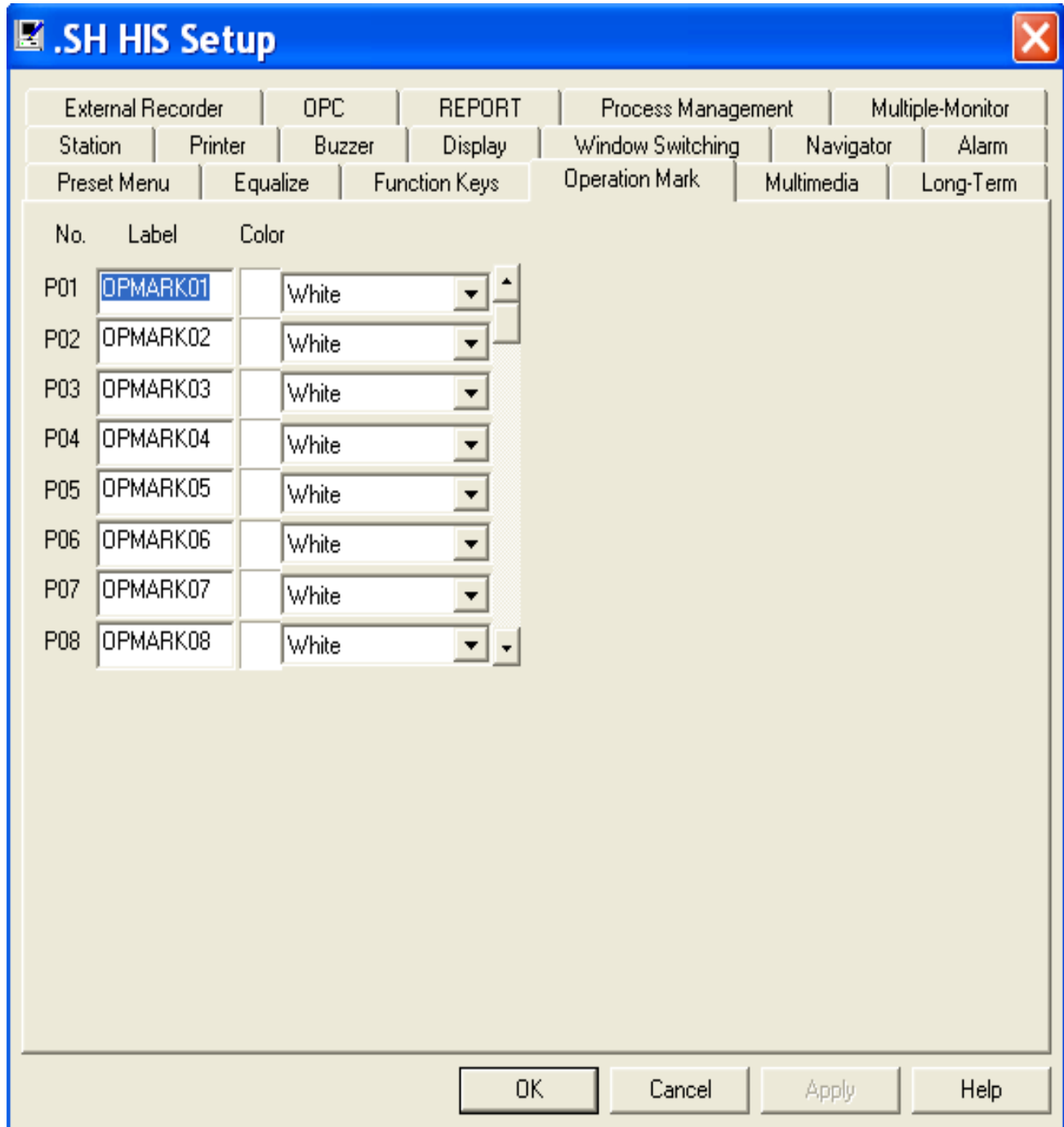


Figure: Operation Mark Tab of HIS Setup



### **Precautions when Using Operation Mark Tab**

Operation marks can be defined in both the Operation Mark Builder and the HIS Setup window. When both are used to define the same operation mark, the contents of the definition downloaded later takes effect

#### **Label**

Enter the label (comment) that will be displayed in the operation mark. Up to eight alphanumeric characters or four double-byte characters may be used.

#### **Color**

Select the display color of the label.

### **Precautions when Using Operation Mark Tab**

Operation marks can be defined in both the Operation Mark Builder and the HIS Setup window. When both are used to define the same operation mark, the contents of the definition downloaded later takes effect.

### **Assignment of Operation Marks**

About 64 operation marks can be assigned. Assign the required operation mark and set the color for each operation mark.

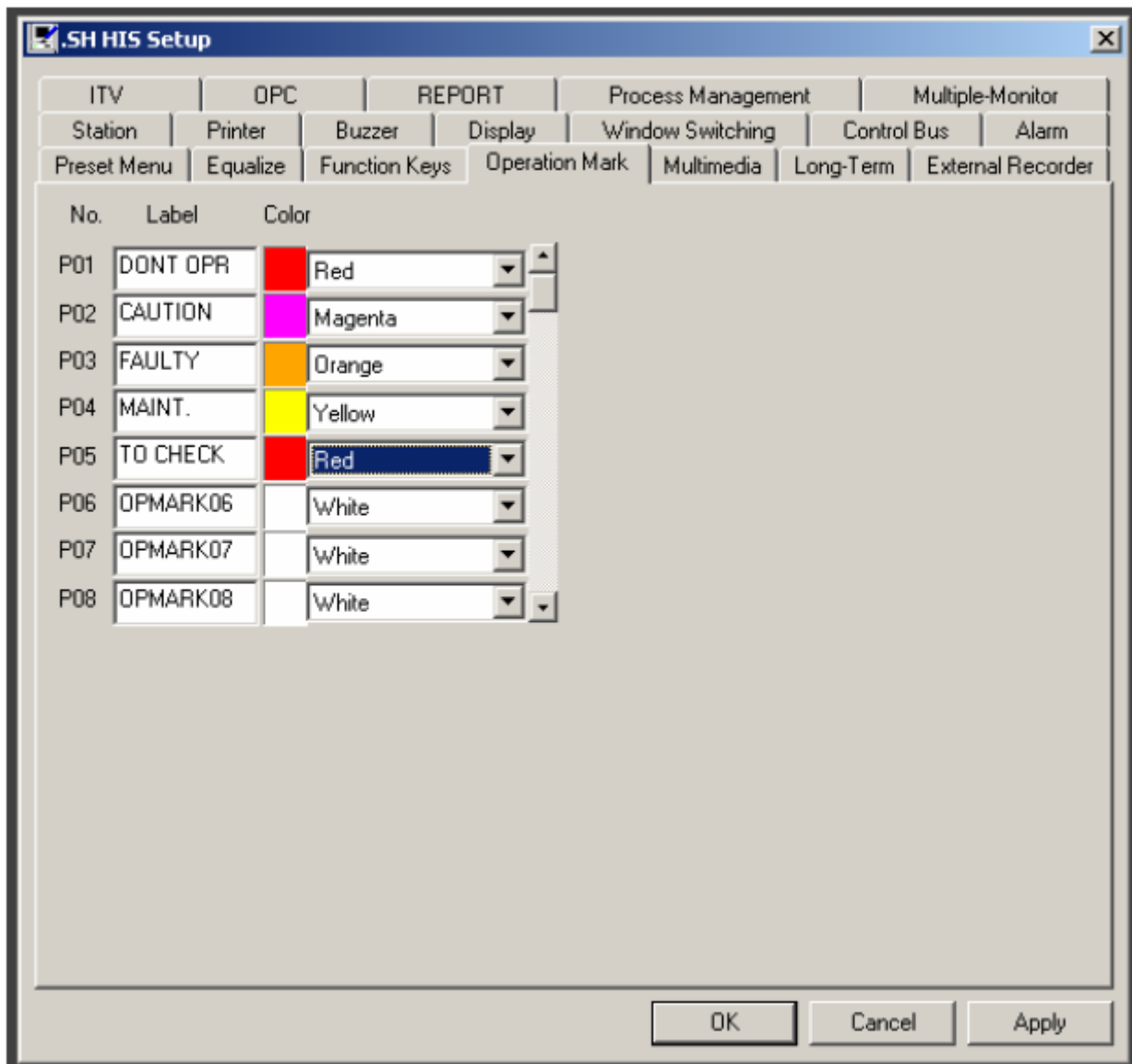


Figure: Example of Operation Mark

The created operation marks can be assigned to the faceplate from the tuning window of the respective tag. The Operation Mark appears on the bottom of the faceplate

## 8.12 Multimedia

When the specified station sends a request for the use of the Multimedia, voice messages and videos stored in the corresponding files are played.

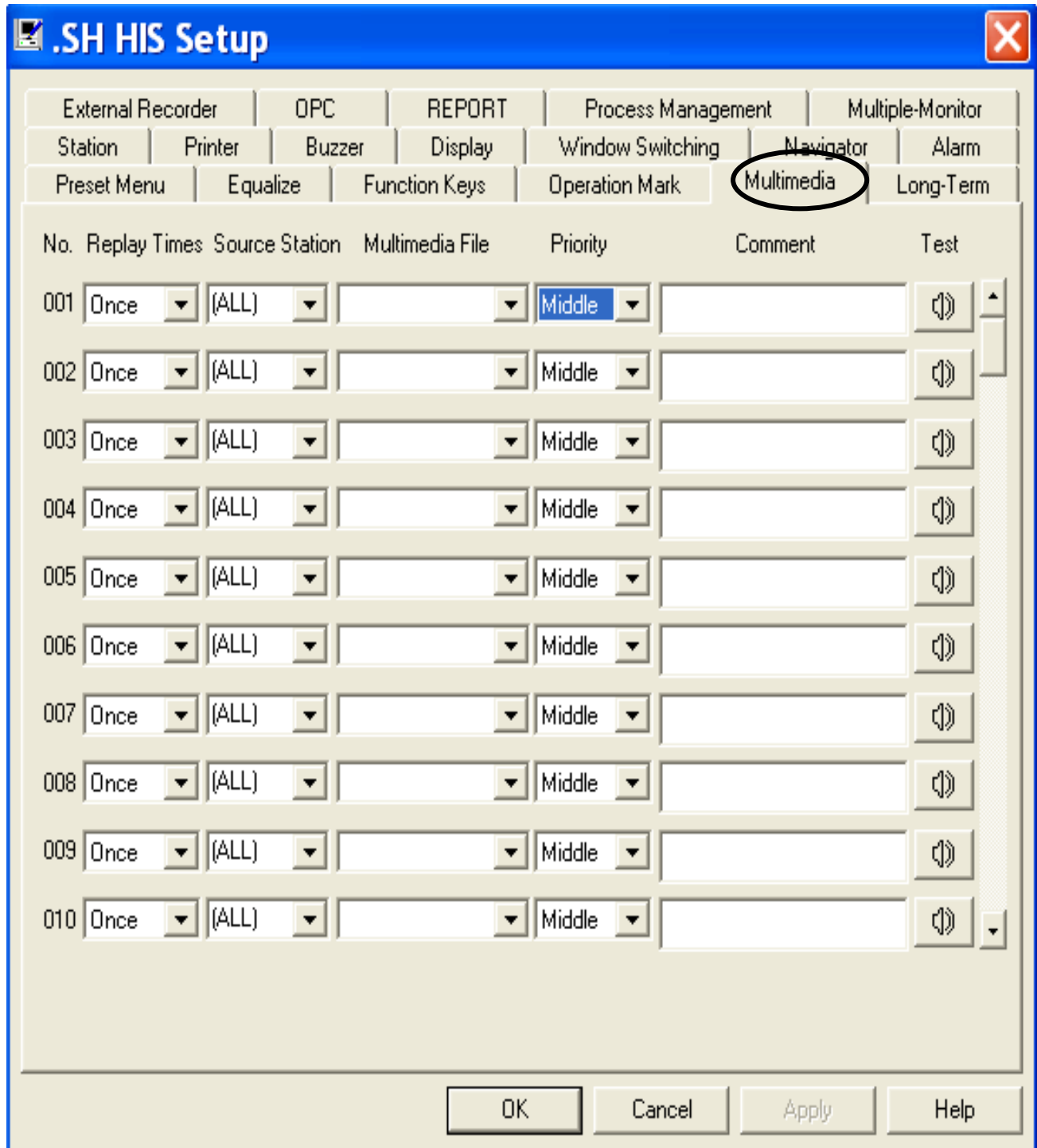


Figure: Multimedia Tab of HIS Setup

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## Applicable Sound Card and Multimedia File Formats

The applicable sound card and multimedia file formats are as follows.

**Sound card:** Sound Blaster PCI128

**File format:**

- Sound only: Sound (.wav), MIDI (.mid, .rmi)
- Video and sound: AVI (.avi) , MPEG (.mpg)

A multimedia file cannot be created on this tab; to create the file, use a commercially available sound recorder or a special software program. Internet Explorer 4.01 or later is required for the file format MPEG.

## Replay Times

Select the number of times to play sound messages or videos. When [Infinity] is selected, always assign a [Stop] to a separate function key. [Stop] can be assigned in the Function Keys tab.

## Source Station

Select the name of the control station that outputs the sound message or video.

## Multimedia File

The combo box for a multimedia file displays a file subordinate to the directory (\HIS\Media\User) where the system was installed. Copy the multimedia file to be executed to the above directory. Enter up to 36 alphanumeric characters for a multimedia file name (including an extension).

## Priority

Select the order of priority for the voice messages or videos to be played. Select from [Maximum], [High], [Middle], and [Low].

## Comment

If it is required, up to 60 alphanumeric characters or 30 double-byte characters may be defined for the sound message or video to be played.

## Test

This is used when testing the sound message or video to be played. Click the test button again to abort the test.

## 8.13 Long-Term

The settings for long-term data archive package may be carried out on this tab. This tab is valid only when the long-term data archive package is installed.

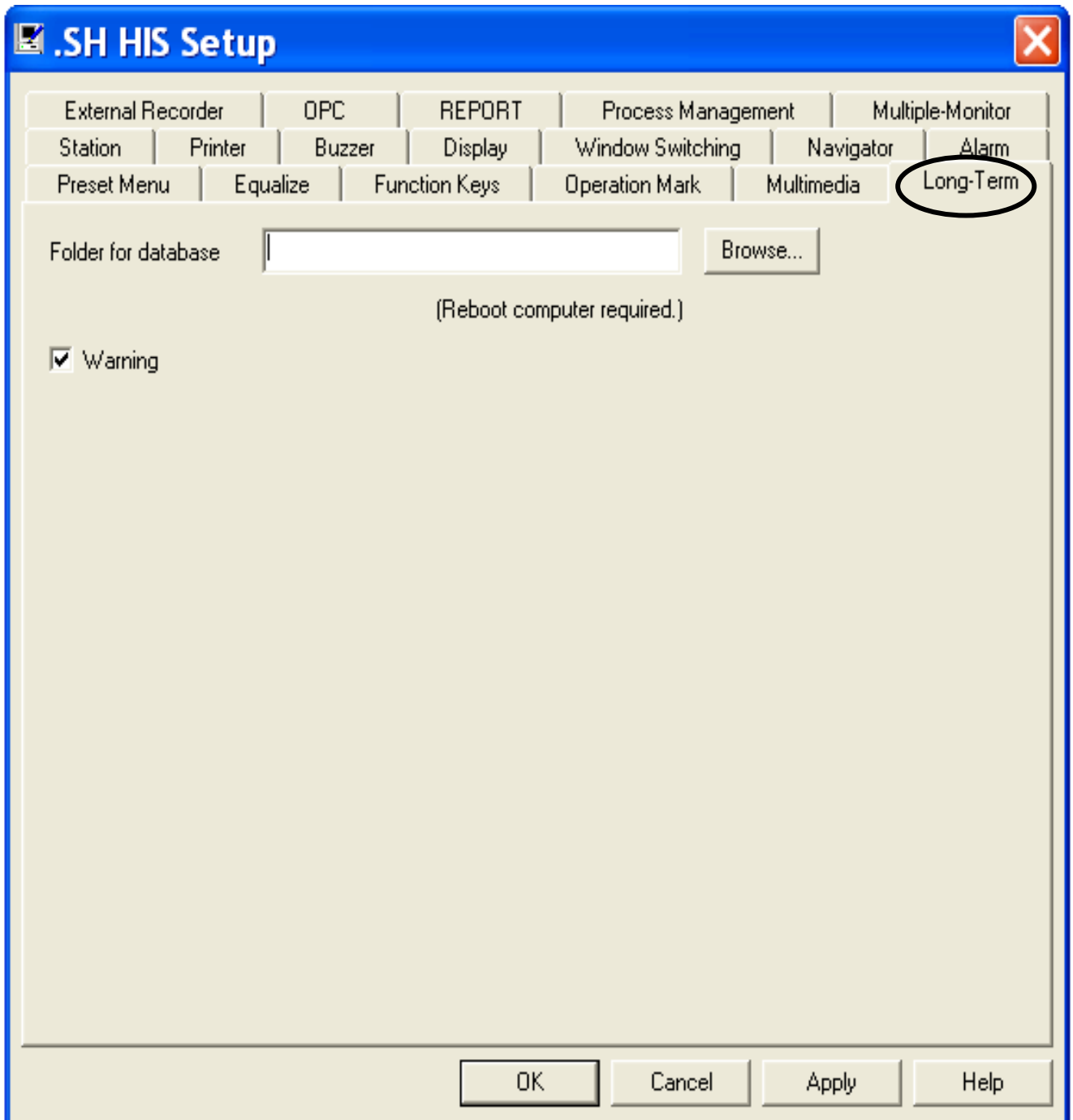


Figure: Long Term Tab of HIS Setup

### **Folder for Database**

Specify the folder for storing the database. When clicking on the [Browse] button, a dialog box for selecting folders may appear. Then specify a folder for the long-term data archive files. When the database folder is changed, the computer needs to be restarted.

When the data stored here is displayed in a trend window on another HIS, a file is shared under the automatically determined shared name.

### **Warning**

When checking this mark, a warning message may prompt at the specified period defined by the builders (then the old files may be deleted to prevent taking full disk space).

## 8.14 External Recorder

Set the recorder output package on the External Recorder tab. This tab is valid only when the recorder output package is installed.

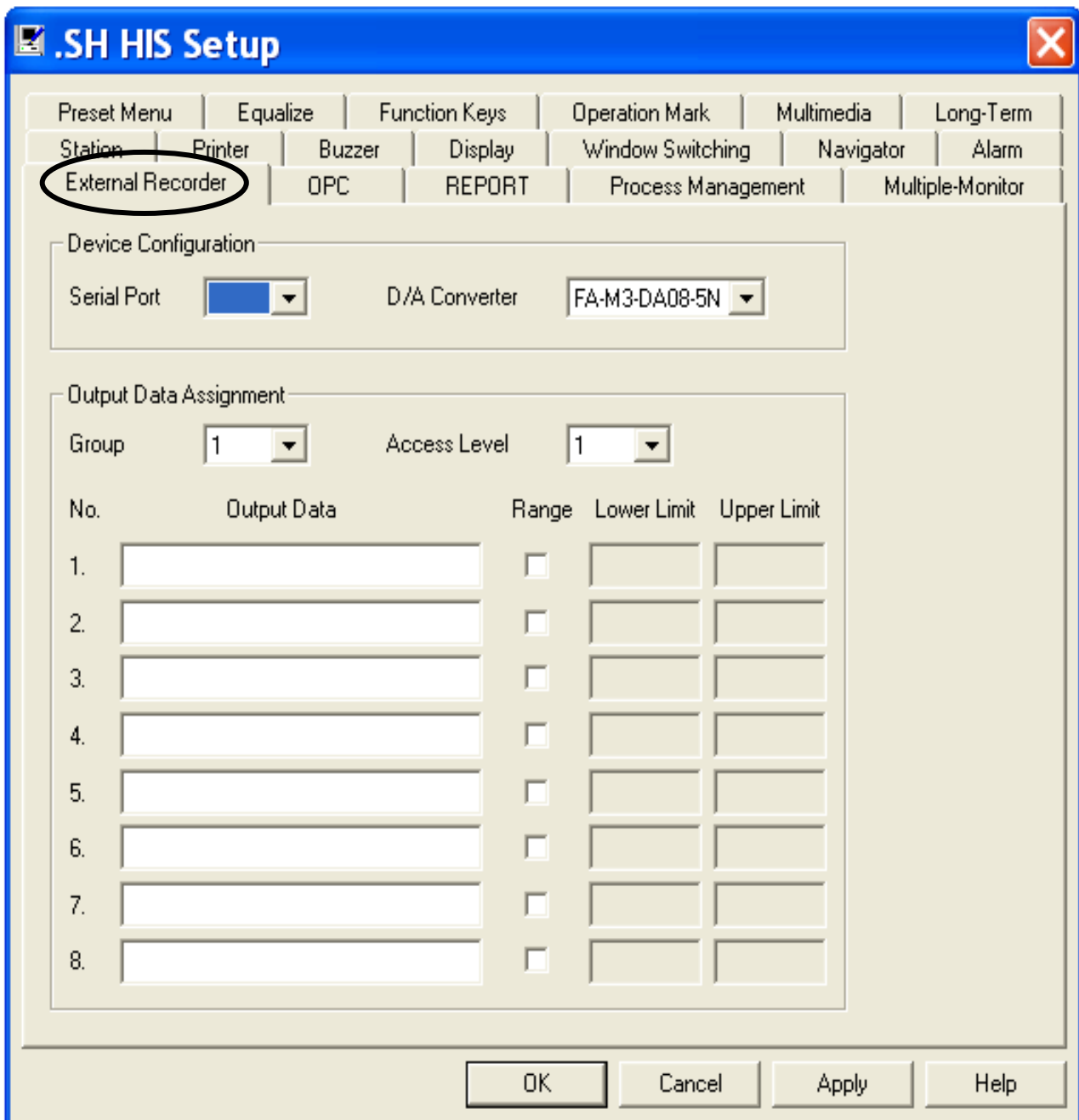


Figure: External Recorder Tab of HIS Setup

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## Device Configuration

Select a device to which the recorder is connected:

**Serial Port:** Select a serial port to which a D/A converter (FA-M3) is connected. Select from the serial ports installed on the HIS that are displayed in the list box.

This item can be changed only with the access level 3.

**D/A Converter:** Select the model name of a D/A converter. Currently, the FA-M3 analog output card [FA-M3-DA08-5N] is the only available option.

This item can be changed only with the access level 3.

## Output Data Assignment

Assign data to be output to the recorder:

**Group:** Select a cluster to which data to be the output to the recorder, is assigned.

Assign the following items for each group:

- **Access Level:** Select the access level. The data setting and change ranges depend on the access level.
- **Output Data:** Assign data to be output to the recorder. Enter up to 42 alphanumeric characters for the data name in the format of a tag name followed by a data item name.

With the data item name omitted, the process measuring value (PV) is automatically assigned. When a function block with no process measuring value is assigned, the data item name is not omissible.

- **Range:** Check this check box to change the range of data to be output to the recorder. With this check box unchecked, the upper and lower limits of the assigned function block are used.
- **Lower Limit, Upper Limit:** Specify lower and upper limits so that the recorder will indicate data output to it in the range of 1-5V DC. This item is valid only with the [Range] check box checked.

If the recorded data is the process measuring value (PV) for the timer block or the counter block, the upper limit for the recorded data (PH) is set for the upper limit, and 0 for the lower limit.



## 8.15 OPC

When Exaopc OPC interface package (For HIS) is applied, the settings can be set on OPC tab. The settings can be set on this tab only when Exaopc OPC interface package (for HIS) is installed.

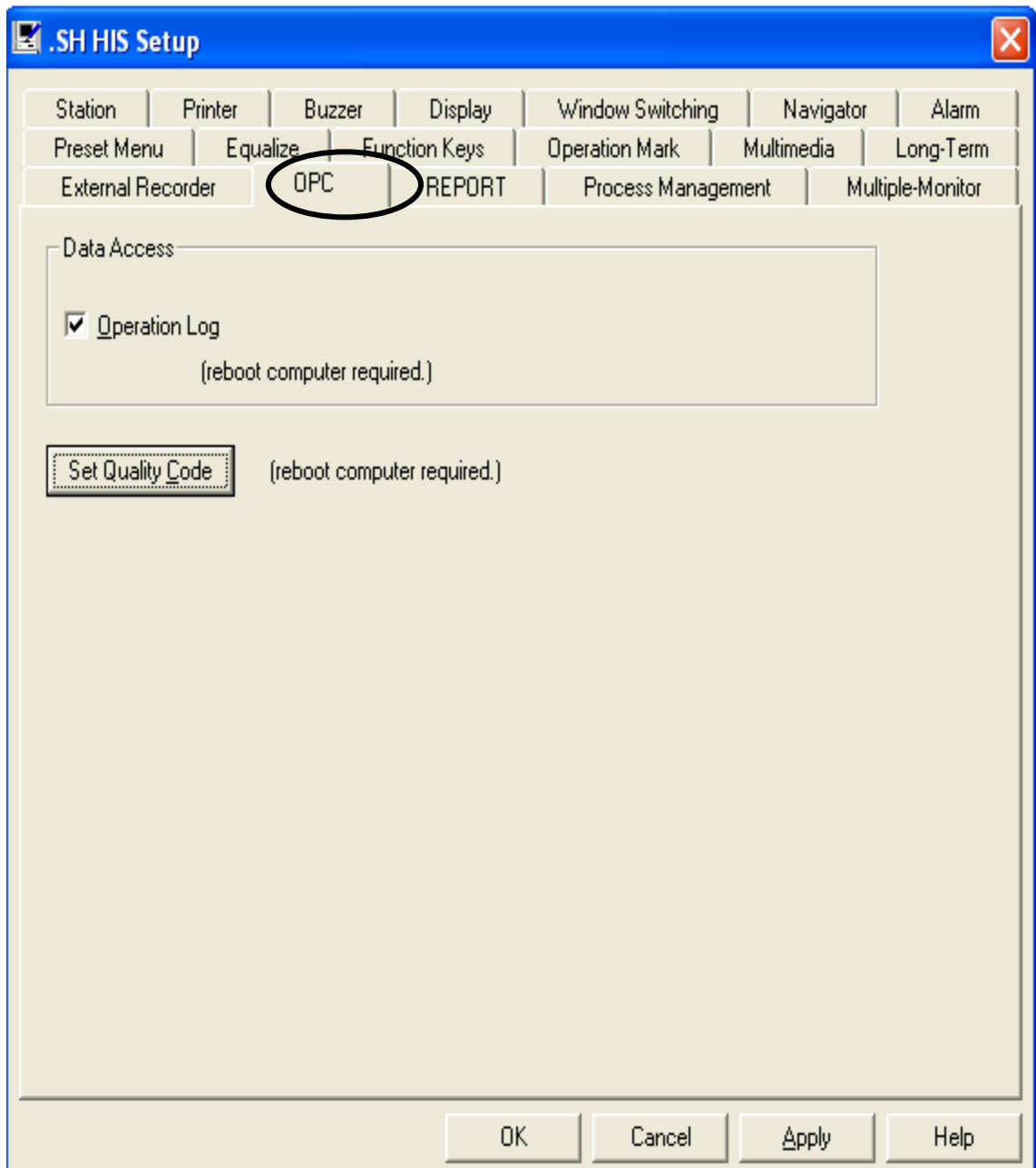


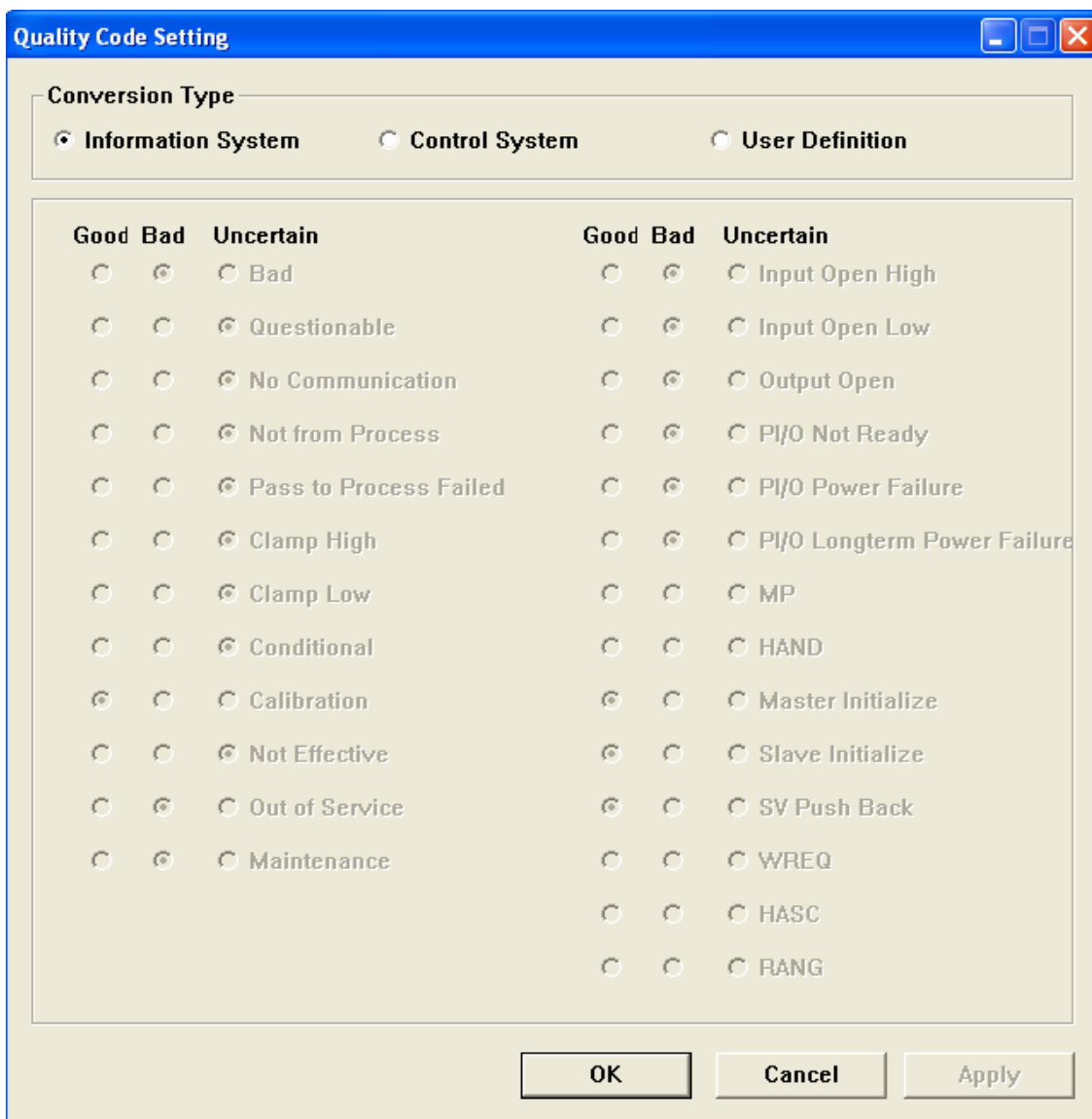
Figure: OPC Tab of HIS Setup

## Data Access

When writing to OPC Data Access server, the operation messages can be logged. Check the option [Operation Log], the operation messages occurred will be logged. However, this setting takes effect only after the PC is restarted.

## Setting Quality Code

Click the [Set Quality Code] button to show the dialog box for setting quality codes.



The image shows a dialog box titled "Quality Code Setting" with a blue title bar and standard window controls. It contains a "Conversion Type" section with three radio buttons: "Information System" (selected), "Control System", and "User Definition". Below this is a large area with two columns of radio buttons for setting quality codes. Each code has three radio buttons labeled "Good", "Bad", and "Uncertain".

Code	Good	Bad	Uncertain
Bad	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Questionable	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
No Communication	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Not from Process	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Pass to Process Failed	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Clamp High	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Clamp Low	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Conditional	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Calibration	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not Effective	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Out of Service	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Maintenance	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Input Open High	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Input Open Low	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Output Open	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
PI/O Not Ready	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
PI/O Power Failure	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
PI/O Longterm Power Failure	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
MP	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
HAND	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Master Initialize	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Slave Initialize	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
SV Push Back	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
WREQ	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
HASC	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
RANG	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

At the bottom of the dialog box are three buttons: "OK", "Cancel", and "Apply".

## Quality Code Setting Dialog Box

### Conversion Type

Select a table to be used for associating the data status of process data and the major classification of quality flags. [Information System] is selected by default.

- **Information System**

Select this option when the information processing system definition table is to be used. The related information is displayed in the bottom section of the screen (no change can be made).

- **Control System**

Select this option when the control processing system definition table is to be used. The related information is displayed in the bottom section of the screen (no change can be made).

- **User Definition**

Select this option when the user definition table is to be used.

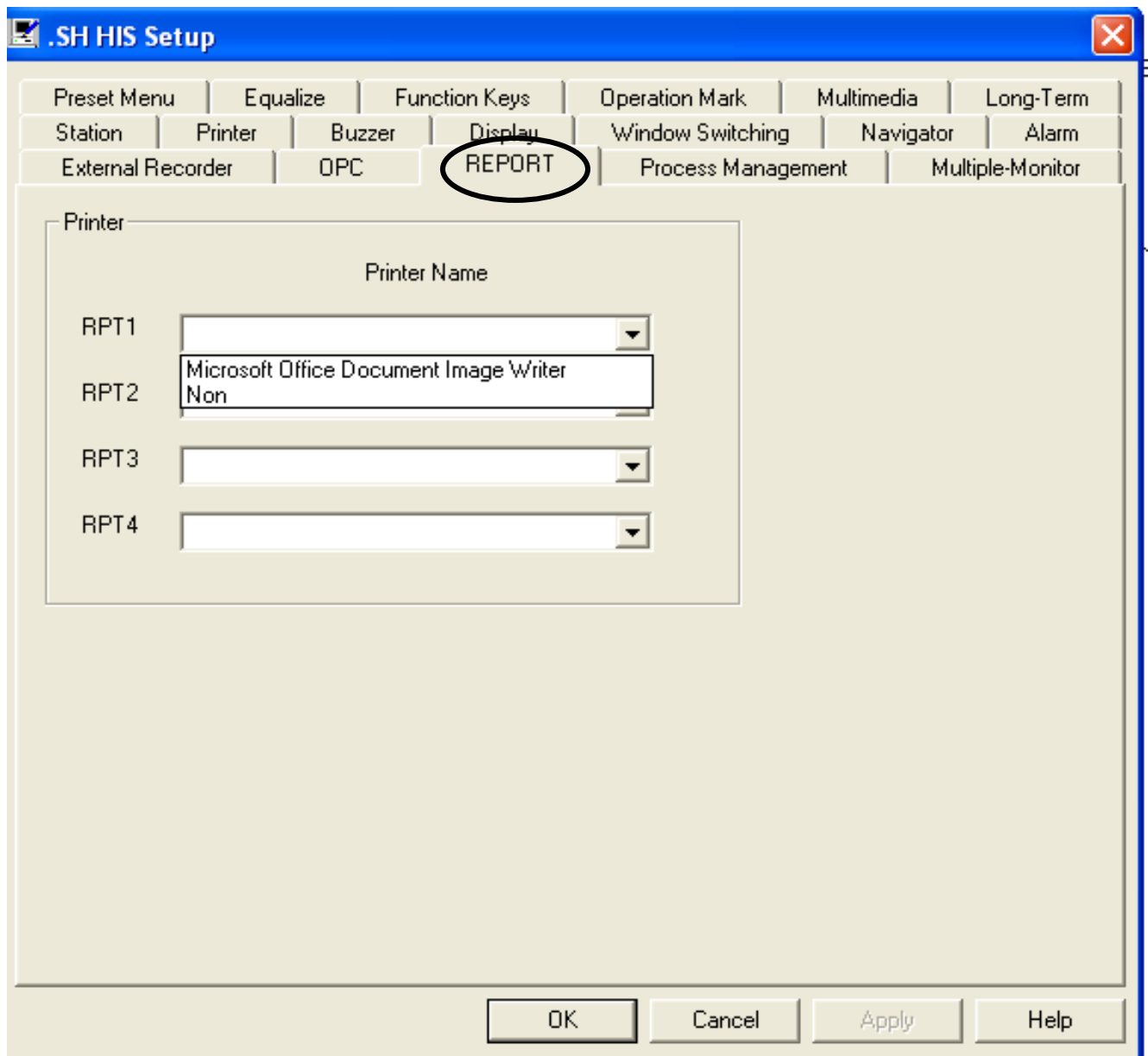
If "User Definition" is selected in the [Conversion Type] section, define the major classification to be associated with each data status.

For example, in order to associate the data status Input Open High to major classification BAD, select the BAD option button from the option buttons next to Input Open High by clicking.

If none of the options among Good, Bad and uncertain is checked, the Good becomes a tacit choice.

## 8.16 Report

Report tab on HIS Setup window is used for setting the report related settings. The settings can be set to Report tab only when Report Package is installed.



### Printer

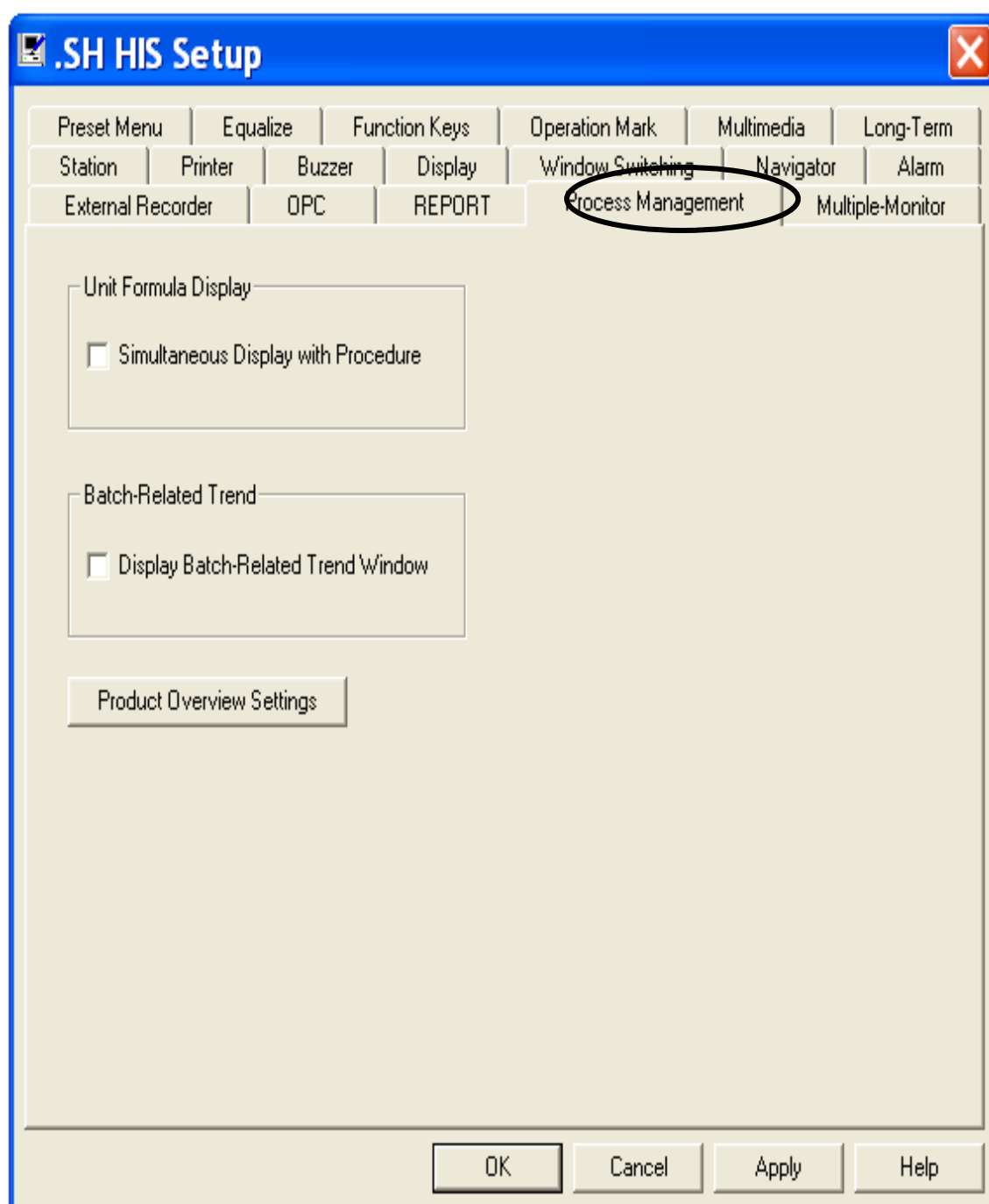
A printer for outputting the report can be designated. If the designation is omitted, the default printer of the HIS will be used.

## 8.17 Process Management

The settings regarding to process management can be set on Process Management tab. The settings can be set only when Process Management package is installed in the HIS.

### Unit Formula Display

If this check box is checked, the formula dialog box displays when the recipe procedure window or unit recipe procedure window is displayed. By default, this check box is not checked.



### **Unit Formula Display**

If this check box is checked, the formula dialog box displays when the recipe procedure window or unit recipe procedure window is displayed. By default, this check box is not checked.

### **Batch Related Trend**

When the option [Display Batch-Related Trend Window] is checked, the trend window linked to the batch can be displayed on the client PC or HIS backup server PC.

If the HIS is the master server, this option will be ignored.

When this option is checked, it is necessary to set the same trend acquisition pen assignments (including the trend type "Acquired by other HIS") as the trend window that has the same name on HIS master server.

If discrepancy exists, trend window different from the HIS master server's may be displayed.

### **Product Overview Settings**

Click [Product Overview Settings] button, Product Overview Settings dialog box displays.

On this dialog box, the toolbar and tool buttons on Product Overview window can be customized.

## 8.18 Multiple-Monitor

The settings regarding to multiple monitors can be set on Multiple-Monitor tab. The settings can be set only when Multiple-Monitor Support Package is installed in HIS.

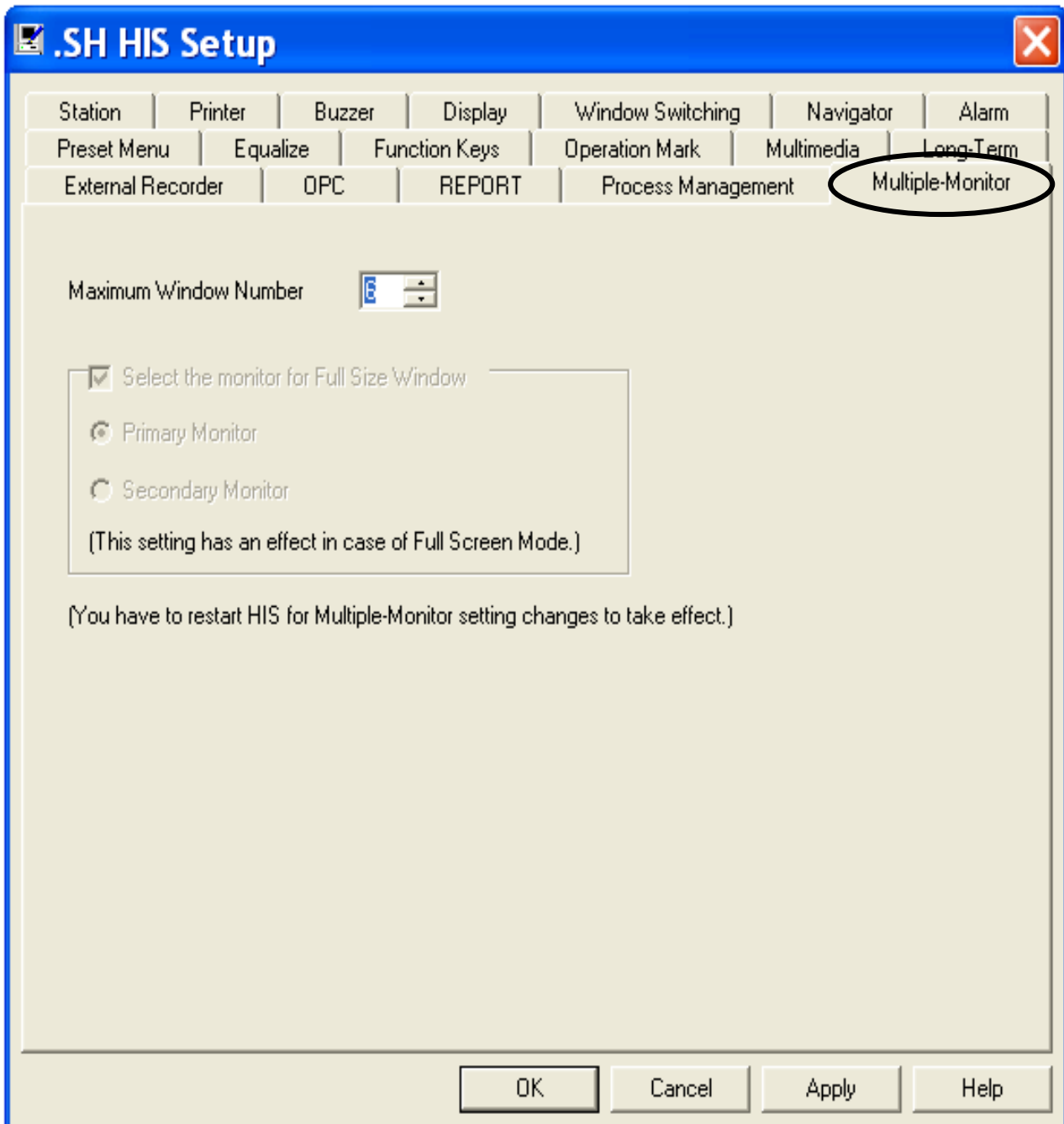


Figure: Multiple Monitor tab of HIS Setup

**Maximum Window Number**

Set the maximum number of windows to be displayed.

The default setting is 6 per HIS. The setting range is from **5 to 10**.

If **7** is set, the refresh period of the windows, except for the full-size window, takes as much as twice time of basic period.

**Select the Monitor for Full-Size Window**

Select **primary monitor** or **secondary monitor** for displaying the full-size window. The full size window is displayed on the selected monitor only.

This setting is valid only when HIS is in full-screen mode.



## 9. Other Windows

---

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## 9.0 Panel Set

Panel Set is automatic setting of predefined windows on the HIS.

- 200 panel sets can be programmed for one HIS.
- Each panel set can set up to 5 Windows.
- Panel sets are created in HIS Engineering Builder.

Panel Sets can be activated by

- Preset Menu
- Function Key on the Operator Keyboard
- Touch Target or Push Button in Graphic Window
- Sequence Table through Sequence Message Request
- Using Name Input Dialog Panel Set can be called with Syntax \$ Tagname

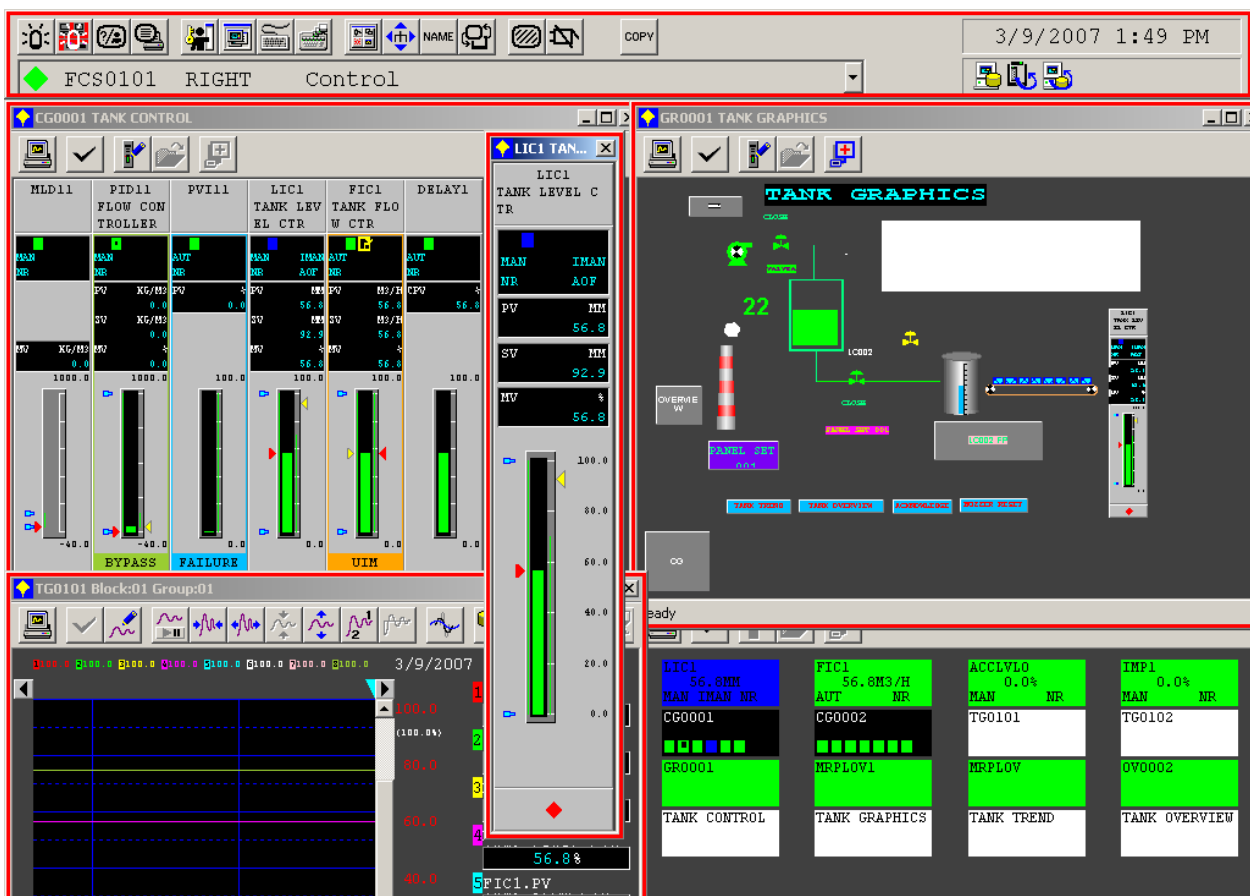


Figure : Example of Panel Set

## 9.1 Digital Input (DI)

Digital Inputs are contact inputs from field to CS3000.

Digital Inputs are used to indicate the

- i) ON / OFF status of pumps, motors, heaters, etc.
- ii) OPEN / CLOSE status of on-off valves.

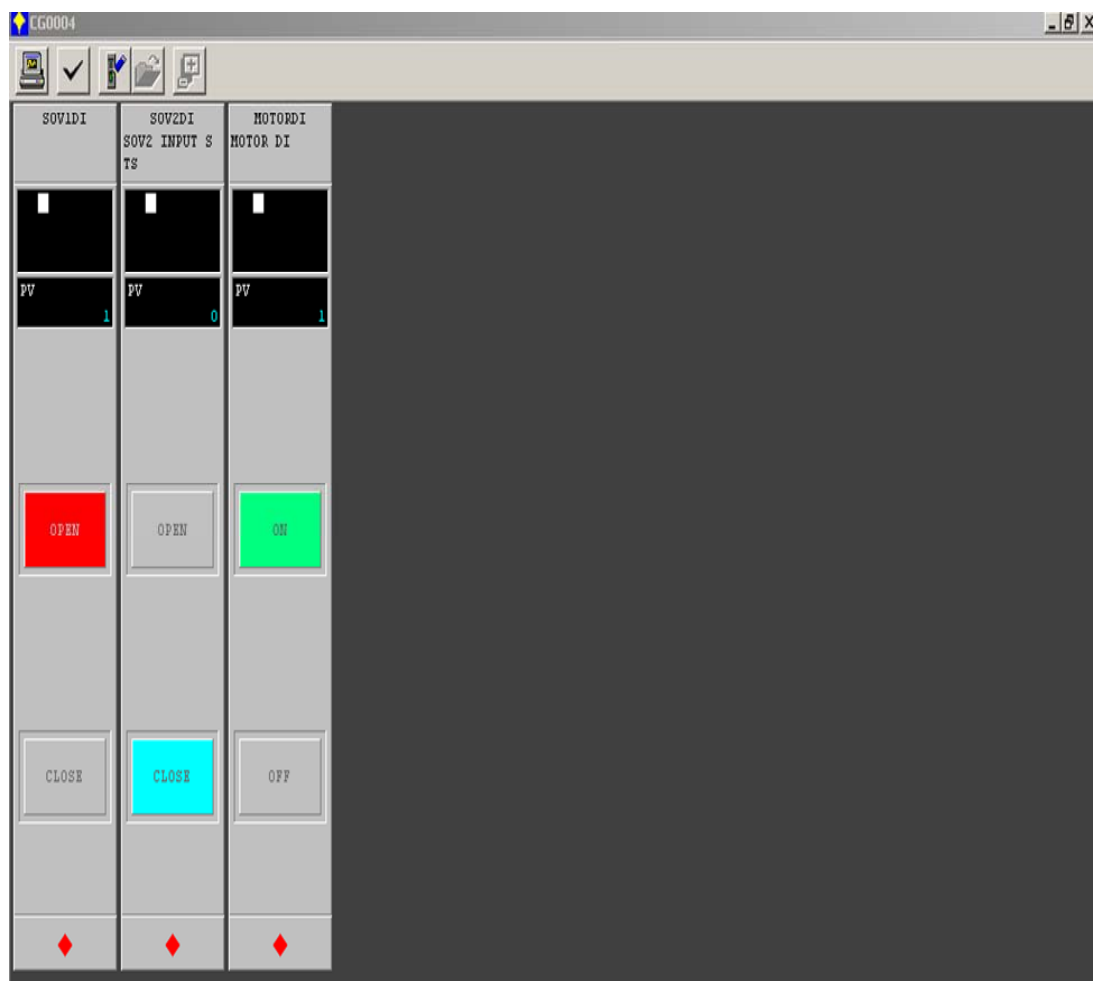


Figure: Example of Digital Inputs (DIs)

**System Code : %ZnnusccSddss**

**%Z - Process Input/Output**

**nn - node number**

**u - I/O unit number**

**s - Slot number**

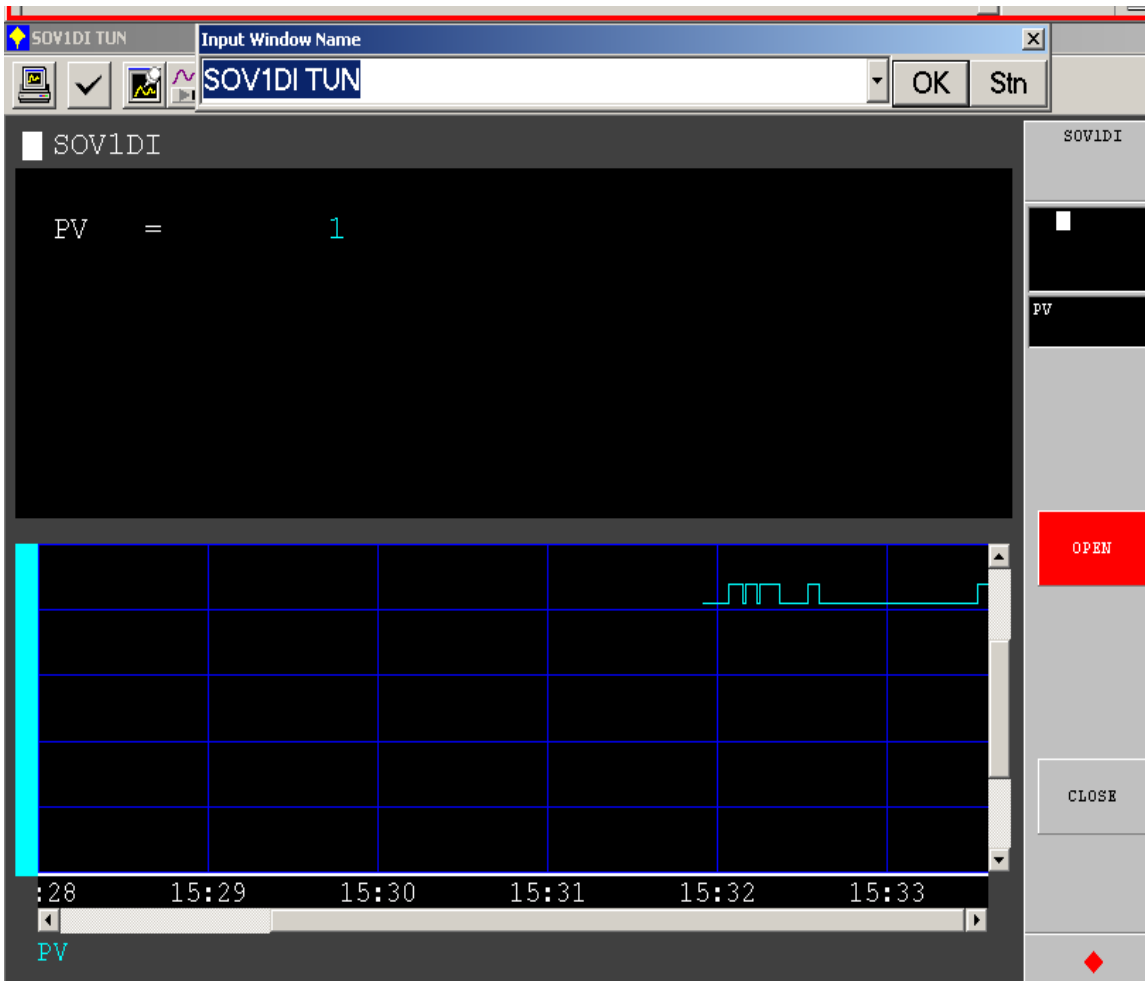
**cc - Channel number**

**S - Station**

**dd - Domain number**

**ss - Station number**

## Digital Input Tuning Window



### Details

- PV=1 Indicates contact is closed in field
- PV=0 indicates contact is open in field
- PV=1, DI=ON
- PV=0, DI=OFF

## 9.2 Digital Output (DO)

Digital Outputs are contact outputs from CS3000 to field.

Digital Outputs are used to

- i) Switch ON / OFF pumps, motors, heaters etc.
- ii) OPEN / CLOSE on-off Valves.

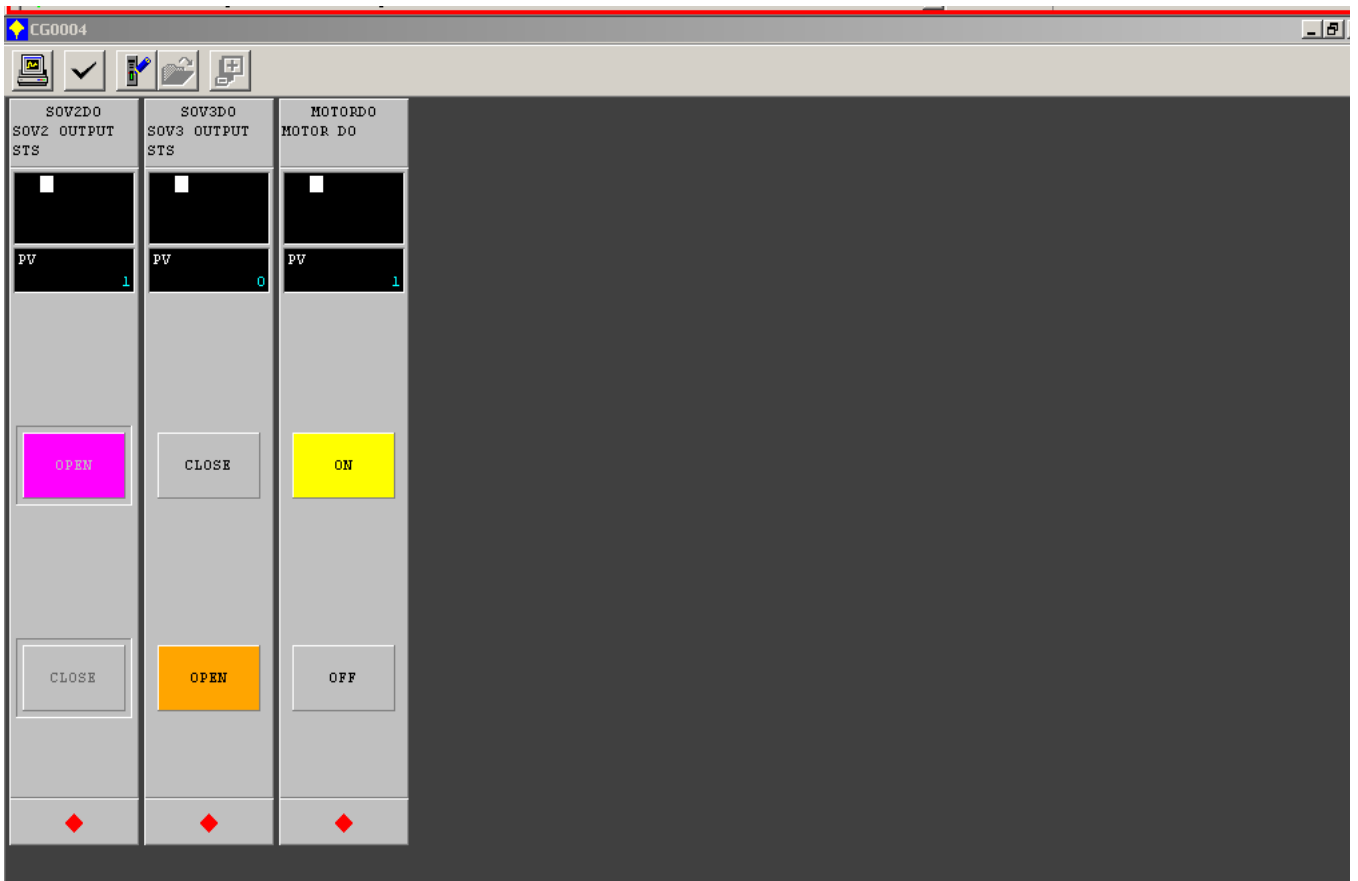


Figure: Example of Digital Inputs (DIs)

**System Code : %ZnnusccSddss**

**%Z - Process Input/Output**

**nn - node number**

**u - I/O unit number**

**s - Slot number**

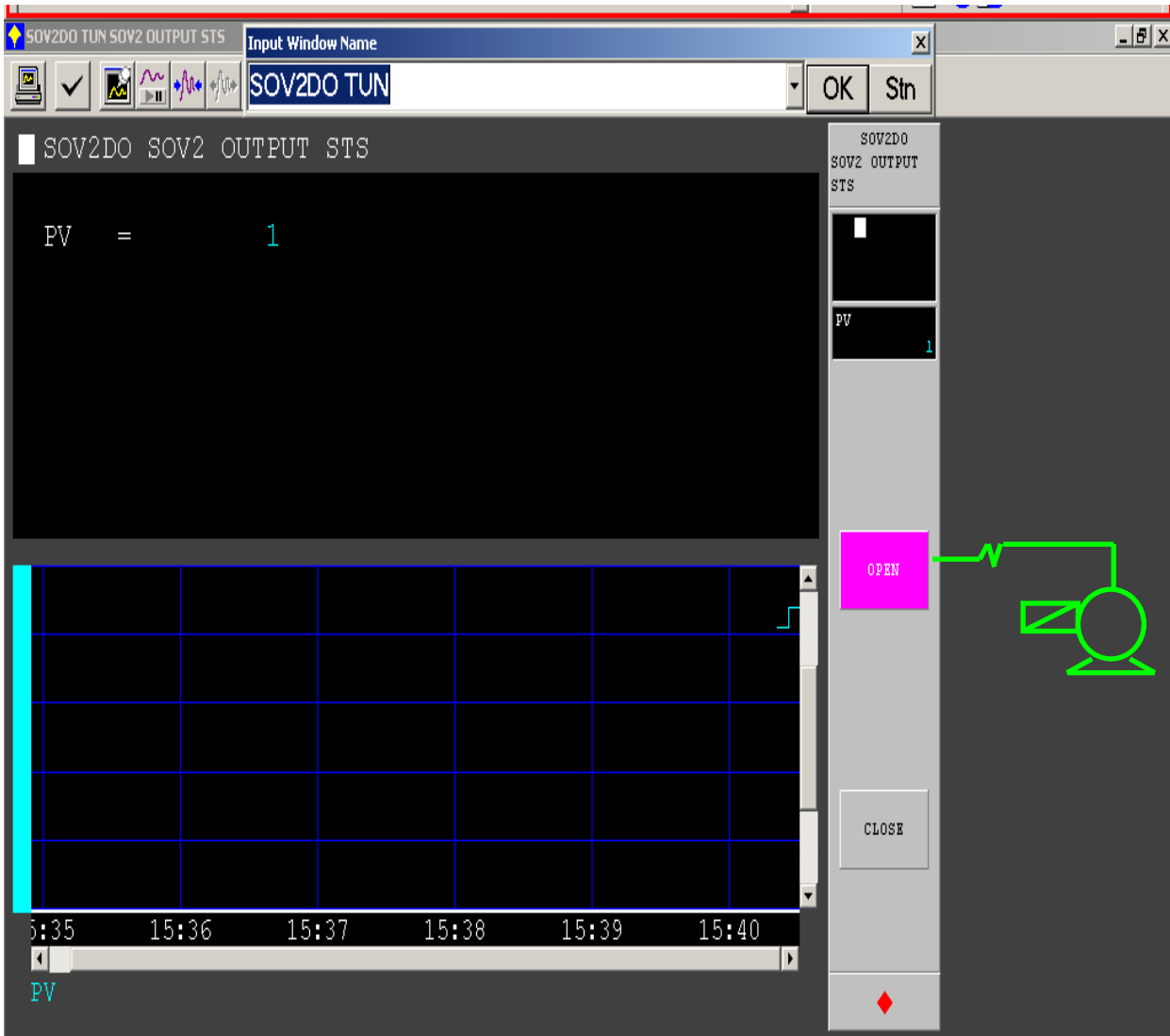
**cc - Channel number**

**S - Station**

**dd - Domain number**

**ss - Station number**

## Digital Output Tuning Window



**PV=1** Indicates output relay is energized

**PV=0** indicates output relay is de energized

**PV=1 DO=ON**

**PV=0 DO=OFF**

---

## 9.3 Switches (SW)

Switches are used to store intermediate variables in the interlocks. Switches are internal flags that can be set and reset whenever required.

Switches are used for auto / man selection, pump selection, speed selection, bypass selection etc..

Switches are classified into Global switches and Common Switches.

**Global Switches:** These are common to all FCS.

The status of global switches is transmitted to other FCS through link transmission. Hence they can be set and referred in any FCS.

**Common Switches:** These are used to within the FCS. They are specific to each FCS.

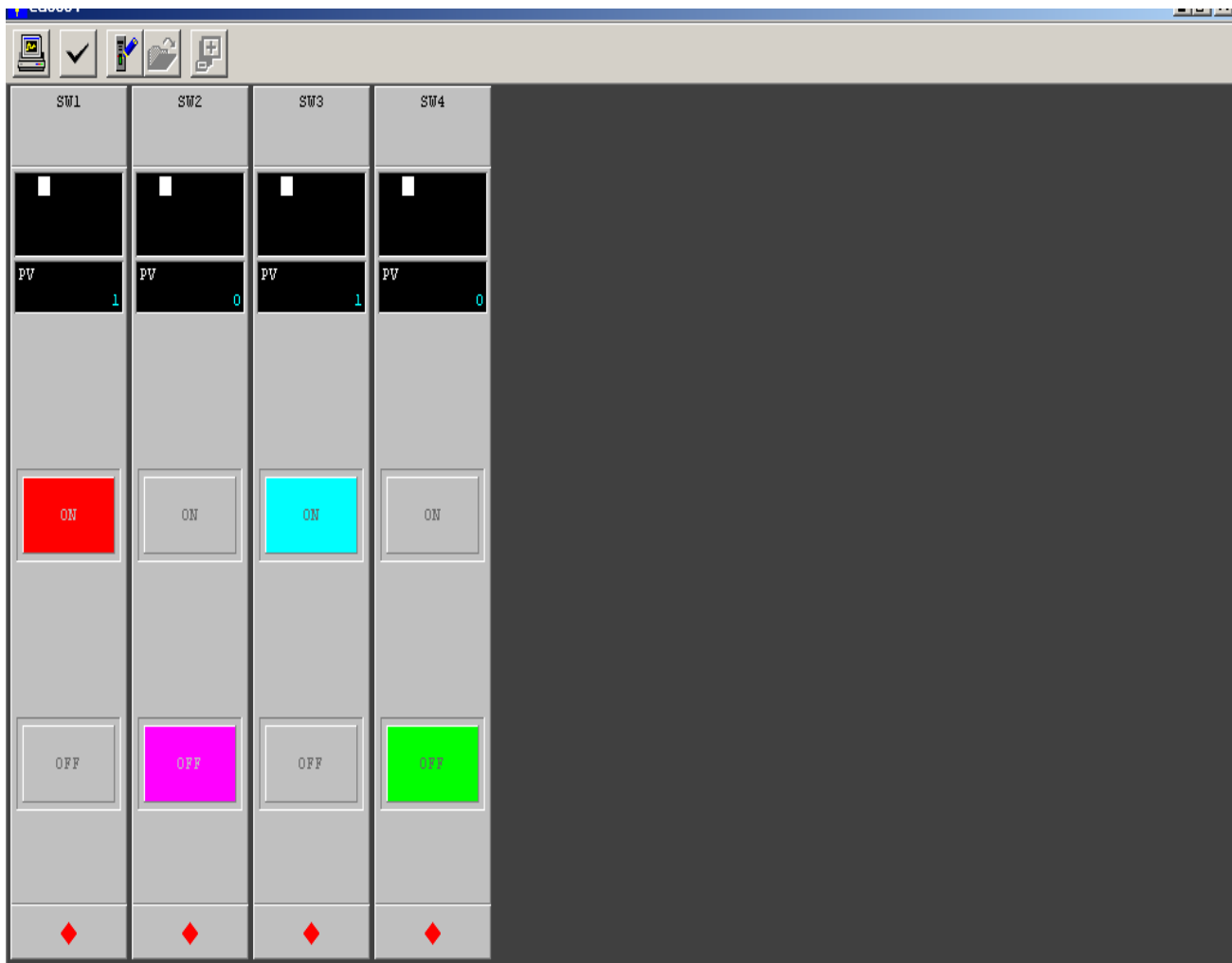
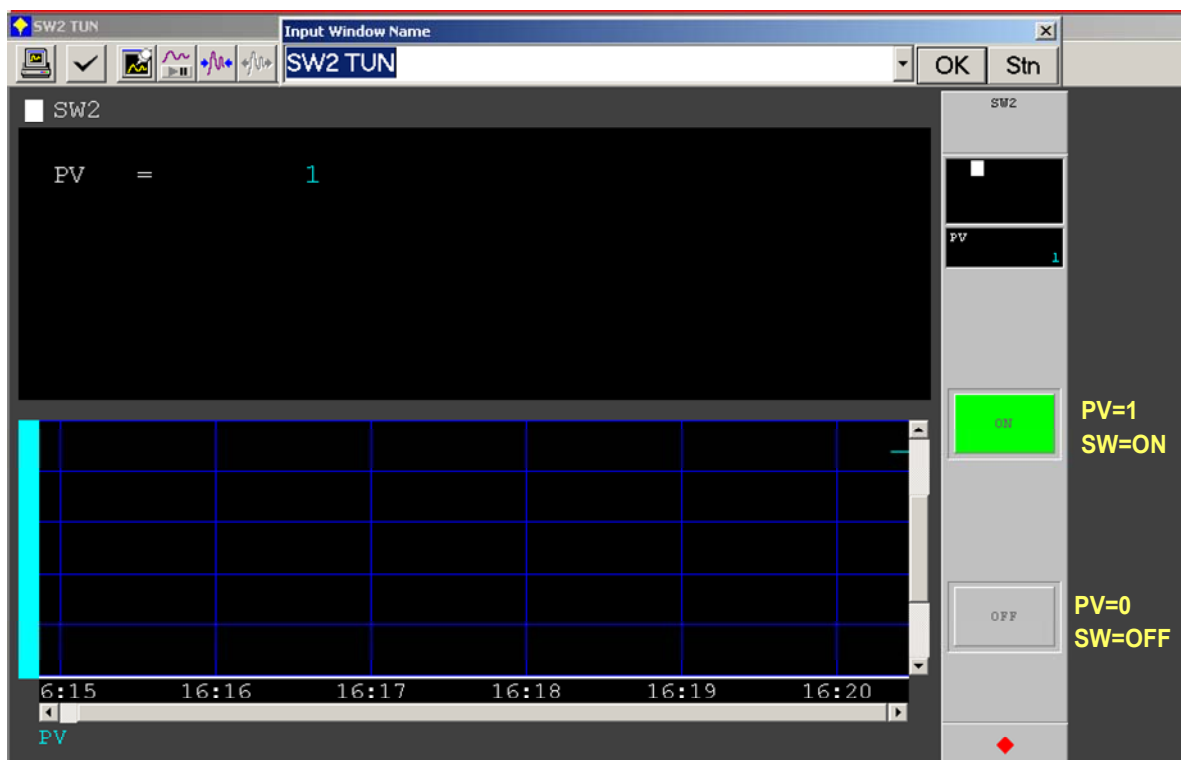


Figure: Example of Switches



**Details:****Global Switches :****Max.256 GS/FCS****System Code: %GSxxxxSddss****%GSxxxx - Switch number (0001 - 0256)****dd - Domain number****ss - Station number****Common Switches****Max.4000 SW/FCS****System Code: %SWxxxxSddss****%SWxxxx - Switch number (0001 - 4000)****dd - Domain number****ss - Station number****Switches Tuning Window**

## 9.4 Timer (TM)

Timers are used to introduce time delays in Sequence Table.

There are two types of timers, They are

- Second timer
- Minute timer

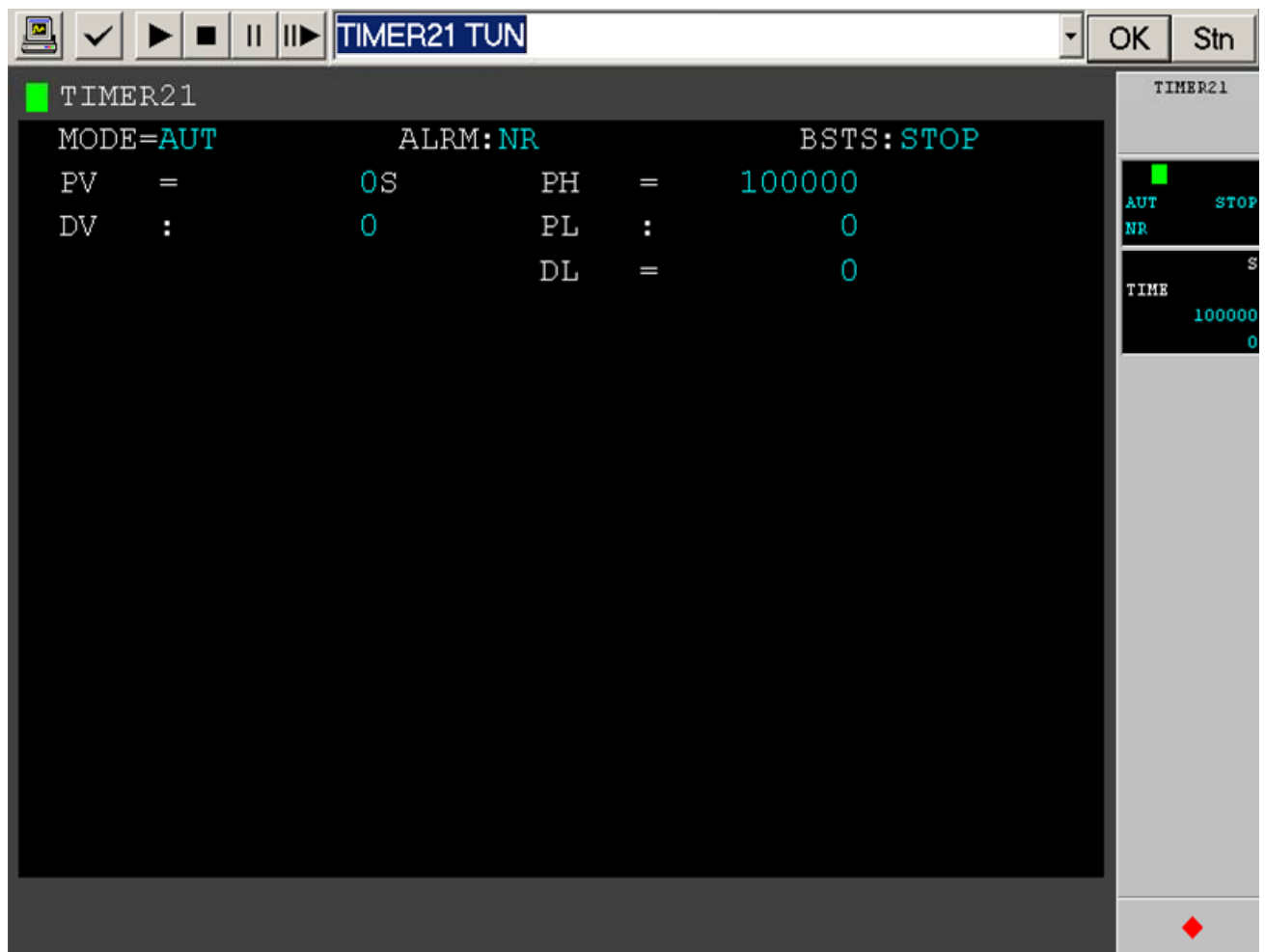
PH = Maximum time the timer should count

PV = Actual time the timer has counted

DV = PH-PV i.e. the time left to finish counting

DL = Deviation limit

### Tuning Window of Timer



---

## Timer Operation

- When the timer is started, PV starts incrementing automatically.  
Then, Alarm status is NR
- When the timer has finished timing, i.e. when  $PV = PH$   
Block status is CTUP
- When the timer is stopped while timing ,Then Block status is STOP
- When the timer is paused while timing ,Then Block Status is PAUS
- When the  $DV < DL$  ,Then Block status is PALM

Any of the alarm status can be referred in sequence table as a condition signal.

## 9.5 Counter (CTS/CTP)

Counter is used to count internal events or external pulses. Counter PV updates by one every time the counter is started

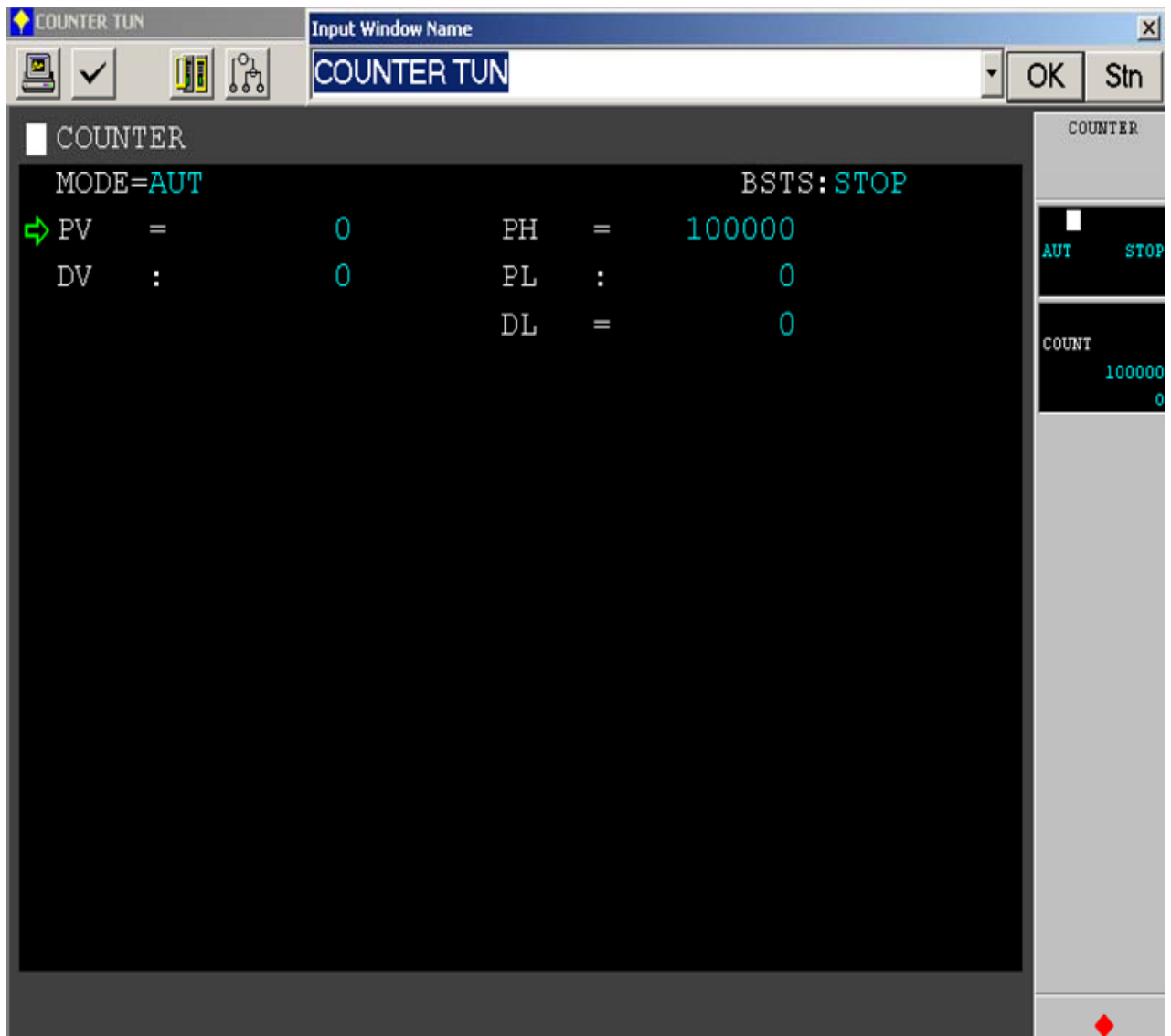
There are two types of Counter

a) CTS – Internal Counter

b) CTP - Pulse counter

Counter operation is same as timer except that pause option is not available.

### Tuning Window of Counter



## 9.6 Annunciator Messages

Annunciator messages are user defined alarms.

These messages are activated through sequence table on a specific condition.

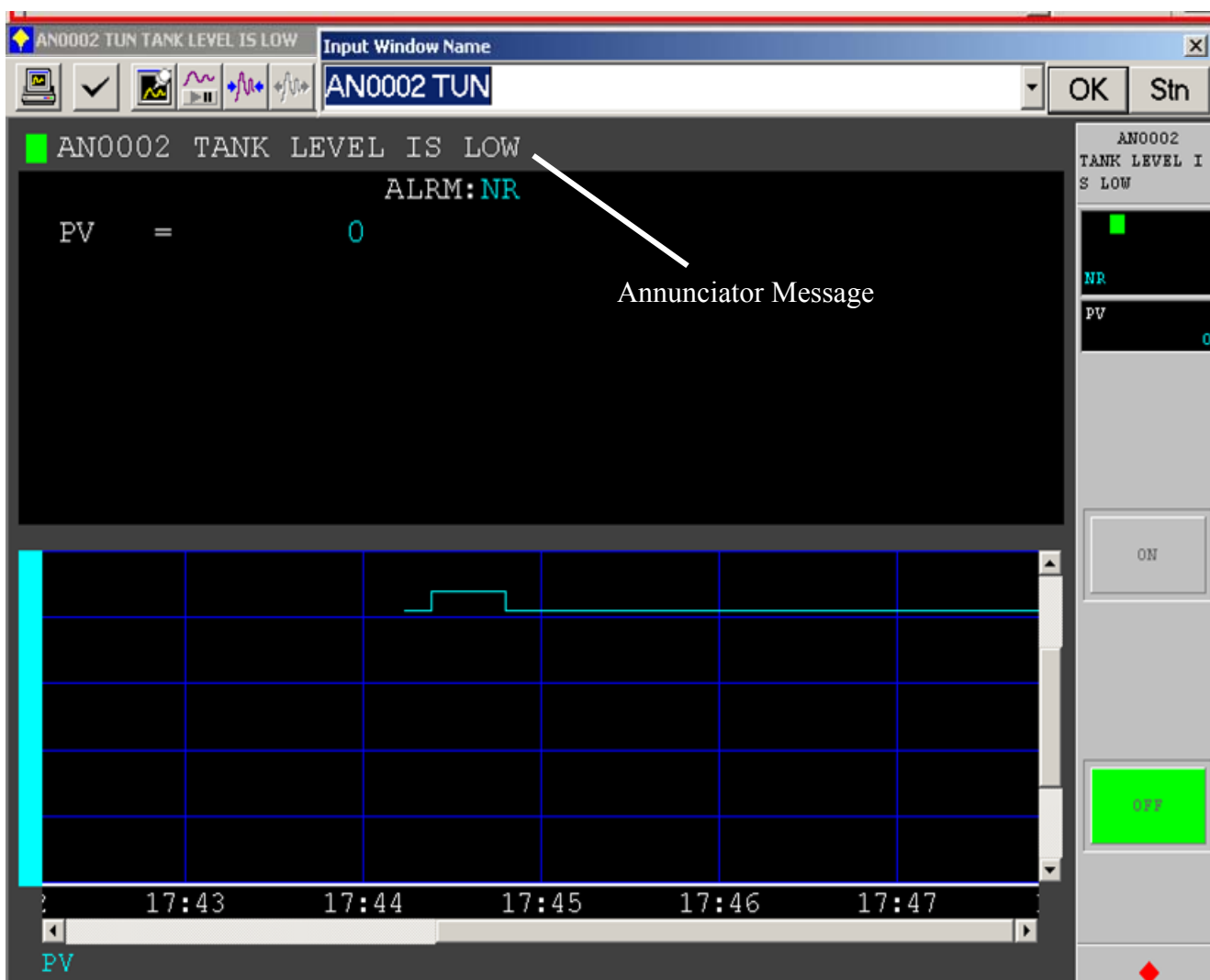
When an annunciator is activated, the annunciator messages appear on the System Message Area as well as on the Process Alarm Window.

Once the alarm is acknowledged, disappears from the System Message Area.

When the annunciator resets, the annunciator messages disappear from Process Alarm Window.

System Code: %ANxxxxSddssaa

### Tuning Window of Annunciator Message



## 9.7 Switch Instruments

There is a category of instruments called status input output instruments generally referred to as SIOs.

Sequence instruments status input output instruments are used to

- Switch ON/OFF motors, pumps, heater etc...
- OPEN / CLOSE on-off valves
- Indicate the ON/OFF status of motors, pumps, heaters etc.
- Indicate the OPEN/CLOSE status of on-off valves.

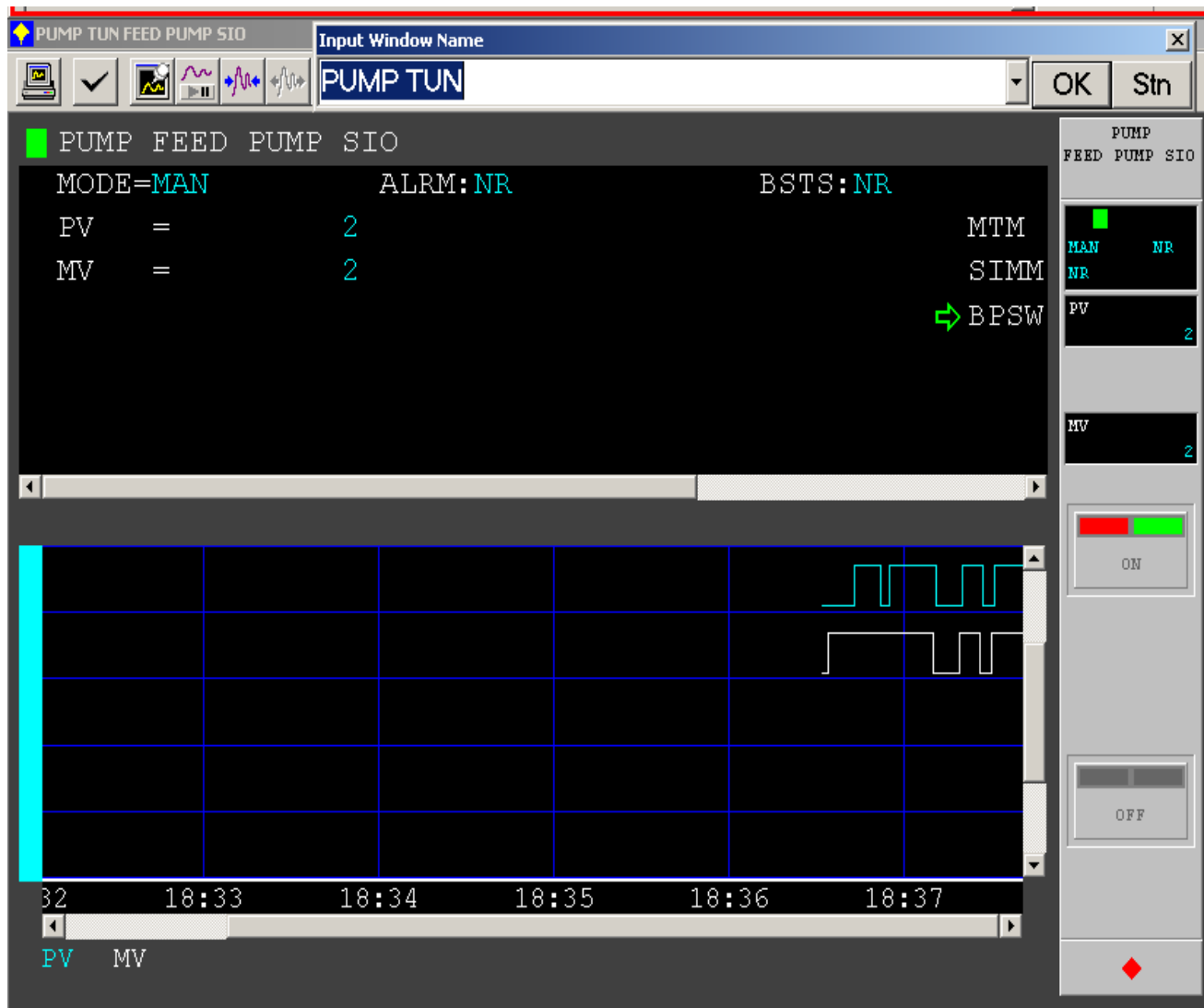


Figure: Example of a Switch Instrument

### 9.7.1 Normal operation of SIO

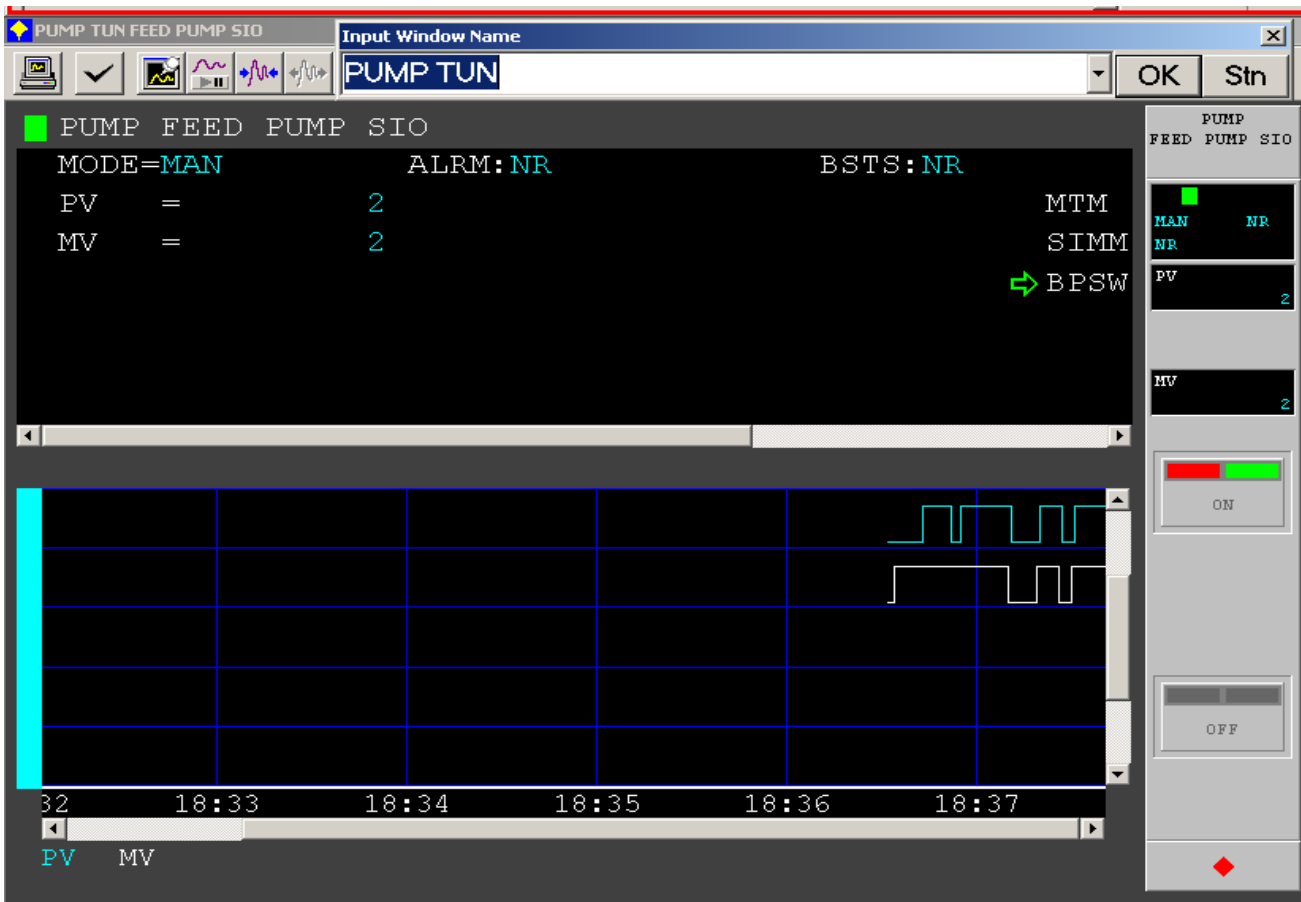


Figure : Example of a Switch Instrument (under Normal Condition)

In SIOs, MV is referred as the output signal of the SIO. PV is referred as the answerback signal of the SIO.

When MV =2, the DO is ON, the output relay is energized. The equipment connected to the relay is ON.

The answerback DI is taken from the contact of the equipment. Since the equipment is ON, the contact closes. So the DI is ON, then PV becomes 2.

When MV =0, DO is OFF, the output relay is de-energized. The equipment connected to the relay is OFF.

Since the equipment is OFF, the answerback contact opens. So the DI is OFF, then PV becomes 0

Alarm Status is NR in the above conditions

### 9.7.2 Abnormal Operation of the SIO.

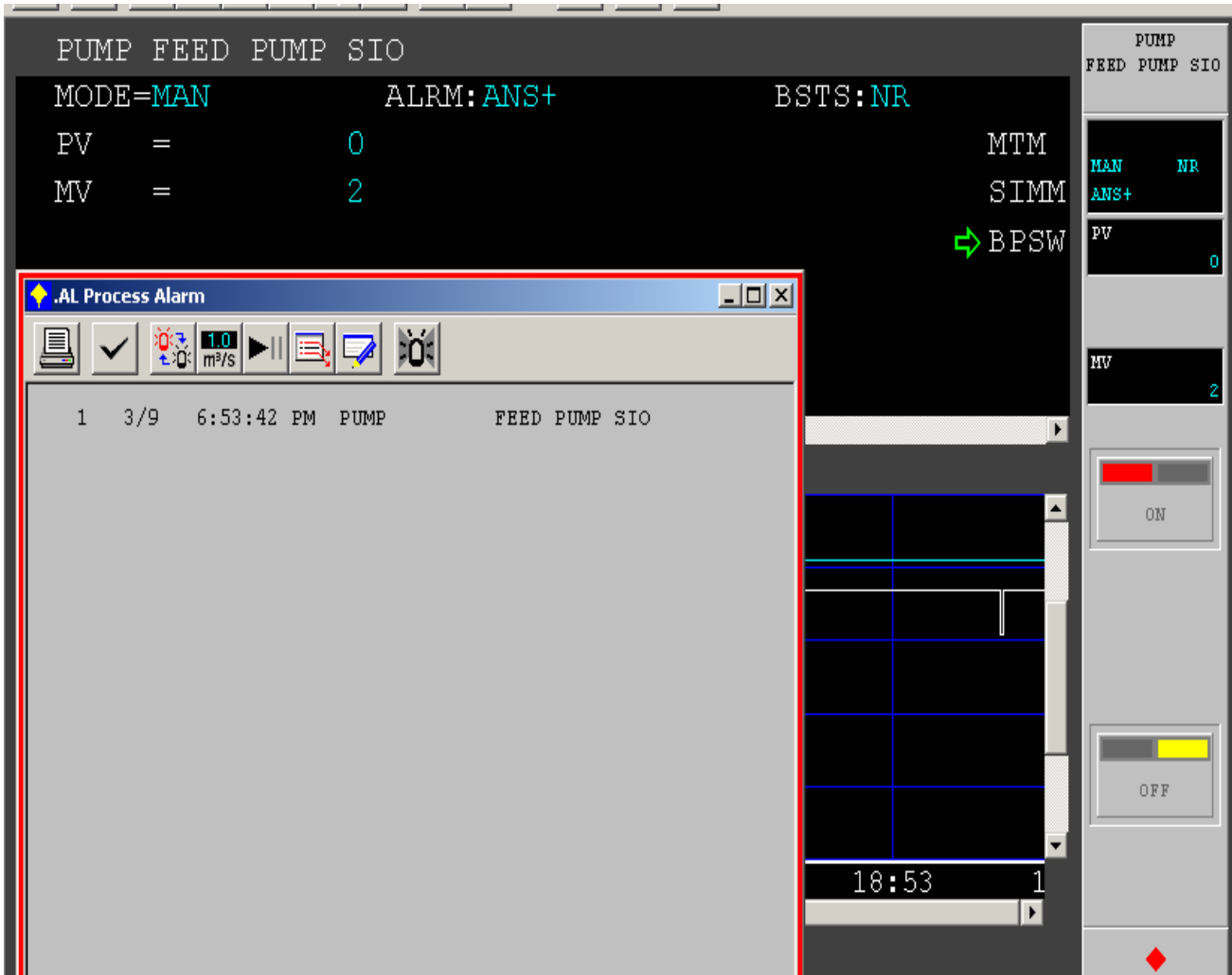


Figure: Example of a Switch Instrument (under Abnormal Condition)

When  $MV = 2$ , the DO is ON, the output relay is energized. The equipment connected to the relay is ON.

If the answerback DI is not ON, then  $PV=0$ , SIO generates an **ANS+** alarm automatically.

Similarly, when  $MV = 0$ , DO is OFF, the output relay is de-energized. The equipment connected to the relay is OFF.

If DI is still ON then PV becomes 2, SIO generates **ANS-** alarm automatically.

This alarm will be displayed in the system Message Area as well as the Process Alarm Window.



## 9.8 Inter Locks

In CS3000, the interlocks / conditions are written in two forms.

- i) Sequence Table: here the logic is represented in a tabular form.
- ii) Logic Chart: here the logic is represented using logic gates in graphical form.

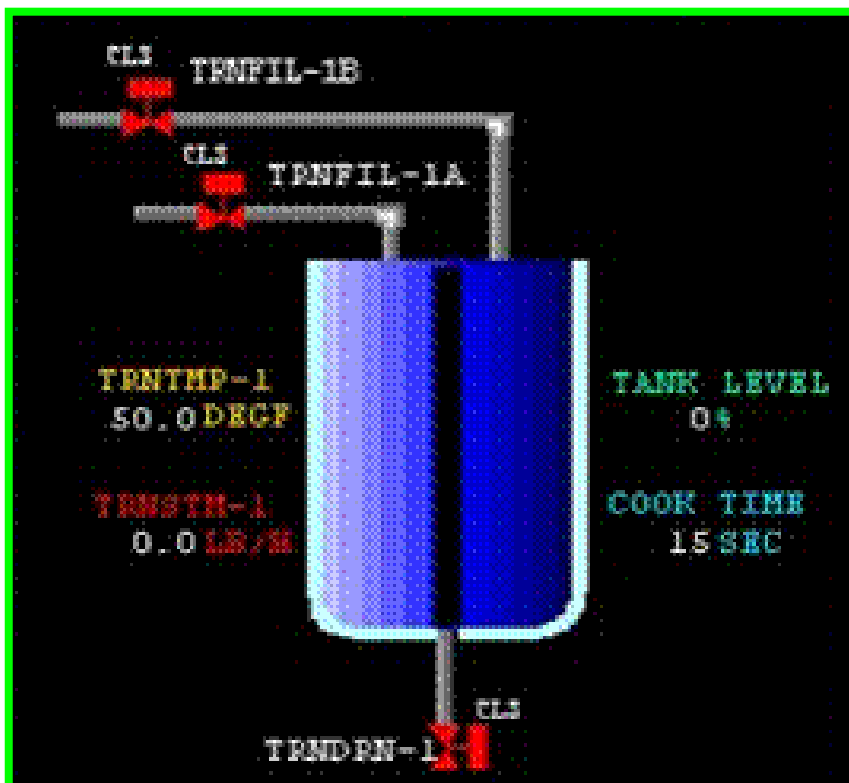


Figure: Snap Shot of a Process

# 9.8.1 Logic Charts

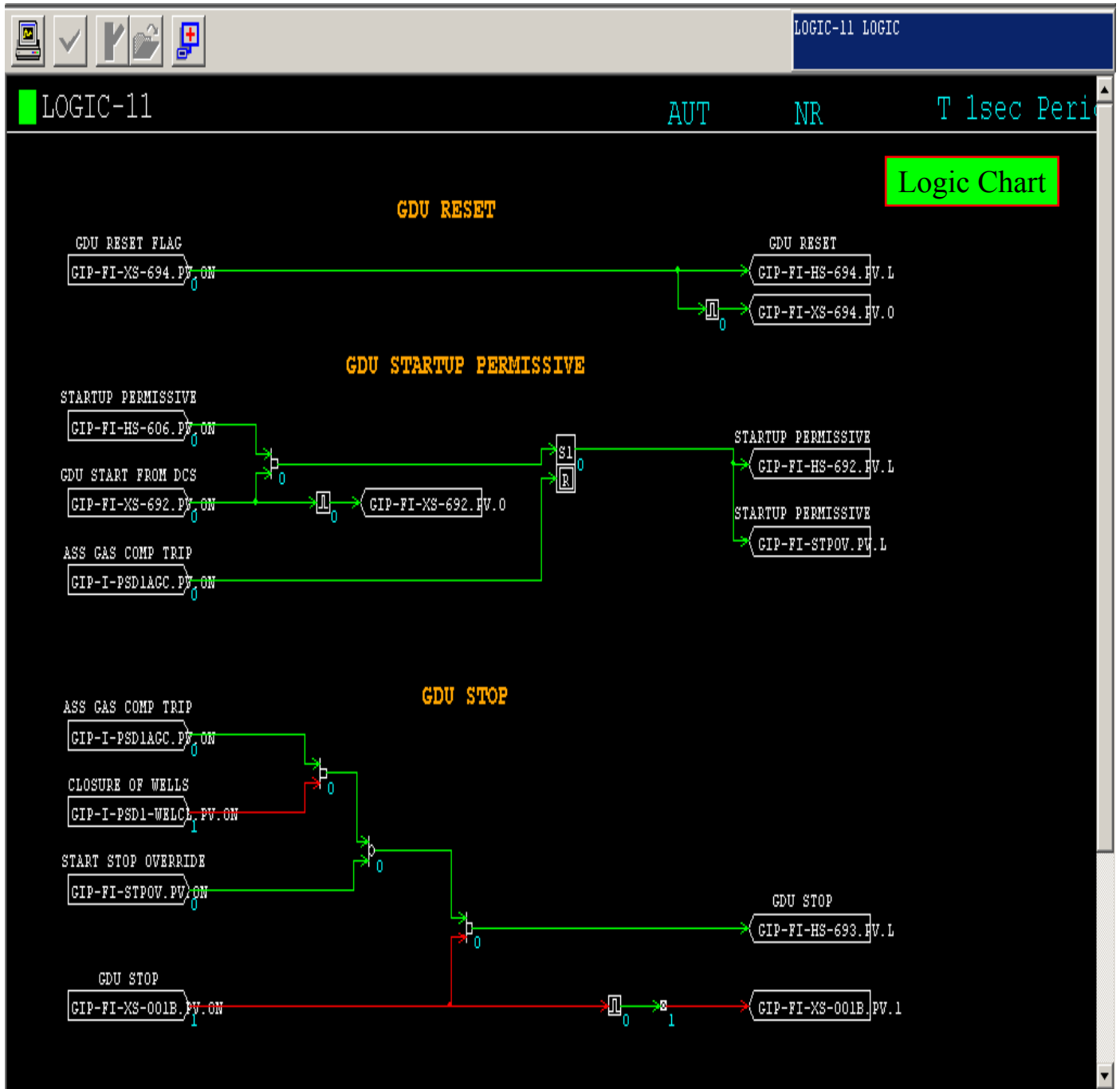
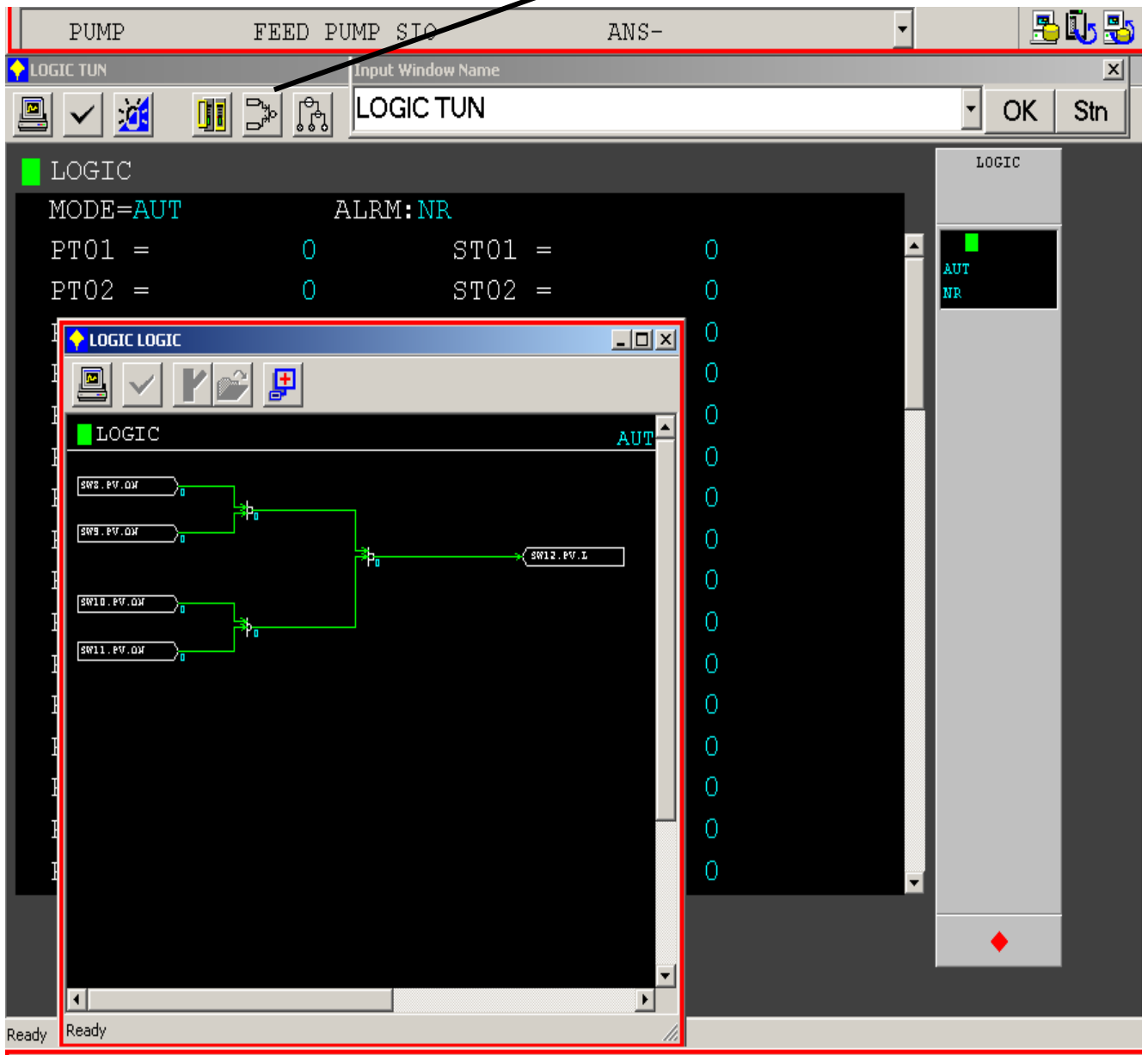


Figure: Process with its Interlocks in LC-64

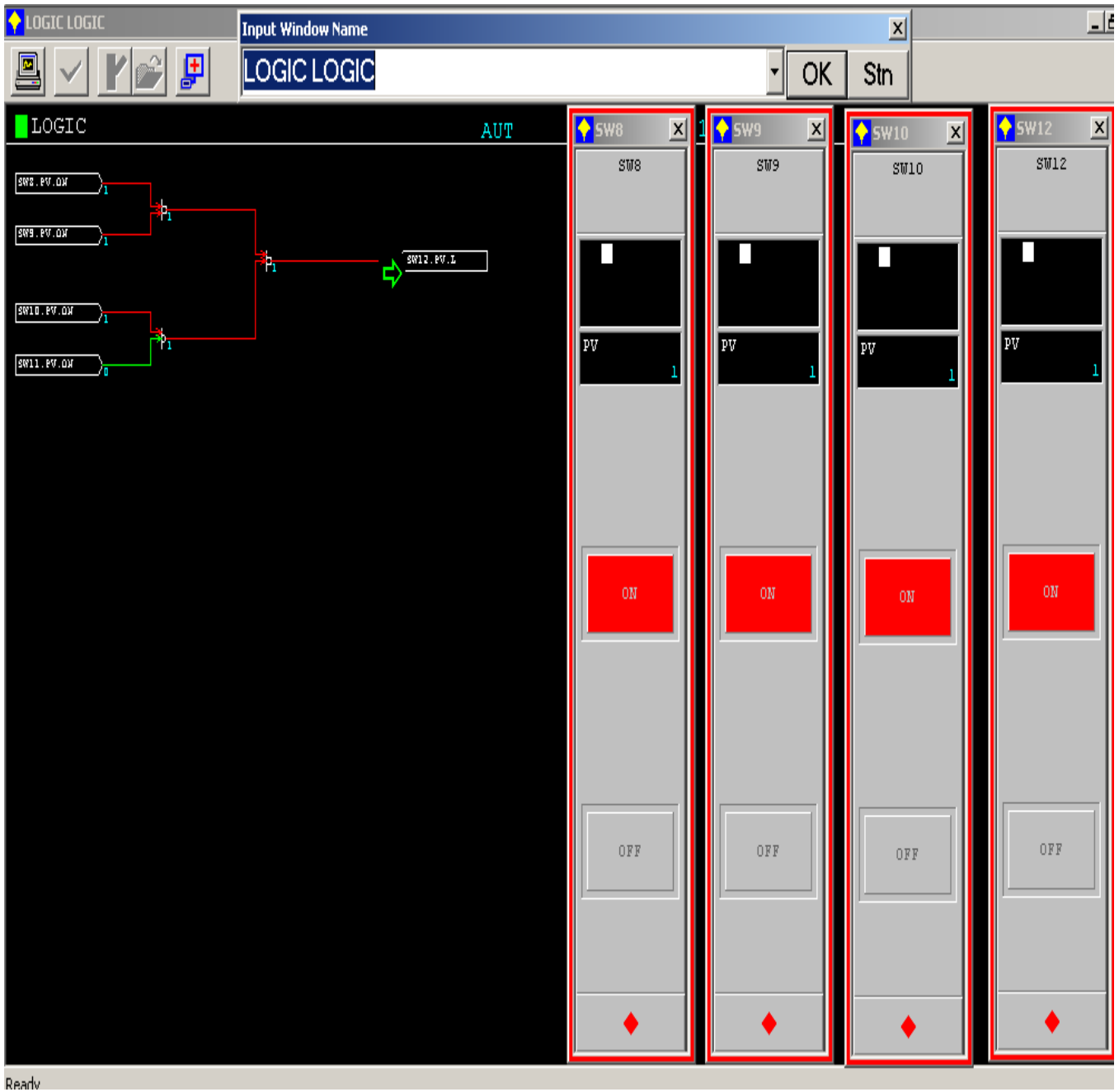
## Methods to call Logic Charts

### i) From Tuning Window

Select this icon to display the Logic Chart



iii) From the Name Input Dialog Box



## 9.8.2 Sequence Table (ST-16)

The screenshot displays a software interface for a Sequence Table (ST-16). At the top, a toolbar contains various icons and a 'COLOUR BAND' label. Below the toolbar, the 'DIGST TABLE' window is open, showing a table with columns for 'No', 'Description', and a grid of 'Y' and 'N' characters. The table is divided into three sections: 'RULES', 'CONDITIONS', and 'ACTIONS'. To the right of the table, four vertical panels represent interlocks SW1, SW2, SW4, and SW6. Each panel shows a 'PV' (Process Variable) value and an 'ON/OFF' button. The 'ON' buttons for SW1, SW4, and SW6 are red, while the 'OFF' button for SW2 is pink. A 'Ready' status is shown at the bottom left.

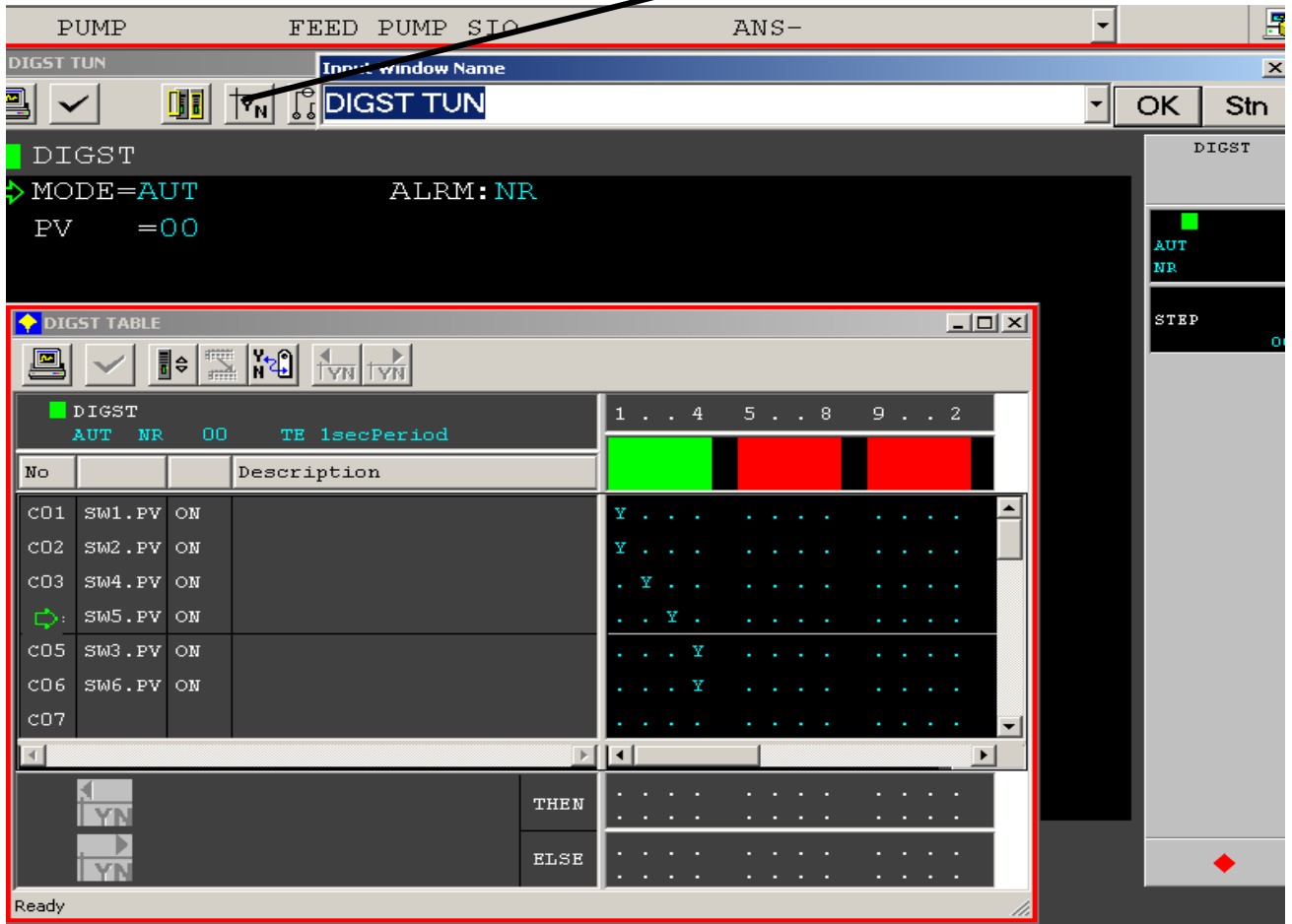
No	Description	1	2	3	4	5	6	7	8
C01	SW1.PV ON	Y	.	.	.	.	.	.	.
C02	SW2.PV ON	Y	.	.	.	.	.	.	.
C03	SW4.PV ON	.	Y	.	.	.	.	.	.
C04	SW5.PV ON	.	.	Y	.	.	.	.	.
C05	SW3.PV ON	.	.	.	Y	.	.	.	.
C06	SW6.PV ON	.	.	.	.	Y	.	.	.
C07		.	.	.	.	.	.	.	.
C08		.	.	.	.	.	.	.	.
A01	SW3.PV L	Y	.	.	.	.	.	.	.
A02	SW6.PV L	.	Y	Y	.	.	.	.	.
A03	SW7.PV L	.	.	.	Y	.	.	.	.
A04		.	.	.	.	.	.	.	.
A05		.	.	.	.	.	.	.	.
A06		.	.	.	.	.	.	.	.
A07		.	.	.	.	.	.	.	.
A08		.	.	.	.	.	.	.	.

Figure: Process with its Interlocks in Sequence Table (ST-16)

Method to call Sequence Table

- i) From Tuning Window

Select this icon to display the Sequence Table



ii) From Name Input Dialog Box

The screenshot displays a control system interface with a main window titled "DIGST TABLE" and four floating dialog boxes for switches SW1, SW2, SW4, and SW6. The main window contains a table with columns for "No", "Description", and a grid of status indicators. The floating dialog boxes show the current state of each switch, including "ON" and "OFF" buttons and a "PV" (Present Value) indicator.

No	Description	1	2	3	4	5	6	7	8
C01	SW1.PV ON	Y	.	.	.	.	.	.	.
C02	SW2.PV ON	Y	.	.	.	.	.	.	.
C03	SW4.PV ON	.	Y	.	.	.	.	.	.
C04	SW5.PV ON	.	.	Y	.	.	.	.	.
C05	SW3.PV ON	.	.	.	Y	.	.	.	.
C06	SW6.PV ON	.	.	.	.	Y	.	.	.
C07		.	.	.	.	.	.	.	.
C08		.	.	.	.	.	.	.	.
A01	SW3.PV L	Y	.	.	.	.	.	.	.
A02	SW6.PV L	.	Y	Y	.	.	.	.	.
A03	SW7.PV L	.	.	.	Y	.	.	.	.
A04		.	.	.	.	.	.	.	.
A05		.	.	.	.	.	.	.	.
A06		.	.	.	.	.	.	.	.
A07		.	.	.	.	.	.	.	.
A08		.	.	.	.	.	.	.	.

The floating dialog boxes show the following states:

- SW1:** PV 1, ON button (red), OFF button (grey).
- SW2:** PV 0, ON button (grey), OFF button (magenta).
- SW4:** PV 1, ON button (yellow), OFF button (grey).
- SW6:** PV 1, ON button (red), OFF button (grey).

At the bottom of the main window, there are "THEN" and "ELSE" sections with a grid of status indicators. The status "Ready" is displayed at the bottom left.

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TE Y109JA01 1st Edition

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**Revision Information**

Title : CS3000 Fundamentals Training manual  
Manual No. : TE Y109JA01-3KFD

**JAN 2009 /1st Edition/R3.07 or later**  
Newly published

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Written by Training centre  
Customer Service Division  
Yokogawa India Limited

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