Technical Information

TI 32R01B10-01E

Safety Instrumented System
ProSafe-RS
System Overview

ProSafe-RS

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Introduction

ProSafe-RS is a safety instrumented system conforming to IEC 61508. This manual explains the various features and functions of safety instrumented systems that ProSafe-RS provides.

Structure of This Manual

This manual provides an overview of the ProSafe-RS system. After reading this manual, see the other documents, such as General Specifications, Instruction Manuals, and so forth, for more detailed coverage of various topics.

This manual consists of 7 chapters. Chapter 1 explains Safety Instrumented System, from Chapter 2 to Chapter 7 explains respectively Features, System Configuration, Safety Control Station (SCS), Test Functions, Related Packages and HIS Operation and Monitoring of ProSafe-RS.

Reference Documents

As for the configuration of whole system, refer to the following document.

- Integrated Production Control System CENTUM VP System Overview (General Overview) (TI 33K01A10-50E)

- 2, "System Configuration" in CENTUM CS 3000 Integrated Production Control System System Overview (TI 33Q01B10-01E)

Target Readership for This Manual

This manual is mainly intended for:

- Managers who are planning to purchase a new safety instrumented system.

- Instrumentation, Power and Computer Engineers who are evaluating ProSafe-RS for purchase or who will be in charge of installation.

Representation of Drawings in This Manual

- Drawings are represented in this manual as illustrations; some features may be emphasized, and some simplified or omitted.

- The drawing illustrations are to help you understand the functions; dimensions, labels and visible features may differ slightly from those of actual drawings.

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1. Safety Instrumented System (ProSafe-RS)

This chapter explains the positioning of safety instrumented system, safety lifecycle and safety evaluation.

Protection Layers of Plant and Safety Instrumented System

IEC 61511 utilizes the concept of protection layers in order to achieve safety, freedom from unacceptable risk. Each protection layer is required to set quantitative risk reduction goals as well as means of achieving these goals independently without interfering with other layers.

According to this idea of protection layers, safety instrumented system is positioned within the mitigation and prevention layers.
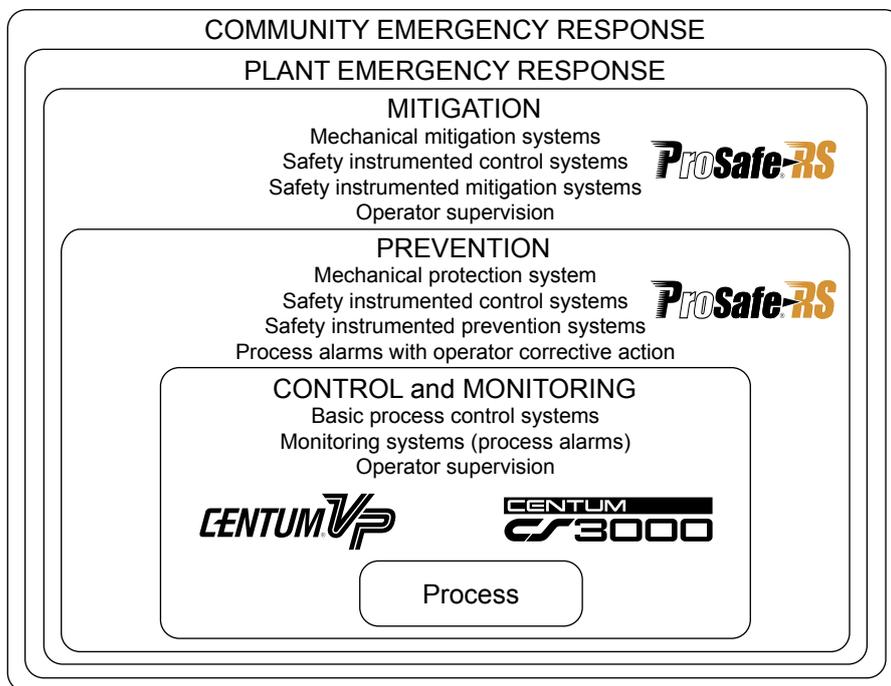
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Figure   Protection Layers and Positioning of Safety Instrumented Systems

Safety Life Cycle

IEC 61508 specifies the management of safety-related systems in terms of lifecycles. In the safety lifecycle, the tasks involved, from the conceptual stage in which a basic safety instrumented system is designed to the decommissioning of the system, are divided into 16 phases as shown in the figure below, and the required tasks to be achieved in each phase are defined. The purpose of these definitions is to minimize the likelihood of human-induced errors. For example, "Hazard and risk analysis" shown in the third frame sets requirements to clarify the hazards and hazardous events that may occur in a plant and its control devices (e.g., DCS).
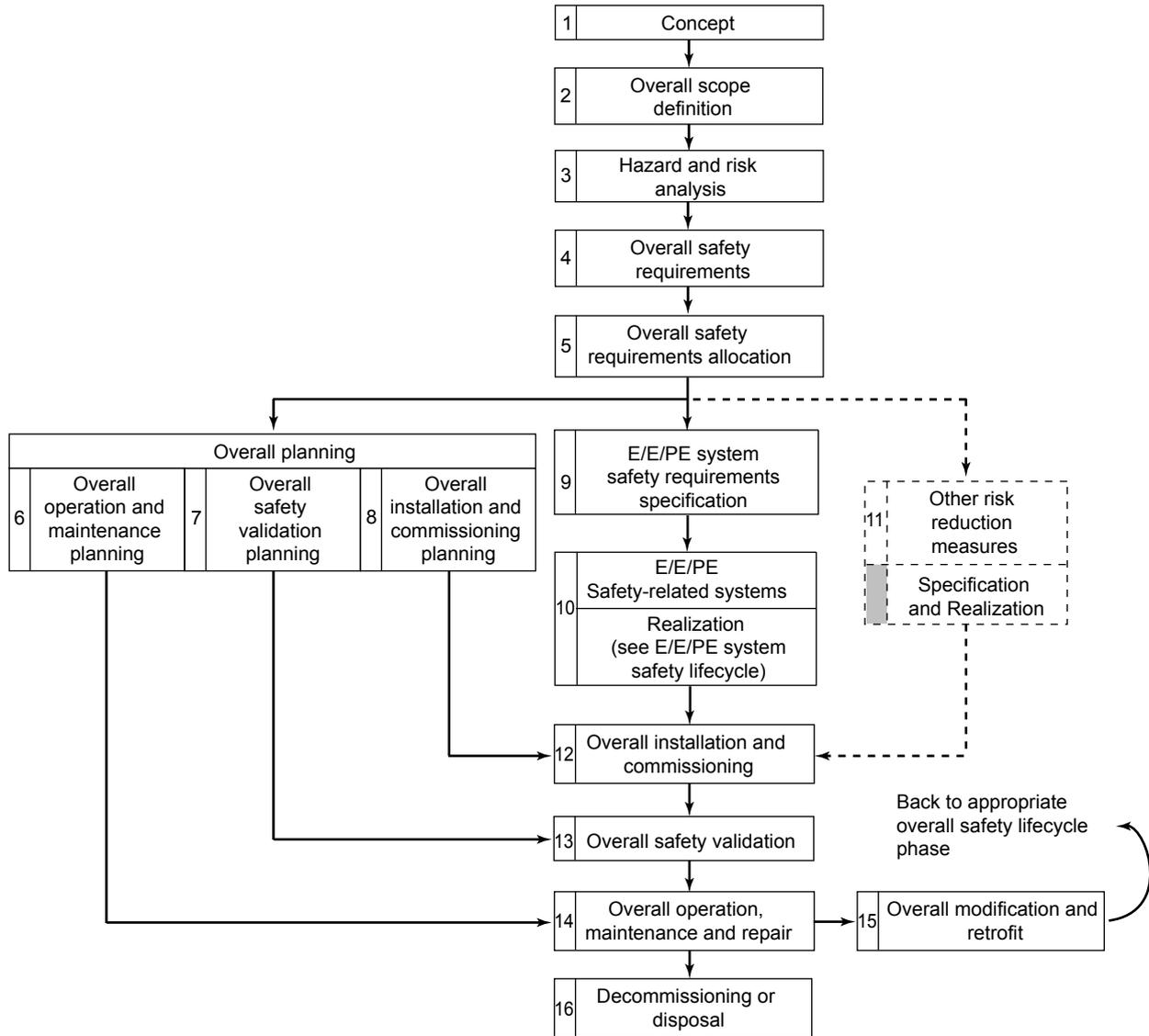
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Figure   Safety Lifecycle

Scales of Safety Evaluation

IEC 61508 introduces the concept of Safety Integrity Level (SIL) as a method for showing the safety integrity requirements. The safety integrity level is classified into four levels according to the value of Probability of Failure on Demand (PFD). PFD is the malfunction probability of a safety instrumented system due to a failure when actuation of the system is requested. The higher the SIL level, the higher the risk reduction level of the plant.

Table　Safety Integrity Level (SIL)

SIL	PFD
4	$\geq 10^{-5}$ to $< 10^{-4}$
3	$\geq 10^{-4}$ to $< 10^{-3}$
2	$\geq 10^{-3}$ to $< 10^{-2}$
1	$\geq 10^{-2}$ to $< 10^{-1}$

For example, specifying SIL3 as the safety integrity requirement for a safety instrumented system means requiring the safety instrumented system to ensure that the frequency of risk occurrence is reduced to less than 1/1000 under the current conditions.

2. Features of ProSafe-RS

ProSafe-RS is a safety instrumented system conforming to safety rating SIL3 as defined by IEC 61508. It not only satisfies requirements to be used in safety instrumentation by itself, but also achieves higher efficiency of operations through integration with CENTUM VP or CENTUM CS 3000 R3 (hereinafter, "CENTUM VP/CS 3000").

Implementation of Control System Technologies

ProSafe-RS employs the CENTUM VP/CS 3000 architecture in its base technologies. Because of this, the following advantages can be expected.

- Basic concepts, such as hardware installation and maintenance methods, can be shared with CENTUM VP/CS 3000.

- Since connection via Vnet/IP or V net is possible, system construction and interface design are made simpler, allowing an improvement of the total engineering efficiency, including design and installation costs.

Achievement of Safety Rating SIL3 with Single Configuration

ProSafe-RS has built-in dual-redundant system matching and self-diagnosis mechanisms embedded within one CPU module and one input/output module, thus making it conform to SIL3 as defined by IEC 61508 in a single component. This allows implementing SIL3 safety loop in a single configuration together with the CPU module and input/output module.

Achievement of High Availability by Redundancy

ProSafe-RS allows selecting dual-redundant module configurations in order to achieve high availability. Since it achieves SIL3 with a single configuration, the safety level of SIL3 can be maintained even if a CPU module or input/output module on one side fails in the dual-redundant configuration.

Security Measures

ProSafe-RS is equipped with the security functions described below.

- Security by using a password for a project database and/or SCS (Safety Control Station)

- The IT security function based on Windows security feature (Revision R2.01 or later)

- Security by giving the control access permission to the user in the CENTUM VP/CS 3000 integration

Integrated Monitoring with CENTUM VP/CS 3000

ProSafe-RS realizes integration with CENTUM VP/CS 3000 and provides a communication to establish access with ProSafe-RS's SCS via Vnet/IP or V net from HIS and FCS. This function allows monitoring SCS operation using the same interface (view or window) as of monitoring FCS from HIS. FCS can read data of SCS. This can be done by the same interface (tag name) as of reading data of one FCS from other FCS.

Integrated Monitoring with FAST/TOOLS

By using FAST/TOOLS, ProSafe-RS safety control stations dotted in a wide area can be operated and monitored.

ProSafe-RS realizes integration with FAST/TOOLS and provides a communication interface to establish access with ProSafe-RS's SCS via Vnet/IP-Upstream from the FAST/TOOL's HMI.

Vnet/IP-Upstream is a control network to integrate ProSafe-RS and FAST/TOOLS. When integrating ProSafe-RS and FAST/TOOLS, please be sure to physically separate Vnet/IP-Upstream network from the Vnet/IP network of ProSafe-RS and CENTUM VP/CS 3000 integrated system. The physical separation means that the two networks should not be linked either directly, through a network switch, or a router.

SEE ALSO For the functional overview, refer to ProSafe-RS Safety Instrumented System Overview (for Vnet/IP-Upstream) (GS 32Q01B30-31E).

Connection with Other Systems

It is possible to read data of SCSs from the host computer using OPC and SOE-OPC. It is also possible to connect to other DCSs and sequencers via subsystem communication (Modbus communication method).

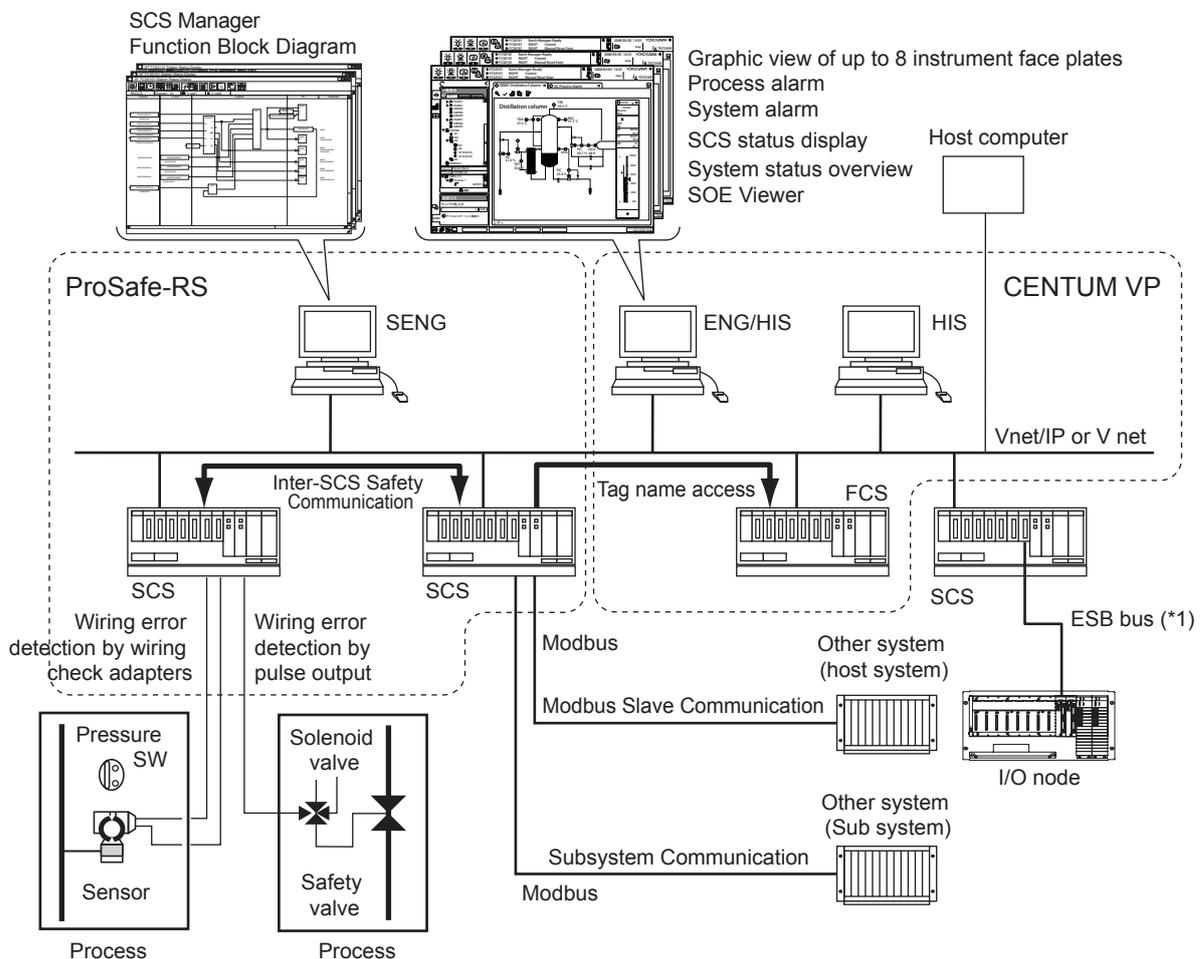# 3.   System Configuration of ProSafe-RS

ProSafe-RS is comprised of SENGs (safety engineering PCs) equipped with engineering and maintenance functions and controller SCSs (safety control stations) for safety. The available configurations are described below.

- **The configuration in which ProSafe-RS is integrated with CENTUM VP/CS 3000**
- **The configuration in which ProSafe-RS is connected to systems other than CENTUM VP/CS 3000 via Modbus**

System Overview

In ProSafe-RS, CPU modules and input/output modules comprising an SCS are placed in single configuration and can be applied to applications of up to IEC 61508 SIL3. If it is desired to improve the availability, modules in required areas are made dual-redundant.

By using inter-SCS safety communication, it is possible to configure SIL3 safety loops across multiple SCSs via Vnet/IP or V net.

*1:   The maximum distance of ESB bus can be extended using fiber optic cable.

Figure   ProSafe-RS System Configuration (Example of CENTUM VP Integration Structure)

- In a CENTUM VP/CS 3000 integration structure, it is possible to monitor operations of both FCS and SCS with HIS.

- SCS engineering is performed from SENG. FCS and HIS engineering are performed from ENG (engineering station for CENTUM VP/CS 3000). Engineering of CENTUM VP/CS 3000 integration function is performed from both SENG and ENG.
  SENG, ENG and HIS software can be installed together in a single PC or separately in several PCs. (*1)

- Host computer that performs production control can access data of FCSs and SCSs via an OPC interface by installing the Exaopc OPC interface package of CENTUM VP or CS 3000 (for HIS).
  By using the SOE OPC interface package of ProSafe-RS, it is also possible to access SOE information of SCS from a host computer.

- In a CENTUM VP/CS 3000 integration structure on V net, it is necessary to connect SENG, ENG and HIS via Ethernet during the engineering.

- In a CENTUM VP/CS 3000 integration structure, it is possible to connect only HIS to ProSafe-RS. In this case, the configuration is the same as the above system configuration without FCS.

- Using the external communication function blocks prepared in ProSafe-RS, it is possible to communicate with external devices without interfering the safety functions of an SCS. In case of a CENTUM VP/CS 3000 integration structure, it is possible to write data in an SCS from HIS and FCS.

  Note that external communication function blocks are required when writing data to an SCS from external devices.

- It is possible to connect an SCS with other systems using Modbus communication functions. SCSs support subsystem communication functions that allow the SCS side to connect to other systems as a communication master, and Modbus slave communication functions that allow other systems to establish connections as Modbus communication masters. In both cases, communication modules are mounted on SCS nodes and used to connect with other systems.
  Note that Modbus communication functions cannot be used in safety loops. They shall be used as interference-free applications.

*1:   When ProSafe-RS R2.xx and CENTUM VP R4.02 or later software are installed in the same PC, ProSafe-RS must be R2.03 or later. In the integration of ProSafe-RS R3 and CS 3000, SENG functions and ENG functions, or SENG functions and HIS functions cannot be installed in the same PC. For more detail, please contact our sales representative or your local distributor.

System Scale

The following conditions on system scale apply to ProSafe-RS systems.

Number of Stations

The maximum number of stations that can be connected in the entire system is as follows for both ProSafe-RS single system configuration and CENTUM VP/CS 3000 integration structures.

- Number of connectable domains: 16

- Number of connectable stations in a domain: 64

- Number of connectable stations: 256

For V net, the maximum number of HIS per domain is limited to 16. When using multiple domains, a bus converter (BCV) and CENTUM VP/CS 3000 ENG functions are required.

To connect V net domain to Vnet/IP domain, V net routers (AVR) and CENTUM VP/CS 3000 ENG functions are required.

For system configuration for Vnet/IP, refer to "ProSafe-RS Safety Instrumented System Overview (for Vnet/IP)" (GS 32Q01B10-31E).

For system configuration for V net, refer to "ProSafe-RS Safety Instrumented System Overview (for V net)" (GS 32Q01B20-31E).

Number of SENGs

At least one SENG is required.

Number of SCSs

The number of SCSs needs to be within the limitation of the number of stations.

3.1   Hardware Configuration Devices

This section explains the hardware configuring the system of ProSafe-RS.

Safety Engineering PC (SENG)

SENG is a device used for performing engineering tasks such as editing, downloading and testing applications as well as carrying out maintenance tasks on safety control stations (SCSs). General-purpose PC is used for an SENG. It is also possible to use a PC with HIS operation and monitoring functions implemented for performing the SENG functions.

Safety Control Station (SCS)

SCS is comprised of a safety control unit (CPU node) and a safety node unit (I/O node). The basic configuration of them is as follows.

- Safety control unit

    - CPU module

    - Power supply module (dual-redundant configuration)

    - Input/Output module

    - ESB bus coupler module (dual-redundant configuration)

    - Devices related to Vnet/IP or V net communication (dual-redundant configuration)

- Safety node unit

    - Power supply module (dual-redundant configuration)

    - Input/Output module

    - ESB bus interface module (dual-redundant configuration)

Implementation Requirements of Safety Control Station

The following requirements apply to the implementation of SCS hardware.

See 4.1, "Hardware Configuration of SCS."

- An SCS can connect I/O nodes to the CPU node to expand inputs and outputs.
  Using SEC402 ESB bus coupler module, up to 13 I/O nodes can be connected to the CPU node (SSC60□). To connect 10 or more I/O nodes, CFS1350/CFS1330 Node Expansion Package is required.
  Using SEC401 ESB bus coupler module, up to 9 I/O nodes can be connected to the CPU node (SSC60□/SSC50□/SSC10□).

- When expanding inputs and outputs, it is necessary to duplicate ESB bus coupler modules and mount them.

- In addition to the requirements above, implementation requirements due to power supply capacity and operation ambient temperature conditions (60 to 70 °C) apply to the implementation of input/output modules.

- Up to four communication modules (two pairs in case of dual-redundant configuration) can be mounted per SCS as communication master modules (ALR111 and ALR121) and up to two modules as Modbus slave communication modules (ALR111, ALR121, and ALE111). Note that it is not allowed to perform both subsystem communication and Modbus slave communication in the same communication module.

Input/Output Modules

ProSafe-RS provides the input/output modules shown in the table below. Input/output modules can be placed in dual-redundant configuration in order to improve the availability.

Table   Types of Input/Output Modules (1/2)

Model	Name	I/O Channels per Module	Signal Connection			
			Pressure Clamp Terminal	MIL Cable	Yokogawa-specific Cable (*2)	
					No option code	Option code
Analog Input/Output Module						
SAI143-S53 SAI143-SE3 (*3)	Analog input module (4 to 20 mA, Module isolation, General-purpose cables (*1))	16	x	x		–
SAI143-S63 SAI143-SF3 (*3)	Analog input module (4 to 20 mA, Module isolation, Yokogawa-specific cables (*2))	16	–	–	x (KS1-□□*B)	x (KS1-□□*B/ SAI143)
SAI143-H5□ SAI143-HE□ (*3)	Analog input module (4-20 mA, HART Communication, Module isolation, General-purpose cable (*1))	16	x	x		–
SAI143-H6□ SAI143-HF□ (*3)	Analog output module (4-20 mA, HART Communication, Module isolation, Yokogawa-specific cable (*2))	16	–	–	x (KS1-□□*B)	x (KS1-□□*B/ SAI143)
SAV144-S53 SAV144-SE3 (*3)	Analog input module (1 to 5 V/1 to 10 V, Module isolation, General-purpose cable (*1))	16	x	x		–
SAV144-S63 SAV144-SF3 (*3)	Analog input module (1 to 5 V/1 to 10 V, Module isolation, Yokogawa-specific cables (*2))	16	–	–	x (KS1-□□*B)	x (KS1-□□*B/ SAI144)
SAT145-S□3 (*3)	TC/mV Input module (Isolated Channels, Yokogawa-specific cables (*2))	16	–	–	x (AKB331-M□□□)	x (AKB331-M□□□/SAT14)
SAR145-S□3 (*3)	RTD Input Module (Isolated Channels, Yokogawa-specific cables (*2))	16	–	–	x (AKB611-M□□□)	x (AKB611-M□□□/SAR14)
SAI533-H53 SAI533-HE3 (*3)	Analog output module (4-20 mA, HART Communication, Module isolation, General-purpose cable (*1))	8	x	x		–
SAI533-H63 SAI533-HF3 (*3)	Analog output module (4-20 mA, HART Communication, Module isolation, Yokogawa-specific cable (*2))	8	–	–	x (KS1-□□*B)	x (KS1-□□*B/ SAI533)
Digital Input/Output Module						
SDV144-S5□ SDV144-SE□ (*3)	Digital input module (no-voltage contact, Module isolation, General-purpose cable (*1))	16	x	x		–
SDV144-S6□ SDV144-SF□ (*3)	Digital input module (no-voltage contact, Module isolation, Yokogawa-specific cables (*2))	16	–	–	x (AKB331-M□□□)	x (AKB331-M□□□/SDV144)
SDV521-S□□ (*3)	Digital output module (24 V DC/2 A, Module isolation, Yokogawa-specific cable (*2))	4	–	–	x (AKB651-M□□□)	x (AKB651-M□□□/SDV521)
SDV526-S33 (*3)	Digital output module (100 - 120 V AC, Module isolation, Yokogawa-specific cable (*2))	4	–	–	x (AKB652-M□□□)	x (AKB652-M□□□/SDV526)
SDV531-S53 SDV531-SE3 SDV531-L5□ SDV531-LE□ (*3)	Digital output module (24 V DC, Module isolation, General-purpose cable (*1))	8	x	x		–

X: Can be connected.
–:   Cannot be connected.
*1:   General-purpose cables are pressure clamp terminals and MIL cables.
*2:   Yokogawa-specific cables are special cables for connecting input/output modules to terminal boards.
       If option codes associated with I/O modules are selected, a wrong connection to I/O modules with different signals can be avoided.
       If no option code is selected, a wrong connection to I/O modules with different signals cannot be avoided.
*3:   Safety (SIL3)

Table　Types of Input/Output Modules (2/2)

Model	Name	I/O Channels per Module	Signal Connection			
			Pressure Clamp Terminal	MIL Cable	Yokogawa-specific Cable (*2)	
					No option code	Option code
Digital Input/Output Module						
SDV531-S63 SDV531-SF3 (*3)	Digital output module (24 V DC, Module isolation, Yokogawa-specific cables(*2))	8	–	–	x (AKB331-M□□□)	–
SDV531-L6□ SDV531-LF□ (*3)	Digital output module (24 V DC, Module isolation, Yokogawa-specific cable (*2))	8	–	–	x (AKB331-M□□□) (AKB651-M□□□)	x (AKB331-M□□□/SDV53L) (AKB651-M□□□/DV53L)
SDV53A-S□3 (*3)	Digital output module (48 V DC, Module isolation, Yokogawa-specific cable (*2))	8	–	–	x (AKB331-M□□□) (AKB651-M□□□)	x (AKB331-M□□□/SDV53A) (AKB651-M□□□/DV53A)
SDV541-S5□ SDV541-SE□ (*3)	Digital output module (24 V DC, Module isolation, General-purpose cables (*1))	16	x	x	–	
SDV541-S6□ SDV541-SF□ (*3)	Digital output module (24 V DC, Module isolation, Yokogawa-specific cables (*2))	16	–	–	x (AKB331-M□□□) (AKB651-M□□□)	x (AKB331-M□□□/SDV541) (AKB651-M□□□/DV541)
Communications Module						
ALR111 (*4)	Serial communication module (RS-232C, 2-port)	Two ports	–	–	x (D-Sub 9-pin connector) (*5)	
ALR121 (*4)	Serial communication module (RS-422/ RS-485, 2-port)	Two ports	–	–	x (M4-terminal block, 10 poles) (*5)	
ALE111 (*4)	Ethernet communication module	One port	–	–	x (RJ-45) (*6)	

X:　　Can be connected.　　　　　　　–:　　Cannot be connected.

*1:　　General-purpose cables are pressure clamp terminals and MIL cables.
*2:　　Yokogawa-specific cables are special cables for connecting input/output modules to terminal boards.
　　　　If option codes associated with I/O modules are selected, a wrong connection to I/O modules with different signals can be avoided.
　　　　If no option code is selected, a wrong connection to I/O modules with different signals cannot be avoided.
*3:　　Safety (SIL3)
*4:　　Interference-free (not safety)
*5:　　A Yokogawa-specific cable can be connected directly without using terminal block.
*6:　　ALE111 can be mounted on SSC60□ or SSC50□ in R3.02.00 or later.

Products Related to Input/Output Modules

Pressure Clamp Terminal Blocks

Pressure clamp terminal blocks are used when wiring input/output modules to field devices directly. They come in two types: for single and dual-redundant configurations.

- For single configuration
  STA4S: Pressure clamp terminal block for analog signals (16-channel with ISA Standards G3)
  STB4S: Pressure clamp terminal block for digital signals (16 or 8-channel with ISA Standards G3)

- For dual-redundant configuration
  STA4D: Pressure clamp terminal block for analog signals, dual-redundant use (16-channel with ISA Standards G3)
  STB4D: Pressure clamp terminal block for digital signals, dual-redundant use (16 or 8-channel with ISA Standards G3)

Dedicated Cable

The following types of dedicated cable are available.

- Signal Cable (40-40 pin) (KS1)
  Used to connect SAI143, SAV144 and SAI533 to SEA4D and SBA4D.

- Signal Cable (50-50 pin) (AKB331)
  Used to connect SAT145 to SBT4D.
  Used to connect SDV144 to SED4D, SBD4D, SRM53D and SRM54D.
  Used to connect SDV531 to SED4D, SBD3D and SRM53D.
  Used to connect SDV53A to SED3D and SBD3D.
  Used to connect SDV541 to SED4D, SBD4D, SRM53D, SRM54D and SBM54D.

- Signal Cable (AKB651)
  Used to connect SDV521 to SED2D and SBD2D.
  Used to connect SDV531-L to SBD3D.
  Used to connect SDV541 to SBD4D.
  Used to connect SDV53A to SBD3D.

- Signal Cable (AKB652)
  Used to connect SDV526 to SWD2D.

- Signal Cable (AKB611)
  Used to connect SAR145 to SBR4D.

Terminal Boards

There are the following five types of terminal boards are available. They support both single and redundant configurations.

- SEA4D: Analog terminal board for single/dual-redundant configuration (16-channel x 2)
  SEA4D is connected with SAI143, SAV144 or SAI533 by using KS1 cable.

- SED2D: Digital terminal board for single/dual-redundant configuration (4-channel x 4)
  SED2D is connected with SDV521 by using AKB651 cable.

- SED3D: Digital terminal board for single/dual-redundant configuration (8-channel x 4)
  SED3D is connected with SDV53A by using AKB331 cable.

- SED4D: Digital terminal board for single/dual-redundant configuration (16-channel x 2)
  SED4D is connected with SDV144, SDV531 or SDV541 by using AKB331 cable.

- SWD2D: Digital terminal board for single/dual-redundant configuration (4-channel x 4)
  SWD2D is connected with SDV526 by using AKB652 cable.

- SBA4D: Terminal board for analog input/output: DIN rail mount type
  (Single and Dual-redundant, 16-channel x 1)
  SBA4D is connected with SAI143, SAV144 or SAI533 by using KS1 cable.

- SBT4D: Terminal board for TC/mV: DIN rail mount type
  (Single and Dual-redundant, 16-channel x 1)
  SBT4D is connected with SAT145 by using AKB331 cable.

- SBR4D: Terminal board for RTD input: DIN rail mount type
  (Single and Dual-redundant, 16-channel x 1)
  SBR4D is connected with SAR145 by using AKB611 cable.

- SBD2D: Terminal board for digital output: DIN rail mount type
  (Single and Dual-redundant, 4-channel x 1)
  SBD2D is connected with SDV521 by using AKB651 cable.

- SBD3D: Terminal board for digital output: DIN rail mount type
  (Single and Dual-redundant, 8-channel x 1)
  SBD3D is connected with SDV531 or SDV53A by using AKB331 or AKB651 cable.

- SBD4D: Terminal board for digital input/output: DIN rail mount type
(Single and Dual-redundant, 16-channel x 1)
SBD4D is connected with SDV144 or SDV541 by using AKB331 cable.
SBD4D is connected with SDV541 by using AKB651 cable.

Relay Boards

Relay boards for dry contact outputs that are equipped with safety relays are provided. They support both single and redundant configurations.

They allow reading back outputs by connecting with digital input modules for SRM53D and SRM54D.

- SRM53D: 8x2 dry contact output (safety relay built-in, M4 terminals)

- SRM54D: 16x1 dry contact output (safety relay built-in, M4 terminals)

- SBM54D: Relay board for Digital output: DIN rail mount type
(Single and Dual-redundant, 16-channel x 1, for SDV541)

Wiring check Adapters

Wiring check adapters are used to detect disconnection and short-circuit failures in field wiring between digital input modules and field devices.

The following two types of wiring check adapters are available.

- SCB100: For detecting disconnection failures
By mounting this adapter in parallel with a sensor switch, it is possible to detect disconnection failures that occur while inputting OFF signals.

- SCB110: For detecting short-circuit failures
By mounting this adapter in series with a sensor switch, it is possible to detect failures due to short-circuit with a power supply line that occur while inputting ON signals and failures due to short-circuit with other channels.

The figure below shows the shapes of SCB100 and SCB110.
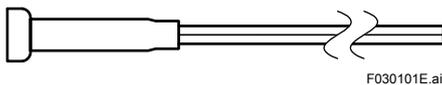
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Figure   Shapes of SCB100 and SCB110

3.2 Safety Communication

ProSafe-RS allows constructing systems in which both safety communication and CENTUM VP/CS 3000 control communication can be performed on V net or Vnet/IP.

This section explains overview of inter-SCS safety communication and SCS link transmission.

Inter-SCS Safety Communication

An SCS can perform inter-SCS safety communication with other SCSs in the same domain or different domains. This allows creating safety loop across two SCSs.

The inter-SCS safety communication function is achieved by dedicated function blocks. It is necessary to use these function blocks to perform inter-SCS safety communication.

Mechanism of Inter-SCS Safety Communication

Function blocks on the sending side (producing side) add data to be written as well as data for guaranteeing the communication quality, which is then sent to the communicating SCS via Vnet/IP or V net. The communication is not limited to communication routes between SCSs in the same domain; routes between SCSs in different domains can also be used. Function blocks on the receiving side (consuming side) perform various inspections for checking the validity of received data and output only data whose quality can be guaranteed. If data received from the network is judged incorrect as a result of these inspections, the function blocks on the receiving side output the pre-determined fail-safe values.

SCS Link Transmission (*1)

SCS link transmission function makes it possible to bilaterally transmit and receive data in stations in the same domain by broadcasting.

Communication between two SCS is called SCS Link Transmission Safety Communication, and communication between SCS and FCS is called SCS Global Switch Communication.

*1:   Supported by ProSafe-RS R1.03.00 or later.

SCS Link Transmission Safety Communication

BOOL-type data can be safely communicated from one SCS to many other SCS by using dedicated I/O function block.

SCS Global Switch Communication

Interference-free communication can be done between SCS and FCS by using dedicated function block.

4. Safety Control Station (SCS)

This chapter explains the hardware and software of a safety control station (SCS).
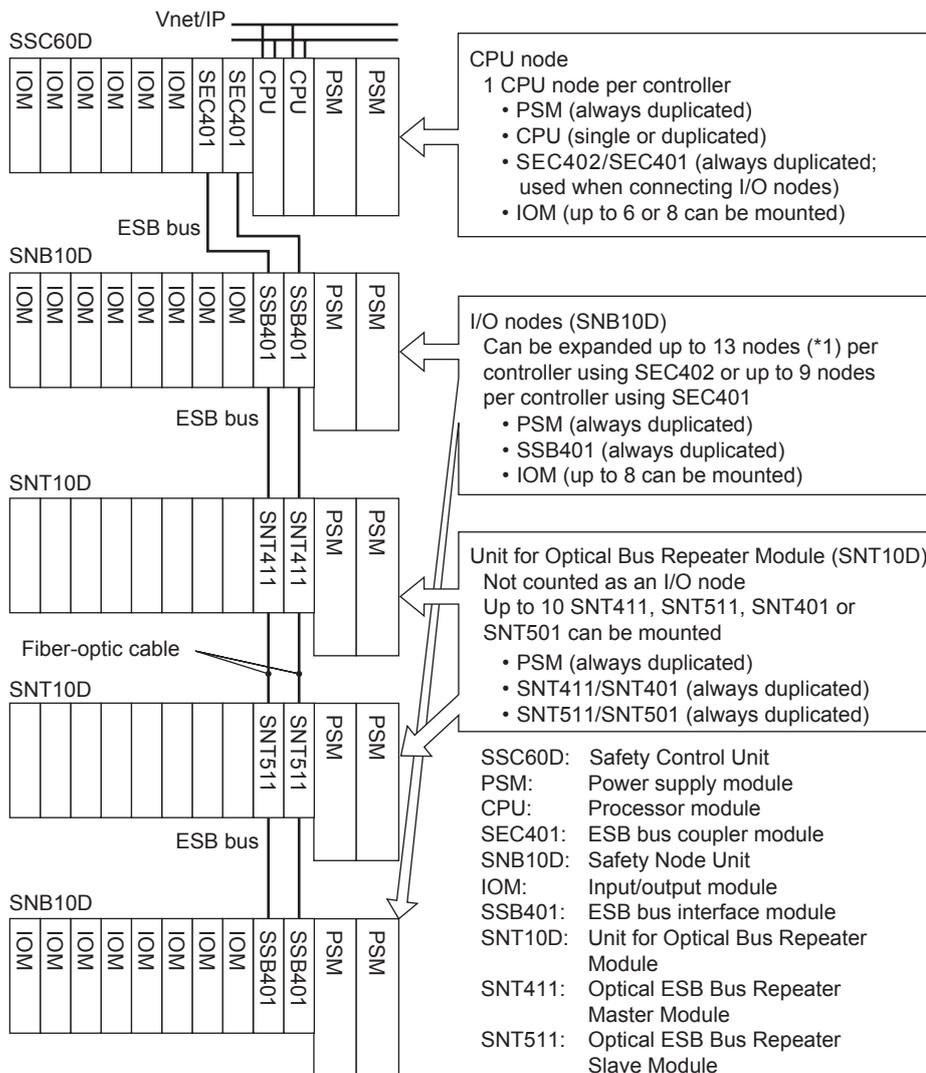
4.1 Hardware Configuration of SCS

SCS is configured with one safety control unit (CPU node) and safety node units (I/O node).

Safety node units are connected by ESB buses.

If Optical ESB Bus Repeater Module is mounted on CPU node, I/O node or Unit for Optical Bus Repeater Module, the maximum distance of ESB bus can be extended using fiber-optic cable.

SEE ALSO For the connecting method of Optical Bus Repeater Module, refer to ProSafe-RS Installation Guidance (TI 32S01J10-01E)

Figure   Example of SSC60D, SNB10D and SNT10D Hardware Configuration

*1: To connect 10 or more I/O nodes, CFS1350/CFS1330 Node Expansion Package is required.

Configuration of Safety Control Units (SSC60S, SSC60D, SSC50S, SSC50D, SSC10S, SSC10D)

Safety control units come in two types: standard type (ambient temperature for SSC60S/SSC60D/SSC50S/SSC50D: -20 to 40°C, ambient temperature for SSC10S/SSC10D: -20 to 50°C) and wide range temperature type (ambient temperature: -20 to 70°C).

The figure below shows a standard type safety control unit in dual-redundant configuration. In the case of single configuration, processor module is mounted in a slot on the left side and dummy cover is mounted on the right side. Power supply modules are always used in dual-redundant configuration. When connecting a safety node unit, ESB bus coupler modules are used in dual-redundant configuration.

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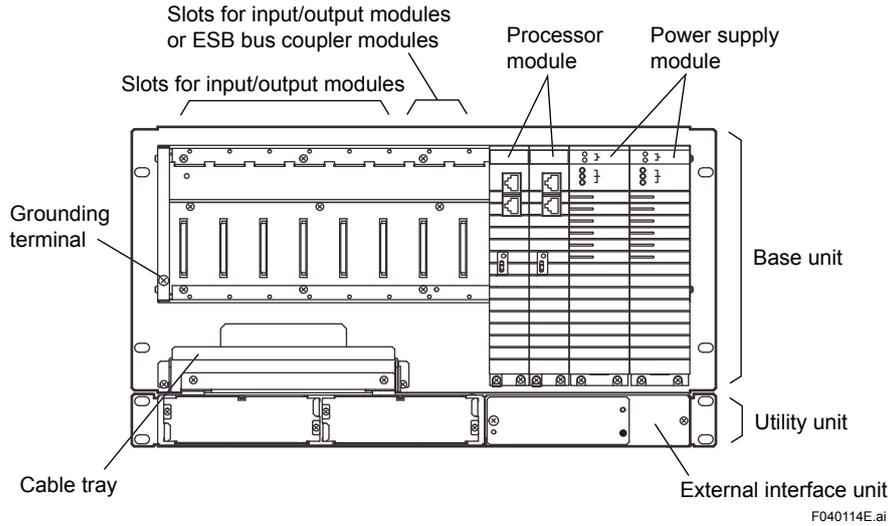
Note: The same figure can be applied to SSC50D Safety Control Unit for Vnet/IP (Standard type).
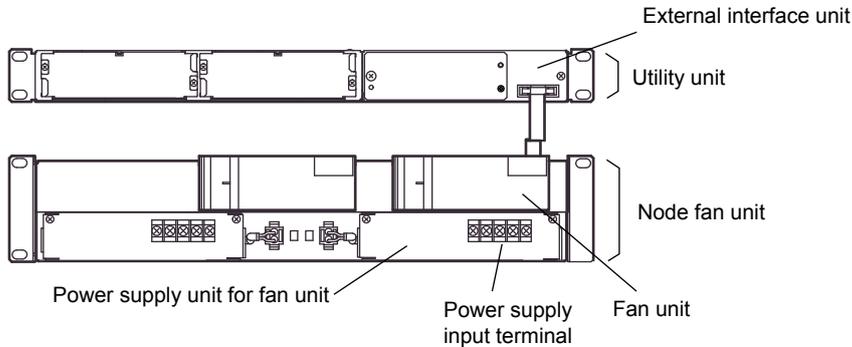
Figure   Configuration of SSC60D Safety Control Unit for Vnet/IP (standard type)

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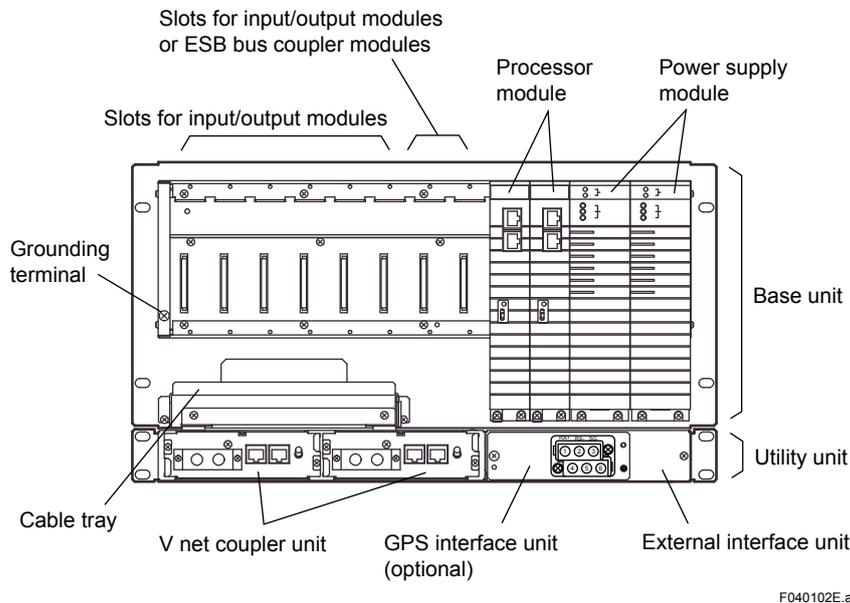
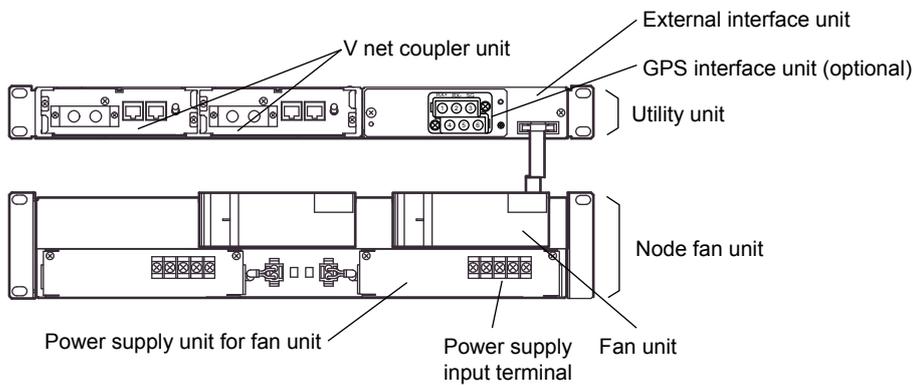**Figure   Configuration of SSC10D Safety Control Unit (standard type)**

Wide range temperature type safety control units are configured in the same way as the standard type units, but are equipped with an additional node fan unit in order to support a wider range of ambient temperatures (-20 to 70°C).

The figure below shows a utility unit and node fan unit that comprise a wide range temperature type safety control unit. The base unit is omitted in the figure.

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Figure　Configuration of Utility Unit and Node Fan Unit for SSC60□/SSC50□ Safety Control Unit for Vnet/IP (wide range temperature type)
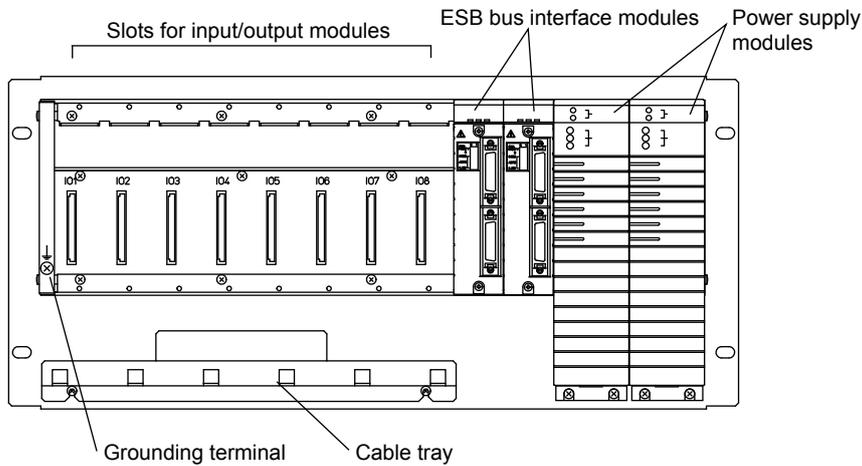

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Figure　Configuration of Utility Unit and Node Fan Unit for SSC10□ Safety Control Unit for V net (wide range temperature type)

Configuration of Safety Node Units (SNB10D)

The figure below shows a safety node unit.

Power supply modules and ESB bus interface modules are always used in dual-redundant configuration.
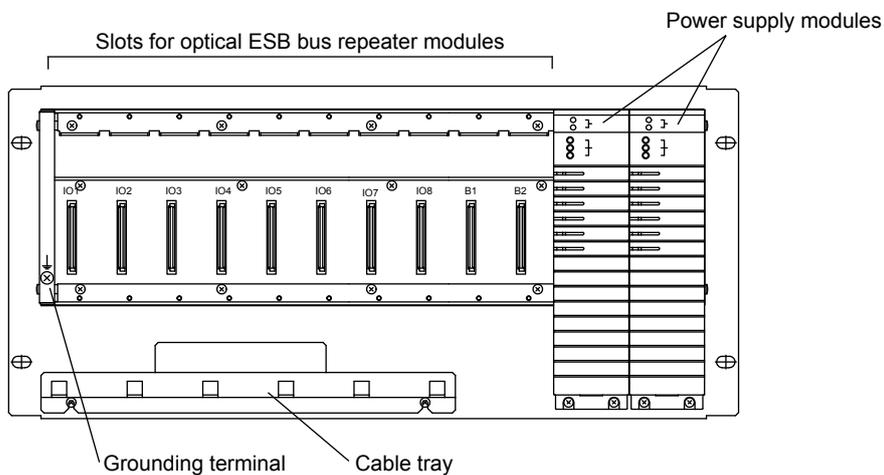

Figure　Configuration of Safety Node Unit

Unit for Optical Bus Repeater Module (Rack Mountable Type) (SNT10D)

The figure below shows a Unit for Optical Bus Repeater Module (Rack Mountable Type).

Power supply modules are always used in dual-redundant configuration.

Figure　Configuration of Unit for Optical Bus Repeater Module (Rack Mountable Type)

4.2   Dual-redundant SCS and Reliability of SCS

Dual-redundant SCSs are provided. A dual-redundant SCS contains a full set of duplicate components such as processor modules, V net couplers (*1) and power supply modules. When connecting additional safety node units, ESB bus coupler modules need to be mounted. ESB bus coupler modules are always used in dual-redundant configuration.

The dual-redundant processor modules (one active, the other standby) can switch from active to standby module without any interruption to control when active module breaking down.

*1:   Only SSC10S and SSC10D have V net couplers.
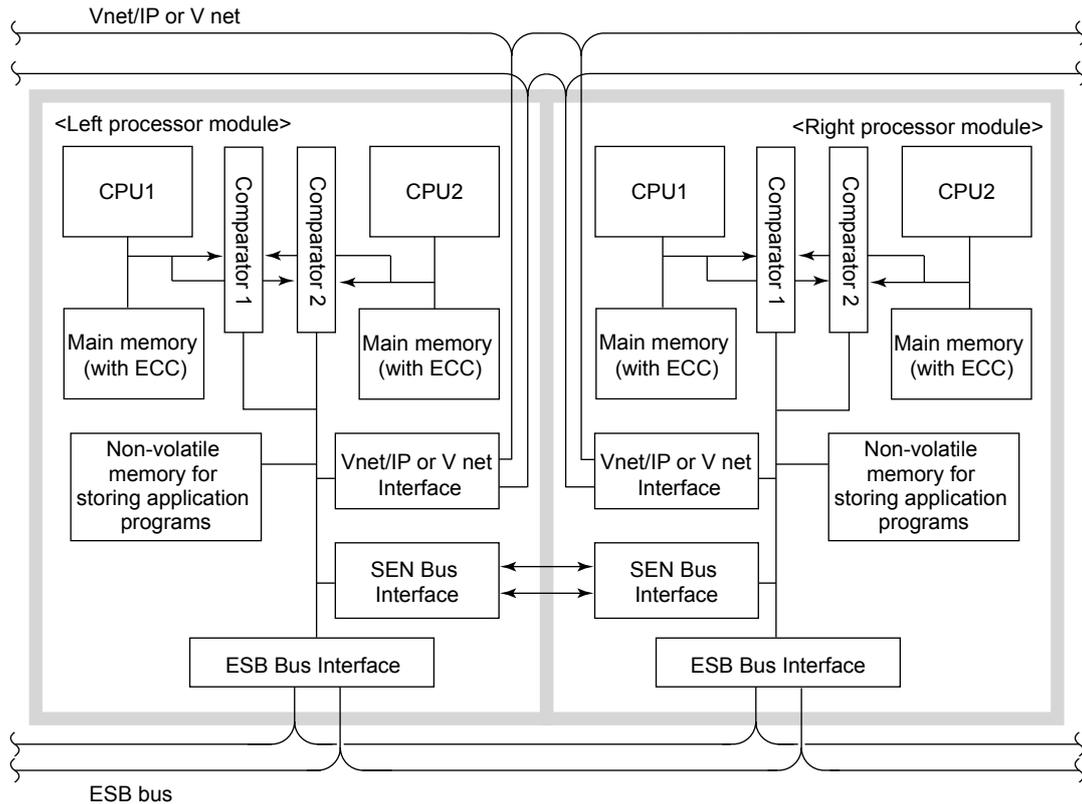
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Figure   Configuration of Dual-redundant Processor Modules (SCS)

SEE ALSO For the information about SCS hardware configuration, refer to 4.1, "Hardware Configuration of SCS."

How an SCS is made dual-redundant is explained below.

CPU

- Each processor module has two CPUs and two main memories. Each CPU module (CPU1 and CPU2) performs the same operation and the operation results are compared by two comparators for each operation cycle. If the operation results of both CPUs match, the operation is regarded as normal and the data is sent to the main memory and bus interface modules. If either one of the comparators detect inconsistency, it is considered an "operation error" and the control right is passed to the processor module on the standby side.
The main memory modules are equipped with ECC (Error Correcting Code); these codes are used to correct temporary bit-reverse errors that occur in the main memories. The main memory modules with ECC are dual-redundant as well, and if their values are different, a matching error occurs and the control right is passed to the processor module on the standby side.

- Each processor module is equipped with a WDT (Watch Dog Timer) and monitors that the safety functions are operating normally. If it detects that the safety functions are not working normally, the control right is transferred to the standby side as well.

- The processor module on the standby side synchronizes with the processor module on the control side to ensure that the same operations are performed. The control right can thus be switched without interrupting the operation. When the processor module obtains the control right, it immediately starts sending operation data to the bus interface modules.

- A processor module conducts self-diagnosis if an operation error occurs. If there is no abnormality in CPU hardware as a result of diagnosis, it regards the error as a temporary operation error and recovers from the abnormal status to the standby status.

- A processor module is equipped with communication interfaces that can support dual-redundancy on CPUs. Vnet/IP or V net interfaces are connected to dual-redundant control buses.

ESB Bus

Each processor module has dual-redundant ESB-bus interface. Normally, the ESB-bus interface on the active processor module is used as active side, and the other ESB-bus on the standby processor module is waiting as standby side. In case ESB bus error happens on active processor module, the standby processor module will be active.

The active ESB-bus interface communicates with safety node units as ESB bus master.

Normally, the dual-redundant ESB buses are used alternately, however, in case ESB bus error happens to one of them, only the other bus will be used for communication. The recovery of ESB bus error is periodically tested. In case some error happens to all extended safety nodes, it is recognized as ESB bus error.

4.3   Operation at SCS Errors

There are three error levels for SCSs: fatal errors, major errors and minor errors. SCSs are able to recover from errors by conducting recovery tasks corresponding to each error level.

Operations at Fatal Error Occurrence

At this error level, hardware and software are unable to function. CPU (both sides for redundancy) stops and output values of all output modules are set to fail-safe values.

Operations at Major Error Occurrence

At this error level, some hardware is unable to function. Operations to be performed at abnormality, which are defined by users in advance, are performed for the failed areas. It is necessary to define such operations at occurrence of major errors individually for a given application.

Operations at Minor Error Occurrence

At this error level, there is no impact on the application logic execution functions themselves. Such situations include when one side of dual-redundant hardware modules fails.

If one hardware side in a dual-redundant configuration fails, the control right is switched to the standby side to continue processing. Such errors are treated as minor errors. The hardware continues to operate in the same way as if it were placed in a single configuration.

4.4   States and Operations of SCS

Depending on the operating mode and security level, SCS can be in one of several states.

Operations of SCS include forcing, override, output enable operation and download.

The figure below shows a rough overview of the relations among these states and operations.
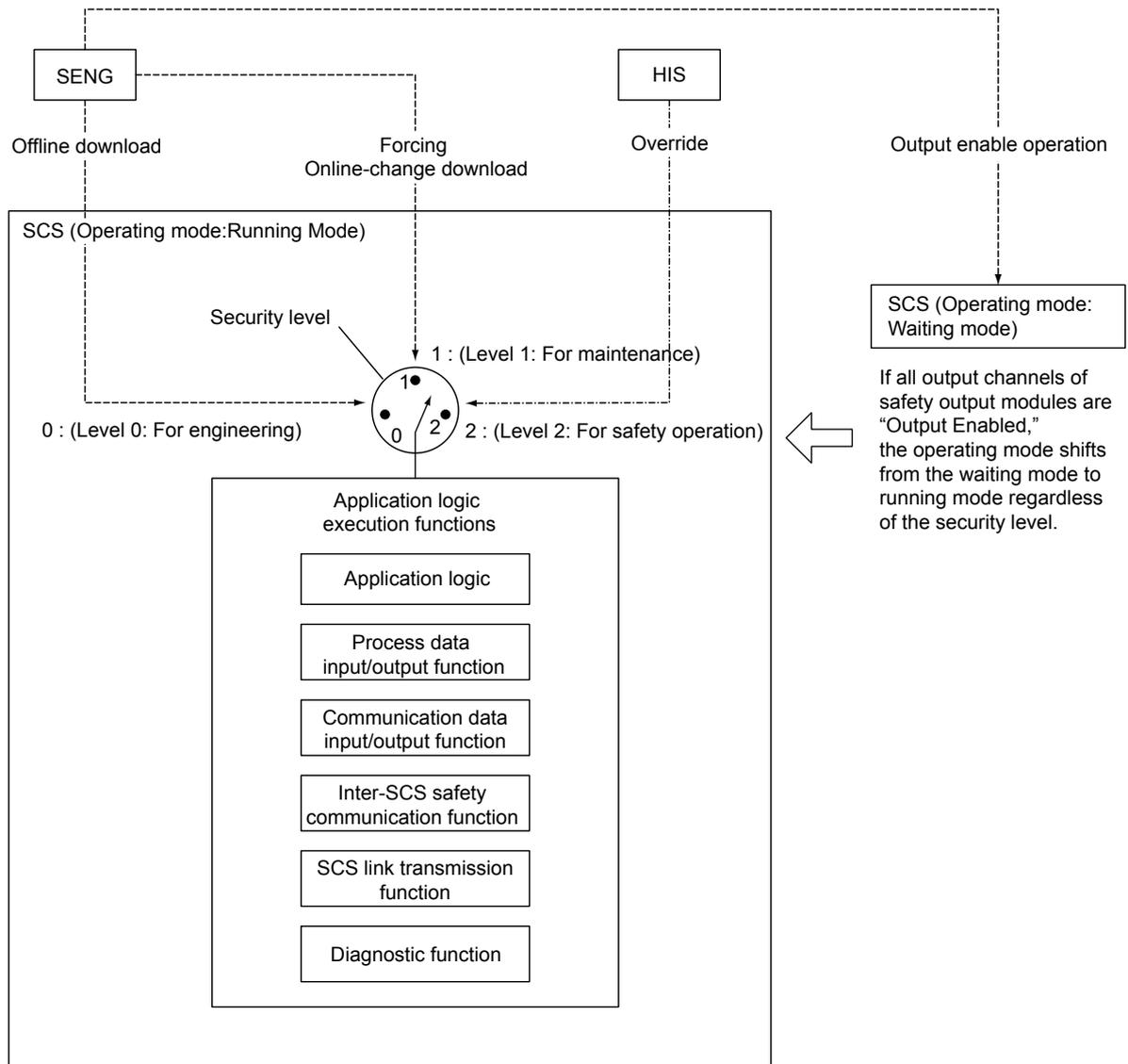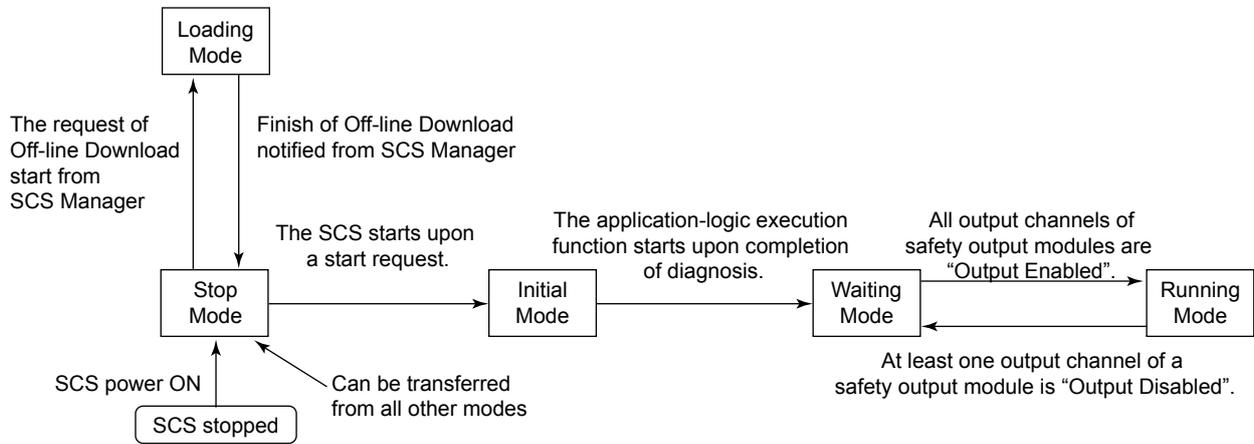

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Figure   States and Operations of SCS

Operating Modes

Operating modes indicate the different running states of an SCS. The operations carried out by the system program of an SCS are determined by the operating mode.

There are five operating modes of an SCS: stop mode, loading mode, initial mode, waiting mode and running mode.


Figure   Transition of Operating Mode

Security Levels

An SCS is equipped with a function to protect internal data from being overwritten by external devices. It always monitors attempts to write data from outside and judges whether user operations should be enabled or disabled according to the security level of the SCS. One SCS has one security level. The security level indicates to what degree the SCS memory is protected from data writing attempts from outside.

There are two levels for the security level: a level (online level) used during constant operation of an SCS and a level (offline level) used when the SCS is not operating.

Security level is protected by password and can be changed when an authorized user enters a password.

The status of the security level changes as shown below.
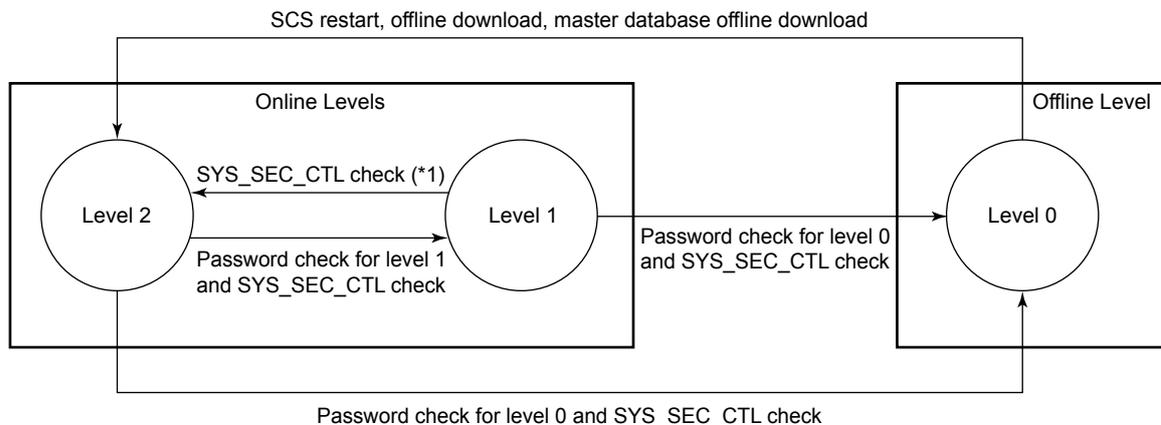
*1:   Using SYS_SEC_CTL (Security Level Protection) block, it can be decided whether security level is changeable or not by discrete input of a foreign key switch. Regardless of the security level change permission status set by SYS_SEC_CTL, it is always possible to shift from security level 1 to security level 2 by entering an RST input in a SYS_SECURE (Security Level Management) block.

Figure   Transition of Security Level

Forcing and Override

Overview of Forcing Function

The forcing function provides a user interface for fixing channel inputs and outputs of input/output modules and variables in application logic to constant values (variable lock), forcibly changing variable values (variable value setting) and so forth for the purpose of SCS maintenance and debugging I/O loop check applications. This function is used by an SENG to forcibly fix input/output variables and internal variables of an SCS and allows fixing all input/output values of each input/output module at the same time as well.

Additionally, it is possible to use SYS_FORCE (Forcing State Management) blocks to monitor the lock status within the application logic and forcibly cancel locking. The forcing function can also be used when performing maintenance tasks.

Overview of Override

Override is a function used to temporarily overwrite values of variables of application logic in an SCS from an HIS in case of CENTUM VP/CS 3000 integration structure. When performing system maintenance and similar, it is used for performing tasks in states where variable values of application logic are temporarily changed. Override can be performed at all security levels.

Differences between Forcing and Override

The table below shows differences between forcing and override.

Table   Differences between Forcing and Override

Item	Forcing	Override
Purpose	Maintenance of SCS and debugging applications from SENG	Maintenance of SCS from HIS in CENTUM VP/CS 3000 integration structure
SCS security level	Can be performed at level 1 or 0	Can be performed at level 2 as well
Necessity of programming	No need for programming	Necessary to use override function block (hereinafter referred to as override FB) to create application logic
Specification of output value	Possible to specify values to be output using the I/O Lock window and so forth	If override is performed while executing an application, pre-programmed values are output as override values.
Requirement for setting variable values	Whether or not forcing can be performed depends on the security level of SCS	Possible to create application logic that allows switching override permission with a mechanical key switch, etc.
Grouping Override (*1)	–	More than one override FB are managed as a logical group and only one override FB in the group can be overridden.

*1:   Supported by ProSafe-RS R1.03.00 or later.

4.5   SOER

SOER (Sequence of Events Recorder) is a function for acquiring and saving analog inputs, discrete inputs, discrete outputs and variables of application logic as event information. This event information can be viewed using SOE Viewer.

A time synchronization function is provided in order to maintain the accuracy of the time at which an event occurs.

Event Acquisition

It is possible to acquire not only discrete inputs (DI) but also changes of discrete outputs (DO) and analog input values as event information. By creating function blocks for SOER, changes in application logic can be acquired as event information as well. This also allows registering changes in communication data with other SCSs.

Saving Events

Event information is saved in an SCS, which eliminates the need to prepare a PC for storing events or keeping the power supply to an SENG turned on at all times.

Event information before and after trip signals, which is particularly important, is saved in the storage location. This information is notified to users without fail.

Viewing Events with SOE Viewer

- Event logs (SOE event information and diagnostic information messages) saved in an SCS are uploaded to an SENG via Vnet/IP or V net and displayed as event messages by means of the SOE Viewer function of the SENG.
- Event logs of up to eight SCSs can be displayed at the same time.
- It is possible to filter event messages so that only desired messages are displayed.
- Trip reports are generated. Generated trip reports can be exported to printers and CSV format files.
- In the case of CENTUM VP/CS 3000 integration structure, SCS process alarm messages can be displayed together by using the HIS historical information.

Time Synchronization Function

An SCS has a function to synchronize time information among SCSs as well as between CPUs and discrete input modules in order to maintain a high accuracy of the event generation time records.

Time Synchronization Method of SCSs Connected to V net

ProSafe-RS allows selecting from two synchronization methods: V net time master method (default), where all stations synchronize to the V net time, and GPS time master method (optional), where the time is acquired from an external source via the IRIG-B interface.

V net Time Master Method (Default)

The V net time is determined by an SENG or HIS, and it becomes the time master. Each of the device time connected with V net is synchronized with the time master.

GPS Time Master Method (Optional)

In this method, a commercially available GPS receiver is used to acquire time information of the IRIG-B format and use this in an SCS designated as the time master. The standard time (date, hour, minute, second) and the synchronization timing are delivered to each connected SCS. Synchronization among individual SCSs is achieved at this synchronization timing. Since GPS is used, it is possible to acquire events with high time accuracy.

Time Synchronization Method of SCSs Connected to Vnet/IP

The Vnet/IP time is determined by an SENG or HIS, and it becomes the time master. Vnet/IP-connected SCS adopts Vnet/IP time for time synchronization. If an SNTP server is installed, the devices' time connected with Vnet/IP synchronizes with Coordinated Universal Time (UTC).

4.6　Connection with Other Systems (Modbus)

An SCS supports a subsystem communication function that allows the SCS side to become the communication master and connect to other systems, and a Modbus slave communication function that allows another system to become the Modbus communication master and connect to the SCS. In both functions, communication modules are mounted in SCS nodes in order to allow connections with other systems.

Note that Modbus communication cannot be used for safety loops. They shall be used as interference-free modules.

There are the following three types of communication modules.

- **RS-232C serial communication module (ALR111)**
- **RS-422/RS-485 serial communication module (ALR121)**
- **Ethernet communication module (ALE111, Modbus Slave Communication only) (*1)**

*1:　ALE111 can be mounted on SSC60□ or SSC50□ in R3.02.00 or later.

Subsystem Communication Function

The subsystem communication function is used for reading and writing input/output data within subsystems from an SCS that acts as a Modbus master. SCSs support the Modbus communication protocol.

It is possible to connect to LED outputs and sequencers by accessing data of other systems via subsystem communication from SCSs.

Modbus Slave Communication Function

With this function, an SCS is able to function as a Modbus slave device. The Modbus slave connection function of an SCS allows the Modbus master (external device) to read and write data in the SCS via the Modbus protocol. The Modbus master requests to access data in the SCS using the Modbus device name as the interface. Not only FCSs of CENTUM VP/CS 3000, but also DCSs made by other manufacturers can connect to an SCS as the Modbus master.

5. Test Functions

The test functions of ProSafe-RS are used for effective debugging of applications, and useful in debugging when you create or change applications.

There are three types of tests, target tests, SCS simulation tests and logic simulation tests.

Target Tests

In a target test, an application is executed on an actual SCS.

It is possible to execute tests in a status where inputs/outputs are disconnected, i.e., without any input/output modules connected, using the forcing function.

In a target test, the test according to each SCS security level can be executed.
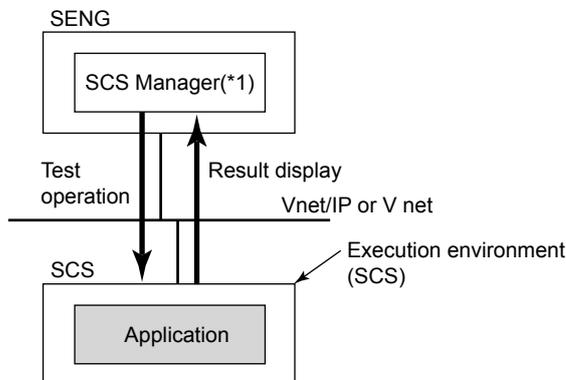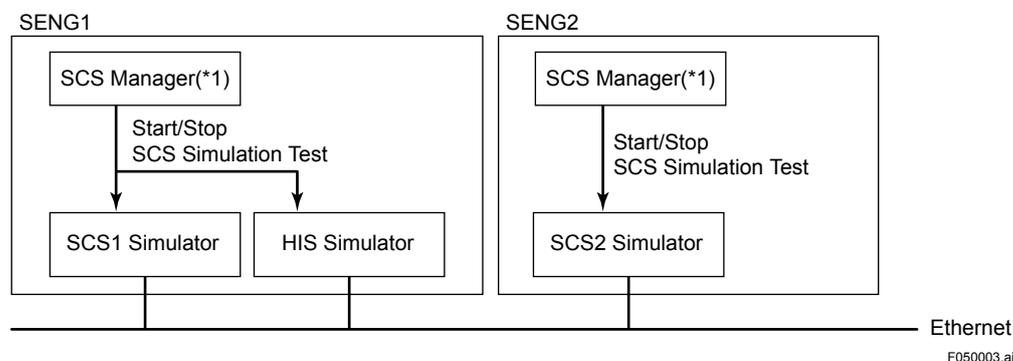

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*1:   A function that controls system engineering and maintenance tasks of an SCS, such as definition of applications to be executed on the SCS, database generation test functions, etc.

Figure   Target Test

SCS Simulation Tests

In an SCS simulation test, an application is executed on an SCS simulator on an SENG. The integrated operation environment for CENTUM VP/CS 3000 is required.

If you use two or more SCS simulators, the test for inter-SCS safety communication can be executed. In an SCS simulation test, the test according to each SCS security level can be executed.

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*1:   A function that controls system engineering and maintenance tasks of an SCS, such as definition of applications to be executed on the SCS, database generation test functions, etc.

Figure   SCS Simulation Tests

Logic Simulation Tests

In a logic simulation test, an application is executed using a logic simulator on an SENG, which allows debugging application logic of each SCS. In a logic simulation test, the test regardless of each SCS security level can be executed.

SENG

SCS Manager(*1)

Test operation | Result display

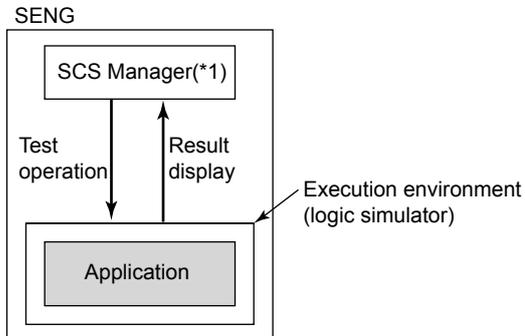Execution environment (logic simulator)

Application

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*1: A function that controls system engineering and maintenance tasks of an SCS, such as definition of applications to be executed on the SCS, database generation test functions, etc.

Figure   Logic Simulation Test

6. ProSafe-RS Related Packages

Various packages are provided in order to improve the integration with CENTUM VP/CS 3000 and systems made by other manufacturers as well as efficiency in operations/ monitoring via integration.

SOE Viewer Package

The SOE Viewer Package provides functions to display event logs (event information, diagnostic information) acquired in an SCS with the sequence of event recorder (SOER) function using a CENTUM VP/CS 3000 HIS or PC (with V net or Vnet/IP interface card). SOE Viewer allows viewing event logs of specified SCSs. It also provides event log filtering, trip report generation and other functions.

Figure   SOE Viewer (Event Mode)

Integration with CENTUM VP/CS 3000

This package runs on SENG and is used to integrate ProSafe-RS and CENTUM VP/CS 3000. In CENTUM VP/CS 3000 integration structure, it is possible to perform the following tasks on SCS from HIS and FCS.

- It is possible to use tag names to operate and monitor the data of SCS from HIS using the same interface as for FCS. It is also possible to read data of SCS from FCS.

- It is possible to manage generation/recovery of process alarms and annunciator alarms detected by SCS in the CAMS for HIS message monitor or process alarm view on HIS.

- It is possible to monitor system alarms generated on SCS in the CAMS for HIS message monitor or system alarm view on HIS.

- It is possible to display the status of SCS in the SCS status display view on HIS.

Access Control and Operation History Management Package

This package is used to set the operation rights of engineers who operate the safety engineering PC (SENG), as well as to record the operation history.
It is useful to prevent engineers from making unintended changes by performing a wrong operation. The recorded operation history can be used for engineer job handover, and troubleshooting and analysis.

Integration with FAST/TOOLS

This package runs on SENG and is used to integrate ProSafe-RS and FAST/TOOLS. In FAST/TOOLS integration structure, it is possible to operate and monitor the data of SCS from FAST/TOOLS.

SOE OPC Interface Package

This package provides functions for installing an OPC server on an HIS of CENTUM VP/CS 3000 or SENG and notifying event logs (event information and diagnostic information) acquired by the SOER function of the SCS to OPC clients via the OPC interface.

7.   HIS Operation and Monitoring Functions

The table below shows what operation and monitoring functions that CENTUM VP/CS 3000 HIS can perform for FCS and SCS.

Table   HIS Operation and Monitoring Functions for FCS and SCS

Classification	HIS function	FCS	SCS	Remarks for ProSafe-RS
Common Operation and Monitoring Functions	Window Call-up	X	X	
	Operating Screen Mode	X	X	
	System Message Window	X	X	
	Window Sizing	X	X	
	Window Hierarchy	X	X	
	Navigator Window	X	X	
	Panel Set	X	X	
	Dynamic Window Set	X	X	
	Circulate Functions	X	X	
	Alarm Processing Functions	X	X	
	Print Screen Functions	X	X	
Operation and Monitoring Windows	Graphic View	X	X	See "Table Mapping Blocks and Elements" for the assigned mapping blocks and elements. 1-second trends cannot be created.
	Tuning View	X	X	
	Faceplate View	X	X	
	Trend View	X	X	
	Trend Point View	X	X	
	Process Alarm View (*1)	X	X	
	Operator Guide View	X	–	SCSs do not generate operation guide messages. (*2)
	Message Monitoring Window	X	X	SCSs do not generate sequence messages. (*2)
Operation and Monitoring Support Functions	Process Reports	X	X	
	Historical Message Reports	X	X	
	Security Functions	X	X	
	Report Functions (Option)	X	X	
	Connecting an ITV Camera	X	X	
	CENTUM Desktop Environment Customization	X	X	
	Voice Messaging	X	–	SCSs do not support %VM (voice messages). (*2)
	Multi-monitor	X	X	
	Advanced Alarm Filter Window	X	X	
System Maintenance Functions	System Status Overview	X	X	
	System Alarm View (*1)	X	X	
	FCS Status Display View	X	–	
	SCS Status Display View	–	X	
	HIS Setting Window	X	X	
	Time Setting Dialog Box	X	X	
	Help Dialog Window	X	X	
Control Status Display Window	Control Drawing View (Option)	X	–	SENGs support this function with a Multi-Language Editor of SCS Manager.
	Sequence Table View	X	–	
	Logic Chart View (Option)	X	–	
	SEBOL View	X	–	
	SFC View	X	–	
Trend Functions	Trends	X	X	1-second trends cannot be created. See "Table Mapping Blocks and Elements" for the assignable mapping blocks and elements.
	Tuning Trend	X	X	
	Displaying Trends from Other Stations	X	X	
	Long-term Data Archive (Option)	X	X	
	External Recorder Output (Option)	X	X	
Individual package	Open Interfaces (Option)	X	–	Supported by the SOE OPC interface package.
	FCS Data Setting/Acquisition Functions (PICOT) (Option)	X	X	Only data settings from external devices (elements) can be used. (*3)
	Server for Remote Operation and Monitoring Function (Option)	X	X	The use of SENG window is banned. Only monitoring with tag name is possible.
	Configured Information Reference Function (Option)	X	–	
	Consolidated Historical Message Viewer Meeting FDA Regulations (Option)	X	X	
	System Integration OPC Station (SIOS) (Option)	X	X	Only data settings (elements) from external devices can be used. (*3)
	SOE package	X	X	Can be supported by SOE Viewer.
	Generic Subsystem Gateway Package (Option)	X	X	Only data settings (elements) from external devices can be used. (*3)
	Plant Resource Manager (PRM)	X	–	

X: available   –:   not applicable
*1:   When CAMS for HIS is enabled, these views are aggregated into the CAMS for HIS Message Monitor.
*2:   See "Table Software Inputs and Outputs that can be used with SCSs" listed later.
*3:   See "Table Mapping Blocks and Elements" listed later.

Mapping blocks or mapping elements are created when you define tag name in the instance of internal variables, input/output variables, or function blocks. Thus, the access with HIS is enabled.

The table below shows a list of mapping blocks and elements.

Table　Mapping Blocks and Elements

Classification	Description	Application Logic Definition		Mapping block/element	
		Classification	Type name	Type	Type name/ element name
Internal variable	BOOL type	Internal variable	BOOL	Mapping element	%WB
	Integer-type (32-bit)	Internal variable	DINT	Mapping element	%WB
	Real number-type(32-bit)	Internal variable	REAL	Mapping element	%WB
Input/output variable	Discrete	I/O structure	IO_BOOL	Mapping element	%Z
	Analog	I/O structure	IO_REAL	Mapping element	%WB
Data setting from external device	Data setting (BOOL)	FB	ECW_B	Mapping element	%WB
	Data setting (integer)	FB	ECW_I	Mapping element	%WB
	Data setting (real number)	FB	ECW_R	Mapping element	%WB
Analog input indication	Analog input FB with data status	FB	ANLG_S	Mapping block	S_ANLG_S
	Analog input	FB	ANLGI	Mapping block	S_ANLGI
Velocity limit	Velocity limit alarm	FB	VEL	Mapping block	S_VEL
Annunciator	Annunciator	FB	ANN	Mapping element	%AN
	First-up Alarm Annunciator (*2)	FB	ANN_FUP	Mapping element	%AN
Override from HIS	Override (BOOL)	FB	OVR_B	Mapping block	S_OVR_B
	Override (integer)	FB	OVR_I	Mapping block	S_OVR_I
	Override (real number)	FB	OVR_R	Mapping block	S_OVR_R
	Override (discrete)	FB	OVR_IB	Mapping block	S_OVR_IB
	Override (analog)	FB	OVR_IR	Mapping block	S_OVR_IR
	Grouping Override (BOOL) (*1)	FB	GOV_B	Mapping block	S_OVR_B
	Grouping Override (discrete) (*1)	FB	GOV_IB	Mapping block	S_GOV_IB
Manual operation	BOOL-Type data manual operation FB with two-position answerback	FB	MOB_11	Mapping block	S_MOB_11
	BOOL-Type data manual operation FB with three-position answerback	FB	MOB_21	Mapping block	S_MOB_21
	Auto-reset BOOL-Type data manual operation	FB	MOB_RS	Mapping block	S_MOB_RS
	Analog-Type data manual operation	FB	MOA	Mapping block	S_MOA
Password	Password entry	FB	PASSWD	Mapping block	S_PASSWD
Subsystem	Subsystem communication input (BOOL)	FB	SCI_B	Mapping element	%WB
	Subsystem communication input (integer)	FB	SCI_I	Mapping element	%WB
	Subsystem communication input (real number)	FB	SCI_R	Mapping element	%WB
	Subsystem communication output (BOOL)	FB	SCO_B	Mapping element	%WB
	Subsystem communication output (integer)	FB	SCO_I	Mapping element	%WB
	Subsystem communication output (real number)	FB	SCO_R	Mapping element	%WB

*1:　Supported by ProSafe-RS R1.03.00 or later.
*2:　Supported by ProSafe-RS R2.03.00 or later.

The table below shows software inputs and outputs that can be used with SCSs.

Table   Software Inputs and Outputs that can be Used with SCSs

Name	Support by SCS	Element
Common switches	x	%SW
Global switch		%GS
Annunciator	x	%AN
Printout message (both printed and historical message)		%PR
Printout message (no printed message, historical messages only)		%PR
Operation guide message		%OG
Multimedia start message		%VM
Sequence message request		%RQ
Supervisory computer event message		%CP
Supervisory computer message output for PICOT		%M3
Signal event message		%EV
SFC/SEBOL return event message output		%RE

x: Supported
Blank: Not supported

Revision Information

- Title   : Safety Instrumented System ProSafe-RS System Overview
- Manual No. : TI 32R01B10-01E

Jun. 2008/1st Edition
Newly published

Dec. 2008/2nd Edition
2.   Section "Security Measures" added
        Section "Integrated Monitoring with FAST/TOOLS" added
3.1   SDV526, AKB652 and SWD2D added
4.1   Figure of Safety Control Unit for Vnet/IP (standard type) corrected
6.   Section "Integration with FAST/TOOLS" added

Jan. 2010/3rd Edition
3.1   SSB401's name changed
        Description of number of I/O nodes added
        SDV53A and SED3D added
4.1   SSB401's name changed
        SSC60S and SSC60D added
7.   ANN_FUP added

Aug. 2011/4th Edition
3.   SAT145, SAR145, SBA4D, SBT4D, SBR4D, SBD2D, SBD3D, SBD4D and SBM54D added
6.   "Access Control and Operation History Management Package" added
7.   Title revised

Nov. 2012/5th Edition
3.1   ALE111, AKB651 and the high-density installation type added
4.6   ALE111 added

Apr. 2013/6th Edition
3.1   Models of Input/Output Modules revised

Sep. 2013/7th Edition
2.   Section "Integrated Monitoring with FAST/TOOLS" revised.

Subject to change without notice.