

MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Reference package for procurement and maintenance review

YOKOGAWA

SCP451-11 S1

SAFETY CONTROL PROCESSOR MODULE

Used with the applicable ProSafe-RS configuration.

REFERENCE PACKAGE

OFFICIAL DOCUMENT

Selected official manufacturer pages follow this cover.

Source: Yokogawa IM 32Q06C10-31E, processor module and maintenance sections

Safety Control Stations (Hardware)

IM 32Q06C10-31E

vigilantplant[®]

Introduction

ProSafe-RS is a safety control system consisted of a safety control station (SCS) and a safety engineering PC (SENG).

This User's Manual describes the hardware of SCS and how to connect the control bus interface card to SENG.

■ Structure of This Document

The purpose of this document is to help readers to fully understand the SCS hardware as well as the hardware installation and maintenance so as to take full advantage of the hardware performance.

This document consists of 8 chapters.

- Chapter 1.
Hardware Configuration and Names of Components
Explains the input and output modules and peripherals used to construct the ProSafe-RS system.
- Chapter 2.
Installing Devices
Explains how to install the main parts of SCS hardware and the terminal boards and how to reserve the service area.
- Chapter 3.
Cable Connection
Explains the wiring methods of power supply cables, grounding cables and control bus cables.
- Chapter 4.
Configuration and Functions of Each Unit
Explains the features of the modules and units used for constructing the safety control unit and safety node unit as well as the LED displays and major setting items.
- Chapter 5.
Signal Cable Connection to Input/Output Modules
Explains how to connect the I/O modules with the field devices.
- Chapter 6.
Control Bus Interface Card
Explains how to install the control bus interface card to the PC/AT compatible PC, how to connect control bus cable to the interface card and how to set its station address.
- Chapter 7.
Maintenance of ProSafe-RS Hardware
Explains the main methods on routine inspections, inspection through the system management window, online maintenance and periodical replacement of the parts (the parts that have defined life span) as well as replacement procedures.
- Chapter 8.
Relay Board
Explains the handling relay board, cable connection and maintenance.

Safety Precautions for Use

■ Safety, Protection, and Modification of the Product

- To protect the system controlled by the Product and the Product itself and to ensure safe operation, please observe the safety precautions described in this Manual. Yokogawa Electric Corporation ("YOKOGAWA") assumes no liability for safety if users fail to observe the safety precautions and instructions when operating the Product.
- If the Product is used in a manner not specified in the User's Manuals, the protection provided by the Product may be impaired.
- If any protection or safety circuit is required for the system controlled by the Product or for the Product itself, please install it externally.
- Use only spare parts that are approved by YOKOGAWA when replacing parts or consumables of the Product.
- Do not use the Product and its accessories such as power cords on devices that are not approved by YOKOGAWA. Do not use the Product and its accessories for any purpose other than those intended by YOKOGAWA.
- Modification of the Product is strictly prohibited.
- The following symbols are used in the Product and User's Manuals to indicate the accompanying safety precautions:



Indicates that caution is required for operation. This symbol is labeled on the Product to refer the user to the User's Manuals for necessary actions or behaviors in order to protect the operator and the equipment against dangers such as electric shock. In the User's Manuals, you will find the precautions necessary to prevent physical injury or death, which may be caused by accidents, such as electric shock resulting from operational mistakes.



Identifies a protective conductor terminal. Before using the Product, you must ground the protective conductor terminal to avoid electric shock.



Identifies a functional grounding terminal. A terminal marked "FG" also has the same function. This terminal is used for grounding other than protective grounding. Before using the Product, you must ground this terminal.



Indicates an AC supply.



Indicates a DC supply.



Indicates the ON position of a power on/off switch.



Indicates the OFF position of a power on/off switch.

■ Notes on Handling User's Manuals

- Hand over the User's Manuals to your end users so that they can keep the User's Manuals on hand for convenient reference.
- Thoroughly read and understand the information in the User's Manuals before using the Product.
- For the avoidance of doubt, the purpose of the User's Manuals is not to warrant that the Product is suitable for any particular purpose but to describe the functional details of the Product.
- Contents of the User's Manuals are subject to change without notice.

3.3.2 Connecting Cables for Vnet/IP

The section explains how to connect the cables for Vnet/IP.



IMPORTANT

When you connect the cables for Vnet/IP to the processor modules of the safety control unit, note the following:

- For each safety control unit, connect "Layer 2 switch for Bus 1 to the BUS 1 connector of the processor module" and connect "Layer 2 switch for Bus 2 to the BUS 2 connector of the processor module."
- Before connecting the cable, remove the processor module from the safety control unit.

■ Cable Wiring for Vnet/IP

The following figure shows the wiring of Vnet/IP for connecting a safety engineering PC and a safety control unit.

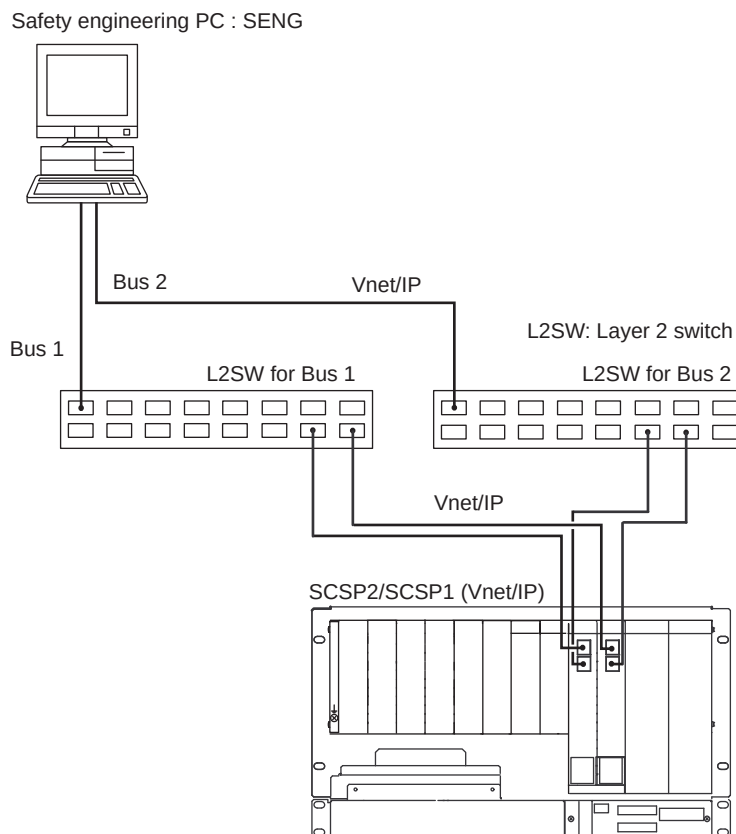


Figure 3.3.2-1 Connecting Cables for Vnet/IP

● Connecting Cables for Vnet/IP

The cables for Vnet/IP are connected to the processor modules of the safety control unit. There are two types of processor modules:

- SCP461 (SSC60S/SSC60D)
- SCP451 (SSC50S/SSC50D)

When connecting Vnet/IP cables:

- **Power On:**
You can only turn on the power after connecting the cables to the processor module.
- **Removing the processor module while the system is running:**
Remove the processor module with the cables connected to it.
- **Mounting the processor module while the system is running:**
You can mount the processor module after connecting the cables to it.

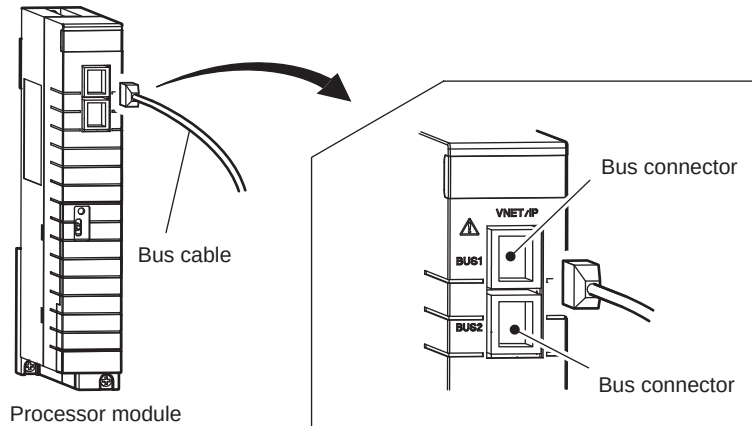


Figure 3.3.2-2 Connecting Cables for Vnet/IP

● SCP461

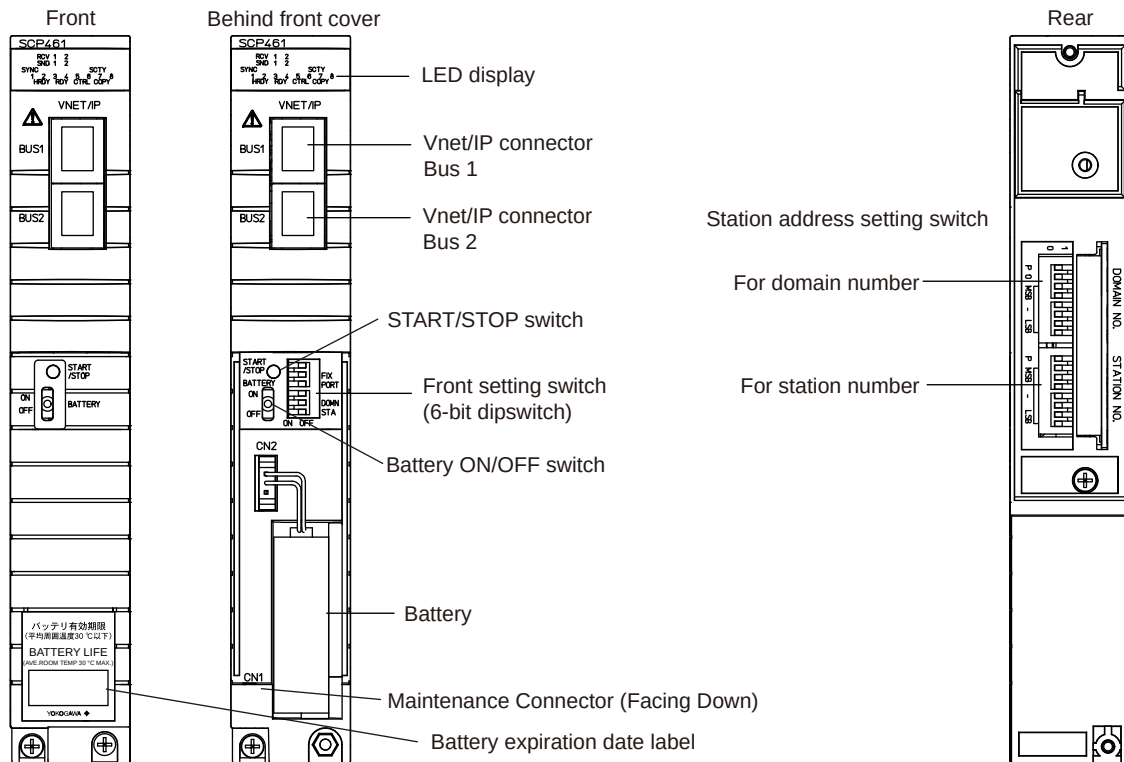


Figure 4.2-2 SCP461 Overview

● SCP451

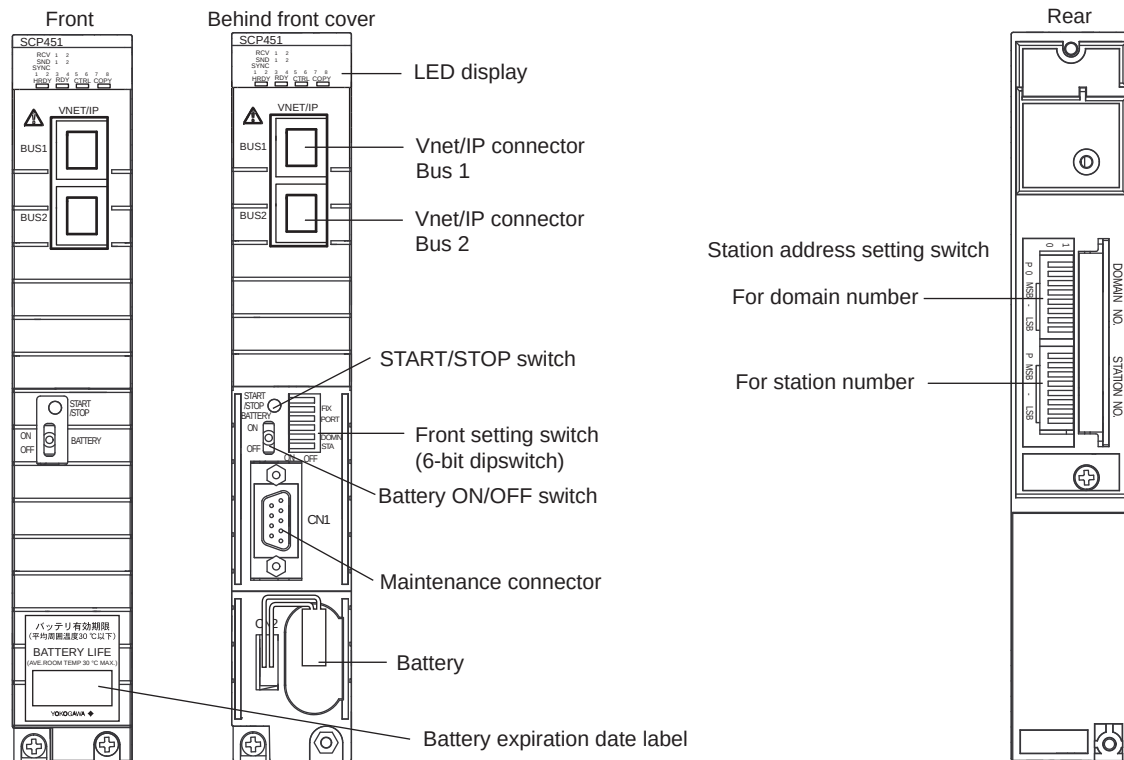


Figure 4.2-3 SCP451 Overview

4.2.1 Battery

In order to protect the processor module management information (in the storage memory) during power failure, the Li batteries are used.

Since the application program information is stored in the non-volatile memories, thus battery backup is not required.



CAUTION

Use batteries specified by Yokogawa Electric.

A label indicating the expiration date of the battery is attached on the lower part of the processor module front cover. This expiration date is valid when the ambient temperature is less than 30 degree Celsius.

The part number of battery pack is S9185FA.

Recommended replacement cycle of battery: Changes according to the ambient temperature as follows:

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

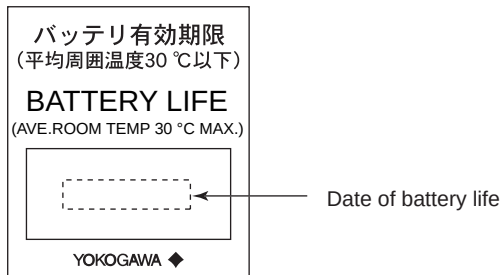


Figure 4.2.1-1 Battery Expiration Date Label

SEE ALSO

For more information about how to replace the battery, refer to:

[7.7.1, "Replacing Battery" on page 7-34](#)

4.2.2 LED Display

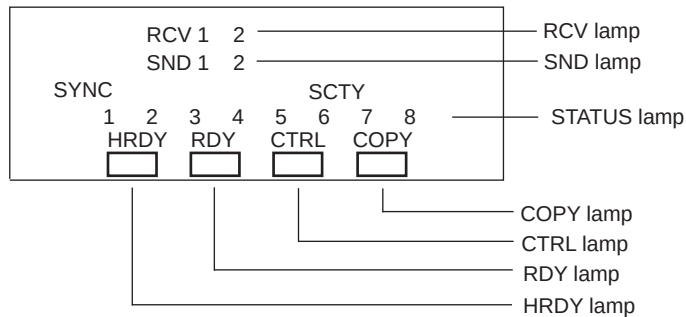


Figure 4.2.2-1 LED Display

- **HRDY:**
The processor module performs self diagnosis. If the processor module hardware is functioning normally, the green lamp turns on. If abnormality is found, the lamp turns off.
- **RDY:**
The green lamp turns on if both the hardware and software are functioning normally. If either of them is abnormal, the lamp turns off.
- **CTRL:**
The green lamp turns on if the processor module is performing control. If the processor module is standby, the lamp turns off.
- **COPY:**
In the dual-redundant type safety control unit, the green lamp turns on when program copy is executed and turns off when program copy is completed.

When a processor module has been replaced or when the unit is stopped and then started again, the standby-side processor module automatically copies the program of the control-side processor module. When copy is completed, the lamp turns off. It is always off in the basic safety control unit (non-redundant configuration).
- **RCV:**
Indicates the control bus communication status. 1 stands for bus1 while 2 stands for bus2.
 - **V net:** When receiving communication frames, the green lamp turns on, otherwise the lamp turns off.
 - **Vnet/IP:** When receiving communication frames, the green lamp blinks, otherwise the lamp turns off.
- **SND:**
Indicates the control bus communication status. 1 stands for bus1 while 2 stands for bus2.
 - **V net:** When sending communication frames, the green lamp turns on, otherwise the lamp turns off.
 - **Vnet/IP:** When sending communication frames, the green lamp blinks, otherwise the lamp turns off.
- **SYNC:**
Indicates the time synchronization status.
 - **V net:** If the module is synchronizing with V net clock or IRIG-B clock, the green lamp turns on, otherwise the lamp turns off.
 - **Vnet/IP:** If the module is synchronizing with Vnet/IP clock, the green lamp turns on, otherwise the lamp turns off.
- **SCTY:**

The green lamp turns on when the security level of the SCS is online-level. If the security level of the SCS is offline-level, the lamp turns off.

- STATUS(1,2,3,4,5,6,7,8):
These lamps are indicating the status of the processor module.
 - When both DOMN and STA bits of the front setting switch (6-bit DIP switch) are off: These lamps are indicating Operating Mode and error status.
 - When the DOMN bit of the front setting switch (6-bit DIP switch) is on: Displays the domain number that was set to the processor module.
 - When the STA bit of the front setting switch (6-bit DIP switch) is on: Displays the station number that was set to the processor module.

7.2.3 Replacing Processor Module

Processor module is to be replaced according to the following procedure.



IMPORTANT

When replacing a non-redundantly configured processor module, take care of the following cautions:

- The memory of processor module to be replaced should be cleared (by switching off the battery).
- After installing the processor module, the master database offline download needs to be performed from the SCS Manager of SENG.

SEE ALSO

For more information about the indication LEDs on front of processor module, refer to:

[4.2, "Processor Module" on page 4-3](#)

For more information about disconnecting the cables for Vnet/IP, refer to:

[3.3.2, "Connecting Cables for Vnet/IP" on page 3-17](#)

For more information about master database offline download, refer to:

[9.3, "Master Database Offline Download" in Engineering Reference \(IM 32Q04B10-31E\)](#)

■ SCP401

● Procedure for Removing Processor Module

1. Make sure that the CTRL LED on the processor module to be removed is OFF (indicates that the module is in standby state). If the LED is ON, push the START/STOP switch to make it OFF.
2. Disconnect the V net coupler cable at the front side of the processor module. And promptly remove the other V net coupler cable.
3. Loosen the screws that fix the processor module.
4. Pull out the processor module straight.

● Installation Procedure

1. Check the processor module to be installed has the same domain number and the station number as the replaced module.
2. Make sure that the BATTERY ON/OFF switch is at the OFF position.
3. Install the processor module into the base unit.
Make sure that the processor module is firmly inserted into the slot at the backboard.
4. Fasten the screws that fix the processor module.
5. Connect the V net coupler cable at the front side of the processor module. And promptly connect the other V net coupler cable.
6. Put the BATTERY ON/OFF switch to ON position.
7. Check the front lamps or the SCS state management window to make sure that the processor module is normal.
Check the diagnostic information window on the SENG for any errors.

- If the processor modules are dual-redundantly configured, the program is copied automatically. The processor becomes standby status after copying.
- If the processor module is not redundantly configured, you need to perform master database offline download.

**SEE
ALSO**

For more information about procedure for exchanging single processor module, refer to:

[7.2.2, "Maintenance for ProSafe-RS Equipment" in Engineering Guide \(IM 32Q01C10-31E\)](#)

■ SCP461/SCP451

● Procedure for Removing Processor Module



IMPORTANT

When you remove the processor module while the system is running, you should not disconnect the cables for Vnet/IP from the processor module.

1. Make sure that the CTRL LED on the processor module to be removed is OFF (indicates that the module is in standby state). If the LED is ON, push the START/STOP switch to make it OFF.
2. Loosen the screws that fix the processor module.
3. Without disconnecting the cables for Vnet/IP, remove the processor module by pulling it toward you.
4. Disconnect the cables for BUS1 and BUS2 from the front of the processor module. For replacement of the processor module, there is no need to disconnect the cables from the Layer2 Switch.

● Overview of Installation Procedures



IMPORTANT

- When you install the processor module to the base unit while the system is running, you should connect the cables for Vnet/IP to the processor module first.
- For ProSafe-RS systems not integrated with the CENTUM system, before you install the processor module to the base unit, you need to erase all internal settings in the processor module in accordance with the procedure for erasing the processor module internal settings.
When integrated with CENTUM system, the procedure for erasing the processor module internal settings is not needed.

**SEE
ALSO**

For more information about procedure to erase internal settings in the processor module, refer to:

“● Procedure to Erase Processor Module Internal Settings” on page 7-12

● Installation Procedure

1. Make sure that the DIP switches for the domain and station numbers as well as the front DIP switches for negotiation set on the processor module to be installed are the same as on the module to be replaced.

2. Make sure that the BATTERY ON/OFF switch is at the OFF position.
3. Connect the cables to both ports of BUS1 and BUS2. There is no need to turn off the power of the Layer2 Switch.
4. Install the processor module into the base unit. Make sure that the processor module is firmly inserted into the slot at the backboard.
5. Fasten the screws that fix the processor module.
6. Put the BATTERY ON/OFF switch to ON position.
7. Check the front lamps or the SCS state management window to make sure that the processor module is normal.
Check the diagnostic information window on the SENG for any errors.
 - If the processor modules are dual-redundantly configured, the program is copied automatically. The processor becomes standby status after copying.
 - If the processor module is not redundantly configured, you need to perform master database offline download.

● Procedure to Erase Processor Module Internal Settings

For the ProSafe-RS system that is not integrated with CENTUM system, erase the processor module internal settings in accordance with the following procedure.

1. Set the DIP switches (SW1) for the domain number on the processor module as follows:

Table 7.2.3-1 Setting of DIP Switches for Domain Number Setting (SW1)

Bit 1	Parity	1
Bit 2		1
Bit 3	MSB	0
Bit 4		0
Bit 5		0
Bit 6		0
Bit 7		0
Bit 8	LSB	1

2. Set the DIP switches (SW2) for the station number on the processor module as follows:

Table 7.2.3-2 Setting of DIP Switches for Station Number Setting (SW2)

Bit 1	Parity	0
Bit 2	MSB	0
Bit 3		0
Bit 4		0
Bit 5		0
Bit 6		0
Bit 7		0
Bit 8	LSB	1

3. Check that the front DIP switches on the processor module are all set to the OFF position:

Table 7.2.3-3 Setting of DIP Switches for Action Mode Setting (SW4)

Bit 6		OFF
Bit 5	FIX	OFF
Bit 4	PORT	OFF
Bit 3		OFF
Bit 2	DOMN	OFF
Bit 1	STA	OFF

4. Without connecting the cables for BUS1 and BUS2, install the processor module to the base unit.
5. Push the START/STOP switch on the processor module to stop the module, and make sure that the HRDY LED is OFF.
6. Keep the processor module at this status for about a minute.
7. Remove the processor module from the base unit.

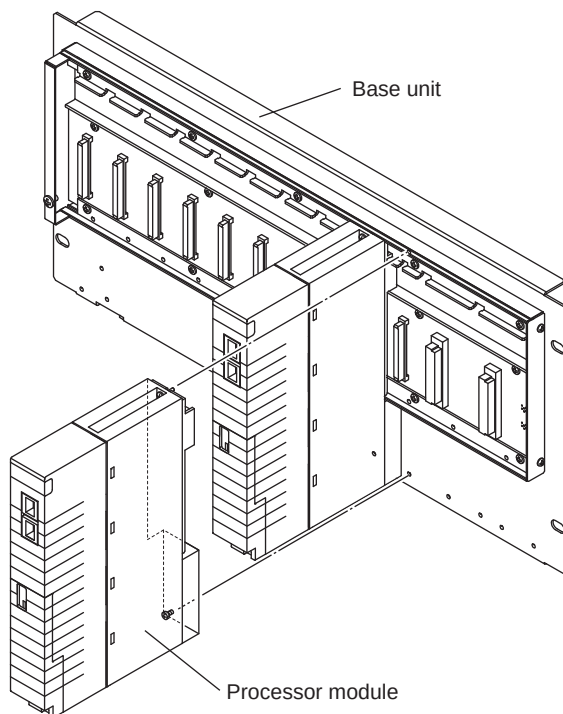


Figure 7.2.3-1 Replacing the Processor Module

SEE ALSO For more information about DIP switches, refer to:

- “● SCP461” on page 4-4
- “● SCP451” on page 4-4

General Specifications

GS 32Q06D20-31E

Models SSC50S, SSC50D
Safety Control Unit,
Duplexed Safety Control Unit
(for Vnet/IP, Rack Mountable Type)

ProSafe-RS

■ GENERAL

This GS provides the hardware specifications of the safety control unit for Vnet/IP, which are intelligent parts of the safety control station (SCS).

■ HARDWARE SPECIFICATIONS

For the criteria for the installation environment, refer to "ProSafe-RS Safety Instrumented System Overview (for Vnet/IP)" (GS 32P01B10-01EN).

● Processor

MIPS R5000 Processor

● Main Memory Capacity

32 MB

● Memory Protection at Power Failure

Application program is stored in flash memory.

Processor Module operation data is stored in NVRAM (nonvolatile memory).

● Temperature Adaptability

A fan unit is provided for high temperature use where the safety control units (SSC50S-F/SSC50D-F) ambient temperature exceeds 40 °C.

● Communications Interface

Vnet/IP interface: Dual-redundant

ESB bus interface: Dual-redundant

● Communication on Vnet/IP

Communication speed: 100 Mbps, Full duplex

Connection: UTP cable (CAT5e or higher), RJ45 connector

Interface: 100BASE-TX compliance

Max. distance: 100 m (distance between SSC50S/SSC50D and Layer 2 switch)

● Connecting Safety Node Units

For each safety control unit, up to nine safety node units can be connected. For installation, ESB bus coupler modules (SEC401) should be mounted on 7-th and 8-th slots.

ESB bus can be extended by Optical ESB bus repeater module.

● Number of I/O Modules Mounted

Up to eight for each safety control unit

Up to 78 for each SCS

● Power Requirements

Specify suffix codes.

Voltage: 100 to 120 V AC, 50 or 60 Hz

Voltage: 220 to 240 V AC, 50 or 60 Hz

Voltage: 24 V DC

● Power Consumption

• SSC50S-S/SSC50D-S

100 to 120 V AC model: 200 VA

200 to 240 V AC model: 230 VA

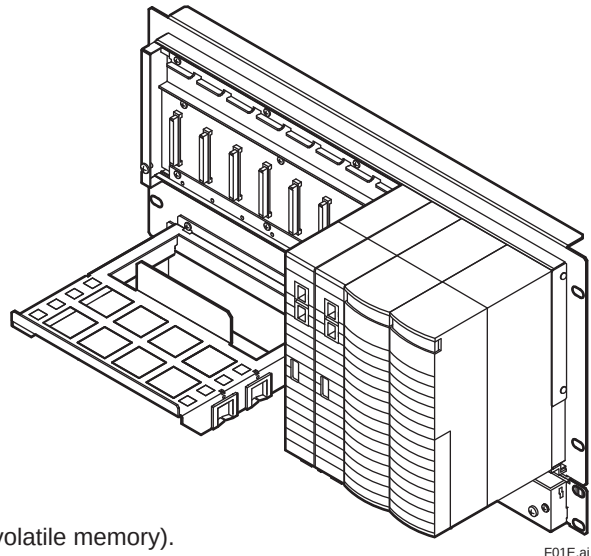
24 V DC model: 5.5 A

• SSC50S-F/SSC50D-F

100 to 120 V AC model: 240 VA

200 to 240 V AC model: 290 VA

24 V DC model: 7.0 A



● Battery

Part No. : S9185FA

Battery's recommended replacement period:

Three years under the average ambient temperature of 30 °C or less.

● Weight

Approx. 7.9 kg (for SSC50S-S)

Approx. 13 kg (for SSC50S-F)

Approx. 8.5 kg (for SSC50D-S)

Approx. 13 kg (for SSC50D-F)

● Mounting

Rack mounting: SSC50S-S/SSC50D-S rack mounted with eight M5 screws

SSC50S-F/SSC50D-F rack mounted with twelve M5 screws

Insulating Bushing: Supplied as accessories

The SCS is composed of a safety control unit, safety node units and an ESB bus connecting them.

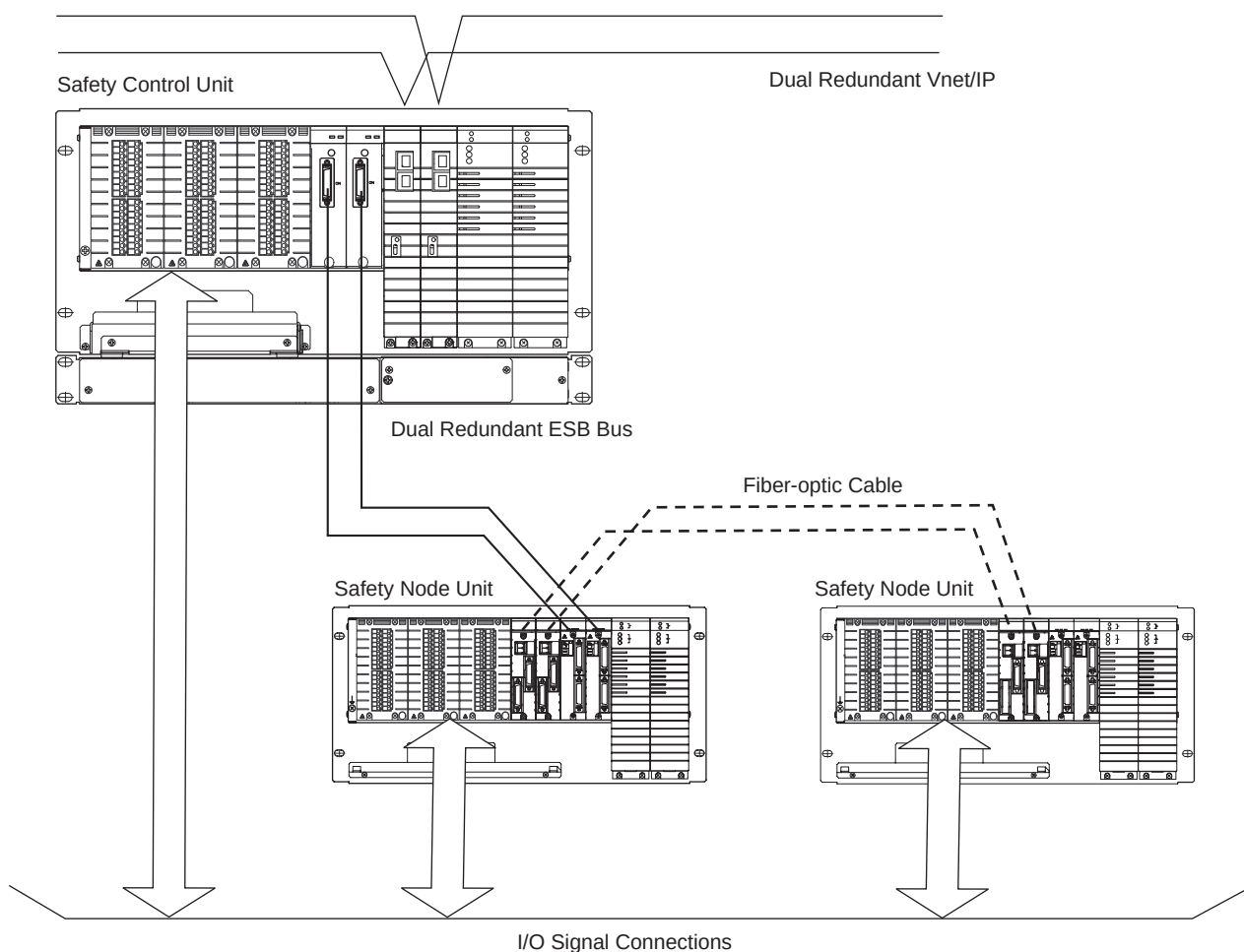


Figure SCS Configuration

● Connections

Power Supply: Connected with M4 screws.

Grounding: Connected with M4 screws.

● Conformity Standards

Refer to "ProSafe-RS Standards Compliant Models" (GS 32P01B60-01EN).

■ MODEL AND SUFFIX CODES

Safety Control Unit

		Description
Model	SSC50S	Safety Control Unit (for Vnet/IP, Rack Mountable Type)
Suffix Codes	-S	Standard Type (-20 to 40 °C) (with ISA Standard G3)
	-F	Wide range temperature (-20 to 70 °C) type (with Fan unit and ISA Standard G3)
	2	Dual-redundant power supply
	5	With no explosion protection
	E	With explosion protection
	1	100-120 V AC power supply
	2	220-240 V AC power supply
	4	24 V DC power supply
Option Code	3	CFS1100 Safety Control Function License (for R3: R3.02.31 or later) (*1)
	4	Without Safety Control Function License (for R4.01.31 or later) (*2)
Option Code	/ATDOC	Explosion Protection Manual

Note: Install the 19-inch rack mountable type devices in a keyed metallic cabinet to conform to the safety standards, the EMC conformity standards and the explosion protection standards.

For details, refer to ProSafe-RS Installation Guidance (TI 32P01J10-01EN).

Note: Select the option code "/ATDOC" to follow the ATEX Directive for use in potentially explosive atmospheres.

Note: When the release number is earlier than R3.02.31 or R4.01.31, use SCP451-□1 as a processor module.

When the release number is R3.02.31 and R4.01.31 or later, use SCP451-□1 or SCP451-□3 as a processor module.

SCP451-□1 and SCP451-□3 can be placed in the same safety control unit.

*1: R3.02.31 patch software must be applied.

*2: R4.01.31 patch software must be applied.

Duplexed Safety Control Unit

		Description
Model	SSC50D	Duplexed Safety Control Unit (for Vnet/IP, Rack Mountable Type)
Suffix Codes	-S	Standard Type (-20 to 40 °C) (with ISA Standard G3)
	-F	Wide range temperature (-20 to 70 °C) type (with Fan unit and ISA Standard G3)
	2	Dual-redundant power supply
	5	With no explosion protection
	E	With explosion protection
	1	100-120 V AC power supply
	2	220-240 V AC power supply
	4	24 V DC power supply
Option Code	3	CFS1100 Safety Control Function License (for R3: R3.02.31 or later) (*1)
	4	Without Safety Control Function License (for R4.01.31 or later) (*2)
Option Code	/ATDOC	Explosion Protection Manual

Note: Install the 19-inch rack mountable type devices in a keyed metallic cabinet to conform to the safety standards, the EMC conformity standards and the explosion protection standards.

For details, refer to ProSafe-RS Installation Guidance (TI 32P01J10-01EN).

Note: Select the option code "/ATDOC" to follow the ATEX Directive for use in potentially explosive atmospheres.

Note: When the release number is earlier than R3.02.31 or R4.01.31, use SCP451-□1 as a processor module.

When the release number is R3.02.31 and R4.01.31 or later, use SCP451-□1 or SCP451-□3 as a processor module.

SCP451-□1 and SCP451-□3 can be placed in the same safety control unit.

*1: R3.02.31 patch software must be applied.

*2: R4.01.31 patch software must be applied.

■ SOFTWARE

When the release number of software is R3, specify "CFS1100 Safety Control Function License" by suffix code. For details on the CFS1100 specifications, refer to "Safety Control Functions Package" (GS 32Q03B20-31E).

When the release number of software is R4.01 or later, specify "Without Safety Control Function License" by suffix code. Software licenses are required for SSC50S and SSC50D separately. For details, refer to "Safety Control Function (for SSC50□), Safety Control Function for SCS Simulator (for SSC50□)" (GS 32P03B20-01EN) and "Project I/O License" (GS 32P03A10-01EN).