

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.

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- Every effort has been made to ensure the accuracy of contents in the User's Manuals. However, should you have any questions or find any errors, contact us or your local distributor. The User's Manuals with unordered or missing pages will be replaced.

■ Warning and Disclaimer

- Except as specified in the warranty terms, YOKOGAWA shall not provide any warranty for the Product.
- YOKOGAWA shall not be liable for any indirect or consequential loss incurred by either using or not being able to use the Product.

■ Notes on Hardware

● Appearance and Accessories

Check the following items when you receive the Product:

- Appearance
- Standard accessories

Contact us or your local distributor in the following cases:

- The Product coating is peeling off.
- The Product itself is damaged.
- Any accessories are missing.

If the following label turns dirty and the information on it becomes illegible, or if the label is peeling off, order a new one with the part number T9029BX to replace it.



: Label attached to the Products such as the power supply module.

● Model and Suffix Codes

The name plate on the Product contains the model and suffix codes. Verify the model and suffix codes with those in the General Specifications (GS) to ensure that the Product matches the order specifications. Should you have any questions, contact us or your local distributor.

Documentation Conventions

■ Symbols

The following symbols are used in the User's Manuals.



CAUTION

Identifies instructions that must be observed to avoid physical injury, electric shock, or death.



WARNING

Identifies instructions that must be observed to prevent damage to the software or hardware, or system failures of the Product.



IMPORTANT

Identifies important information required to understand operations or functions.

TIP

Identifies additional information.

**SEE
ALSO**

Identifies referenced content.

In online manuals, you can view the referenced content by clicking the links that are in green text. However, this action does not apply to the links that are in black text.

■ Drawing Conventions

Drawings used in the User's Manuals may be partially emphasized, simplified, or omitted for the convenience of description.

Drawings of windows may be slightly different from the actual screenshots with different settings or fonts. The difference does not hamper the understanding of basic functionalities and operation and monitoring tasks.

■ Integration with CENTUM

The Product can be integrated with CENTUM VP or CENTUM CS 3000. In the User's Manuals, the integration with CENTUM VP or CENTUM CS 3000 is referred to as "Integration with CENTUM."

In the User's Manuals, the explanations for integrating the Product with CENTUM VP or CENTUM CS 3000, the glossary for various features of CENTUM VP is used instead of the glossary for CENTUM CS 3000. For example, the term "CENTUM VP System Alarm View" is used instead of "CENTUM CS 3000 System Alarm window." Nevertheless, if the features for integrating the Product with CENTUM VP and CENTUM CS 3000 are different, both features will be explained separately.

**SEE
ALSO**

For more information about the functions and usage of CENTUM VP components for integrating the Product with CENTUM VP, refer to:

User's Manuals (IM), Technical Information (TI), and General Specifications (GS) of CENTUM VP

For more information about the features and usage of CENTUM CS 3000 components for integrating the Product with CENTUM CS 3000, refer to:

User's Manuals (IM), Technical Information (TI), and General Specifications (GS) of CENTUM CS 3000

■ Explanation of Hardware and Software Behaviors in the User's Manuals

In the User's Manuals, system behaviors are explained assuming that the latest versions of YOKOGAWA software and hardware at the time of publication of the User's Manuals are installed.

If additional precise information about the safety of legacy versions of software or hardware is required, a link to the corresponding explanation is provided. Please refer to the information according to your system.

■ Station Types

A safety control station (hereafter referred to as SCS) is named according to the type of the safety control unit used in it.

Table Info-1 Names of SCS and Safety Control Unit Used

Name of SCS	Model of the safety control unit
SCSV1-S	SSC10S/SSC10D
SCSP1-S	SSC50S/SSC50D
SCSP2-S	SSC60S/SSC60D
SCSU1-S	SSC57S/SSC57D

In the User's Manuals, the following abbreviations may be used to describe functions of these SCS as a whole.

- SCSV1: Abbreviation of SCSV1-S
- SCSP1: Abbreviation of SCSP1-S
- SCSP2: Abbreviation of SCSP2-S
- SCSU1: Abbreviation of SCSU1-S

Conformity Standards and Cautions

■ Conformity Standards

The Product conforms to various standards.

**SEE
ALSO**

For more information about the standards that the Product conforms to, refer to:

General Specifications (GS) for the Product

● Standards

The standards that the Product conforms to are described in the following table:

Table Info-2 Standards

Category	Standard
Functional safety standards (*1) (*2)	IEC 61508
Programmable controllers (*1) (*2)	IEC 61131-2
Safety Standards (*2) (*3) (*4)	[CSA] • CAN/CSA-C22.2 No.61010-1 [100-120 V AC power supply] [CE Marking] Low Voltage Directive • EN 61010-1, EN 61010-2-030 [100-120 V AC (*5), 220-240 V AC, and 24 V DC power supply] [EAC Marking] (*6) • CU TR 004
EMC Standards (*2)	[CE Marking] EMC Directive • EN 55011 Class A Group 1 [100-120 V AC (*5), 220-240 V AC, and 24 V DC power supply] (*7) • EN 61000-6-2 [100-120 V AC (*5), 220-240 V AC, and 24 V DC power supply] (*8) • EN 61000-3-2 [220-240 V AC power supply] (*9) • EN 61000-3-3 [220-240 V AC power supply] [RCM] • EN 55011 Class A Group 1 [220-240 V AC and 24 V DC power supply] (*7) [KC Marking] • Korea Electromagnetic Conformity Standard [100-120 V AC (*10), 220-240 V AC, and 24 V DC power supply] [EAC Marking] (*6) • CU TR 020

*1: Safety control stations comply with this standard.

*2: The devices must be installed in a metal cabinet with lock and key to meet the safety standards and EMC Standards.

*3: To ensure that all the hardware devices satisfy the safety standards, the dedicated breakers conforming to the following specifications must be installed in the power supply distribution board:

- [CSA] CSA C22.2 No.5 or UL 489
- [CE Marking] EN 60947-1 and EN 60947-3

*4: The Product must be grounded to a protective grounding system that is suitable for the power distribution system or must conform to the safety standards of the country or region where the Product is used.

*5: SSC10S/SSC10D (100-120 V AC power supply) are excluded from CE Marking conformity.

*6: The EAC mark is as follows:



*7: Class A hardware devices are designed for use in an industrial environment.

*8: Regarding surge immunity, a lightning arrester or an equivalent equipment must be installed.

*9: Regarding the requirements on the limits for harmonic current emissions, the active filter circuitry or an external power supply unit with proper harmonic filters should be used.

*10: SSC10S/SSC10D (100-120 V AC power supply) are excluded from KC Marking conformity.

In relation to the CE Marking, the manufacturer and the authorised representative for Pro-Safe-RS in the EEA are indicated below:

- Manufacturer:

Devices included in the Product belong to the measurement categories of No.1, which are shown in the following table. The rated transient overvoltage of the measurement categories of No.1 is 1500 V.



WARNING

Devices included in the Product belong to the measurement categories of No.1, which are shown in the following table. Do not use the devices for measurements that belong to the measurement categories of No.2, No.3, and No.4.

The following table describes the standard numbers and measurement categories.

Table Info-3 Standard Numbers and Measurement Categories

No.	Standard number		Description
	IEC/EN/CSA 61010-1:2001	EN 61010-2-030	
No.1	Measurement category I	O (Other)	Measurements performed on circuits not directly connected to MAINS.
No.2	Measurement category II	Measurement category II	Measurements performed on circuits directly connected to the low-voltage installation.
No.3	Measurement category III	Measurement category III	Measurements performed in a building installation.
No.4	Measurement category IV	Measurement category IV	Measurements performed at the source of the low-voltage installation.

● Tightening Torque of Screws



CAUTION

The recommended tightening torque for the Product is shown in the following table. However, if the tightening torque of the screw is specified in the User's Manuals, follow the instructions described in the User's Manuals.

Table Info-4 Recommended Tightening Torque

Nominal diameter of a screw	M2.6	M3	M3.5	M4	M5	M6	M8	M10
Recommended tightening torque (N·m)	0.35	0.6	0.8	1.2	2.8	3.0	12.0	24.0

**SEE
ALSO**

For more information about each nominal diameter of a screw, refer to:

ProSafe-RS Installation Guidance (TI 32S01J10-01E)

● Power Cable Wiring



CAUTION

Connect the power cables according to the procedure specified in the User's Manuals of the device.

Power cables must conform to the safety standards of the country where the device is installed.

SEE ALSO

For more information about power cables wiring, refer to:

- [3.1, "Power Cable Wiring" on page 3-2](#)
 - ProSafe-RS Installation Guidance (TI 32S01J10-01E)
 - User's Manuals of each device
-

● Grounding



CAUTION

The Product requires the protective grounding defined by the safety standards.

You must ground the Product according to the procedure specified in the User's Manuals to prevent electric shock and to minimize the effect of noise.

SEE ALSO

For more information about grounding, refer to:

- [3.2, "Grounding" on page 3-6](#)
 - ProSafe-RS Installation Guidance (TI 32S01J10-01E)
 - User's Manuals of each device
-

● I/O Cable Wiring



CAUTION

Wire I/O cables according to the procedure specified in the User's Manuals.

SEE ALSO

For more information about I/O cable wiring, refer to:

- [5., "Signal Cable Connection to Input/Output Modules" on page 5-1](#)
 - ProSafe-RS Installation Guidance (TI 32S01J10-01E)
 - User's manual of each device
-

- **Connected Devices**



CAUTION

To ensure CSA standard conformity for the entire system of the Product, all the devices connected to the system of the Product should conform to CSA standards.

- **Maintenance**



CAUTION

- The Product maintenance should be performed only by personnel who have undergone specialized training.
 - When a device turns dirty, use a vacuum cleaner or a soft dry cloth to clean it.
 - During maintenance, wear a wrist strap and follow Electrostatic Discharge (ESD) precautions.
 - If any existing caution label is peeling off, or is dirty and illegible, order a new one with the part number T9029BX to replace it.
-

**SEE
ALSO**

For more information about maintenance, refer to:

- [7., "Maintenance of ProSafe-RS Hardware" on page 7-1](#)
 - ProSafe-RS Installation Guidance (TI 32S01J10-01E)
 - User's manual of each device
-

- **Modules, Cards, Cables, and Connectors**



CAUTION

When the power is on, only modules, cards, cables, and connectors that are allowed in the User's Manuals can be replaced, removed, or installed.

**SEE
ALSO**

For more information about replacing, and removing or installing modules, cards, cables, and connectors, refer to:

- [7., "Maintenance of ProSafe-RS Hardware" on page 7-1](#)
 - ProSafe-RS Installation Guidance (TI 32S01J10-01E)
 - User's manual of each device
-

● Batteries



CAUTION

- You must use only YOKOGAWA-designated batteries.
 - When mounting or replacing batteries, you must follow the procedure specified in the User's Manuals of the device.
 - When replacing batteries while the power supply is on, do not put your hands inside the device to prevent electric shock.
-

SEE ALSO

For more information about battery, refer to:

- [4.2.1, "Battery" on page 4-5](#)
 - [7.7.1, "Replacing Battery" on page 7-34](#)
 - ProSafe-RS Installation Guidance (TI 32S01J10-01E)
 - User's manual of each device
-

● Fuses



CAUTION

- Use only YOKOGAWA-designated fuses for replacement.
 - Turn off the power supply before replacing the fuses.
-

SEE ALSO

For more information about replacing fuses, refer to:

- [7.8, "Replacing Parts on Terminal Board" on page 7-40](#)
 - [8.5.2, "Parts Replacement" on page 8-23](#)
 - ProSafe-RS Installation Guidance (TI 32S01J10-01E)
 - User's manual of each device
-

● Fan Unit



CAUTION

When replacing the fan unit while the power supply is on, do not put your hands inside the device to prevent electric shock.

SEE
ALSO For more information about fan unit, refer to:

- [7.7.2, “Replacing Node Fan Unit” on page 7-37](#)
 - ProSafe-RS Installation Guidance (TI 32S01J10-01E)
 - User's manual of each device
-

■ Guidelines for Selecting a Power Supply Unit

Regarding the system of the Product, you must take note of the following precautions by using a power supply unit to satisfy the various requirements of the EMC regulations:

- Prevent power supply problems such as power failure or short interruptions.
- Protect the power supply unit against power line noise and lightning surge.
- Suppress power supply harmonic current from devices.

You must consult with the power supply unit suppliers, and then select and install a suitable power supply unit with the considerations described in the following sections.

● Notices on Deciding the Output Capacity of Power Supply Unit

Consult with the power supply unit suppliers and decide a suitable output capacity of the power supply unit with the following considerations:

- Power consumption
Power consumed in both volt-ampere (VA) and watt (W).
- Device crest factor
Ratio of the peak value to the effective value of input current supplied to each device.
- Device inrush current
The maximum inrush current when power is turned on.
- Power failure backup time
Time required to back up the devices when power fails.
- Reserve capacity
An extra power capacity for additional devices and so on.

SEE
ALSO For more information about power consumption, rush current, and power and ground cabling, refer to:
ProSafe-RS Installation Guidance (TI 32S01J10-01E)

● Crest Factor

The crest factor refers to the ratio of the peak value to the effective value of any input current of a device.

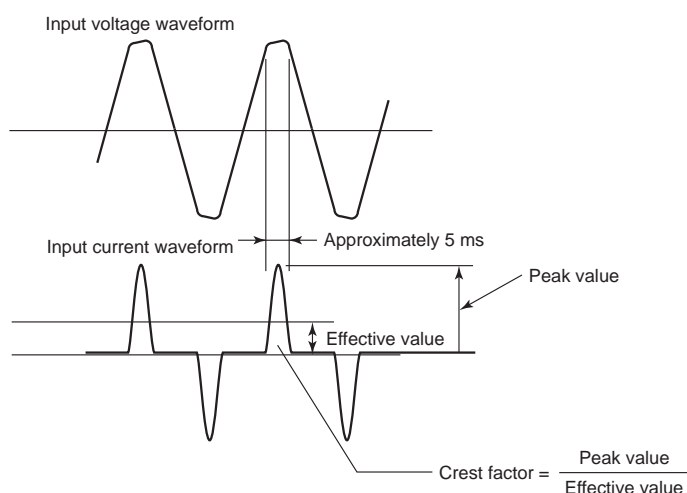


Figure Info-1 Input voltage and current waveforms

Crest Factor=Peak value of the current supplied to the device / Effective value of the current

When selecting a power supply unit, you need to estimate the power supply output capacity, based on the crest factor of the input current supplied to every connected device. Estimate the device crest factors by using the following approximate values when selecting a power supply unit:

- 100 V system: Crest factor about 3
- 220 V system: Crest factor about 6

● How to Decide the Power Supply Unit

The commonly used methods for determining the power supply unit capacity with consideration of the crest factor are shown below. Note that the power supply unit capacity should be finally decided after consulting with the power supply unit supplier:

- If the power unit crest factor is larger than the device crest factor, the power unit can be used to its full rated capacity. However, factors such as device inrush current, backup time, and reserve capacity must be taken into consideration separately.
- If the power unit crest factor is smaller than the device crest factor, the power unit capacity must be calculated using the following formula. Factors such as device inrush current, backup time, and reserve capacity must be taken into consideration separately.

Power unit output capacity = Total device power consumption × Capacity coefficient

Capacity coefficient = Device crest factor/Power unit crest factor

● Inrush Current

When a device is turned on, the large inrush current flows in because of the momentary charging current for capacitors. Therefore, the minimum requirement is that the inrush current produced by turning on some devices should not cause any voltage fluctuations that may affect other devices. For turning on all devices together, a soft start or switching to uninterruptible backup power should be required.

When the power is turned on, the inrush current can trip the overload protector, and then may switch to the backup power or commercial power supply. You should select a power supply unit that can automatically and seamlessly recover the normal power supply when overload- ing ends.

● **Suppressing Harmonic Current**

To suppress the power supply harmonic current that flows to a low-voltage distribution system, a power supply unit or an active filter as described below should be installed between a device and the low-voltage distribution system:

- A power supply unit that can suppress the power supply harmonic current, such as a high power factor inverter-type uninterruptible power unit
- An active filter unit for suppressing the power supply harmonic current

For Europe, you must select a power supply unit that can meet the requirements on the limits for harmonic current emissions of the EMC Directives.

Aside from determining the output capacity of the power supply unit, you should also determine the capacity of the harmonic current suppressing unit after consultation with the supplier of your power supply unit.

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Safety Control Stations (Hardware)

IM 32Q06C10-31E 4th Edition

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	CMPL 32S06K10-01E (SNB10D).....	CMPL 2-1
	CMPL 32S06K11-01E (SNT10D).....	CMPL 3-1

CMPL 32R06D20-01E (SSC60S, SSC60D)..... CMPL 4-1

1. Hardware Configuration and Names of Components

This section explains the ProSafe-RS hardware configuration and names of components.

- Safety Control Units (for V net) names and models:

Table 1-1 Safety Control Units (for V net)

Name	Model
Standard Type Safety Control Unit (for V net, Rack Mountable Type)	SSC10S-S
Wide Range Temperature Type Safety Control Unit (for V net, Rack Mountable Type)	SSC10S-F
Duplexed Standard Type Safety Control Unit (for V net, Rack Mountable Type)	SSC10D-S
Duplexed Wide Range Temperature Type Safety Control Unit (for V net, Rack Mountable Type)	SSC10D-F

- Safety Control Units (for Vnet/IP) names and models:

Table 1-2 Safety Control Units (for Vnet/IP)

Name	Model
Standard Type Safety Control Unit (for Vnet/IP, Rack Mountable Type)	SSC60S-S and SSC50S-S
Wide Range Temperature Type Safety Control Unit (for Vnet/IP, Rack Mountable Type)	SSC60S-F and SSC50S-F
Duplexed Standard Type Safety Control Unit (for Vnet/IP, Rack Mountable Type)	SSC60D-S and SSC50D-S
Duplexed Wide Range Temperature Type Safety Control Unit (for Vnet/IP, Rack Mountable Type)	SSC60D-F and SSC50D-F

- Safety Node Unit (Rack Mountable Type) (Model: SNB10D)
- Unit for Optical Bus Repeater Module (Rack Mountable Type) (Model: SNT10D)
- Input/Output Modules
- Peripherals of Input/Output Modules

In the nest of the safety control unit (also referred to as CPU node), both of the processor modules and the input and output modules can be installed. The maximum number of safety node units (also referred to as I/O nodes which are placed under the safety control unit) that can be connected to a safety control unit are as follows:

- SSC60S/SSC60D: Up to 13
- SSC50S/SSC50D, SSC10S/SSC10D: Up to 9

The control bus for SSC10S/SSC10D is V net and for SSC60S/SSC60D and SSC50S/SSC50D are Vnet/IP.

TIP

In this manual, safety control stations are named and differentiated as follows:

- SCS : Safety Control Station (any model)
 - SCSP2 : Vnet/IP Safety Control Station (CPU Node: SSC60S/SSC60D)
 - SCSP1 : Vnet/IP Safety Control Station (CPU Node: SSC50S/SSC50D)
 - SCSV1 : V net Safety Control Station (CPU Node: SSC10S/SSC10D)

■ Configuration of a Control System with ProSafe-RS

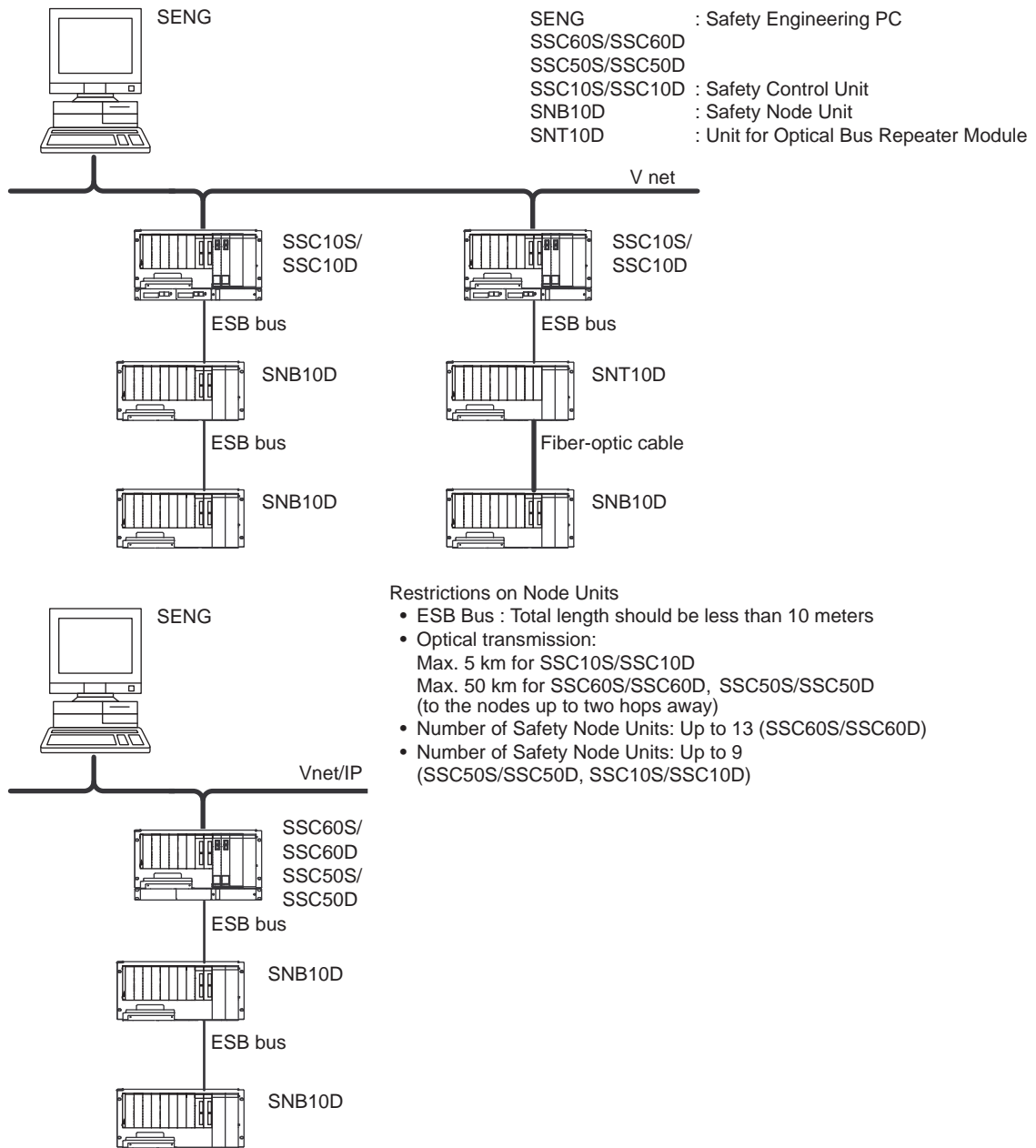


Figure 1-1 Configuration of a Control System with ProSafe-RS

■ Restrictions on Module Installation

Restrictions are applied on the number of I/O modules installed in the safety control unit and safety node unit, and the number of optical ESB bus repeater modules installed in the unit for optical bus repeater module.

SEE ALSO

For more information about restrictions on I/O module installation, refer to:

ProSafe-RS Outline of I/O Modules (GS 32Q06K20-31E)

For more information about restrictions on optical ESB bus repeater module installation, refer to:

Optical ESB Bus Repeater Module(GS 32Q06L15-31, GS 32Q06L16-31)

1.1 Configuration of Safety Control Unit

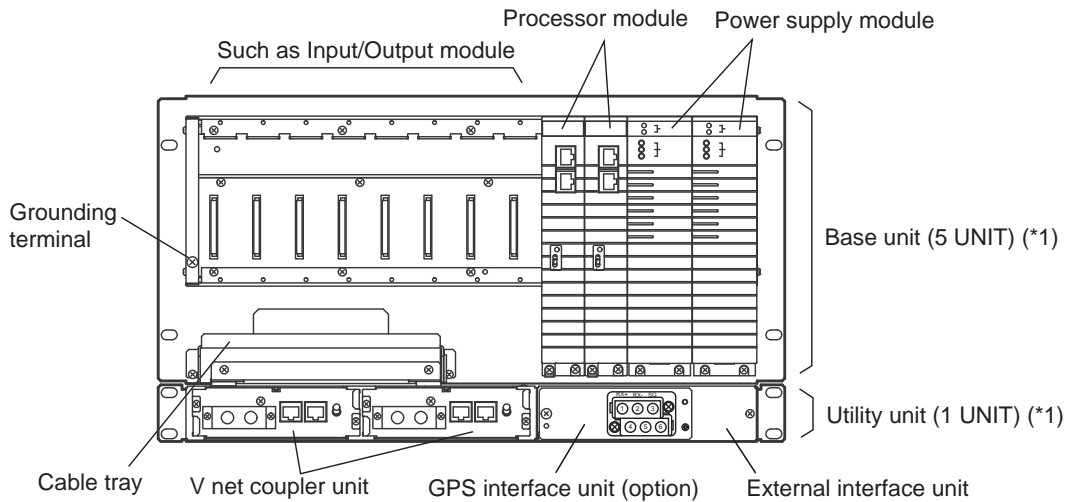
There are two types of safety control unit. The standard type safety control unit (Ambient Temperature: -20 to 50 deg. C) and wide range temperature type safety control unit (Ambient Temperature: -20 to 70 deg. C).

In this manual, the illustrations and descriptions are mainly focused on the standard type safety control unit in which the cooling fans are not installed.

■ Standard Type Safety Control Unit for V net

The components of the standard type safety control unit (Model: SSC10S-S/SSC10D-S) are shown in the following figure.

In this figure, the control unit is a duplexed type (redundant configuration). The power supply modules are always dual-redundantly configured. For a non-redundant configuration, a single processor module is installed to the left slot. The slot at the right is covered using a dummy cover. If a safety node is connected, the ESB bus coupler modules are installed with the redundant configuration.



*1: 1 UNIT=44.45 mm

Figure 1.1-1 Configuration of Safety Control Unit (SSC10D-S)

Table 1.1-1 Model Names of Safety Control Unit Components (Standard type)

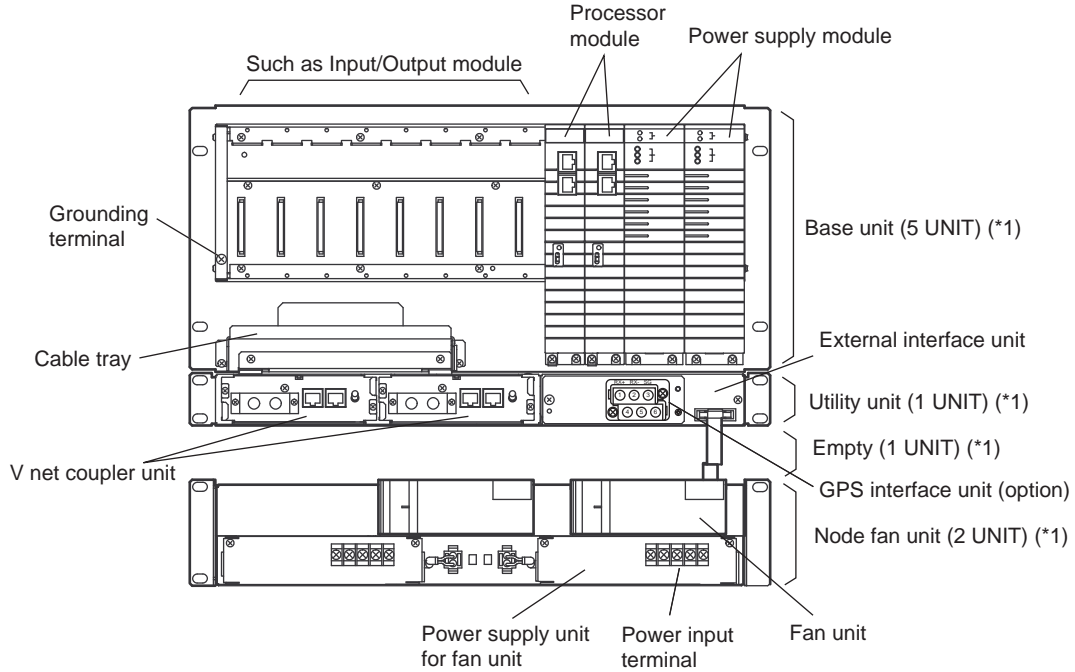
Name	Standard type safety control unit			
	Single configuration (SSC10S-S)		Duplexed configuration (SSC10D-S)	
Power supply module (100-120 V AC)	SPW481	2pcs	SPW481	2pcs
Power supply module (220-240 V AC)	SPW482	2pcs	SPW482	2pcs
Power supply module (24 V DC)	SPW484	2pcs	SPW484	2pcs
Processor module	SCP401	1pcs	SCP401	2pcs
Dummy cover (for processor module)(*1)	T9083VB	1pcs	-	-
Dummy cover (for I/O module)(*2)	SDCV01	as required	SDCV01	as required
ESB bus coupler module(*3)	SEC401	2pcs	SEC401	2pcs
V net coupler unit	AIP504	2pcs	AIP504	2pcs
External interface unit for standard type safety control unit	-	1pcs	-	1pcs
GPS interface unit (option)	-	1pcs	-	1pcs

- *1: For non-redundant configuration, used to cover the slot at right-hand side of the single processor module.
- *2: Used to cover the empty I/O module slot.
- *3: Required if the safety nodes are used.

■ Wide Range Temperature Type Safety Control Unit for V net

The components of the wide range temperature type safety control unit (Model: SSC10S-F/ SSC10D-F) are shown in the following figure.

This type of control unit consists of the standard type control unit and cooling fan unit so as to work in a wider range of ambient environment (-20 to 70 deg. C).



*1: 1 UNIT=44.45 mm

Figure 1.1-2 Configuration of Safety Control Unit (SSC10D-F)

Table 1.1-2 Model Names of Safety Control Unit Components (Wide Range Temperature Type)

Name	Wide range temperature type safety control unit			
	Single configuration (SSC10S-F)		Duplexed configuration (SSC10D-F)	
Power supply module (100-120 V AC)	SPW481	2pcs	SPW481	2pcs
Power supply module (220-240 V AC)	SPW482	2pcs	SPW482	2pcs
Power supply module (24 V DC)	SPW484	2pcs	SPW484	2pcs
Processor module	SCP401	1pcs	SCP401	2pcs
Dummy cover (for processor module)(*1)	T9083VB	1pcs	-	-
Dummy cover (for I/O module)(*2)	SDCV01	as required	SDCV01	as required
ESB bus coupler module(*3)	SEC401	2pcs	SEC401	2pcs
V net coupler unit	AIP504	2pcs	AIP504	2pcs
External interface unit (for wide range temperature type safety control unit)	-	1pcs	-	1pcs
Power supply unit for fan unit (100-120/220-240 V AC)	S9159FA	2pcs	S9159FA	2pcs
Power supply unit for fan unit (24 V DC)	S9160FA	2pcs	S9160FA	2pcs
Fan unit	AIP602	2pcs	AIP602	2pcs

Continues on the next page

Table 1.1-2 Model Names of Safety Control Unit Components (Wide Range Temperature Type) (Table continued)

Name	Wide range temperature type safety control unit			
	Single configuration (SSC10S-F)		Duplexed configuration (SSC10D-F)	
GPS interface unit (option)	-	1pcs	-	1pcs

- *1: For non-redundant configuration, used to cover the slot at right-hand side of the single processor module.
- *2: Used to cover the empty I/O module slot.
- *3: Required if the safety nodes are used.

■ Standard Type Safety Control Unit for Vnet/IP

The components of the standard type safety control unit for Vnet/IP (Model: SSC50S-S/SSC50D-S) are shown in the following figure.



IMPORTANT

The operating temperature range for the standard type safety control unit for Vnet/IP is -20 to 40 deg. C. Be sure to use it within the range.

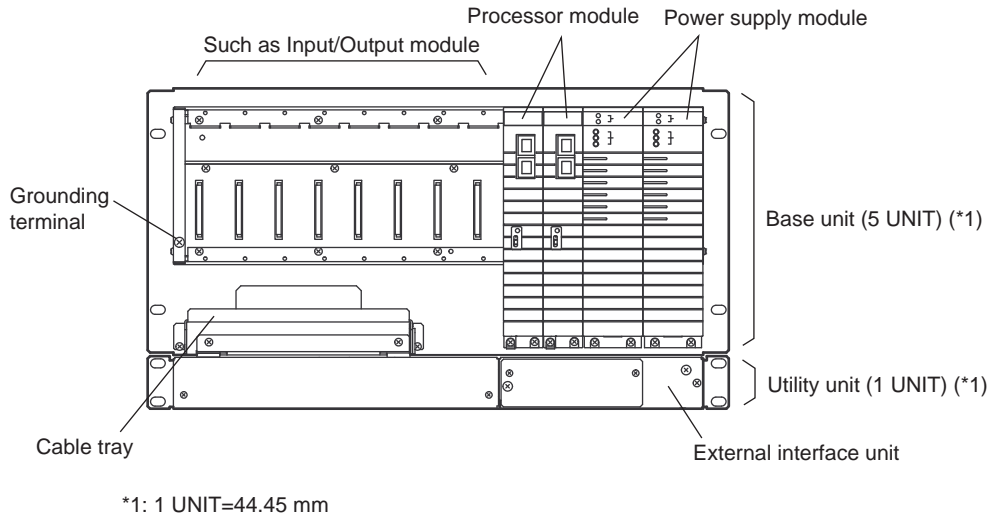


Figure 1.1-3 Configuration of Safety Control Unit for Vnet/IP (SSC50D-S)

Table 1.1-3 Model Names of Safety Control Unit for Vnet/IP Components (Standard Type)

Name	Standard type safety control unit for Vnet/IP			
	Single configuration (SSC50S-S)		Duplexed configuration (SSC50D-S)	
Power supply module (100-120 V AC)	SPW481	2pcs	SPW481	2pcs
Power supply module (220-240 V AC)	SPW482	2pcs	SPW482	2pcs
Power supply module (24 V DC)	SPW484	2pcs	SPW484	2pcs
Processor module	SCP451	1pcs	SCP451	2pcs
Dummy cover (for processor module) (*1)	T9083VB	1pcs	-	-
Dummy cover (for I/O module) (*2)	SDCV01	as required	SDCV01	as required
ESB bus coupler module(*3)	SEC401	2pcs	SEC401	2pcs
External interface unit for standard type safety control unit	-	1pcs	-	1pcs

- *1: For non-redundant configuration, used to cover the slot at right-hand side of the single processor module.

- *2: Used to cover the empty I/O module slot.
- *3: Required if the safety nodes are used.

■ Wide Range Temperature Type Safety Control Unit for Vnet/IP

The components of the wide range temperature type safety control unit for Vnet/IP (Model: SSC50S-F/SSC50D-F) are shown in the following figure.

The cooling fan unit is added to the standard type control unit so that the control unit works in wider range of ambient environments (-20 to 70 deg. C).

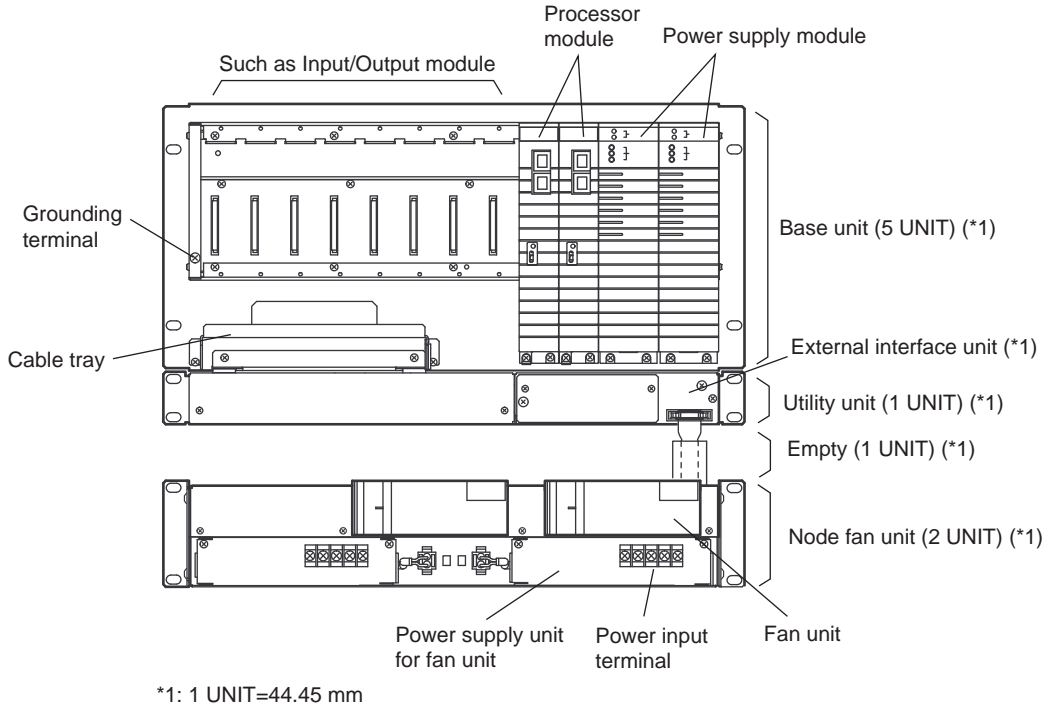


Figure 1.1-4 Configuration of Safety Control Unit for Vnet/IP (SSC50D-F)

Table 1.1-4 Model Names of Safety Control Unit for Vnet/IP Components (Wide Range Temperature Type)

Name	Wide range temperature type safety control unit for Vnet/IP			
	Single configuration (SSC50S-F)		Duplexed configuration (SSC50D-F)	
Power supply module (100-120 V AC)	SPW481	2pcs	SPW481	2pcs
Power supply module (220-240 V AC)	SPW482	2pcs	SPW482	2pcs
Power supply module (24 V DC)	SPW484	2pcs	SPW484	2pcs
Processor module	SCP451	1pcs	SCP451	2pcs
Dummy cover (for processor module)(*1)	T9083VB	1pcs	-	-
Dummy cover (for I/O module)(*2)	SDCV01	as required	SDCV01	as required
ESB bus coupler module(*3)	SEC401	2pcs	SEC401	2pcs
External interface unit for wide range temperature type safety control unit	-	1pcs	-	1pcs
Power supply unit for fan unit (100-120/220-240 V AC)	S9159FA	2pcs	S9159FA	2pcs
Power supply unit for fan unit (24 V DC)	S9160FA	2pcs	S9160FA	2pcs
Fan unit	AIP602	2pcs	AIP602	2pcs

*1: For non-redundant configuration, used to cover the slot at right-hand side of the single processor module.

- *2: Used to cover the empty I/O module slot.
- *3: Required if the safety nodes are used.

■ Standard Type Safety Control Unit for Vnet/IP

The components of the standard type safety control unit for Vnet/IP (Model: SSC60S-S/SSC60D-S) are shown in the following figure.



IMPORTANT

The operating temperature range of the standard type safety control unit for Vnet/IP is -20 to 40 deg. C. Be sure to use it within the range.

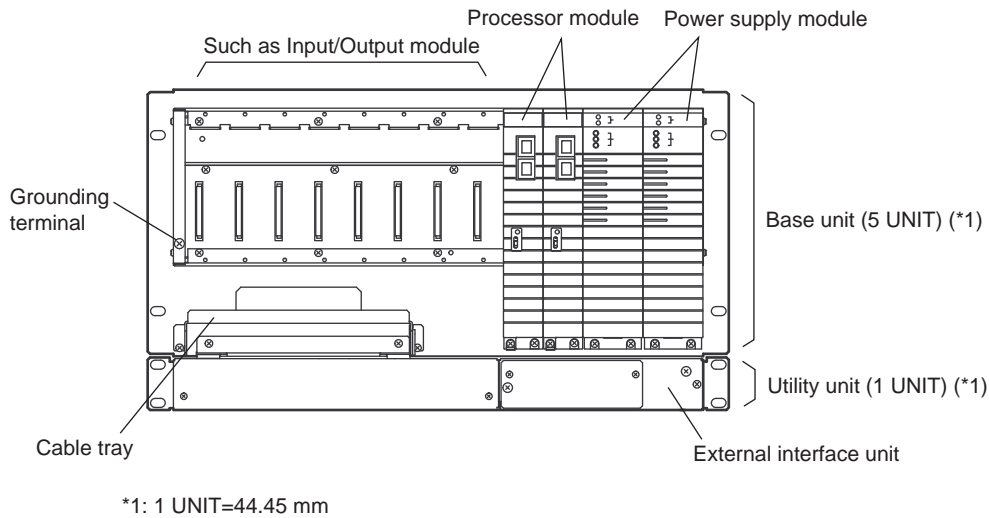


Figure 1.1-5 Configuration of Safety Control Unit for Vnet/IP (SSC60D-S)

Table 1.1-5 Model Names of Safety Control Unit for Vnet/IP Components (Standard Type)

Name	Standard type safety control unit for Vnet/IP			
	Single configuration (SSC60S-S)		Duplexed configuration (SSC60D-S)	
Power supply module (100-120 V AC)	SPW481	2pcs	SPW481	2pcs
Power supply module (220-240 V AC)	SPW482	2pcs	SPW482	2pcs
Power supply module (24 V DC)	SPW484	2pcs	SPW484	2pcs
Processor module	SCP461	1pcs	SCP461	2pcs
Dummy cover (for processor module)(*1)	T9083VB	1pcs	-	-
Dummy cover (for I/O module)(*2)	SDCV01	as required	SDCV01	as required
ESB bus coupler module(*3)	SEC402/ SEC401	2pcs	SEC402/ SEC401	2pcs
External interface unit for standard type safety control unit	-	1pcs	-	1pcs

- *1: For non-redundant configuration, used to cover the slot at right-hand side of the single processor module.
- *2: Used to cover the empty I/O module slot.
- *3: SEC402 or SEC401 is required for connecting the safety node units.

■ Wide Range Temperature Type Safety Control Unit for Vnet/IP

The components of the wide range temperature type safety control unit for Vnet/IP (Model:SSC60S-F/SSC60D-F) are shown in the following figure.

The cooling fan unit is added to the standard type control unit so that the control unit works in wider range of ambient environments (-20 to 70 deg. C).

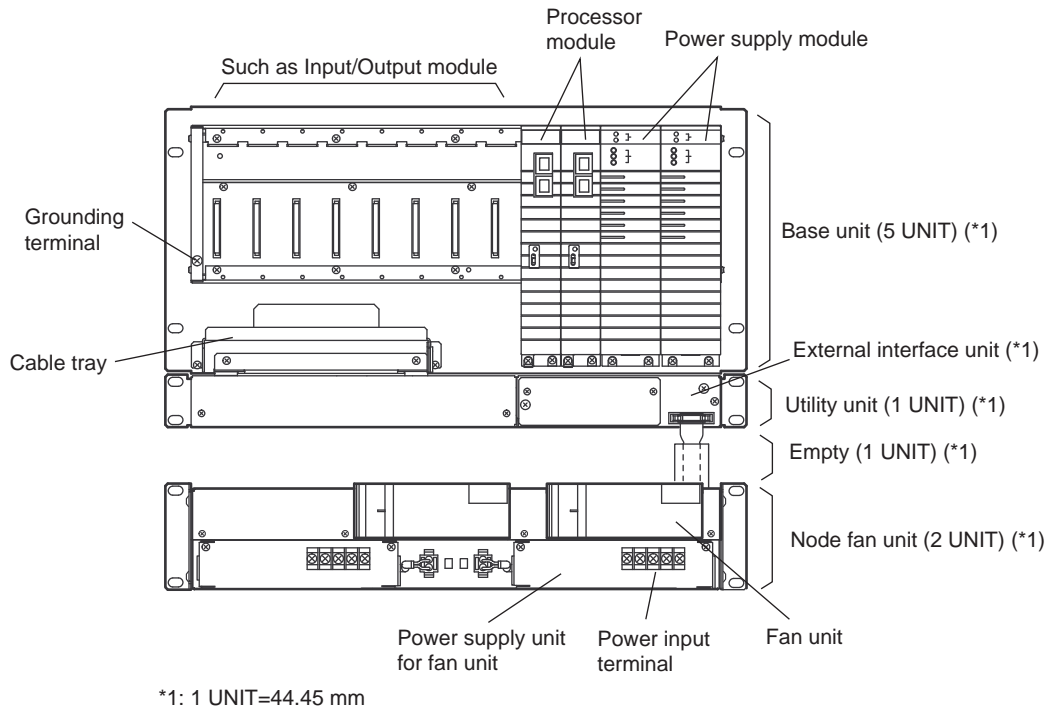


Figure 1.1-6 Configuration of Safety Control Unit for Vnet/IP (SSC60D-F)

Table 1.1-6 Model Names of Safety Control Unit for Vnet/IP Components (Wide Range Temperature Type)

Name	Wide range temperature type safety control unit for Vnet/IP			
	Single configuration (SSC60S-F)		Duplexed configuration (SSC60D-F)	
Power supply module (100-120 V AC)	SPW481	2pcs	SPW481	2pcs
Power supply module (220-240 V AC)	SPW482	2pcs	SPW482	2pcs
Power supply module (24 V DC)	SPW484	2pcs	SPW484	2pcs
Processor module	SCP461	1pcs	SCP461	2pcs
Dummy cover (for processor module) (*1)	T9083VB	1pcs	-	-
Dummy cover (for I/O module) (*2)	SDCV01	as required	SDCV01	as required
ESB bus coupler module (*3)	SEC402/ SEC401	2pcs	SEC402/ SEC401	2pcs
External interface unit (for wide range temperature type safety control unit)	-	1pcs	-	1pcs
Power supply unit for fan unit (100-120/220-240 V AC)	S9159FA	2pcs	S9159FA	2pcs
Power supply unit for fan unit (24 V DC)	S9160FA	2pcs	S9160FA	2pcs
Fan unit	AIP602	2pcs	AIP602	2pcs

*1: For non-redundant configuration, used to cover the slot at right-hand side of the single processor module.

*2: Used to cover the empty I/O module slot.

*3: SEC402 or SEC401 is required for connecting the safety node units.

**IMPORTANT**

- Even if an external interface unit is connected to the standard type safety control unit, the status of fans unit cannot be monitored.
- When changing the standard type safety control unit into wide range temperature type safety control unit, a new SCS project needs to be created on the SCS Manager and off-line download to the hardware. The same procedure needs to be performed when changing the wide range temperature type safety control unit into standard type safety control unit.

The following figure shows a three-dimensional image of wide range temperature type safety control unit and the node fan unit.

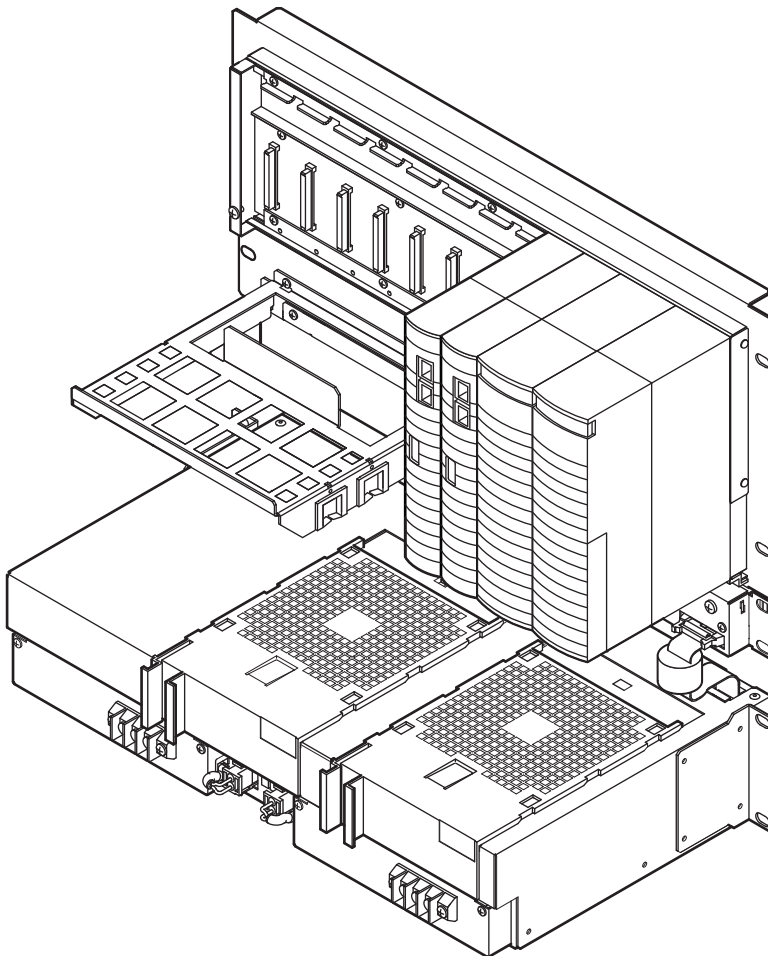


Figure 1.1-7 Wide Range Temperature Type Safety Control Unit

1.2 Configuration of Safety Node Unit

The following figure shows the units that make up the safety node unit (Model: SNB10D).

The power supply modules and ESB bus interface modules are always dual-redundantly configured.

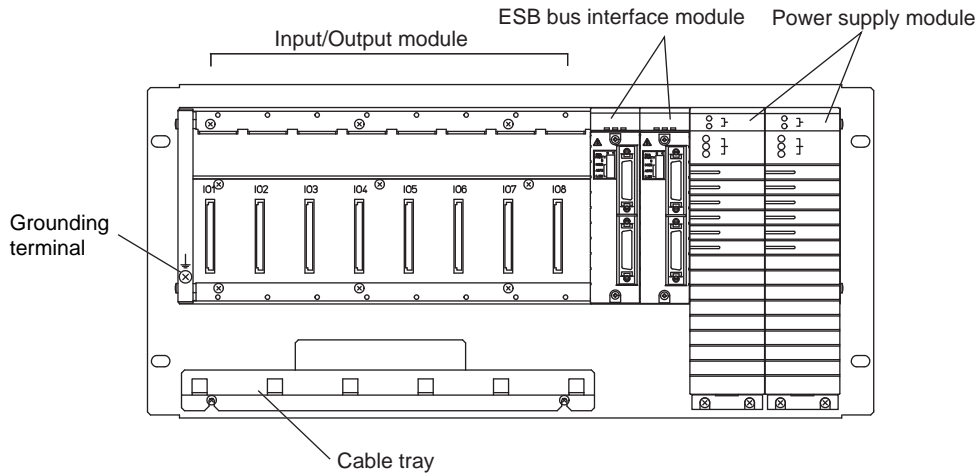


Figure 1.2-1 Configuration of Safety Node Unit

■ Configuration of SNB10D

Table 1.2-1 Module Name and Model of Safety Node Unit

Name	Safety node unit	
	SNB10D	
Power supply module (100-120 V AC)	SPW481	2pcs
Power supply module (220-240 V AC)	SPW482	2pcs
Power supply module (24 V DC)	SPW484	2pcs
ESB bus interface module	SSB401	2pcs
Dummy cover (for I/O module) (*1)	SDCV01	as required

*1: :To cover the empty I/O module slot.

1.3 Configuration of Unit for Optical Bus Repeater Module

The following figure shows the components of the unit for optical bus repeater module (Model: SNT10D).

The power supply modules are always dual-redundantly configured.

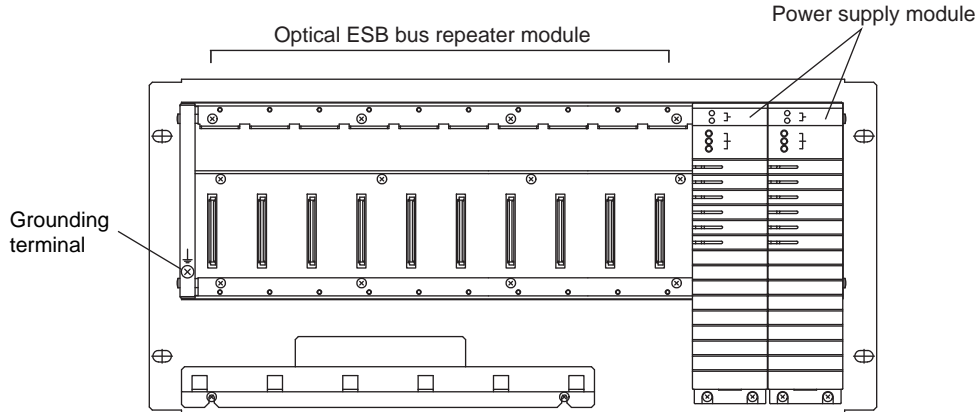


Figure 1.3-1 Configuration of Unit for Optical Bus Repeater Module

■ Configuration of SNT10D

Table 1.3-1 Module Name and Model of Unit for Optical Bus Repeater Module

Name	Unit for Optical Bus Repeater Module	
	SNT10D	
Power supply module (100-120 V AC)	SPW481	2pcs
Power supply module (220-240 V AC)	SPW482	2pcs
Power supply module (24 V DC)	SPW484	2pcs
Dummy cover (for I/O module) (*1)	SDCV01	as required

*1: To cover the empty optical ESB bus repeater module slot.

Optical ESB bus repeater master module (SNT401/SNT411) and optical ESB bus repeater slave module (SNT501/SNT511) are installable in the unit for optical bus repeater module.

1.4 Input/Output Modules

The following types of ProSafe-RS input/output modules are available:

- Analog Input/Output Modules
- Digital Input/Output Modules
- Communication Modules

1.4.1 Analog Input/Output Modules

The analog input module receives analog signals and converts them into internal data in safety control unit. The analog output module converts internal data to analog signals and outputs them.

■ Types of Analog Input/Output Modules

The following types of analog I/O modules are available in ProSafe-RS:

- SAI143: 4 to 20 mA input, 16 channels, module isolation
- SAV144: 1 to 5 V DC/1 to 10 V DC input, 16 channels, module isolation
- SAT145: TC/mV input, 16 channels, isolated channels
- SAR145: RTD input, 16 channels, isolated channels
- SAI533 : 4 to 20 mA output, 8 channels, module isolation

■ External View of Analog Input/Output Modules

The connections with the analog I/O modules vary with the types of adapters. Pressure clamp terminals, terminal boards (with signal cable interface adapter) and MIL cables are used for the connections. Since SAT145 and SAR145 have a built-in signal cable interface adapter, they can be connected only through the terminal board.

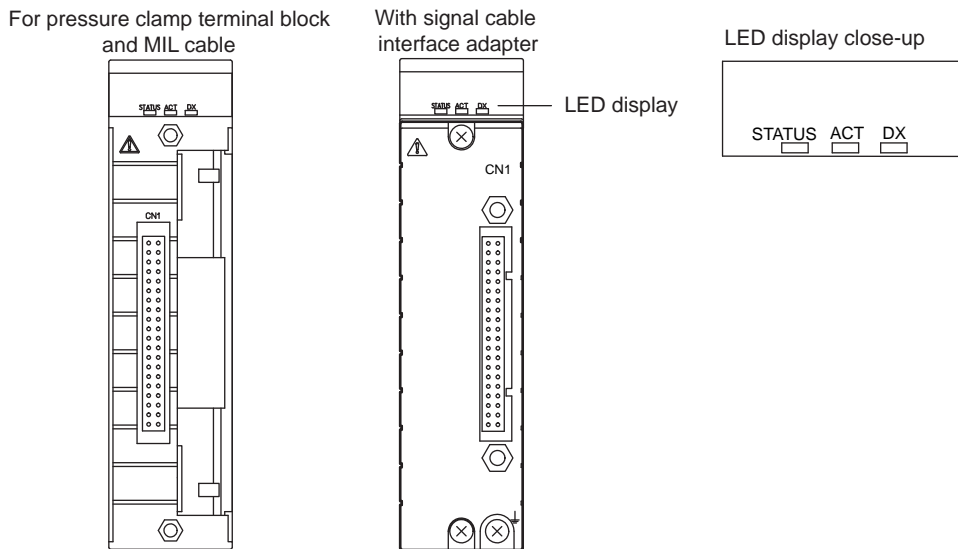


Figure 1.4.1-1 External View of Analog Input/Output Module

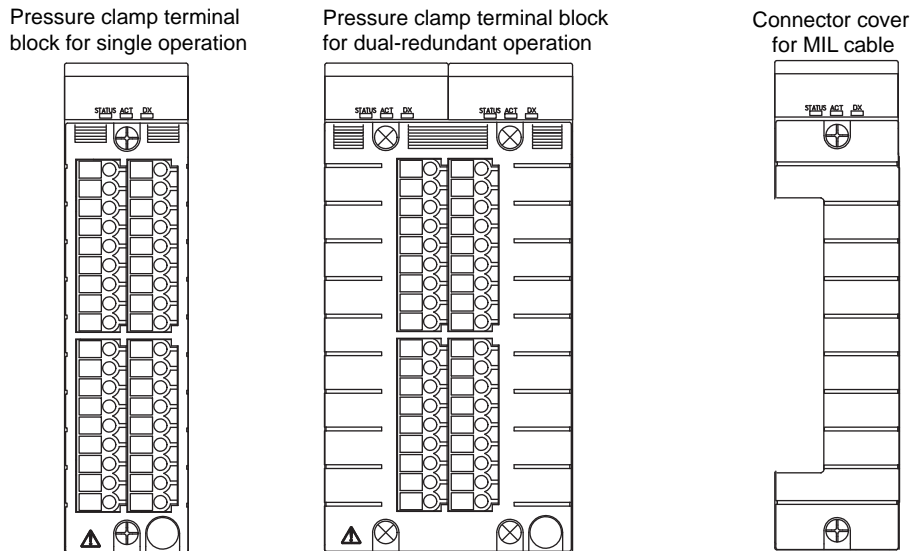


Figure 1.4.1-2 External View of Terminal Blocks

■ Setup Elements

In the case of SAI143 analog input module, there is an option to select power supply for each channel using the setting pins, depending on the type of signal transmitter.

● Setting of SAI143

The setting pins of S1 to S16 are used for setting the power supply to the field devices. The setting pins are located on the right side of the SAI143 analog input module printed circuit board.

For all channels, the default setting is “Yes”, power supply for 2-wire type transmitter is “ON.”

Display of setting pins	Setting pin	Power supply to transmitter		Remarks Channel No.	Setting pin	Power supply to transmitter		Remarks Channel No.
		Yes (2-wire)	No (4-wire)			Yes (2-wire)	No (4-wire)	
<div style="border: 1px solid black; padding: 2px; display: inline-block;">S1 to S16</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-top: 5px;"> 1 2 3 4 5 6 </div>	S1	1 2	2 3	1	S5	1 2	2 3	5
	S2	4 5	5 6	2	S6	4 5	5 6	6
	S3	1 2	2 3	3	S7	1 2	2 3	7
	S4	4 5	5 6	4	S8	4 5	5 6	8
	S9	1 2	2 3	9	S13	1 2	2 3	13
	S10	4 5	5 6	10	S14	4 5	5 6	14
	S11	1 2	2 3	11	S15	1 2	2 3	15
	S12	4 5	5 6	12	S16	4 5	5 6	16

Figure 1.4.1-3 Setting Pins of SAI143 Analog Input Module

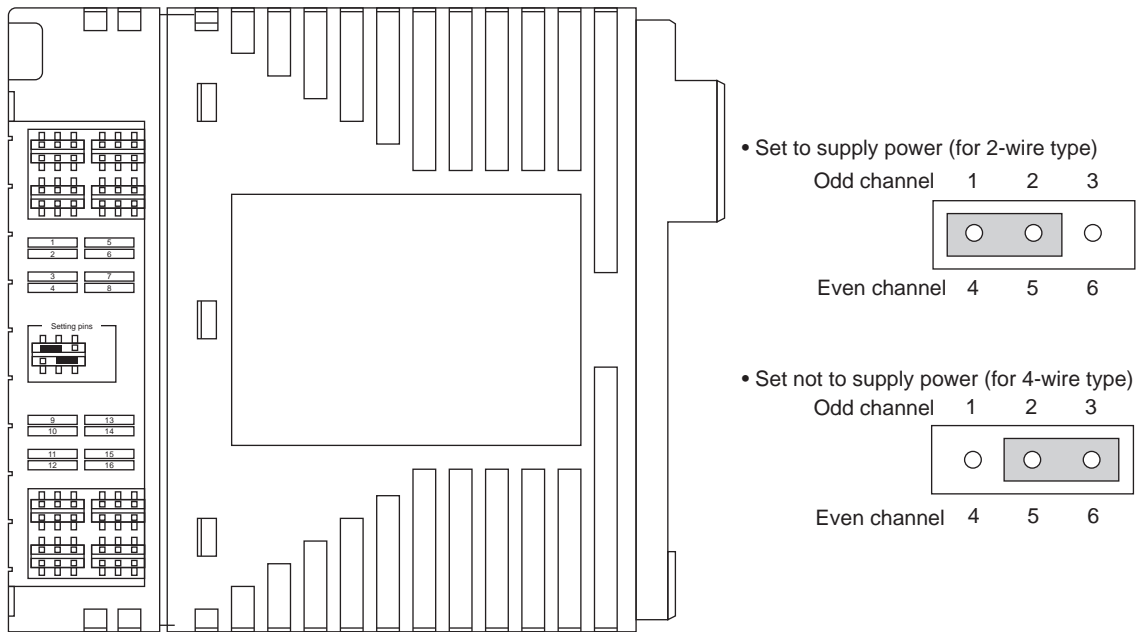


Figure 1.4.1-4 Setting of SAI143 Analog Input Module

1.4.2 Digital Input/Output Modules

The digital input module receives digital signals and converts them into internal data in the safety control unit, or converts internal data and outputs digital signals.

■ Types of Digital Input/Output Modules

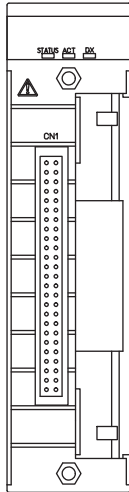
The following types of digital input/output modules are available in ProSafe-RS:

- SDV144 : Non-voltage contact input, 16 channels, module isolation
- SDV521 : 24 V DC output, 4 channels, module isolation
- SDV526 : 100-120 V AC output, 4 channels, module isolation
- SDV531 : 24 V DC output, 8 channels, module isolation
There is a different behavior between SDV531-S13 and SDV531-S23/-S33 as follows when a short circuit occurs on the field side:
 - SDV531-S13
When short-circuit occurs on the field side, the Output Shutoff Switch is activated and the output of all channels on the module becomes OFF. When the short-circuit error is resolved, the outputs can be recovered by starting the output module from the SCS Status Management Window and performing the Output Enable Operation. Then the recovered output channels will output the application logic values. Without performing the Output Enable Operation, all the outputs will be kept OFF.
 - SDV531-S23/-S33
When short-circuit occurs on the field side, the output of output channel corresponding to that field device becomes OFF. When the short-circuit error is resolved, the output channel can be recovered by performing the Output Enable Operation. Recovered channel will output the application logic values. Without performing the Output Enable Operation, this channel will output the fail-safe value.
- SDV531-L : 24 V DC output, 8 channels, module isolation, long distance type
- SDV53A : 48 V DC output, 8 channels, module isolation
- SDV541 : 24 V DC output, 16 channels, module isolation

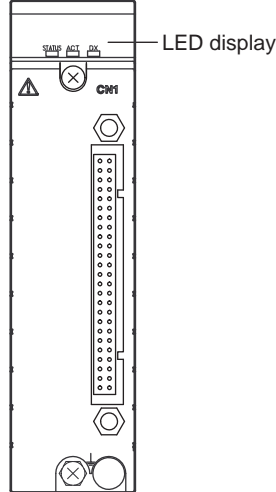
■ External View of Digital Input/Output Modules

The connections with the digital I/O modules vary with the types of adapters. Pressure clamp terminals, terminal boards (with signal cable interface adapter) and MIL cables are used for the connections. The following figure shows the external view of the SDV144, SDV541, and SDV531. Since SDV521, SDV526 and SDV53A have a built-in signal cable interface adapter, they can be connected only through the terminal board.

For pressure clamp terminal block and MIL cable



With signal cable interface adapter



LED display close-up

16 channels (SDV144, SDV541)

1	5	9	13
2	6	10	14
3	7	11	15
4	8	12	16
STATUS ACT DX			

4 channels (SDV521, SDV526)

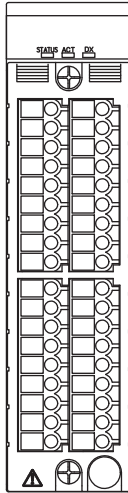
1			
2			
3			
4			
STATUS ACT DX			

8 channels (SDV531, SDV53A)

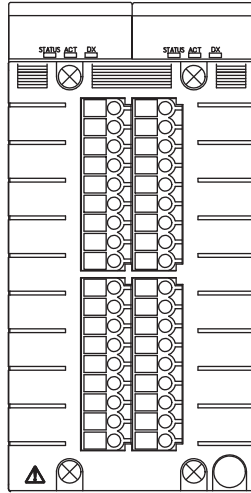
1	5		
2	6		
3	7		
4	8		
STATUS ACT DX			

Figure 1.4.2-1 External View of Digital Input/Output Module

Pressure clamp terminal block for single configuration



Pressure clamp terminal block for dual-redundant configuration



Connector cover for MIL cable



Figure 1.4.2-2 External View of Terminal Blocks

1.4.3 Communication Modules

The communication module is used for linking the safety control station with external devices through the communication lines to convert the signals for data exchange.

Types and External View of Communication Modules

The following types of communication modules are available:

- ALR111: RS-232C communication module
- ALR121: RS-422/RS-485 communication module
- ALE111: Ethernet communication module



IMPORTANT

When using ALE111, use the style S1 module with unit revision U:2 or later. The unit revision is indicated on the top of the module. However, the unit revision is not indicated if it is U:0.

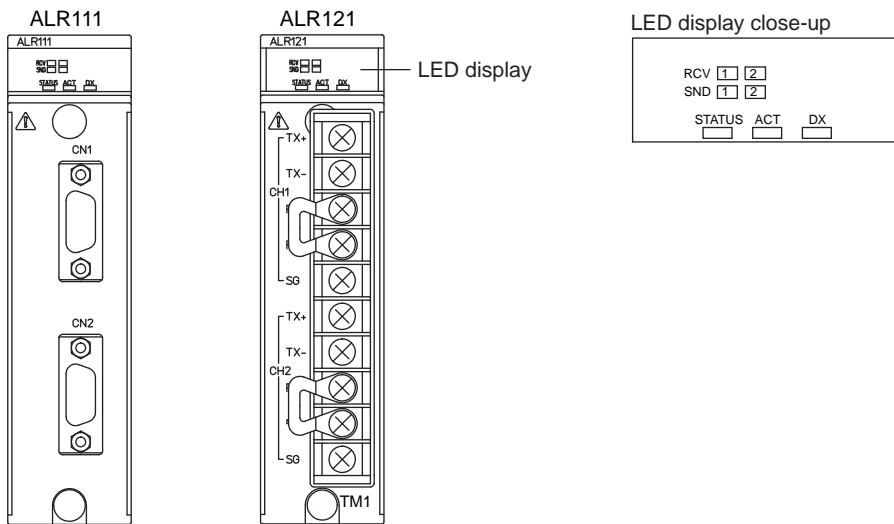


Figure 1.4.3-1 External View of Serial Communication Module

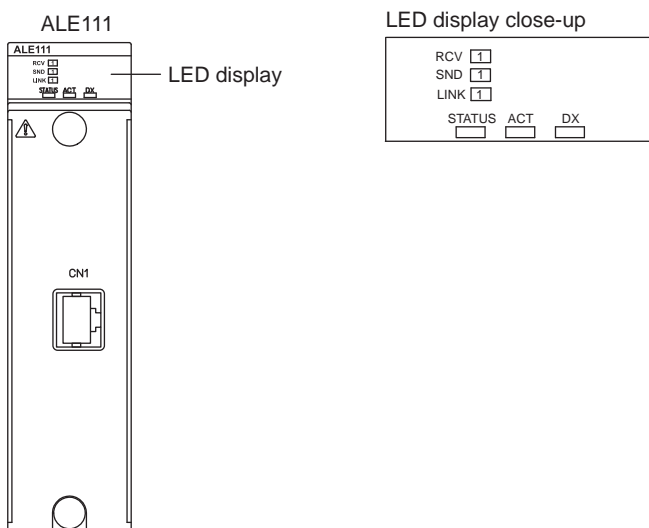


Figure 1.4.3-2 External View of Ethernet Communication Module

1.5 Accessories Related to Input/Output Modules

The following accessories related to I/O modules are available:

- Pressure Clamp Terminal Block
- Relay Board
- Terminal Board
- Connector Cover for MIL Cable
- Wiring Check Adapter (for Digital Input)

1.5.1 Pressure Clamp Terminal Blocks

The pressure clamp terminal block is used for wiring the field devices directly to the I/O module.

The pressure clamp terminal block for single use and dual-redundant use are different.

■ Types of Pressure Clamp Terminal Blocks

The following types of pressure clamp terminal blocks are available.

Table 1.5.1-1 Pressure Clamp Terminal Blocks

Configuration	Model	Name	I/O points
Single	STA4S	Pressure clamp terminal block for analog I/O	16-channel
	STB4S	Pressure clamp terminal block for digital I/O	16-channel
Dual-redundant	STA4D	Dual-redundant pressure clamp terminal block for analog I/O	16-channel
	STB4D	Dual-redundant pressure clamp terminal block for digital I/O	16-channel

■ External View of Pressure Clamp Terminal Blocks

The models of pressure clamp terminal blocks are shown in the table above. Though the internal circuits vary with the number of channels, analog or digital signals or input/output, the external dimensions and appearance are the same. The following figure shows the terminal blocks for single and dual-redundant configurations.

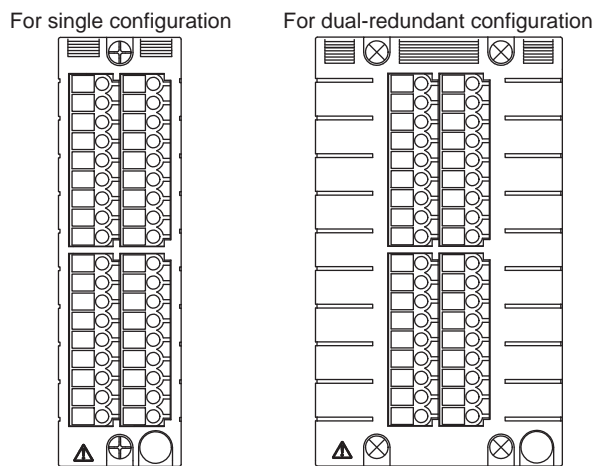


Figure 1.5.1-1 External View of Pressure Clamp Terminal Blocks

1.5.2 Connector Cover for MIL Cable

Connector cover for MIL cable over the I/O modules is used for the secure connection of the MIL cable to the connector.

■ Types of Connector Cover for MIL Cable

The following models of connector cover for MIL Cable are available:

- SCCC01: For flat ribbon cable
- SCCC02: For discrete wire cables (DI, DO cables)

■ External View of Connector Cover for MIL Cable

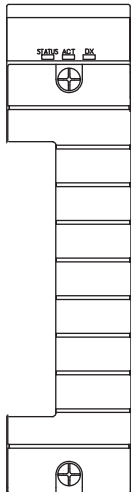


Figure 1.5.2-1 Connector Cover for MIL Cable

1.5.3 Terminal Boards

The terminal boards are used to connect the field devices for passing the signals.

The terminal boards are used together with the I/O modules with signal cable interface adapter.

■ Types of Terminal Boards

The following types of terminal boards are available: All boards support single or dual redundancy for the input/output modules. The unused connectors should be covered by the attached connector caps.

Table 1.5.3-1 Types of 19-inch Rack Mountable Terminal Boards

Model	Name	Connectable I/O module
SEA4D	Analog Terminal Board (Single and Dual-Redundant)	SAI143, SAI533, SAV144
SED2D	Digital Terminal Board (Single and Dual-Redundant)	SDV521
SED3D	Digital Terminal Board (Single and Dual-Redundant)	SDV53A
SED4D	Digital Terminal Board (Single and Dual-Redundant)	SDV144, SDV531, SDV541
SWD2D	Digital Terminal Board (Single and Dual-Redundant)	SDV526

Table 1.5.3-2 Types of DIN Rail Mountable Terminal Boards

Model	Name	Connectable I/O module
SBA4D	Terminal board for Analog (single and dual-redundant)	SAI143, SAI533, SAV144
SBT4D	Terminal board for TC/mV (single and dual-redundant)	SAT145
SBR4D	Terminal board for RTD input (single and dual-redundant)	SAR145
SBD2D	Terminal board for Digital output (single and dual-redundant)	SDV521
SBD3D	Terminal board for Digital output (single and dual-redundant)	SDV531, SDV53A
SBD4D	Terminal board for Digital (single and dual-redundant)	SDV144, SDV541

■ 19-inch Rack Mountable Terminal Board Design

- SEA4D Design

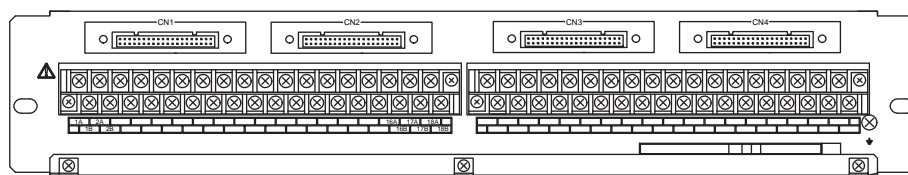


Figure 1.5.3-1 SEA4D

- **SED2D Design**

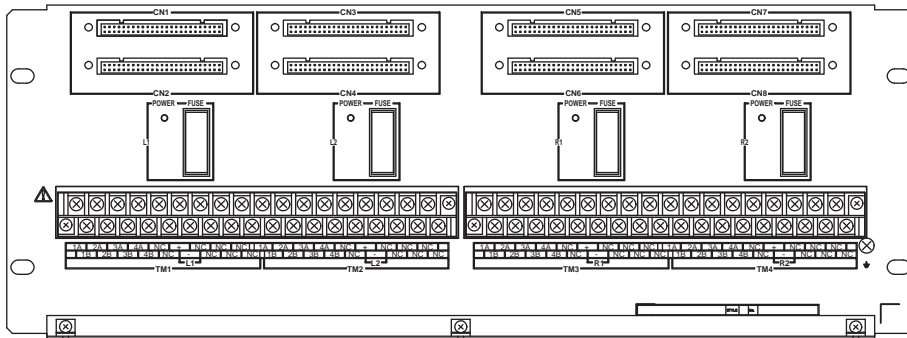


Figure 1.5.3-2 SED2D

- **SED3D Design**

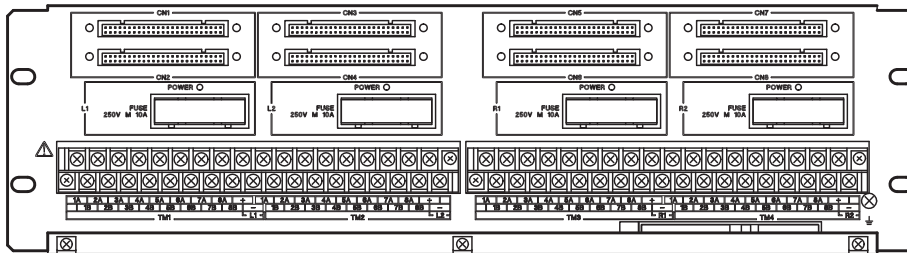


Figure 1.5.3-3 SED3D

- **SED4D Design**

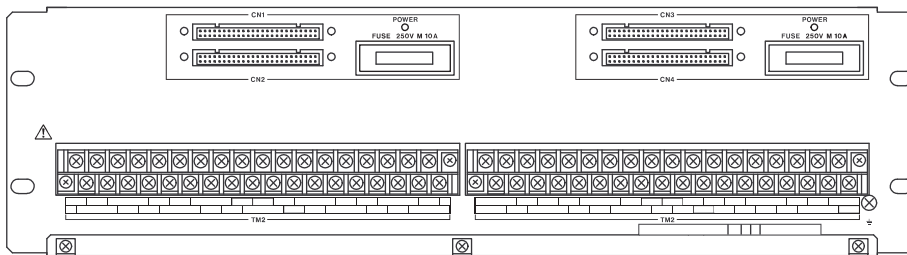


Figure 1.5.3-4 SED4D

- **SWD2D Design**

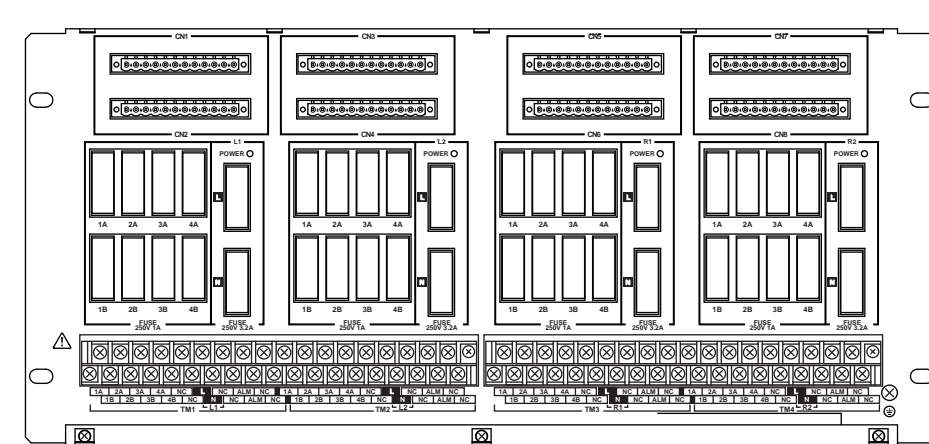


Figure 1.5.3-5 SWD2D

■ DIN Rail Mountable Terminal Board Design

- **SBA4D Design**

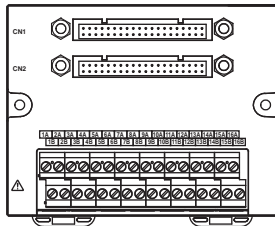


Figure 1.5.3-6 SBA4D

- **SBT4D Design**

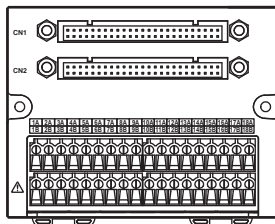


Figure 1.5.3-7 SBT4D

- **SBR4D Design**

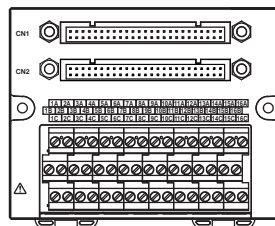


Figure 1.5.3-8 SBR4D

- **SBD2D Design**

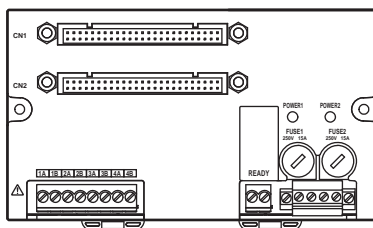


Figure 1.5.3-9 SBD2D

- **SBD3D Design**

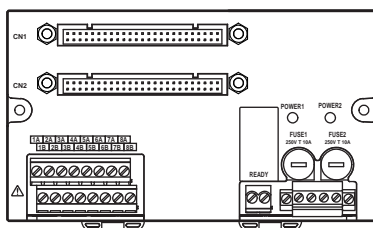


Figure 1.5.3-10 SBD3D

- **SBD4D Design**

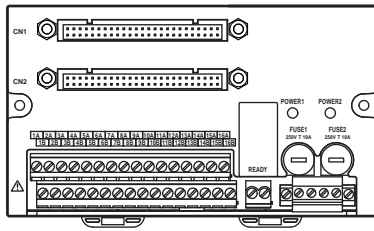


Figure 1.5.3-11 SBD4D

1.5.4 Relay Boards

The relay board amplifies the signals from the digital output module and outputs the amplified signals to field devices.

Types of Relay Boards

The following types of relay boards are available:

Table 1.5.4-1 Types of 19-Inch Rack Mountable Relay Boards

Model	Name	Connectable I/O module
SRM53D	8x2 dry contact outputs	SDV531
		SDV144 (readback)
SRM54D	16x1 dry contact outputs	SDV541
		SDV144 (readback)

Table 1.5.4-2 Types of DIN Rail Mountable Relay Boards

Model	Name	Connectable I/O module
SBM54D	Relay board for Digital output (single and dual-redundant)	SDV541

19-Inch Rack Mountable Relay Board Design

SRM53D Design

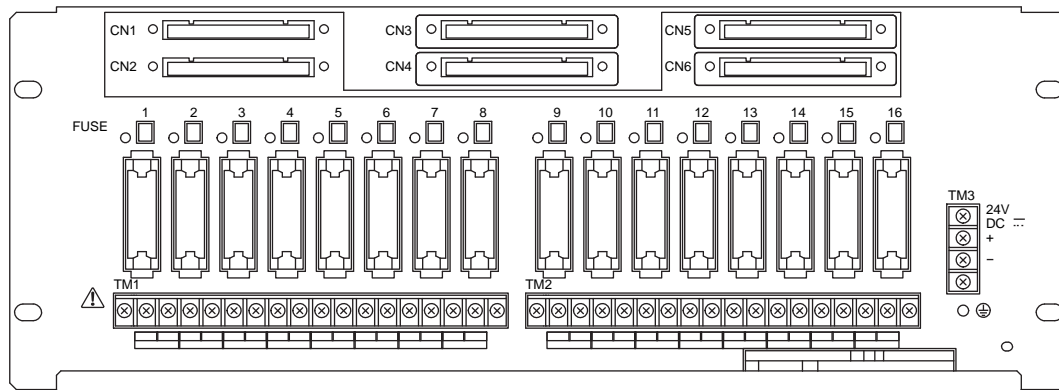


Figure 1.5.4-1 SRM53D

SRM54D Design

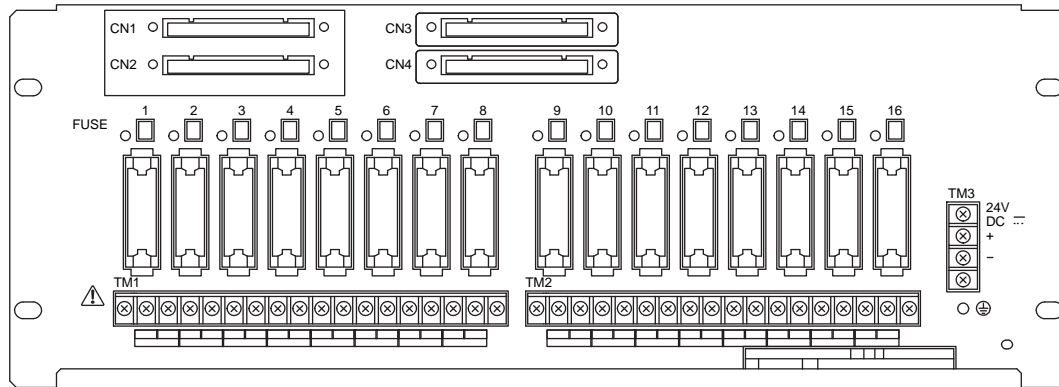


Figure 1.5.4-2 SRM54D

■ DIN Rail Mountable Relay Board Design

- SBM54D Design

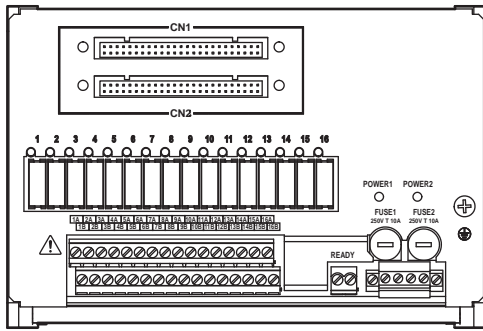


Figure 1.5.4-3 SBM54D

1.5.5 Wiring Check Adapter for Digital Input

The wiring check adapter for digital input is a device for inspecting the wiring conditions between the digital input module and the field devices so as to find out the open circuit or short circuit problems.

Types of Wiring Check Adapter

The following two models of wiring check adapters are available.

- SCB100: For testing open circuit
Putting this tester in parallel with the field device switch, the open circuit of the loop during the OFF signal can be found.
- SCB110: For testing short circuit
Putting this tester in series with the field device switch, the short circuit of the loop during the ON signal can be found with the power line or other channels.

When testing for open circuits or short circuits, install the previously mentioned adapters and activate the diagnostic features in the input modules.

SEE ALSO

For more information about diagnostic features of the input modules, refer to:

■ Items set for each channel (discrete input) in A4.6, "Items set for discrete inputs" in Safety Control Station Reference (IM 32Q03B10-31E)

External View of Wiring Check Adapter

The following figure shows the external view of SCB100/SCB110 wiring check adapter.

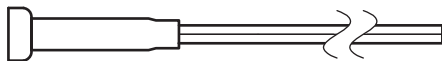


Figure 1.5.5-1 External View of SCB100/SCB110 Wiring Check Adapter

Usage of Wiring Check Adapter

Connect the wiring check adapter as follows: In the following figures, DCn and INn indicate the input channel numbers for SDV144.

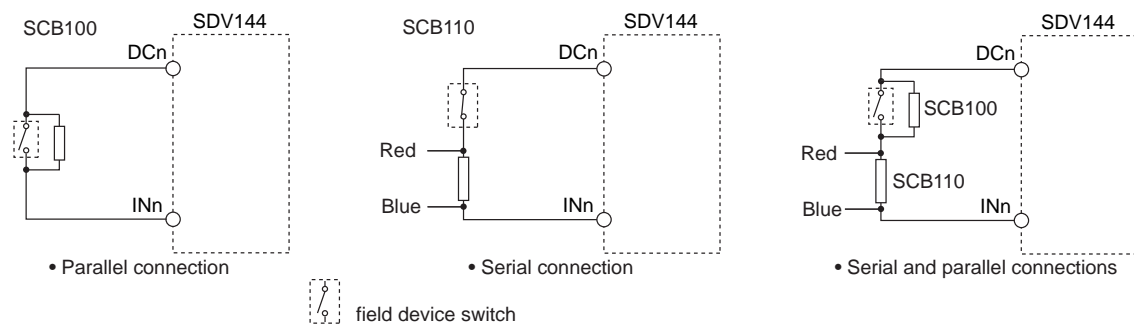


Figure 1.5.5-2 Usage of Wiring Check Adapter



IMPORTANT

Do not stress the wiring check adapter.

SCB110 has a polarity. It does not work properly if you install it wrongly.

**SEE
ALSO**

For more information about the input channel number of SDV144, refer to:

- 5.4.4, "Connection with a Terminal Board (Digital Input/Output Module)" on page 5-28
 - 5.6, "Circuit Diagrams of Input/Output Modules" on page 5-47
 - 5.4.1, "Digital Input Module, 16-Channel (SDV144)" on page 5-25
-

2. Installing Devices

This section explains the procedure and precautions for installing each device.

- Installing rack mountable device
- Installing terminal boards

2.1 Installing Rack Mountable Devices

This chapter explains the procedure for installing the safety control unit, the safety node unit, and the unit for the optical ESB bus repeater module, on a 19-inch rack.

SEE ALSO For more information about installation of ProSafe-RS hardware, refer to:
ProSafe-RS Installation Guidance (TI 32S01J10-01E)

■ Space for Heat Radiation

The sufficient spaces for heat radiation should be reserved.

- When a safety control unit, a safety node unit, and a unit for optical bus repeater module are installed on the same rack, they should be placed away from each other at least for 3 UNIT (1 UNIT=44.45mm).
- If the repeaters and other devices are installed on the same rack, they should be placed away from each other at least for 3 UNIT (1 UNIT=44.45mm).

SEE ALSO For more information about equipment installation environment, refer to:
ProSafe-RS Installation Guidance (TI 32S01J10-01E)

■ Maintenance Spaces

Be sure to allow spaces for maintenance.

- All cables for units and I/O modules are connected to the front.
- The indicator lamp checks, setting, inspection, removal, and insertion of each module or unit are done from the front of the equipment.
- Adequate space is required for suction and exhaust of the cooling fan of equipment.
- Allow a space of at least 1000 mm in front of the equipment for wiring and maintenance.

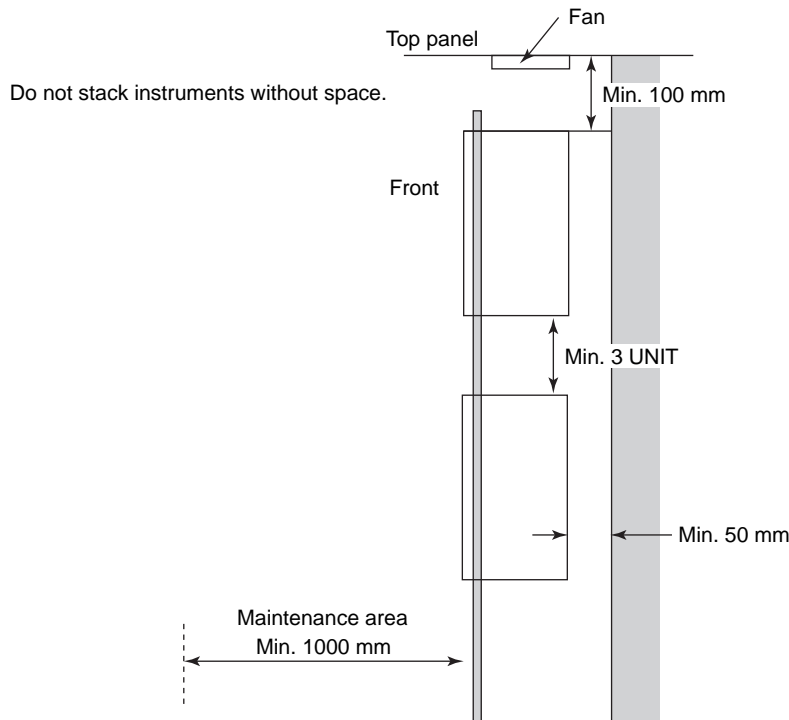


Figure 2.1-1 Rack Mounting Space

■ Installation of Rack Mountable Device

Take note of the following information when installing a rack mountable device on a rack or an instrument panel.

● Insulation from the Rack

Attach insulation bushings to isolate the rack-mountable SCS from the rack. Insulation bushings are supplied with the rack-mountable SCS.



WARNING

When you install the 'SCS with insulation bushings attached' on a rack or an instrument panel, do not keep the SCS hung on loose screws in an unstable status. Too much force may apply to the insulation bushings and cause damaged or broken insulation bushings.

● Installation Procedure

1. Fasten a pair of insulation bushings together to each of the screw holes on the plate or the bracket on the SCS.
The tapering end of the insulation bushings must come to the front side where a screw enters.
2. Using eight M5 screws to fix the device onto the rack or the panel.
3. Make sure that the device is electrically isolated from the rack.

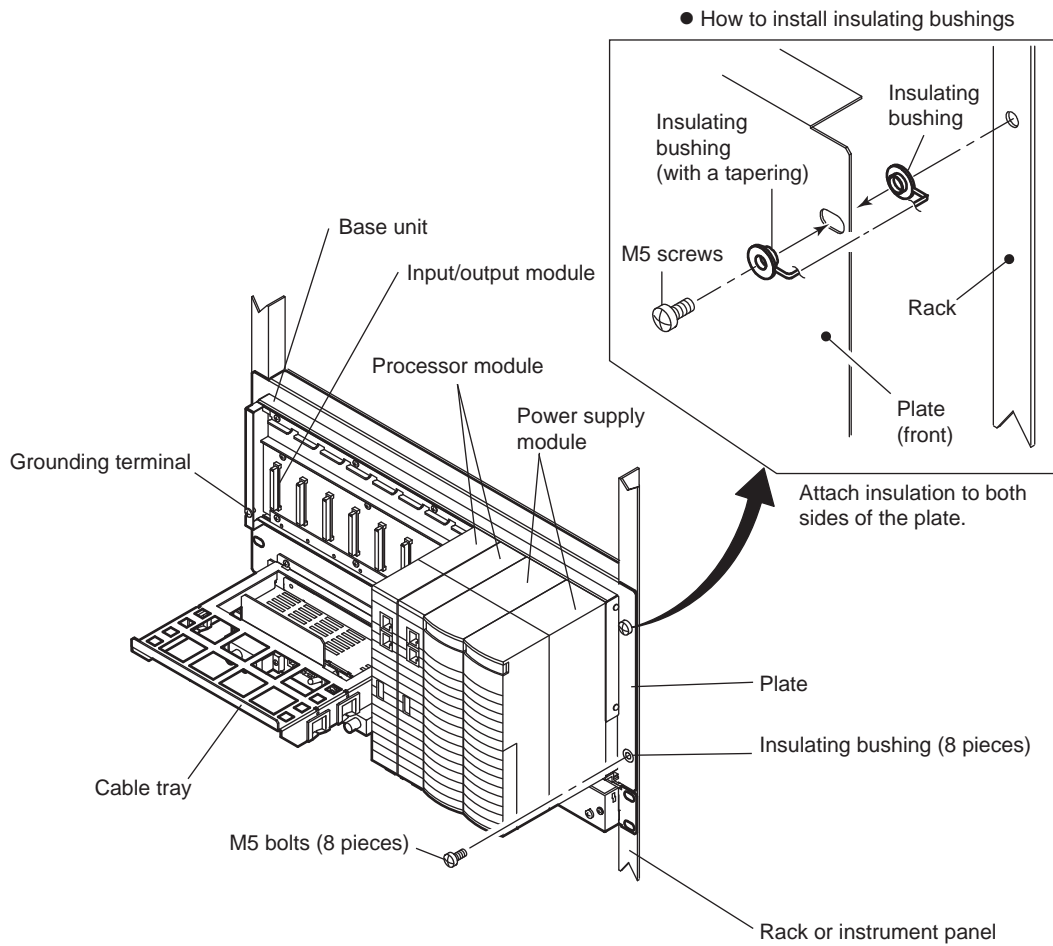


Figure 2.1-2 Mounting Safety Control Unit or Safety Node Unit on a Rack



IMPORTANT

- There is no power switch on the safety control unit, the safety node unit, and the unit for optical bus repeater module. Provide a separate switch or breaker for turning on/off the power.
- If multiple node units exist, all the units should be grounded by connecting to the earth terminal separately.

2.2 Installing a Terminal Board

Terminal boards can be installed on a rack, on a wall, or on a DIN rail. The installation method depends on the type of terminal board.

**SEE
ALSO**

For more information about types of terminal boards, refer to:

“■ Types of Terminal Boards” on page 1-22

2.2.1 Installing a 19-inch Rack Mountable Terminal Board

19-inch rack mountable terminal board can be installed on a rack or mounted on a wall.

**SEE
ALSO**

For more information about mounting on a rack or wall surface, refer to:

- [“■ Mounting on a Rack” on page 8-19](#)
 - [“■ Mounting on a Wall Surface” on page 8-20](#)
-

2.2.2 Installing a DIN Rail Mountable Terminal Board

DIN rail mountable terminal boards can be installed on a DIN rail or mounted on a wall.

■ Installing and Uninstalling from a DIN Rail

Use a DIN rail that is equivalent to the TH35-7.5 in IEC 60715 and EN 50022.



IMPORTANT

On the back of DIN rail mountable terminal board, there are two bumps (projections) for fixing screws on the wall. When installing, make sure these bumps do not contact the screw tops on the DIN rail.

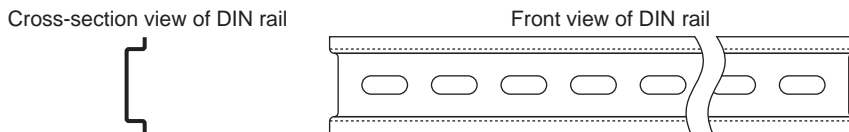


Figure 2.2.2-1 DIN Rail Design

● Procedure for Mounting onto a DIN Rail

1. As shown in the following figure, insert one side of the unit (the side without the latches) onto the DIN rail.

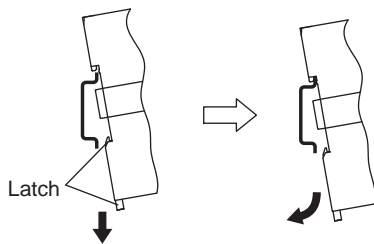


Figure 2.2.2-2 Mounting onto a DIN Rail (1/2)

2. Push the unit in until you hear a clicking sound from the latches.



Figure 2.2.2-3 Mounting onto a DIN Rail (2/2)



IMPORTANT

If the latches do not click onto the DIN rail easily, do not force them. Use a screwdriver to pull the latches from the outside while sliding the unit in.

● Procedure for Uninstalling from a DIN Rail

1. Use a flathead screwdriver to release the two DIN rail installation latches.

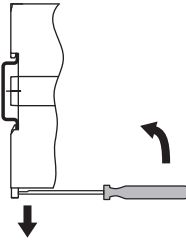


Figure 2.2.2-4 Uninstalling from a DIN Rail (1/3)

2. The end with the latches becomes loose.

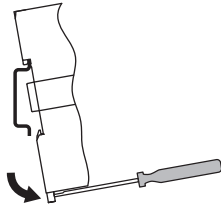


Figure 2.2.2-5 Uninstalling from a DIN Rail (2/3)

3. Remove the terminal board from the end without latches.



Figure 2.2.2-6 Uninstalling from a DIN Rail (3/3)



IMPORTANT

Do not forcefully rotate the terminal board when removing it.

● Fasteners

When installing onto a DIN rail, you can use fasteners to hold it in place. These fasteners are not supplied and should be purchased separately. Mount the terminal board onto the DIN rail and then secure it in place with the fasteners. To remove the board, take the fasteners off and then remove the terminal board from the DIN rail.

■ Mounting on a Wall Surface

The following figure shows the screw installation dimensions for a DIN rail mountable terminal board. Installation screws for the terminal board are not supplied and should be purchased separately. You need two installation screws. If you are using binding heads, use M4 screws with a length of at least 10 mm. If you are using screws with washers, use M4 screws with a length of at least 12 mm. The screw tightening torque is approximately 0.8 N·m.

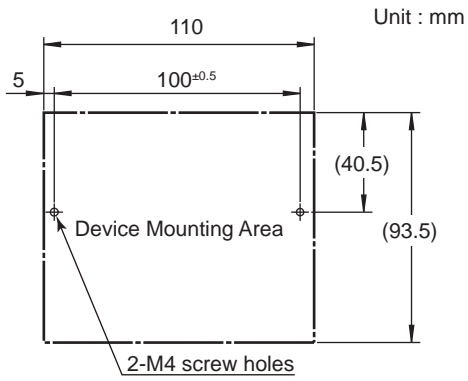


Figure 2.2.2-7 Screw Installation Dimensions for the SBA4D, SBT4D, and SBR4D

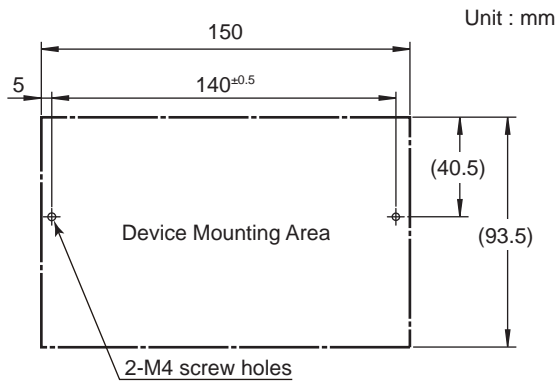


Figure 2.2.2-8 Screw Installation Dimensions for the SBD2D, SBD3D, and SBD4D

2.2.3 Precautions during Installation

■ Terminal Board Installation Direction

Install the DIN rail mountable terminal board in the direction shown in the following figure.



IMPORTANT

When installing the SBD2D in direction b or direction c, ensure that the following conditions are met.

- When the ambient temperature is less than 60 deg. C, the total current of the loads of all channels must be lower than the specified limit (8 A).
- When the ambient temperature is at 70 deg. C, the total current of the loads of all channels must be lower than 6 A.
- When the ambient temperature is between 60 deg. C and 70 deg. C, more precise calculation for current limit can be figured out by reducing 0.2 A from 8 A per 1 degree increment from 60 deg. C.

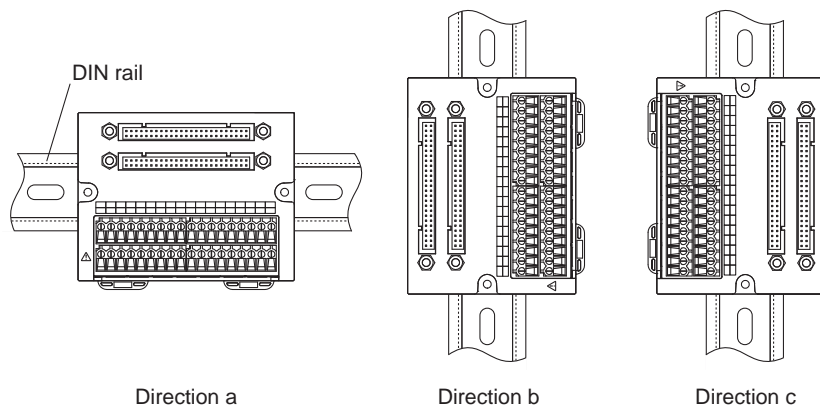


Figure 2.2.3-1 Terminal Board Installation Direction

■ Restrictions When Installing the SBT4D

To maintain reference junction compensation accuracy, the terminal board must not be affected by ambient heat. When installing a heat source nearby, install the heat source above the terminal board and terminal board wiring. If you must install the heat source next to or below the terminal board, install a heat shield.



IMPORTANT

The reference junction compensation is accurate when the ambient temperature is stable. If the ambient temperature changes, the measurements of the reference junction compensation accuracy will be incorrect until the temperature becomes stable again.

3. Cable Connection

The types of cable connections to the safety control unit, safety node unit and terminal board which has already been installed are as follows:

- Power Cable Wiring
- Grounding
- Connecting Control Bus Cables
 - Connecting V net Cables
 - Connecting the Cables for Vnet/IP
- Connecting ESB Bus Cables
- Connecting ESB Bus Fiber-Optic Cables

3.1 Power Cable Wiring

This section explains how to connect the power supply cable to the cabinet.

■ Power Cable Wiring



CAUTION

- The power cable must be wired through a conduit at the entrance of the cabinet for the following reasons:
 - To prevent the power cable from being damaged through direct contact with the metal plate.
 - To prevent an excessive load being applied to the power supply connection terminals due to the weight of the cable itself.
- Turn off the power supply source, and be sure that no electricity is flowing into the power cable to be connected before starting the work.
- After the power cable has been connected, turn on the power to the power cable with the breaker in the power panel turned OFF. Then, confirm with a tester that normal power is being supplied to the power input terminal.
- Wire the power cable by keeping a minimum distance of 1 cm from other signal wiring.

SEE ALSO

For more information about power cable wiring and grounding, refer to:

ProSafe-RS Installation Guidance (TI 32S01J10-01E)

■ Connecting Power Cables to Each Device

Power supply cables for each device are to be prepared by the user.

● Connecting Power Cables to the Power Supply Module and the Power Unit for the Fan

Connect the power supply using the following sequence of steps.

1. Attach the Plugs for M4 screws to the end of the cables.
2. Remove the protective cover of the power supply module.
3. For AC power supply, connect the non-grounding side to the terminal L and the grounding side to the terminal N.
For 24V DC power supply, connect the non-grounding side to the terminal (+) and the grounding side to the terminal (-).
4. Replace the protective cover.

● Connecting the Power Cable to the Power Distribution Unit

Yokogawa also provides the following power distribution units and power cables as one of the choices.

- Power distribution unit
AEPV7D-111: 100-120 V AC
AEPV7D-211: 220-240 V AC

- AEPV7D-411: 24 V DC
- AEP7D-11: 100-120 V AC
- AEP7D-21: 220-240 V AC
- AEP7D-41: 24 V DC

- Power cable (with connector for power distribution unit)
 - S9756UV: For AEPV7D-111 or AEP7D-11, 2 m
 - S9757UV: For AEPV7D-211 or AEP7D-21, 2 m
 - S9758UV: For AEPV7D-411 or AEP7D-41, 2 m

- Connecting procedure

The following figure shows the power terminal of AEP7D.

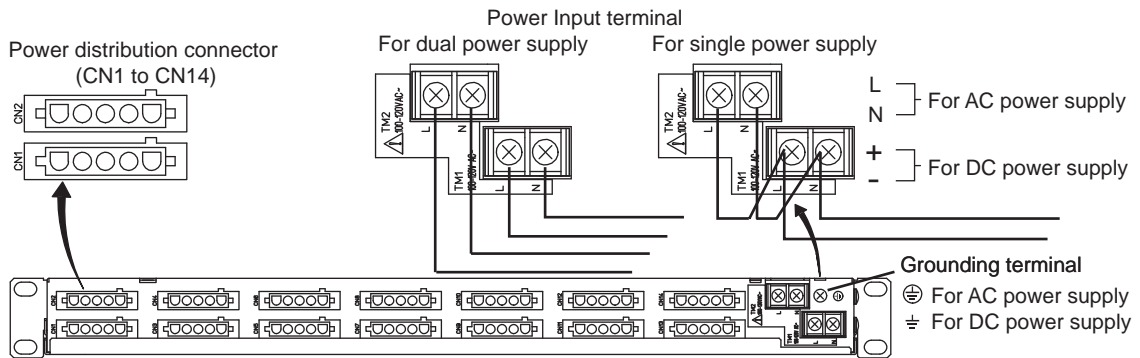


Figure 3.1-1 Power Distribution Unit (AEP7D) and Power Input Terminal

SEE ALSO For more information about power distribution unit, refer to:

[4.9, "Power Distribution Unit" on page 4-25](#)

● **Connecting a Power Cable to a DIN Rail Mountable Terminal Board**

Connect the power supply using the following sequence of steps.



CAUTION

You can use dual power supply. Before connecting the power supply, check the positive and negative polarity.

1. Prepare the ends of the cable.
2. Connect the power cable to the power input terminals.

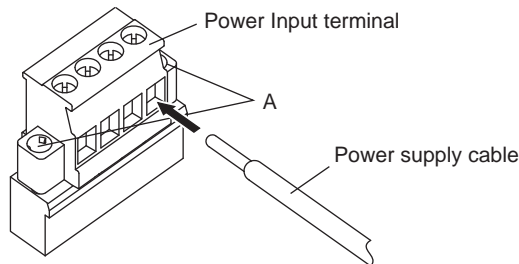


Figure 3.1-2 Connecting the Power Cable

TIP Loosen screw A, the terminal will be exposed from the body and then connect the power cable to the terminal.

SEE ALSO For more information about used cables and recommended cable thickness, refer to:

“■ Pressure Clamp Terminal Wiring for the Terminal Board” on page 5-10

■ Connecting the Power Cable to the Power Supply Module

Connect the power supply using the following sequence of steps.

1. Remove the protective cover of the power supply modules by following the steps.
 - There is a claw at the lower side of the protective cover (marked with a circle in the following figure).
 - Push the upper part of the claw to unlock it.
 - Gently pull the protective cover to open it.
2. Connect the cables of AC (100 V or 220 V AC) to L and N terminals and connect the cables of DC (24 V DC) to (+) and (-) terminals. The grounding cable must be connected to grounding terminal.
3. Put back the protective cover after the wiring is completed.

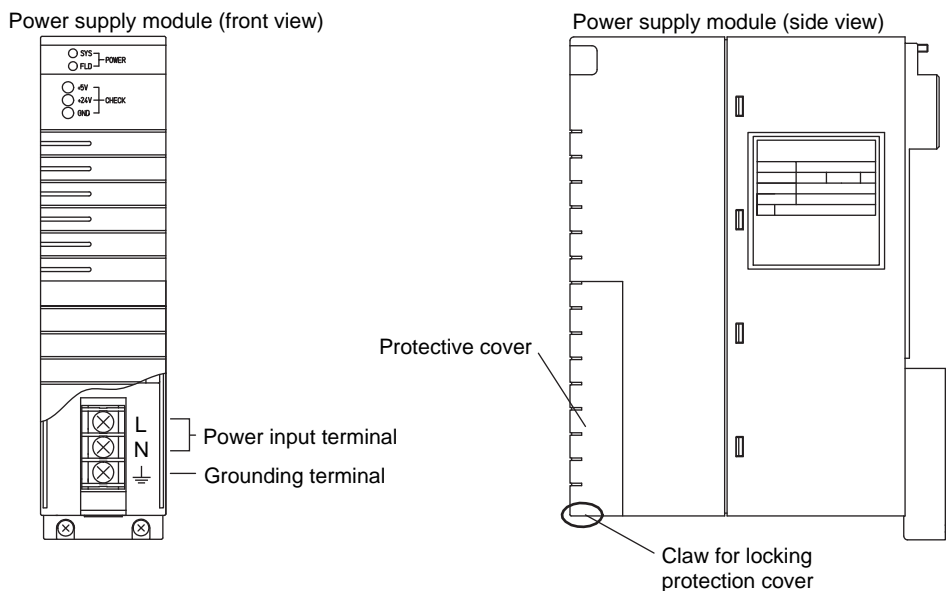


Figure 3.1-3 Connecting Power Cable

● If Power Distribution Unit is Used

The method for connecting power cable is the same as previously described.

The power supply module cables should be connected to the CN1 to CN14 distribution connectors respectively.

When dual power supplies are applied, the odd numbered distribution connectors are used for TM1 supply and the even numbered distribution connectors are used for TM2 supply.

● Connecting Power Cable to Power Supply Unit for Fan Unit

Connect the power cable to the power input terminal and the grounding terminal.

Connect the power cables to the corresponding terminals of power supply unit for fan unit on either left-hand side or right-hand side respectively.

SEE
ALSO

For more information about connecting power cable to fan unit, refer to:

4.8, "Node Fan Unit" on page 4-23

3.2 Grounding

To protect from external noises, the safety control units, safety node units, unit for optical bus repeater modules, and terminal boards with grounding terminals must be grounded.

**SEE
ALSO**

For more information about grounding terminals for each device, refer to:

ProSafe-RS Installation Guidance (TI 32S01J10-01E)

■ Wiring for Grounding

Use the grounding terminals to ground the devices.
Pull down the grounding wire through the tray and from the right side of the rack.

- Ground the grounding terminal to the protective grounding system.
- The thickness of the grounding wire should be approximately 2 mm².

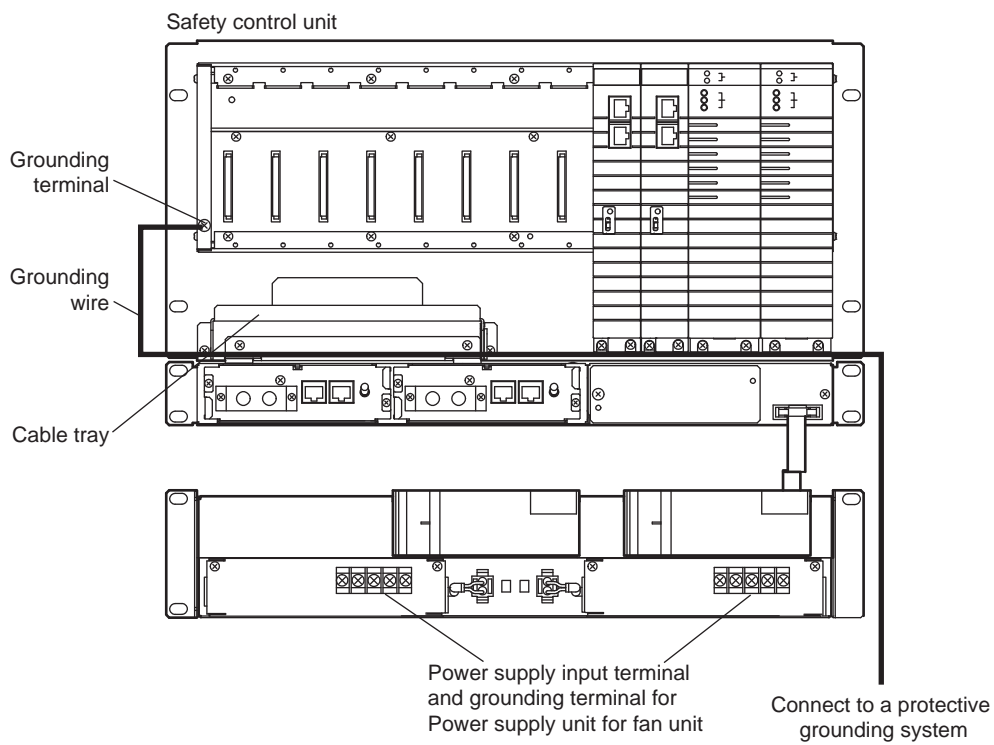


Figure 3.2-1 Grounding of safety Control Unit

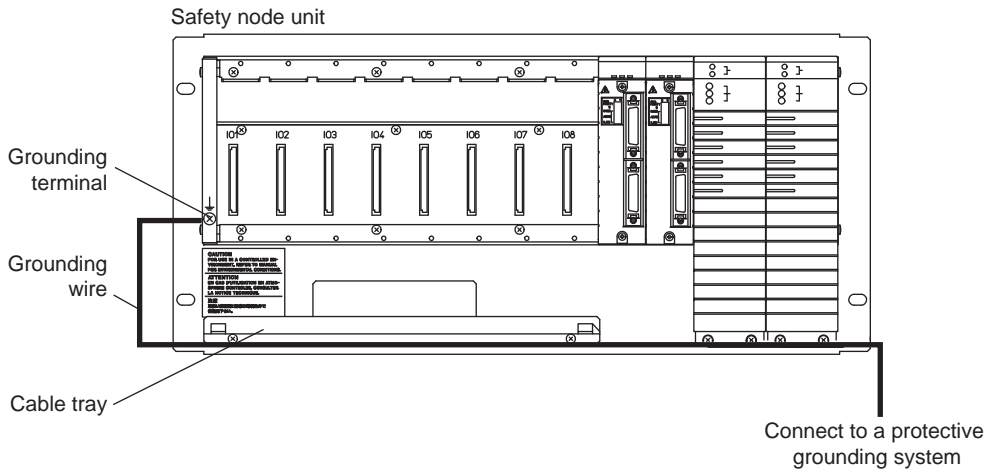


Figure 3.2-2 Grounding of Safety Node Unit

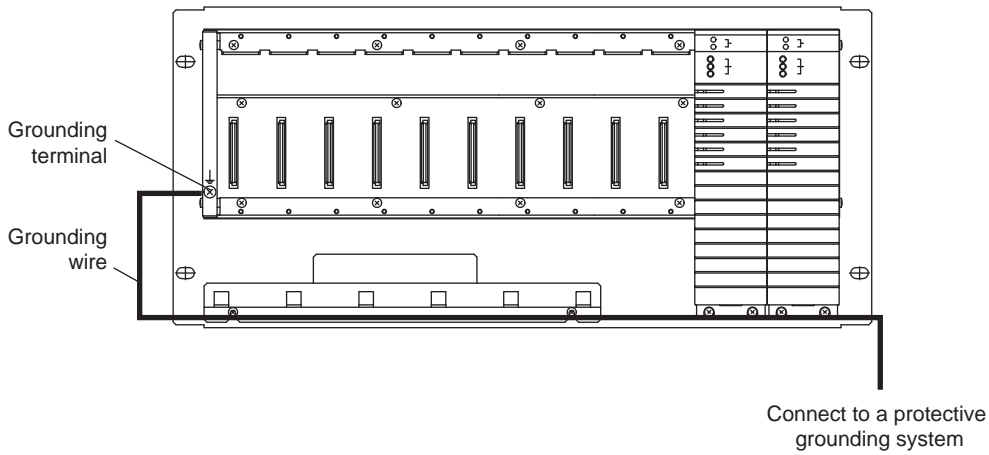


Figure 3.2-3 Grounding of Unit for Optical Bus Repeater Module

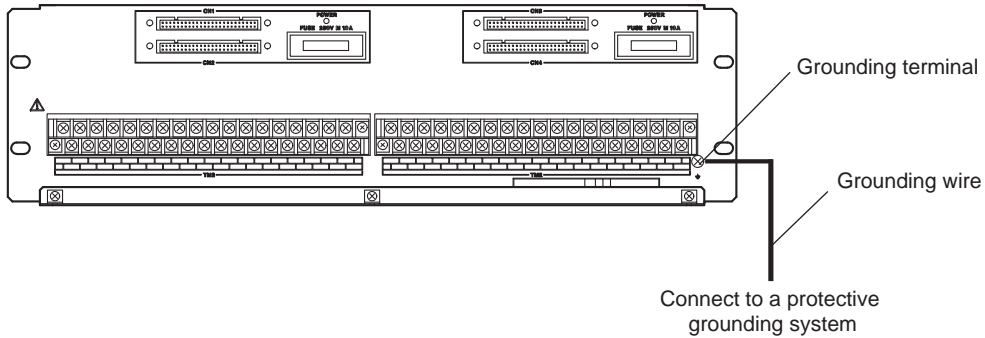


Figure 3.2-4 Terminal Board Grounding

3.3 Connecting Control Bus Cables

This section describes how to connect a control bus cable to the safety control unit. The control bus that is connected to the SCS can be either a V net or a Vnet/IP, depending on the SCS type.

3.3.1 Connecting V net Cable

How to connect V net cable is explained as follows.

The 10BASE-2 type cable is used as the V net cable. The V net branch connector for V net coupler is a BNC connector.



IMPORTANT

Note the following points when connecting a cable to the V net coupler unit:

- Always connect "bus 1 to bus 1" or "bus 2 to bus 2" on the safety control units.
 - In the V net wiring, if the V net coupler unit for the safety control unit is the terminus, install a V net terminator on the connection port of the unwired V net branch connector.
-

■ Wiring of V net Cable

The following figure shows the wiring of V net for connecting a safety engineering PC and a safety control unit.

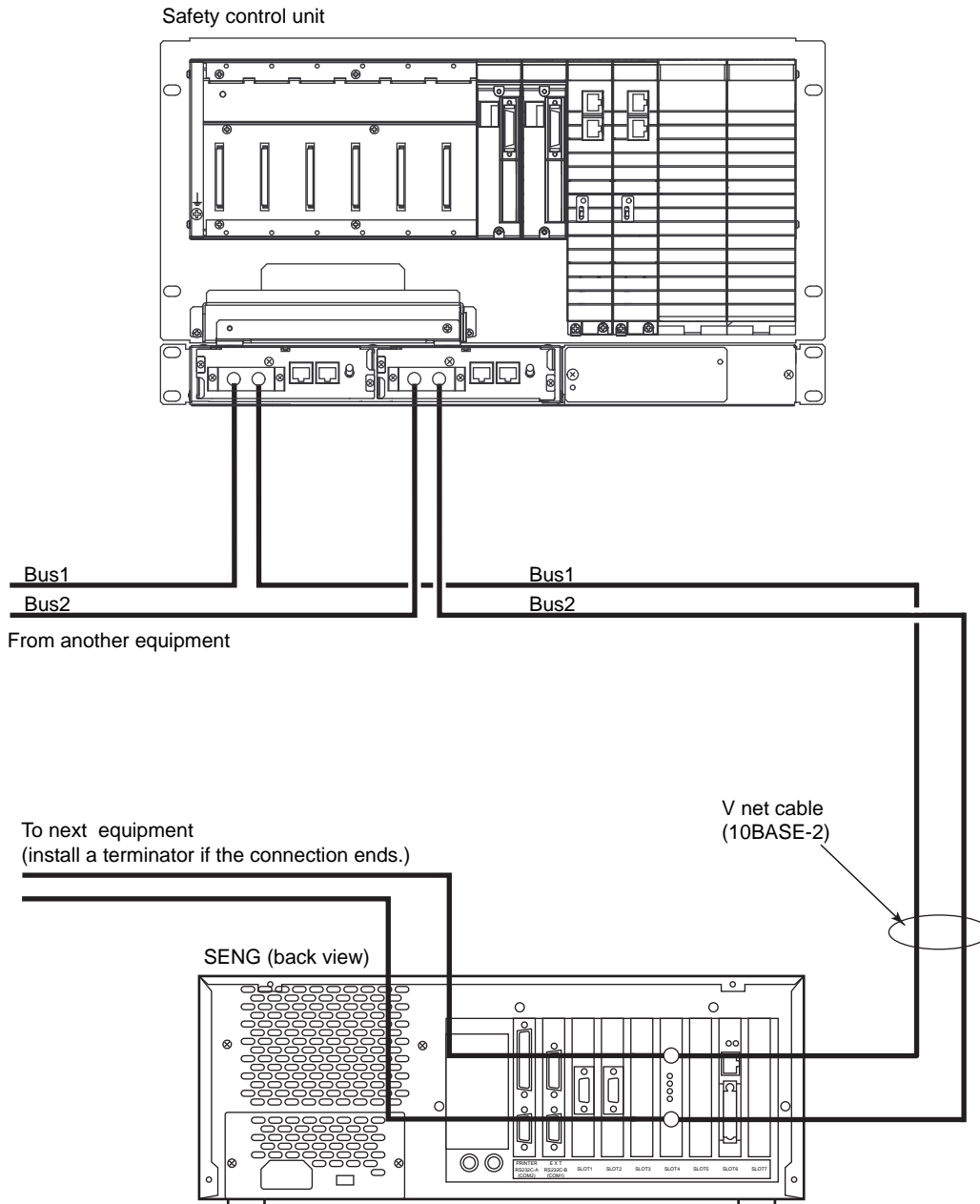


Figure 3.3.1-1 Wiring of V net Cable

● **Connecting V net Cable**

When connecting V net cables:

1. Move the bus 1 communication switch on the V net coupler unit to the DSBL position.
2. Connect the V net cable (10BASE-2) to the V net branch connector (BNC connector) on the V net coupler unit using bus 1.
3. After connecting the V net cable, put a black silicone rubber cover over it. (Silicone rubber cover is an accessory of safety control unit. Part number : T9070UQ)
4. Turn the communication switch on V net coupler unit into ENBL position.

Repeat steps 1 to 4 for bus 2.

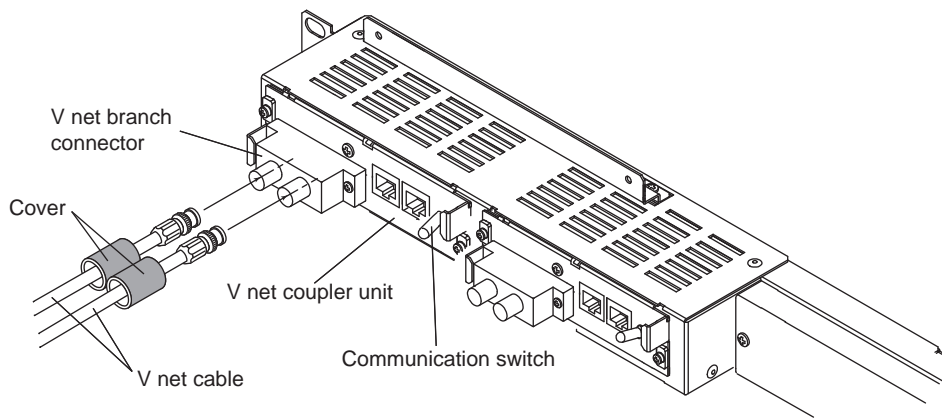


Figure 3.3.1-2 Connecting V net Cable

■ Wiring of V net Coupler Cable

A V net coupler cable is used to link the V net coupler unit and processor module. The modular connectors with keys are used on each side of the cable. Connect the connectors as illustrated in the following figure. However, following drawing shows a dual-redundant system. If the processor is single, CN3 will not be used.

- Use the bus1 cable to connect CN2 of coupler unit to BUS1 connector on left side processor module.
- Use the bus1 cable to connect CN3 of coupler unit to BUS1 connector on right side processor module.
- Use the bus2 cable to connect CN2 of coupler unit to BUS2 connector on left side processor module.
- Use the bus2 cable to connect CN3 of coupler unit to BUS2 connector on right side processor module.

The wiring route is shown in the following figure. The cable can be pulled through the corner hole of the cable tray.

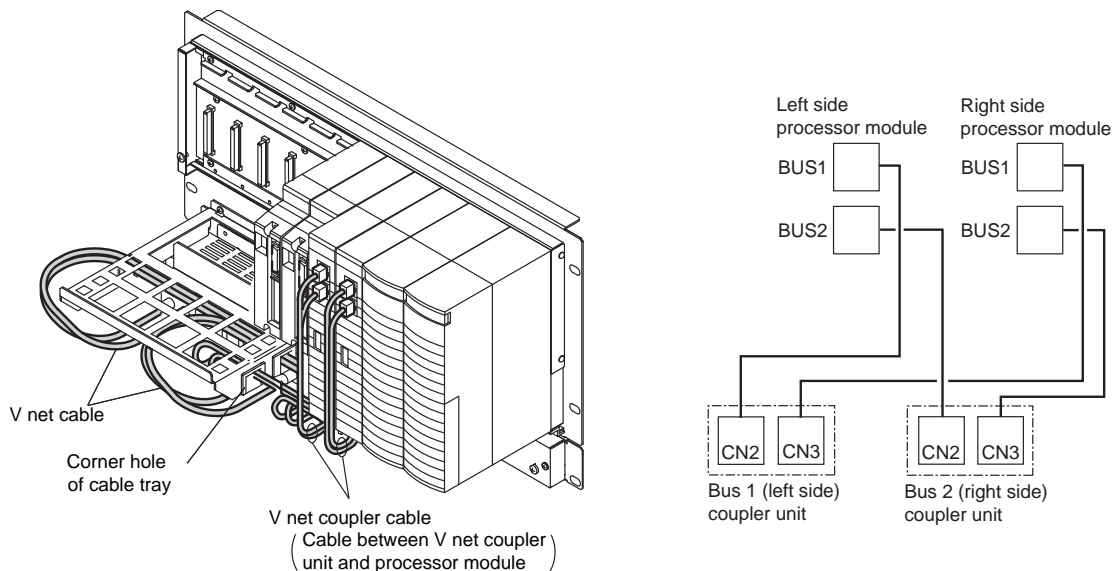


Figure 3.3.1-3 V net Coupler Cable Route

**SEE
ALSO**

For more information about connecting and disconnecting the V net coupler cable, refer to:

- 7.2.1, "Replacing V net Coupler Unit" on page 7-7
- 7.2.3, "Replacing Processor Module" on page 7-10

■ V net Conversion

Connecting the devices with different size of V net cables is explained as follows.

● Using the Control Bus Conversion Adapter

Control bus conversion adapter (Model : YCB147) is an adapter for connecting the V net cable (10BASE-5) with V net cable (10BASE-2).

An BNC type connector is provided on one side of YCB147. The V net cable (10BASE-2) from safety control unit is connected on this connector.

The other side of YCB147 is provided with N type connector, the V net cable (10BASE-5) is connected on this connector.

It is required to install the clamp filters to V net cables.

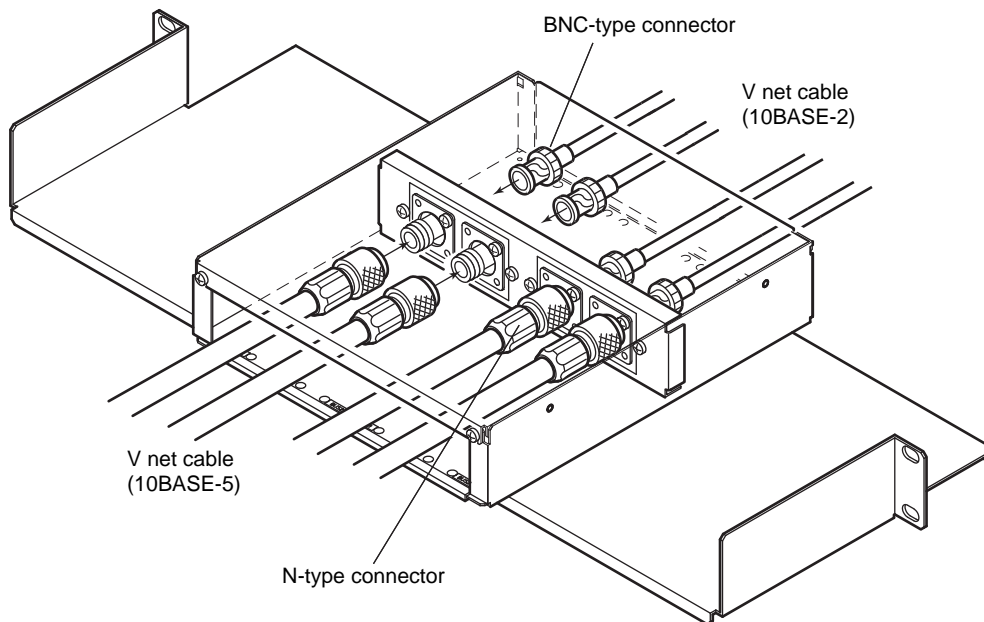


Figure 3.3.1-4 Adapter for Connecting the V net Cable (10BASE-2) with V net Cable (10BASE-5)

● Using the Control Bus Converter Unit

V net cable (10BASE-2) and V net cable (10BASE-5) can be connected via the control bus converter unit (YCB149).

However, the weight and strength of the cables are different, the control bus converter unit needs to be fixed firmly as follows.

- Fix the control bus converter unit as close as possible to the V net connector to reduce the load of the bus.
- Fix the control bus converter unit somewhere near safety control unit above the floor level to make maintenance convenient.
- Place the control bus converter unit in an area isolated from human traffic.
- On the 10BASE-5 V net cables, clamp filters are attached.

The following figure shows an example of the control bus converter unit installation.

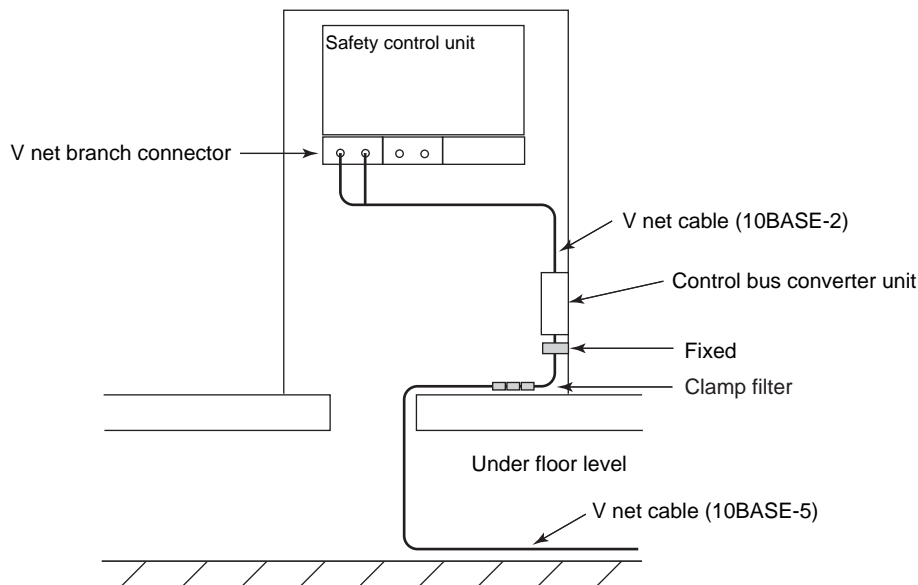


Figure 3.3.1-5 Using the Control Bus Converter Unit

● Calculating Total Distance when Using Different Cables

When using 10BASE-2 and 10BASE-5 cables, the total length of the cables must satisfy the following formula:

Length of 10BASE-2 cable + Length of 10BASE-5 cable x 0.4 ≤ 185

Example: If Length of 10BASE-2 cable = 5 m; Length of 10BASE-5 cable = 450 m

Total Distance = 5 m + 450 m x 0.4 = 185 m

Since the above lengths of cables are satisfying the formula, the total distance of V net is within the limit.

■ Attaching Clamp Filters (Ferrite Cores)

After completing the V net cable (10BASE-5 cable) connection, attach the clamp filters (included with the product) to the V net cables over the cable sheath in order to improve noise isolation.



IMPORTANT

The clamp filter case is made of plastic.

The clamp filter case may crack when opened and closed at a sub-zero temperature (in centigrade) or following a mechanical shock such as a fall. Maintain the applicable operating temperature range and storage temperature range for each device.

● Clamp Filter Set

Clamp filter is provided with V net cable (10BASE-5 cable).

- 6 ferrite cores (part No. A1179MN) per V net cable (10BASE-5 cable)
- Binding bands (ferrite core accessories)

● **Positions to Attach Clamp Filters**

The distance between the clamp filters and the connector should be as small as possible in order to prevent intrusion of noise from the portion between the V net conversion adapter or electrical transceiver and clamp filters.

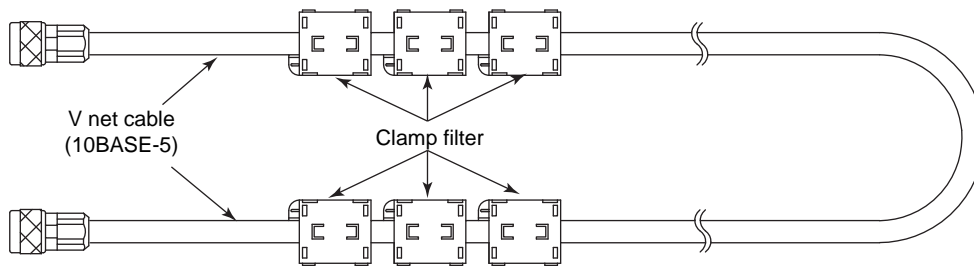


Figure 3.3.1-6 Positions to Attach Clamp Filters

● **Attaching Clamp Filters**

1. Release the two locking hooks of a clamp filter. The clamp filter can then be opened up to 150 degrees.

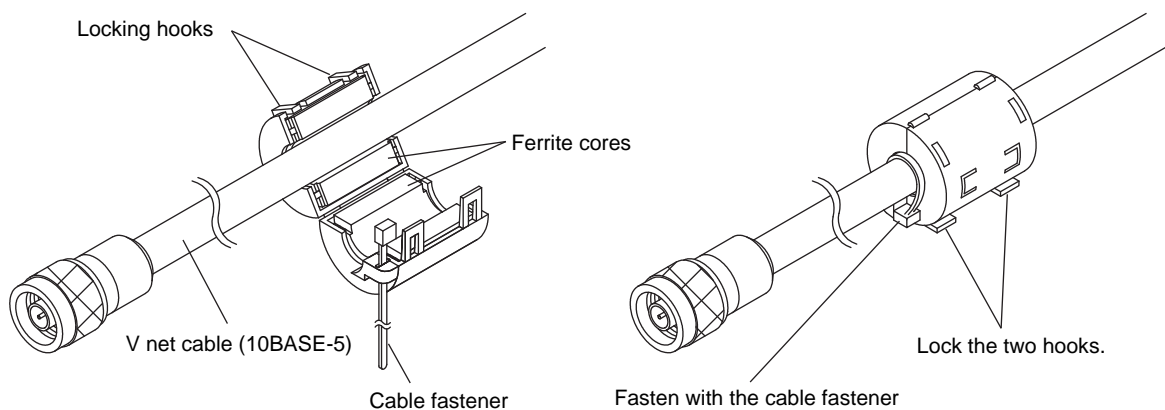


Figure 3.3.1-7 Attaching a Clamp Filter

2. Fit the V net cable into the cylindrical gap in the opened clamp filter.
3. Close the clamp filter and lock the two locking hooks.
4. Put a cable fastener through one side of the clamp filter and fasten the cable fastener over the cable sheath to fix the clamp filter.
5. In the same manner, attach three clamp filters (two more) close to each other on each side of the cable.
6. Install three clamp filters on the other end of the V net cable.

● **Grounding the V net**

The V net cables (10BASE-5) must be grounded by using a grounding unit for V net.



CAUTION

For safety reasons, the grounding unit for V net (YCB117) grounds devices connected to the V net using one grounding point. One grounding point within each segment is sufficient for V net grounding. To enhance safety, place the ground point near the center (in terms of distance) of each segment. A segment refers to the range of the V net network in which communication can be performed on the same bus without a repeater.

● **V net Grounding Unit Components**

Table 3.3.1-1 V net Grounding Unit Components

Name	Component and quantity
Main body	Metallic block : 2 M4 bolt : 2 M4 washer : 2
Cable	Grounding conductor 800 mm : 1

● **Using V net Grounding Unit to Ground V net Cable**

The following explains how to use the V net grounding unit to ground the V net cable.

1. Unscrew the two bolts of the grounding unit, and then separate the unit into the two metal blocks.
2. There are two types of metal blocks, built-in claw type and separate claw type. For the separate claw type metal block, insert the claw to the metal block.
3. As indicated in the figure, use the two metal blocks to clamp the V net cable. Connect the M4 ring terminal of the ground cable to a bolt. And then alternately tighten the two bolts so that the grounding unit and the grounding cable are fixed on the V net cable. Tightening the bolts makes the claw on the metal block penetrates the insulation sheath of the V net cable and contacts the conductive shield so as to electrically connect the cable shield to the metal block.

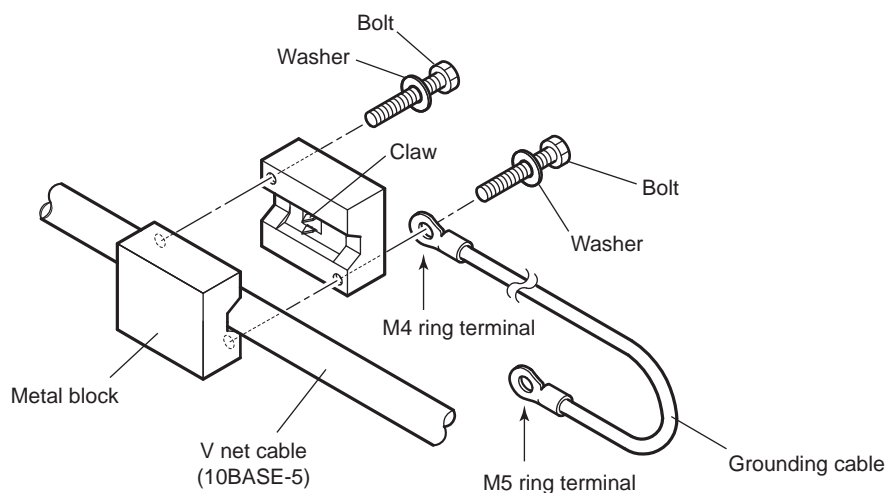


Figure 3.3.1-8 Assembly of V net Grounding Unit

4. Connect the M5 ring terminal at one end of the grounding cable to the grounding bar of the cabinet or to the grounding bar that is connected to the protective grounding system.

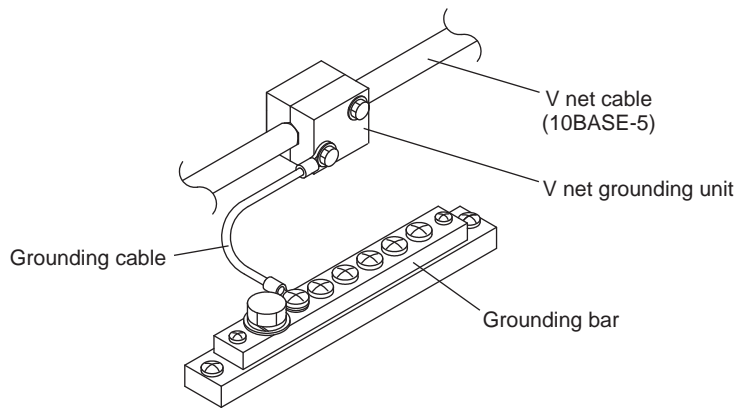


Figure 3.3.1-9 Connecting V net Grounding Unit



IMPORTANT

Make sure that the metallic blocks do not come into contact with any conductor having a potential different from that of the destination of the grounding cable.

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.

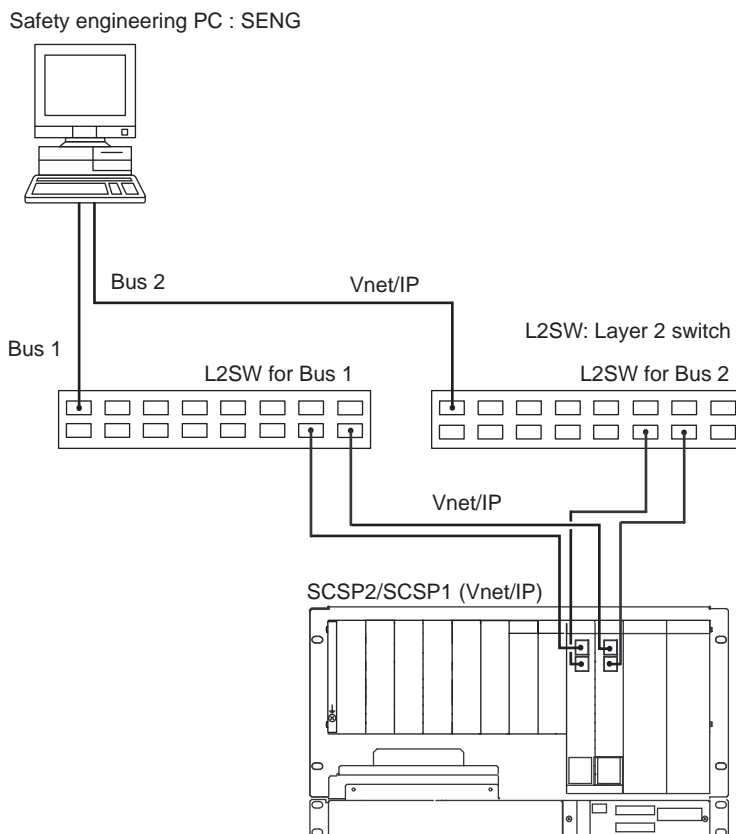


Figure 3.3.2-1 Connecting Cables for Vnet/IP

● 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.

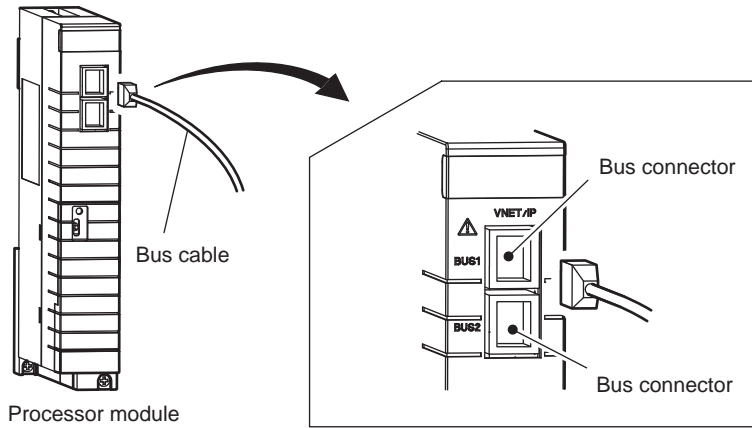


Figure 3.3.2-2 Connecting Cables for Vnet/IP

3.4 Connecting ESB Bus Cable

This section describes the connections of ESB bus cables and fiber-optic cables.

3.4.1 Connecting ESB Bus Cable

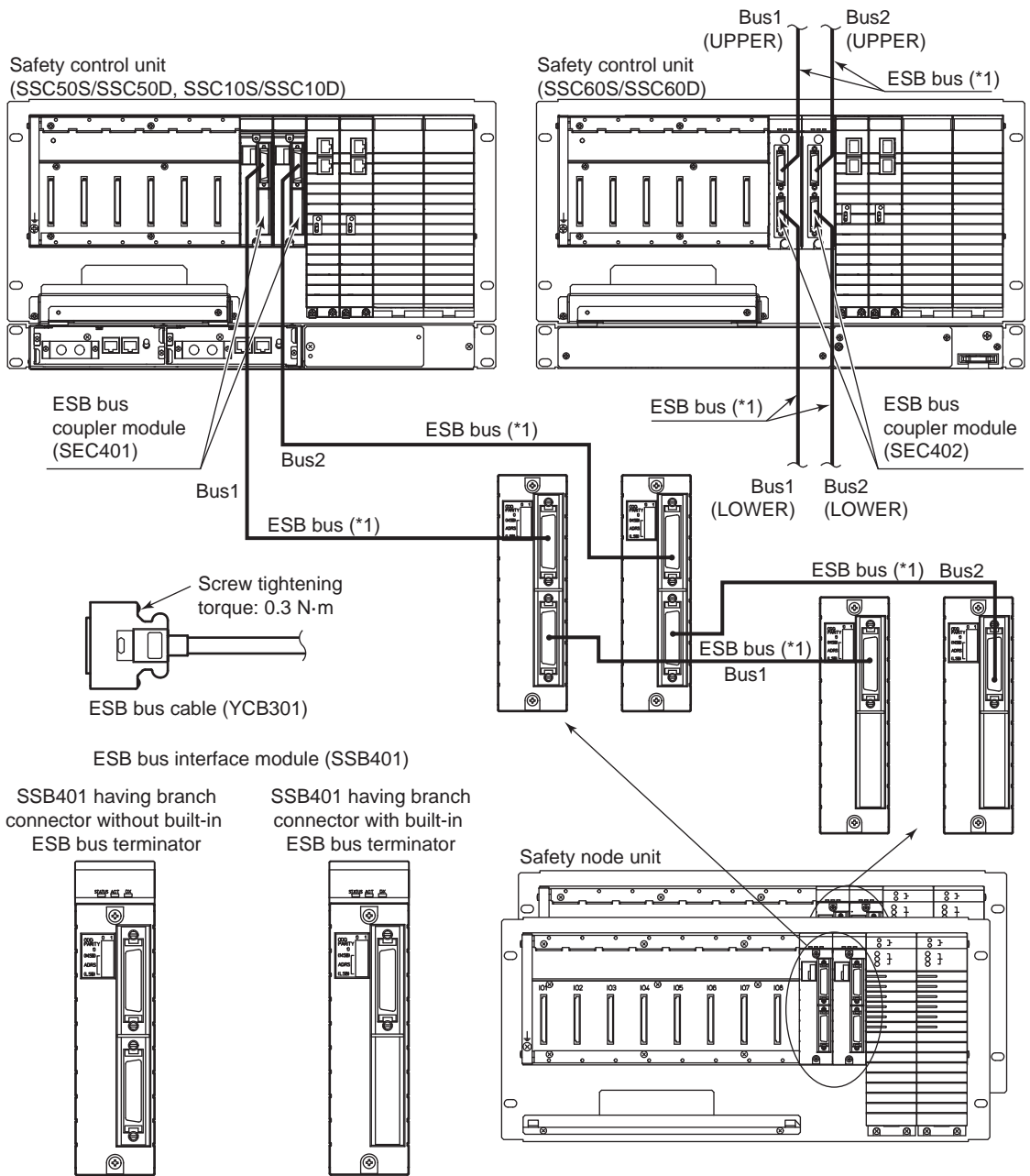
How to install ESB bus coupler module to the safety control unit, how to connect safety node unit, and how to connect the optical ESB bus repeater module are explained in this section.

■ ESB Bus

The communication bus to link the safety control unit and the safety node units is referred as ESB bus.

The ESB bus coupler module on the safety control unit is at one end of the ESB bus and it has a branch connector with built-in ESB bus terminator.

Connect an ESB bus interface module that has a branch connector with built-in ESB bus terminator to the safety node unit at the other end of the ESB bus. Connect an ESB bus interface module that has a branch connector without built-in ESB bus branch connector to the safety node units in between the two ends of ESB bus. The following figure shows an example of an ESB bus connection.



*1: Total transmission distance of ESB bus1 and ESB bus2 is less than 10 m each.

Figure 3.4.1-1 ESB Bus Connection

3.4.2 Connecting ESB Bus Fiber-Optic Cable

This section describes how to connect the safety control unit, the safety node unit, and the unit for optical bus repeater module with the optical ESB bus repeater module mounted onto each in order to extend the ESB bus using the fiber-optic cables.

There are star type and chain type connections.

■ Types of Optical ESB Bus Repeater Module

The following models of optical ESB bus repeater modules are available:

- SNT401 optical ESB bus repeater master module
- SNT411 optical ESB bus repeater master module 5 km to 50 km (for SCSP2/SCSP1)
- SNT501 optical ESB bus repeater slave module
- SNT511 optical ESB bus repeater slave module 5 km to 50 km (for SCSP2/SCSP1)

■ Transmission Distance

Combination of optical ESB bus repeater modules determines the transmission distance.

Table 3.4.2-1 Transmission Distance

Combinations	Each Stage	2 Stage Total
SNT401 and SNT501	Maximum 5 km	Maximum 10 km (SCSP2/SCSP1) Maximum 5 km (SCSV1)
SNT411 and SNT511	Minimum 5 km Maximum 50 km	5 km to 50 km
Mix of combination of SNT401 and SNT501 and that of SNT411 and SNT511	Stage with a combination of SNT401 and SNT501: maximum 5 km Stage with a combination of SNT411 and SNT511: maximum 50 km	5 km to 50 km



IMPORTANT

With the SCSP2/SCSP1, the maximum extension length of the combinations “SNT401 + SNT501” and “SNT411 + SNT511” must be less than 50 km.

■ ESB Bus Connection

Both ends of the modules connected with the ESB bus must be terminated. Use the following modules for a terminator.

- ESB Bus Coupler Module (SEC402/SEC401)
Both SEC401 and SEC402 have built-in terminators. The SEC401 and SEC402 can be directly used at the end of the bus.
- ESB Bus Interface Module (SSB401)
Two types exist: Branch connector with built-in ESB bus terminator and branch connector without built-in ESB bus terminator. For a terminator, use the branch connector with built-in ESB bus terminator.
- Optical ESB Bus Repeater Master Module (SNT401/SNT411)
Two types exist: Branch connector with built-in ESB bus terminator and branch connector without built-in ESB bus terminator. For a terminator, use the branch connector with the built-in ESB bus terminator.

- Optical ESB Bus Repeater Slave Module (SNT501/SNT511)
This module has a branch connector with a built-in ESB bus terminator, so you can use it as is.

Examples of connecting optical ESB bus repeater modules are shown as follows using SNT401 (optical ESB bus repeater master module) and SNT501 (optical ESB bus repeater slave module).

■ Star Type Connection

The star type is used for connecting safety node unit with optical ESB bus repeater module mounted and unit for optical bus repeater module to safety control unit. Both ends of the ESB bus should be terminated. The following figure shows an example of the star type connection. Examples of connecting SNT401 and SNT501 to safety control unit (SSC10S/SSC10D) are shown as follows. The same connection can be applied to SSC60S/SSC60D and SSC50S/SSC50D.

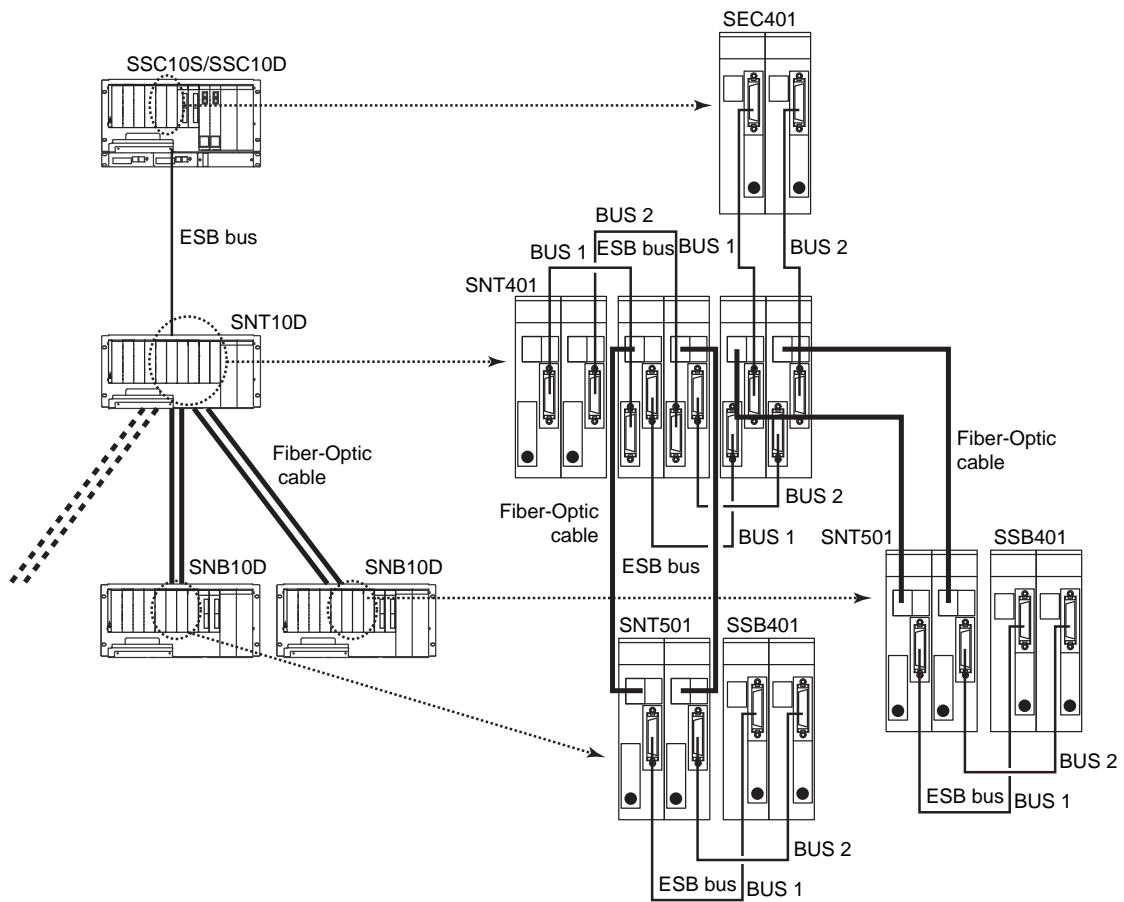
Mount the ESB bus coupler module (SEC401) on the safety control unit (SSC10S/SSC10D); mount the optical ESB bus repeater master module (SNT401) on the unit for optical bus repeater module (SNT10D); connect the SEC401 and the SNT401 with the ESB bus.

Mount the ESB bus interface module (SSB401) and the optical ESB bus repeater slave module (SNT501) onto the lowest-level safety node unit (SNB10D) and connect with the ESB bus.

For the modules at the end of ESB bus, use a connector unit with terminator for ESB bus.

Connect the optical ESB bus repeater modules (SNT401 and SNT501) with fiber-optic cables.

The optical ESB bus repeater module must always be dual-redundantly configured.



●: Connector unit with terminator for ESB bus

Note: Max. five SNB10Ds are connectable to one SNT10D.

Figure 3.4.2-1 Example of Star Type Connection

■ Chain Type Connection

For the chain type connection, two methods are available: Using safety control unit and safety node unit; using unit for optical bus repeater module. The optical ESB bus repeater module must always be duplicated.

● Using Safety Control Unit and Safety Node Unit

This is the method in which required the optical ESB bus repeater modules are mounted onto safety control unit and safety node unit each. Both ends of the ESB bus should be terminated on each level. The following figure shows an example of this connection.

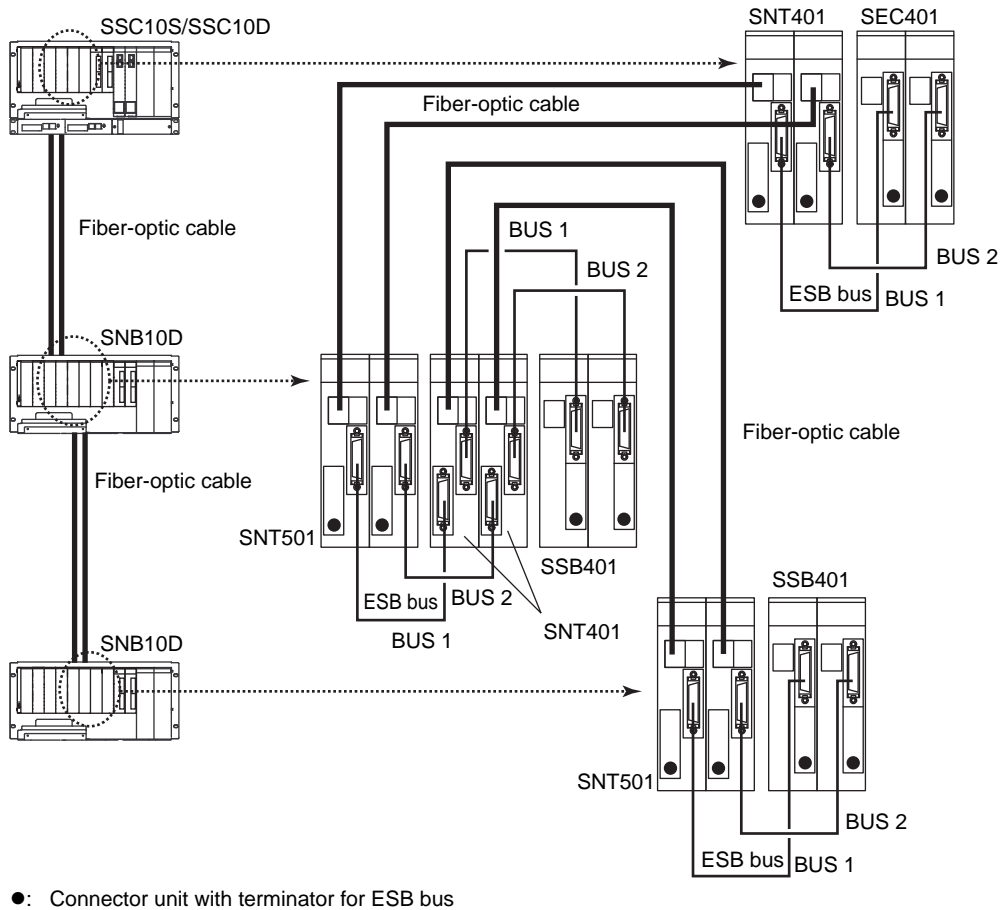
Mount the ESB bus coupler module (SEC401) and the optical ESB bus repeater master module (SNT401) on the safety control unit (SSC10S/SSC10D) with the ESB bus.

Mount the ESB bus interface module (SSB401), the optical ESB bus repeater master module (SNT401), and the optical ESB bus repeater slave module (SNT501) on the safety node unit (SNB10D) with the ESB bus.

Mount the ESB bus interface module (SSB401) and the optical ESB bus repeater slave module (SNT501) on the lowest-level safety node unit (SNB10D) with the ESB bus.

For the modules at the end of ESB bus, use a connector unit with terminator for ESB bus.

Connect the optical ESB bus repeater modules (SNT401 and SNT501) with fiber-optic cables.



●: Connector unit with terminator for ESB bus

Figure 3.4.2-2 Example of Chain Type Connection: Using Safety Control Unit and Safety Node Unit

● **Using Unit for Optical Bus Repeater Module**

This section explains how to connect the optical bus repeater module with a mounted optical ESB bus repeater to a safety control unit and a safety node unit. Both ends of the ESB bus should be terminated on each level. The following figure shows an example of this connection.

Mount the ESB bus coupler module (SEC401) on the safety control unit (SSC10S/SSC10D); mount the optical ESB bus repeater master module (SNT401) on the unit for optical bus repeater module (SNT10D); connect the SEC401 and the SNT401 with the ESB bus.

Mount the ESB bus interface module (SSB401) on the safety node unit (SNB10D); mount the optical ESB bus repeater master module (SNT401) and the optical ESB bus repeater slave module (SNT501) on the unit for optical bus repeater module (SNT10D); connect the SSB401 and the SNT401 with the ESB bus.

Mount the ESB bus interface module (SSB401) on the lowest-level safety node unit (SNB10D); mount the optical ESB bus repeater slave module (SNT501) on the unit for optical bus repeater module (SNT10D); connect the SSB401 and the SNT501 with the ESB bus.

For the modules at the ends of ESB bus, use a connector unit with terminator for ESB bus.

Connect the optical ESB bus repeater modules with fiber-optic cables.

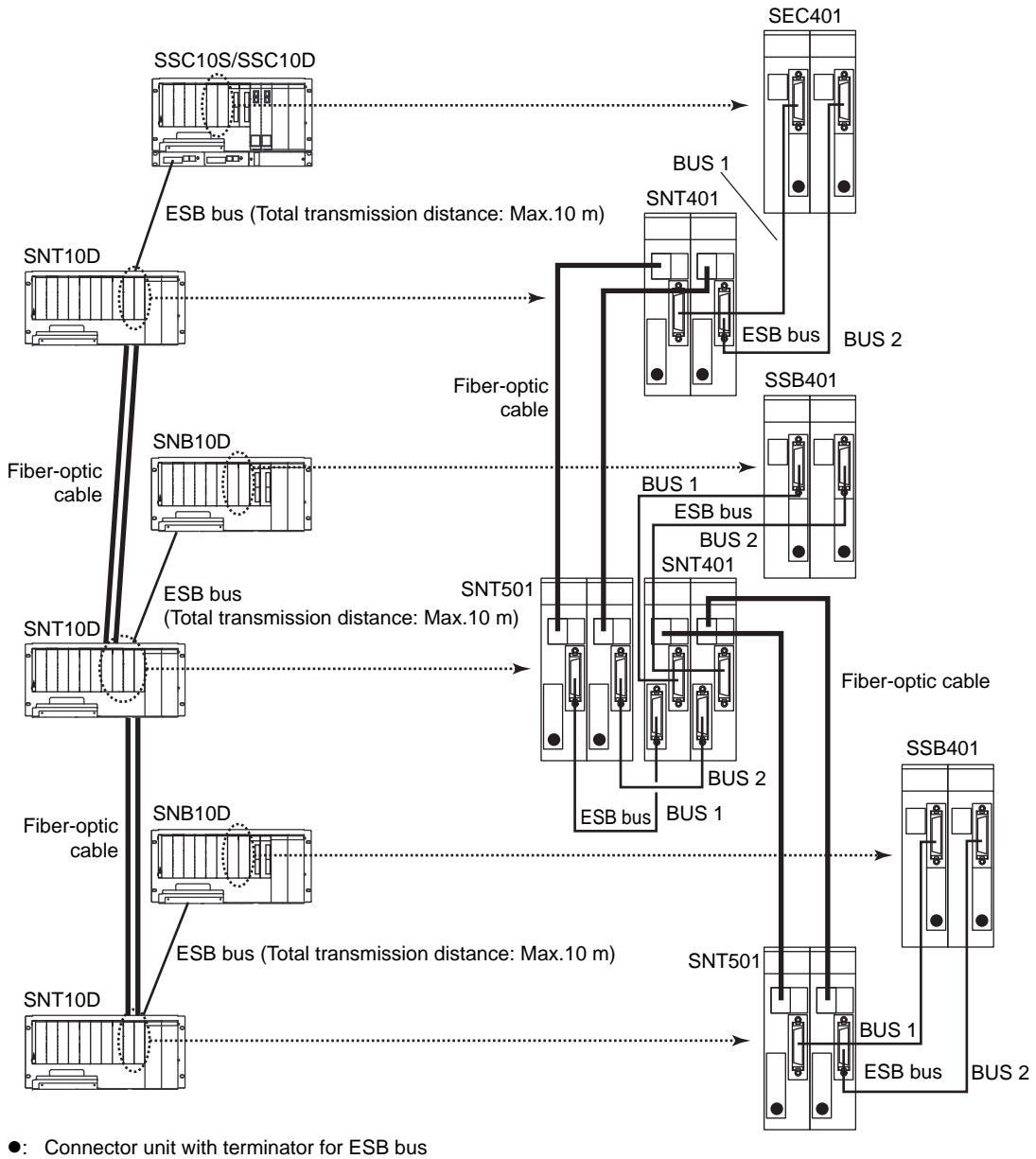


Figure 3.4.2-3 Chain Type: Using Unit for Optical Bus Repeater Module

■ The Number and Location of Optical ESB Bus Repeater Modules

The connectable number of optical ESB bus repeater modules and their location are determined by each unit (SSC60S/SSC60D, SSC50S/SSC50D, SSC10S/SSC10, SNB10D, or SNT10D).

The optical ESB bus repeater module must always be duplicated.



IMPORTANT

Note the following points when using optical ESB bus repeater modules.

- The optical ESB bus repeater master module and the optical ESB bus repeater slave module both connected to ESB bus1 must be mounted on the odd-numbered slots. The Optical ESB bus repeater master module and the optical ESB bus repeater slave module both connected to ESB bus2 must be mounted on the even-numbered slots.
- Be sure to put a dummy cover (SDCV01) on each slot with no module.

SEE ALSO

For more information about restrictions on optical ESB bus repeater module installation, refer to:

Model SNT10D Unit for Optical Bus Repeater Module (GS 32Q06K11-31E)

● **Safety Control Unit (SSC60S/SSC60D, SSC50S/SSC50D, SSC10S/SSC10D)**

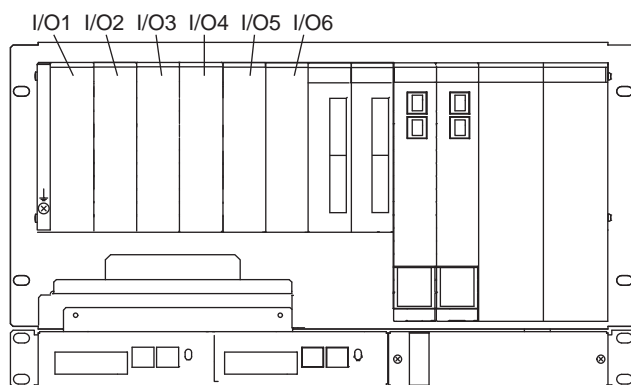


Figure 3.4.2-4 Safety Control Unit (SSC60S/SSC60D, SSC50S/SSC50D, SSC10S/SSC10D)

- Slots for optical ESB bus repeater modules: Slots I/O1 to I/O6
You can use slots I/O1 to I/O6. Use an odd-number slot and the next even-number slot together.

● **Safety Node Unit (SNB10D)**

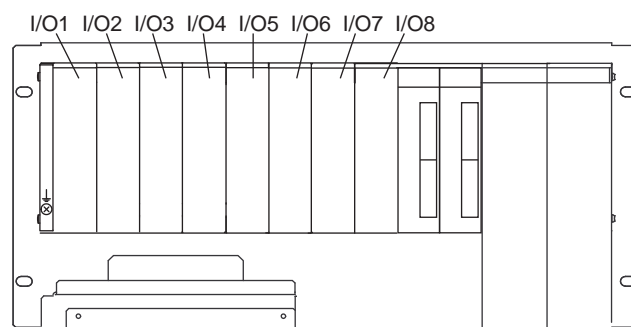


Figure 3.4.2-5 Safety Node Unit (SNB10D)

- Slots for optical ESB bus repeater modules: Slots I/O1 to I/O8
You can use slots I/O1 to I/O8. Use an odd-number slot and the next even-number slot together.

● **Unit for Optical Bus Repeater Module (SNT10D)**

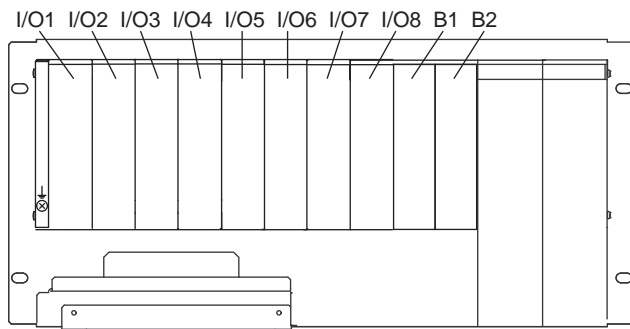


Figure 3.4.2-6 Unit for Optical Bus Repeater Module (SNT10D)

- Slots for optical ESB bus repeater modules: Slots I/O1 to I/O8, B1, B2
You can use slots I/O1 to B2. Use an odd-number slot and the next even-number slot together.

4. Configuration and Functions of Each Unit

In this chapter, settings, displays and functions of the modules and units configured in the safety control unit and safety node units are explained.

- Power Supply Module
- Processor Module
- ESB Bus Coupler Module
- ESB Bus Interface Module
- Optical ESB Bus Repeater Module
- V net Coupler Unit
- External Interface Unit
- Node Fan Unit
- Power Distribution Unit

4.1 Power Supply Module

A power supply module is connected to a 100 to 120 V AC or 220 to 240 V AC or 24 V DC main source and supplies insulated +5 V and +24 V to each installed I/O module through the back board.

The +5 V and +24 V outputs support dual-redundant insulated output operation.

Power supply modules available to ProSafe-RS: SPW481 (100-120 V AC), SPW482 (220-240 V AC), SPW484 (24 V DC)

■ Configuration

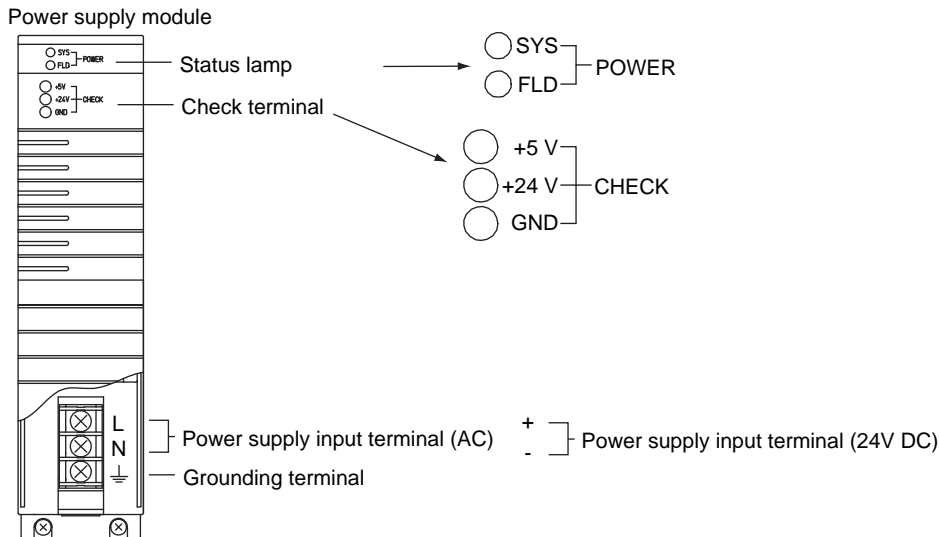


Figure 4.1-1 Power Supply Module

● Power Supply Input Terminal

This terminal receives the specified power supply voltage.

- L (+) : Line
- N (-) : Neutral
- Grounding terminal: For grounding

SEE ALSO

For more information about removing power supply module, refer to:

[7.2.2, "Replacing Power Supply Module" on page 7-8](#)

For more information about power distribution unit, refer to:

[4.9, "Power Distribution Unit" on page 4-25](#)

For more information about models of Yokogawa power distribution units and power cables, refer to:

[3.1, "Power Cable Wiring" on page 3-2](#)

● Status LEDs

- SYS: The lamp is ON when +5 V is output properly. Otherwise, the lamp is OFF.
- FLD: The lamp is ON when +24 V is output properly. Otherwise, the lamp is OFF.

● Check Terminal

It is possible to measure output voltages of +5 V DC and +24 V DC using these terminals for maintenance purposes.

4.2 Processor Module

Control algorithm calculations are performed in the processor modules.

Three types of processor modules are available: one for V net (Model: SCP401) and the other for Vnet/IP (Model: SCP461/SCP451).

■ Configuration

The following diagram shows the front and rear views of processor module.

The batteries are installed behind the front cover.

The DIP switches for setting domain number and station numbers are placed at the rear part of the processor module. When setting the DIP switches, it is necessary to remove the processor module from the safety control unit.

● SCP401

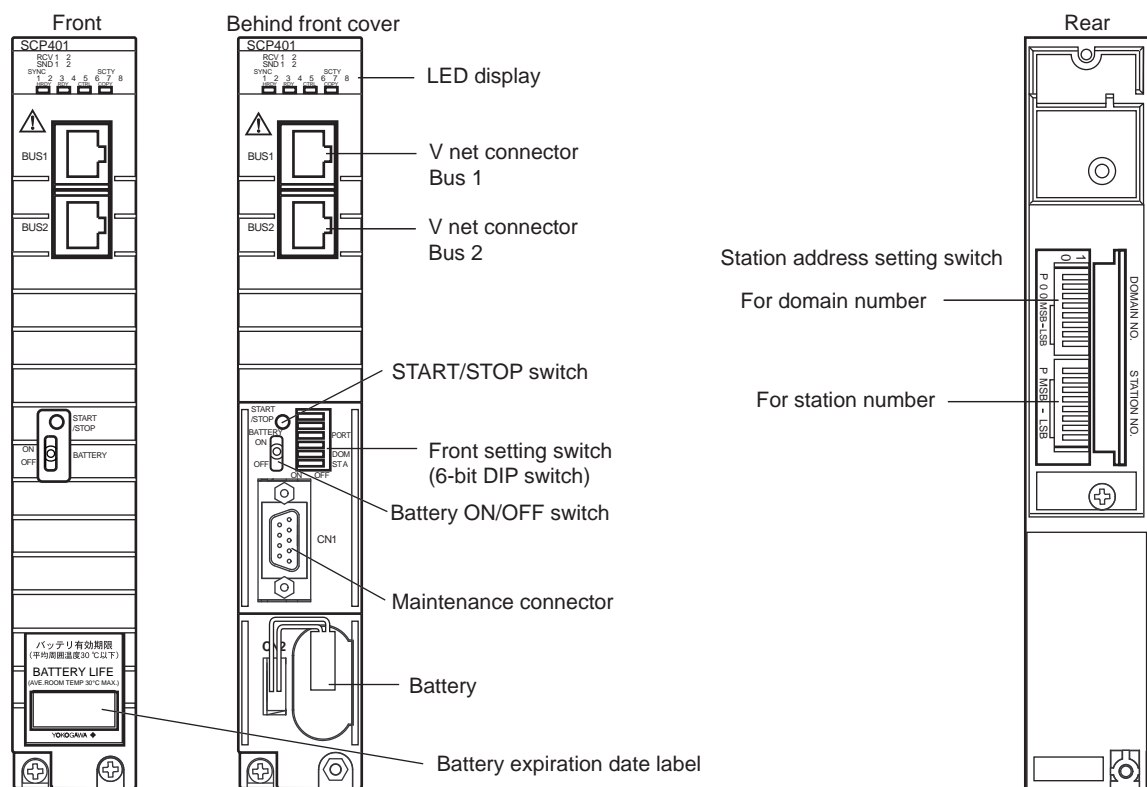


Figure 4.2-1 SCP401 Overview

● SCP461

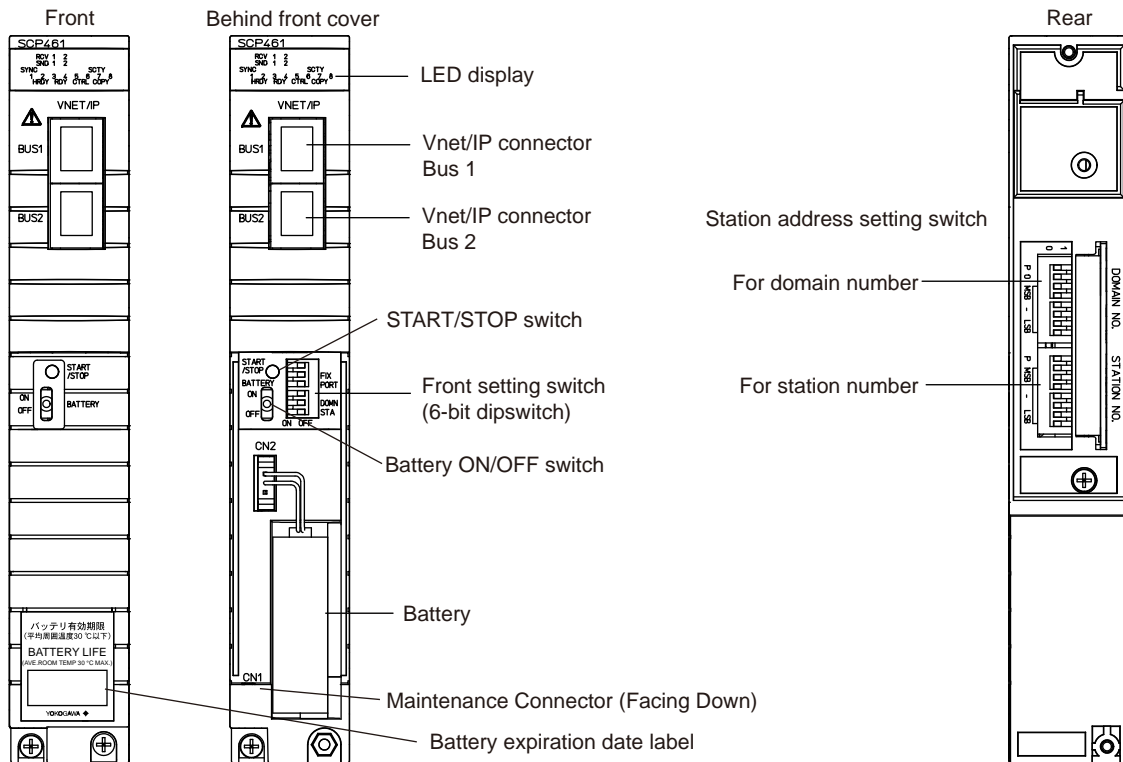


Figure 4.2-2 SCP461 Overview

● SCP451

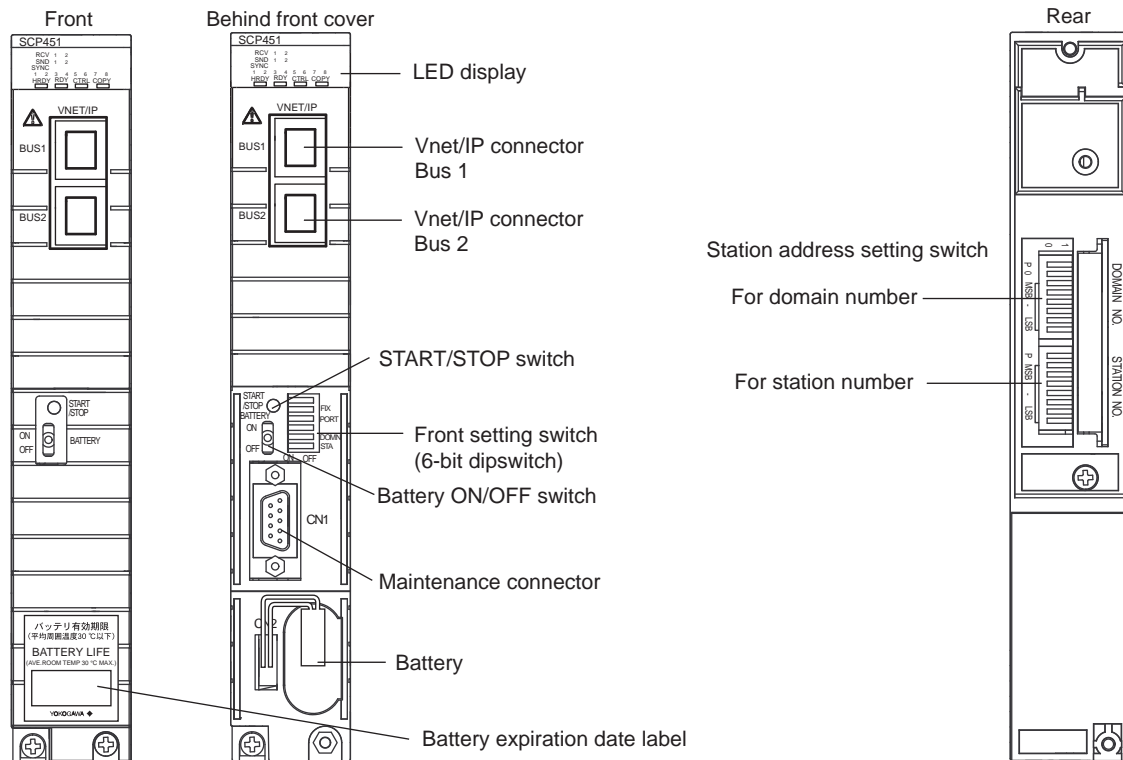


Figure 4.2-3 SCP451 Overview

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

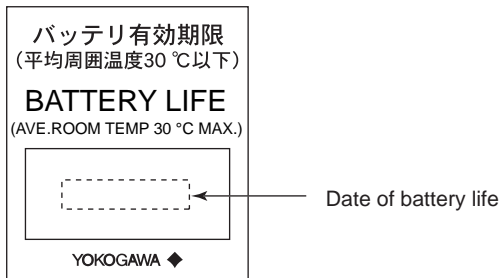


Figure 4.2.1-1 Battery Expiration Date Label

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

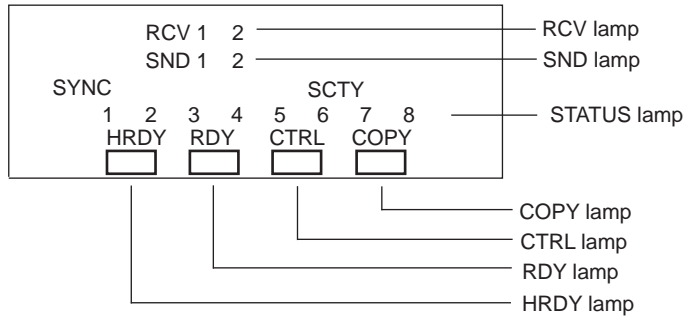


Figure 4.2.2-1 LED Display

- **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.

4.2.3 Setting Switches

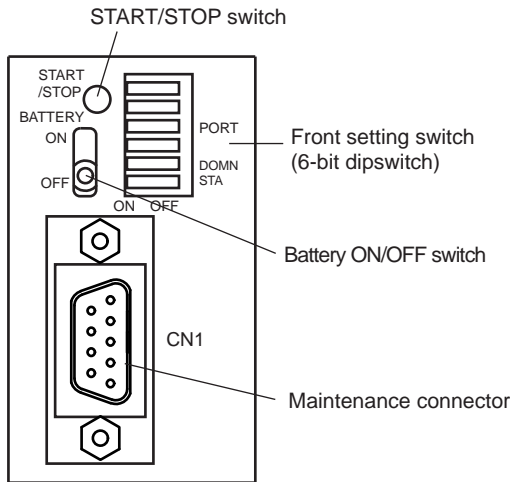


Figure 4.2.3-1 SCP401 Setting Switch

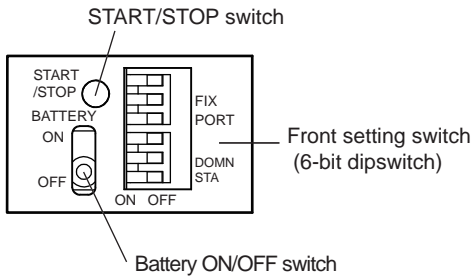


Figure 4.2.3-2 SCP461 Setting Switch

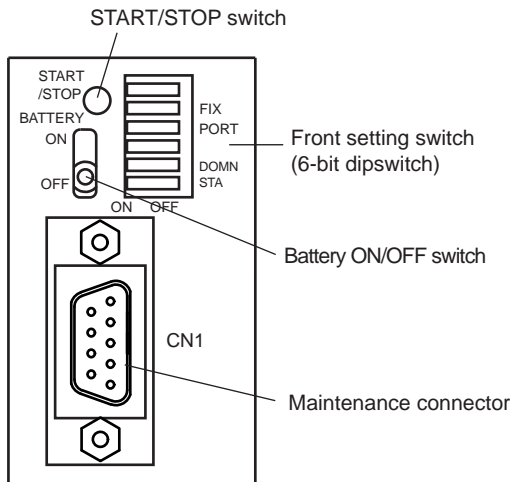


Figure 4.2.3-3 SCP451 Setting Switch

- **START/STOP:**
This maintenance switch is used for forcing the processor module CPU stop or restart.
If this switch is pressed when the processor module is still operating, the CPU will stop. If this switch is pressed when the processor module 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 non conductive slender bar of around 1 to 2 mm diameter.
- **Battery ON/OFF switch:**

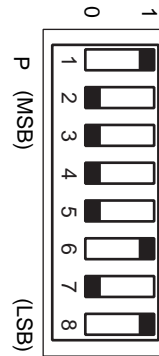
When this switch is on, battery backup is activated for protecting the processor module management information (in the storage memory) during power failure.

ON: Enables the backup. Select this position during normal operation.

OFF: Disables the backup.

- Front setting switch (6-bit DIP switch)
 - PORT: Port for maintenance (In usual operations, set to OFF position).
 - DOMN: Indicates on STATUS LED the domain number that was set to the processor module, if this switch is ON. (In usual operations, set to OFF position).
 - STA: Indicates on STATUS LED the station number that was set to the processor module, if this switch is ON. (In usual operations, set to OFF position).
 - FIX (SCP461/SCP451 only):
Negotiation (Default : OFF)
ON : Force
OFF : Auto

The following figure is an example of STATUS LED indication: If the station number is set as 5 (10000101).



If the station number is set as shown in the right side figure, the LED displays as follows (the numbered bits are lit):



Figure 4.2.3-4 STATUS LED Indication

When both DOMN and STA switches are off, the status lamps display operating mode and error status.

Table 4.2.3-1 Status Lamps Display Operating Mode and Error Status

STATUS lamps	Display	Description
1, 2	Operating Mode	<ul style="list-style-type: none"> • Running mode: 1 and 2 on • Waiting mode: 1 off, 2 on • Others: 1 and 2 off
3	Security level	Turns on only for security level 2. (*1)
4	Safety control station error (*2)	<ul style="list-style-type: none"> • Error occurred: off • Normal: on
5, 6, 7	Unused	Always on
8	Writing to flash memories	Writing: off, Otherwise: on

*1: Security level 0 corresponds to offline level and security levels 1 and 2 correspond to online level.

*2: This lamp may be linked to the SYS_DIAG output.

SEE ALSO For more information about SYS_DIAG function block, refer to:

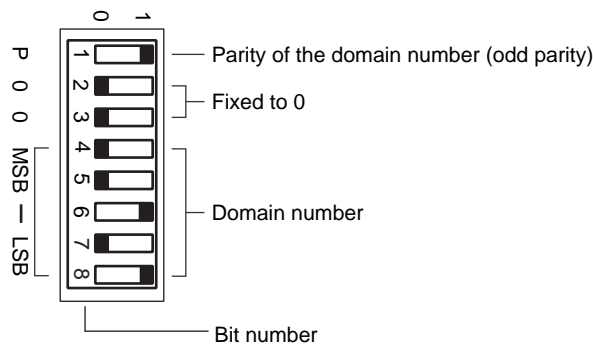
C10.6, "SYS_DIAG (diagnostic information output)" in Safety Control Station Reference (IM 32Q03B10-31E)

■ Setting the Domain Number

A domain stands for a range of stations in a network connected by control bus. Set the domain number in the range of 1 to 31. To set a domain number, set the DIP switches as follows.

- Setting DIP switches
 - 0: In the state shown in the following figure, the switch is tilted toward the left.
 - 1: In the state shown in the following figure, the switch is tilted toward the right.

Bits 2 and 3 must always be zeros (0s).



MSB: Most Significant Bit
LSB: Least Significant Bit

Figure 4.2.3-5 Domain Number Setting Switches

Table 4.2.3-2 Domain Number and DIP Switch Positions

Domain number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Bit 1	0	0	1	0	1	1	0	0	1	1	0	1	0	0	1	0
Bit 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bit 5	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
Bit 6	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0
Bit 7	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0
Bit 8	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0

Table 4.2.3-3 Domain Number and DIP Switch Positions

Domain number	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Bit 1	1	1	0	1	0	0	1	1	0	0	1	0	1	1	0
Bit 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Continues on the next page

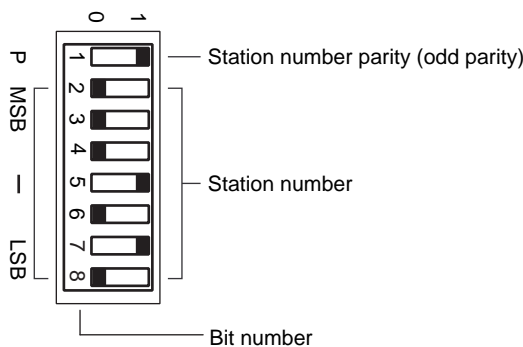
Table 4.2.3-3 Domain Number and DIP Switch Positions (Table continued)

Domain number	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Bit 5	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Bit 6	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
Bit 7	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
Bit 8	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

■ Setting the Station Number

Set the station number to a value from 1 to 64. To set a station number, set the DIP switches as follows.

- Setting DIP switches
 - 0: In the state shown in the following figure, the switch is tilted toward the left.
 - 1: In the state shown in the following figure, the switch is tilted toward the right.



MSB : Most Significant Bit
 LSB : Least Significant Bit

Figure 4.2.3-6 Station Number Setting Switches

Table 4.2.3-4 Station Number and DIP Switch Positions

Station number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Bit 1	0	0	1	0	1	1	0	0	1	1	0	1	0	0	1	0
Bit 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bit 5	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
Bit 6	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0
Bit 7	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0
Bit 8	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0

Table 4.2.3-5 Station Number and DIP Switch Positions

Station number	17	18	-----	30	31	32	33	-----	60	61	62	63	64		
Bit 1	1	1	-----	1	0	0	1	-----	1	0	0	1	0		
Bit 2	0	0		0	0	0	0		0	0	0	0	0	1	
Bit 3	0	0		0	0	1	1		1	1	1	1	1	0	
Bit 4	1	1		1	1	0	0		0	1	1	1	1	0	
Bit 5	0	0		1	1	0	0		0	1	1	1	1	0	
Bit 6	0	0		1	1	0	0		0	1	1	1	1	0	
Bit 7	0	1		1	1	0	0		0	0	0	0	1	1	0
Bit 8	1	0		0	1	0	1		1	0	1	0	0	1	0

4.3 ESB Bus Coupler Module

ESB bus coupler module (Model: SEC401) is installed in the safety control unit for communicating with the ESB bus interface module (Model: SSB401) installed in the safety node unit. The ESB bus coupler module is always dual-redundantly configured.

ESB bus coupler module (Model: SEC402) is installed in the safety control unit (SSC60S/SSC60D) for communicating with the ESB bus interface module (Model: SSB401) installed in the safety node unit. The ESB bus coupler module is always dual-redundantly configured.

■ Configuration

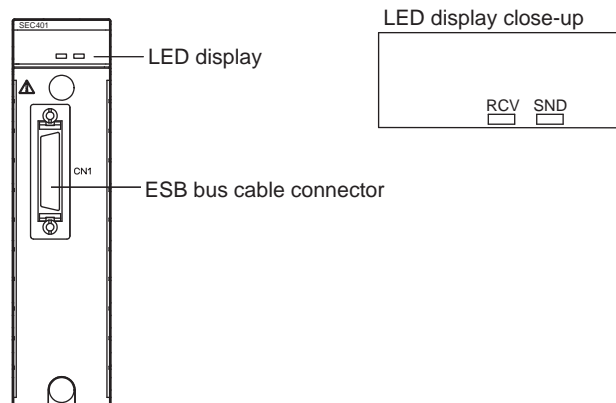


Figure 4.3-1 SEC401

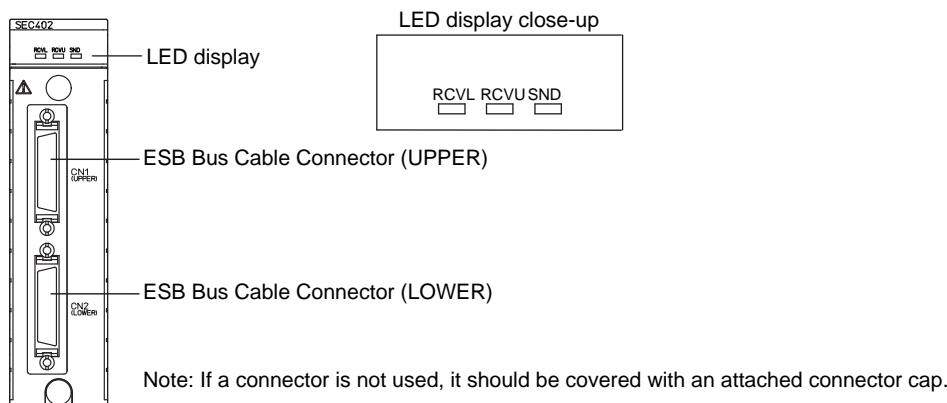


Figure 4.3-2 SEC402

● LED Display (SEC401)

- RCV: When receiving ESB bus communication frames from safety node units, the LED flashes, otherwise the LED is off.
- SND: When sending ESB bus communication frames to safety node units, the LED flashes, otherwise the LED is off.

● LED Display (SEC402)

- RCVL: When receiving response frames from the safety node units through the lower side port, the LED flashes, otherwise the LED is off.
- RCVU: When receiving response frames from the safety node units through the upper side port, the LED flashes, otherwise the LED is off.
- SND: When sending command frames to safety node units through the lower side port or the upper side port, the LED flashes, otherwise the LED is off.

- **ESB Bus Cable Connector**

This connector is used for ESB bus cable (YCB301).

4.4 ESB Bus Interface Module

ESB bus interface module (Model: SSB401) is installed in the safety node unit for communicating with the ESB bus coupler module (Model: SEC402/SEC401) installed in the safety control unit. The ESB bus interface module is always dual-redundantly configured.

■ Configuration

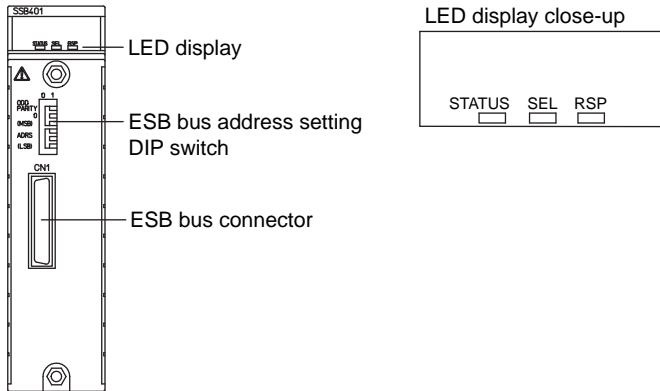


Figure 4.4-1 SSB401

● LED Display

- STATUS: This LED turns on when the self-diagnosis has been completed normally and the ESB interface is operating normally, otherwise it is turned off.
- SEL: This LED flashes during data transmission to an I/O module, otherwise it is off.
- RSP: This LED flashes during data reception from an I/O module, otherwise it is off.

● ESB Bus Connector

The ESB bus connector is connected to a connector unit for ESB bus, (shown in the following figure), via an ESB bus cable (YCB301).

Connect the ESB bus cable connector to a connector unit with terminator for ESB bus to terminate the ESB bus.

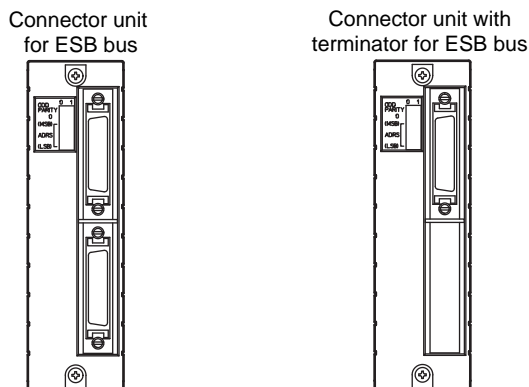


Figure 4.4-2 Connector Unit for ESB Bus and Connector Unit with Terminator for ESB Bus



WARNING

The ESB bus are always dual-redundantly configured. When connecting or disconnecting the connector unit for ESB bus, make sure the bus 1 and bus 2 are correctly identified and connected.

● **ESB Bus Address Setting DIP Switches**

When multiple node units are connected to an ESB bus, it is possible to select a node unit to be accessed by setting the node address using these switches.

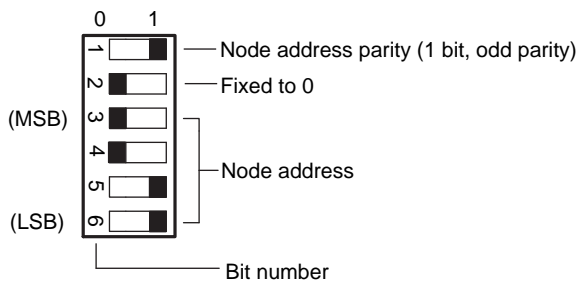
■ **Setting Node Addresses**

ESB bus node number can be defined by setting the Dip switches.

The node number can be designated in the range of 2 to 10 for a safety node unit that is connected to SCSP1/SCSV1, or in the range of 2 to 14 for a safety node unit that is connected to SCSP2. It is possible to match the required node numbers by setting the DIP switches as follows:

- Setting DIP switches
 - 0: In the state shown in the following figure, the switch is tilted toward the left.
 - 1: In the state shown in the following figure, the switch is tilted toward the right.

Node number 1 is reserved for the safety control unit.



MSB : Most Significant Bit
LSB : Least Significant Bit

Figure 4.4-3 Node Number Setting DIP Switches

Table 4.4-1 Node Number and Switch Positions

Node number	2	3	4	5	6	7	8	9	10	11	12	13	14
Bit 1	0	1	0	1	1	0	0	1	1	0	1	0	0
Bit 2	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit 3	0	0	0	0	0	0	1	1	1	1	1	1	1
Bit 4	0	0	1	1	1	1	0	0	0	0	1	1	1
Bit 5	1	1	0	0	1	1	0	0	1	1	0	0	1
Bit 6	0	1	0	1	0	1	0	1	0	1	0	1	0



IMPORTANT

Make sure that the node number setting DIP switches are correctly set.

4.5 Optical ESB Bus Repeater Module

An optical ESB bus repeater module converts electric signals sent through the ESB bus connecting safety control unit to the safety node unit and safety node unit to another safety node unit, into optical signals. As a result, it is possible to extend the transmission distance.

The optical ESB bus repeater module is connectable to safety control unit, safety node unit, and the unit for optical bus repeater module. The type of module (master or slave) determines which unit it is connectable to.

■ Types of Optical ESB Bus Repeater Module

The following models of optical ESB bus repeater modules are available: The optical ESB bus repeater module must always be dual-redundantly configured.

Table 4.5-1 Optical ESB Bus Repeater Module

Model	Name	Description
SNT401 SNT411	Optical ESB bus repeater master module	<ul style="list-style-type: none"> Mountable units: Safety control unit SSC10S/SSC10D: SNT401 SSC60S/SSC60D, SSC50S/SSC50D: SNT401/ SNT411 Safety node unit Unit for optical bus repeater module
		<ul style="list-style-type: none"> Module types: Connector unit for ESB bus Connector unit with terminator for ESB bus
		<ul style="list-style-type: none"> Total transmission maximum length of fiber-optic cable(*1) 5 km: SNT401 50 km: SNT411(*2)
SNT501 SNT511	Optical ESB bus repeater slave module	<ul style="list-style-type: none"> Mountable units: Safety node unit Unit for optical bus repeater module
		<ul style="list-style-type: none"> Total transmission maximum length of fiber-optic cable(*1) 5 km: SNT501 50 km: SNT511(*2)

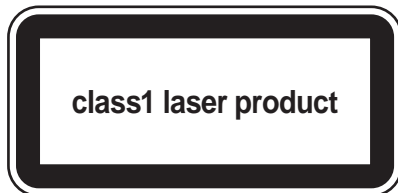
*1: With SSC60S/SSC60D, SSC50S/SSC50D, even if the optical ESB bus repeater modules are used on two levels, the maximum extension length of the optical fiber cable is 50 km.

*2: The minimum length is 5 km.



CAUTION

This product is a laser class 1 product acceptable IEC 60825.



■ Configuration

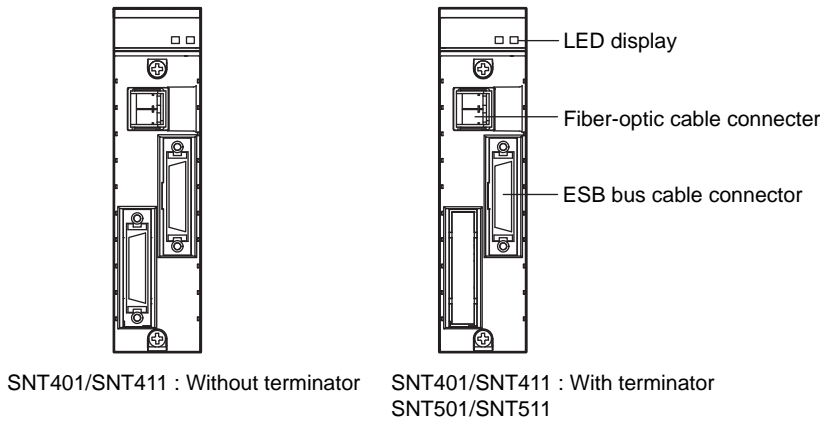


Figure 4.5-1 Optical ESB Bus Repeater Module

● LED Display

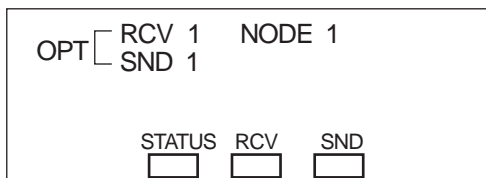


Figure 4.5-2 LED Display

- STATUS: If the self-diagnosis is successfully completed, the green lamp turns on.
- RCV/SND: If the ESB bus frame is received or sent, the green lamp turns on.
- OPT RCV-1/OPT SND-1: If the optical transmission frame is received or sent, the green lamp turns on.
- NODE-1: If the DIP switch 1 is set to 1 (Node), the green lamp turns on.

● DIP switch

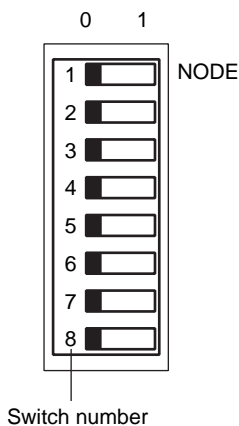


Figure 4.5-3 DIP switch

Set the DIP switch to indicate which unit the optical ESB bus repeater module is mounted on-to. Remove the connector unit with terminator for ESB bus before changing the DIP switch setting.

- Switch 1: "0" if the module is mounted onto the unit for optical bus repeater module.

“1” if the module is mounted onto the safety control unit or the safety node unit.

- Switches 2 to 5: Always “0”
- Switches 6 to 8: Used for maintenance. Usually “0” for routine operation.



IMPORTANT

Make sure that the DIP switches are correctly set.

● **Fiber-Optic Cable Connector**

This connector is used for fiber optic cable. Use the following fiber-optic cables.

Table 4.5-2 Fiber-Optic Cable Specifications

		Specifications
Optical connector type		Type LC (conforming to the IEC 61754-20)
Max. permissible optical loss		0 to 16 dB@1.3 μm: SNT401 and SNT501 3 to 16 dB@1.55 μm: SNT411 and SNT511 style S2 and higher(*1) 1 to 16 dB@1.55 μm: SNT411 and SNT511 style S1(*1)
Fiber-optic cable	Type	Quartz singlemode fiber (JIS C 6835 Type SSMA-9.3/125 or IEC 60793-2-50 Type B1.1)
	Number of cores	2-core
	Max. length	50 km: SNT411 and SNT511 5 km: SNT401 and SNT501

*1: When using SNT411 and SNT511 modules, if any of the SNT411 or SNT511 modules are style S2 or higher, make sure that the optical attenuation between the SNT411 and SNT511 modules is at least 3 dB. If the attenuation is less than 3 dB, use an attenuator.
 If all of the SNT411 and SNT511 modules are style S1, make sure that the attenuation is at least 1 dB. If the attenuation is less than 1 dB, use an attenuator.
 It is possible to mix styles S2 and S1.

● **ESB Bus Cable Connector**

This connector is used for ESB bus cable (YCB301).

The connector unit with the terminator for the ESB bus is attached, since the optical ESB bus repeater slave module (SNT501/SNT511) is always at the end of the ESB bus.

4.6 V net Coupler Unit

The V net coupler unit (Model: AIP504) is installed in the safety control unit and located between the processor module and the V net cable so as to perform the signal isolation and signal level conversion.

■ Configuration

Two V net couplers are used because V net is a dual-redundant. The one installed in the left is for Bus 1.

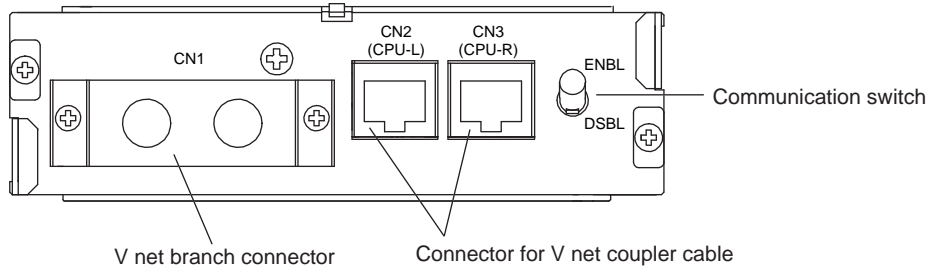


Figure 4.6-1 V net Coupler Unit

● V net Branch Connector

V net branch connector is used for the connection of V net cables (10BASE-2).

● V net Coupler Cable Connector

When connecting the V net coupler unit and processor module, the V net coupler cable is used for connection. The connector is modular type with a polarization key.

● Communication Switch

- ENBL (up):
Connects bus to the processor module. Leave the switch in this position normally.
- DSBL (down):
Disconnects bus from the processor module.

This is a locking type switch.

To toggle the switch position, pull the switch lever to unlock it first.

The upper side is ENBL and the lower side is DSBL.

4.7 External Interface Unit

The external interface units are applied when the safety control unit is linking with external signal devices.

■ Configuration

The external interface units include two types: one for standard type safety control unit and the other for wide range temperature type safety control unit.

The IRIG-B interface unit can be attached as an option to both the standard type and wide range temperature type safety control unit.

However, the IRIG-B interface unit cannot be used on the SSC60S/SSC60D, SSC50S/SSC50D safety control unit for Vnet/IP.

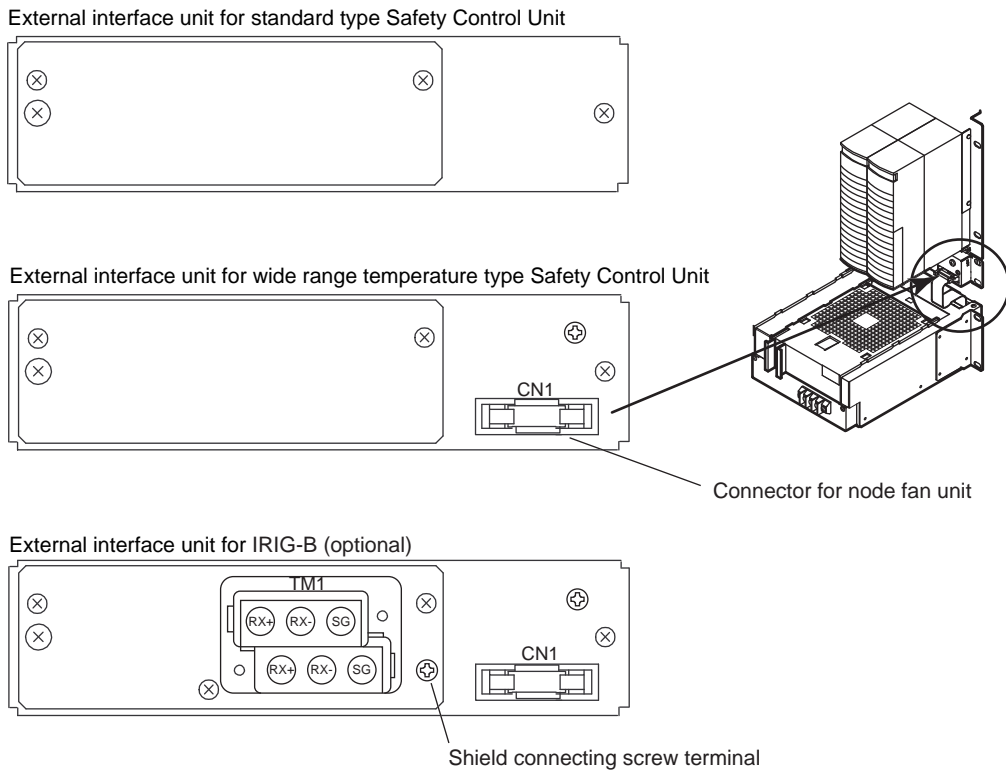


Figure 4.7-1 External Interface Unit

● External Interface Unit for Standard Type Safety Control Unit

The external interface unit for standard type safety control unit is not for connecting any external device.

The external interface unit has a built-in internal temperature sensor (thermometer) for monitoring the ambient temperature of the safety control unit.

The signals will be converted into the temperature information by the HKU function (House Keeping Unit) in the processor module.

When the ambient temperature abnormality occurs it can be monitored through the SCS status management window on SENG, using the SCS maintenance Support Tools.

SEE ALSO For more information about SCS state management window, refer to:

[7.1.2, "Inspection by SCS State Management Window" on page 7-5](#)

- **External Interface Unit for Wide Range Temperature Type Safety Control Unit**

The external interface unit for wide range temperature type safety control unit is used when connecting node fan unit to the safety control unit.

Same as the external interface unit for standard type safety control unit, a temperature sensor is built-in.

The signals regarding the status of fans are passed to the HKU (House Keeping Unit) in the processor module.

- Passing the pulse input signals from fans
- Passing control output signals of fan rotation.

- **External Interface Unit for IRIG-B**

The external interface unit for IRIG-B is optional, it is used for high accuracy synchronization of SOE (Sequence Of Event). The RS-422 port (connector block) receives the IRIG-B signals (IRIG-B 000) from GPS, and the IRIG-B signals are converted from RS-422 level to TTL level.

- Cable connection Between GPS and IRIG-B Unit
Connect the wires of RX+ and RX- in the cable to 1 and 2 terminals or to 4 and 5 terminals respectively.

If signal ground (SG) wire is available, connect it to 3 or 6 terminal. Regarding the SG wire, see the specification of IRIG-B unit.

The shield ground wire of the cable should be connected to the shielding terminal of the interface unit.

On the safety control unit at the end of the RS-422 cable, a terminator should be connected to 1 and 2 terminals or 4 and 5 terminals.

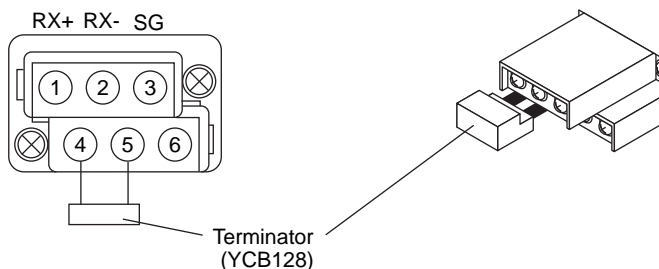


Figure 4.7-2 Signal Wiring Terminals

4.8 Node Fan Unit

The node fan unit is connected to the wide range temperature type safety control unit to suppress the temperature increase and to prevent the functional errors actions as well as the component fatigues caused by the high temperature.

■ Configuration

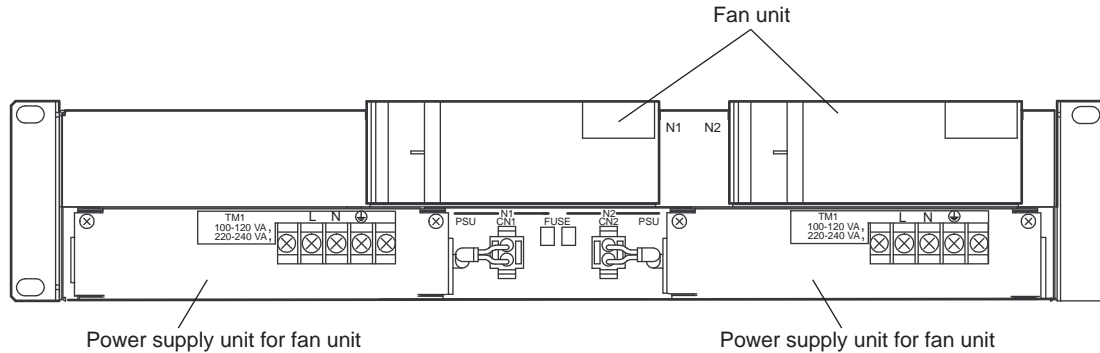


Figure 4.8-1 Node Fan Unit

● Fan Unit

The fan revolution varies with the ambient temperature for two levels.

- When the ambient temperature is higher than 35 degree C, or when the other fan is abnormal, the fan revolves at high speed.
- When a fan revolves at an abnormally very low speed, the abnormality can be monitored through the SCS status management window on SENG.

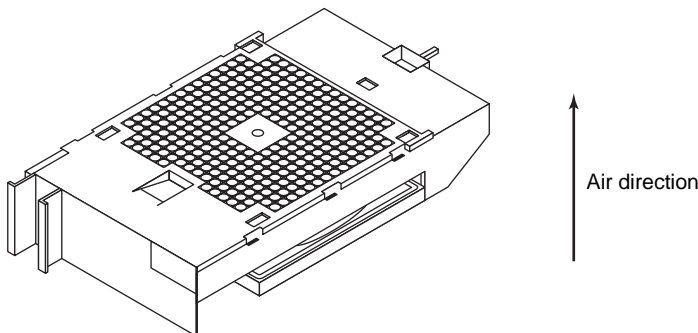


Figure 4.8-2 Fan Unit

● Power Supply Unit for Fan Unit

The power supply unit for fan unit receives the designated power supply at the input terminals and outputs 12 V DC for running the fan.

The power output is connected to the fan unit through the backboard of the node fan unit.

The power output connector can be conveniently disconnected for replacement of the fan power supply unit for fan unit.

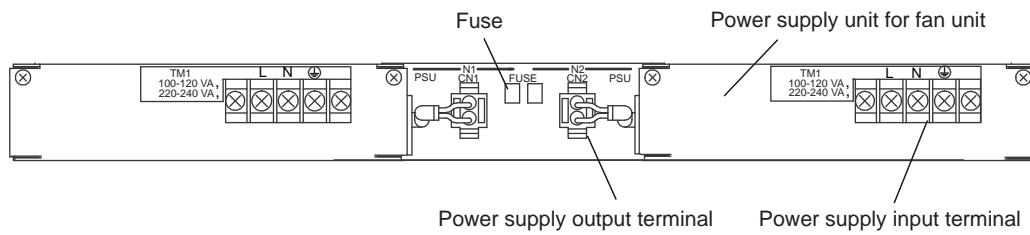


Figure 4.8-3 Power Supply Unit for Fan Unit

● **Fuse for Fan Power Supply Unit**

A fuse is used for protecting the power supply unit for fan unit.

**SEE
ALSO**

For more information about replacing fan unit, refer to:

[7.7.2, “Replacing Node Fan Unit” on page 7-37](#)

For more information about replacing fuse for fan power supply unit, refer to:

“■ [Replacing Fuse for Fan Power Supply Unit” on page 7-38](#)

For more information about replacing power supply unit for fan unit, refer to:

“■ [Replacing Power Supply Unit for Fan Unit” on page 7-38](#)

For more information about connecting power cable for power supply unit for fan unit, refer to:

“● [Connecting Power Cable to Power Supply Unit for Fan Unit” on page 3-4](#)

4.9 Power Distribution Unit

The power distribution unit (Model: AEP7D, AEPV7D) needs to be ordered separately.

The power distribution unit receives the power supply from the designated input terminals and outputs the power through the distribution connectors.

The safety control unit, safety node unit or optical ESB bus repeater does not have power switch to turn on or off the power supply.

You need to plug or unplug the power supply cable from the power distribution connector for turning the power on or off.

■ AEP7D Configuration

AEP7D can be used in a dual-redundant power supply scheme. The two power supplies may use two separate power sources. Each power supply has seven distribution ports.

● TM1, TM2 Terminals

These terminals (M4 screws) are used for connecting external power supplies.

- L (+) : Ungrounded
- N (-) : Grounded

● Grounding terminal

The grounding wire can be connected to this terminal (M4 screw).

● CN1 and Odd Number Connectors

CN1 and odd number connectors are the power distribution connectors.

In the dual power supply configuration, one power supply connected to TM1 terminal is distributed to the CN1 and odd number distribution connectors.

● CN2 and Even Number Connectors

CN2 and even number connectors are the power distribution connectors.

In the dual power supply configuration, one power supply connected to TM2 terminal is distributed to the CN2 and even number distribution connectors.

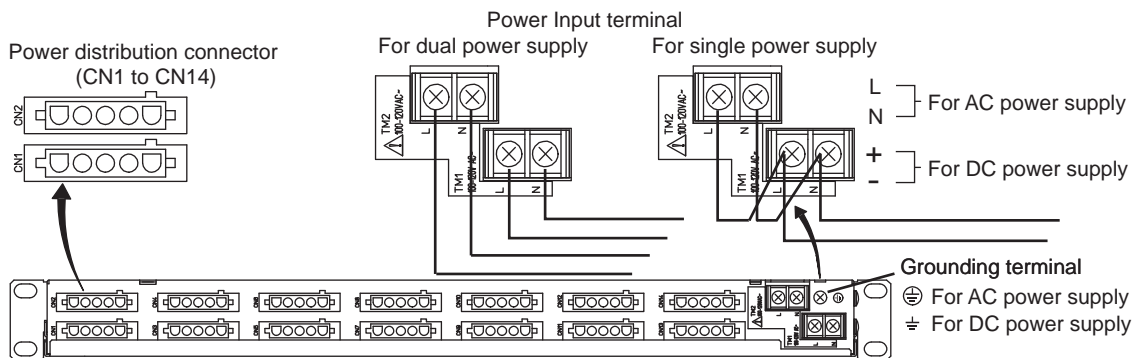


Figure 4.9-1 Power Distribution Unit

■ AEPV7D Configuration

AEPV7D can be used in a dual-redundant power supply scheme. The two power supplies may use two separate power sources. Each power supply has seven distribution ports. The two power supplies are independent from each other, and maintenance can be performed for one supply while the other is supplying power.

- **TM1 Terminals for AC Power**

Terminals for connecting external AC power source (M4 screws)

- L : Line
- N : Neutral

- **TM1 Terminals for DC Power**

Terminals for connecting external DC power source (M4 screws)

- + : Positive
- - : Negative

- **TM2 Terminals for DC Power**

Terminals for connecting external DC power source (M4 screws)

- + : Positive
- - : Negative

- **Grounding Terminal**

A terminal for connecting grounding wire (M4 screw)

- **AC Power Distribution**

CN1 to CN7 connectors are used for distributing the AC power input from TM1 terminals.

- **DC Power Distribution**

CN1 and CN2 connectors are used for distributing the DC power input from TM1 terminals.

CN3 to CN7 connectors are used for distributing the DC power input from TM2 terminals.

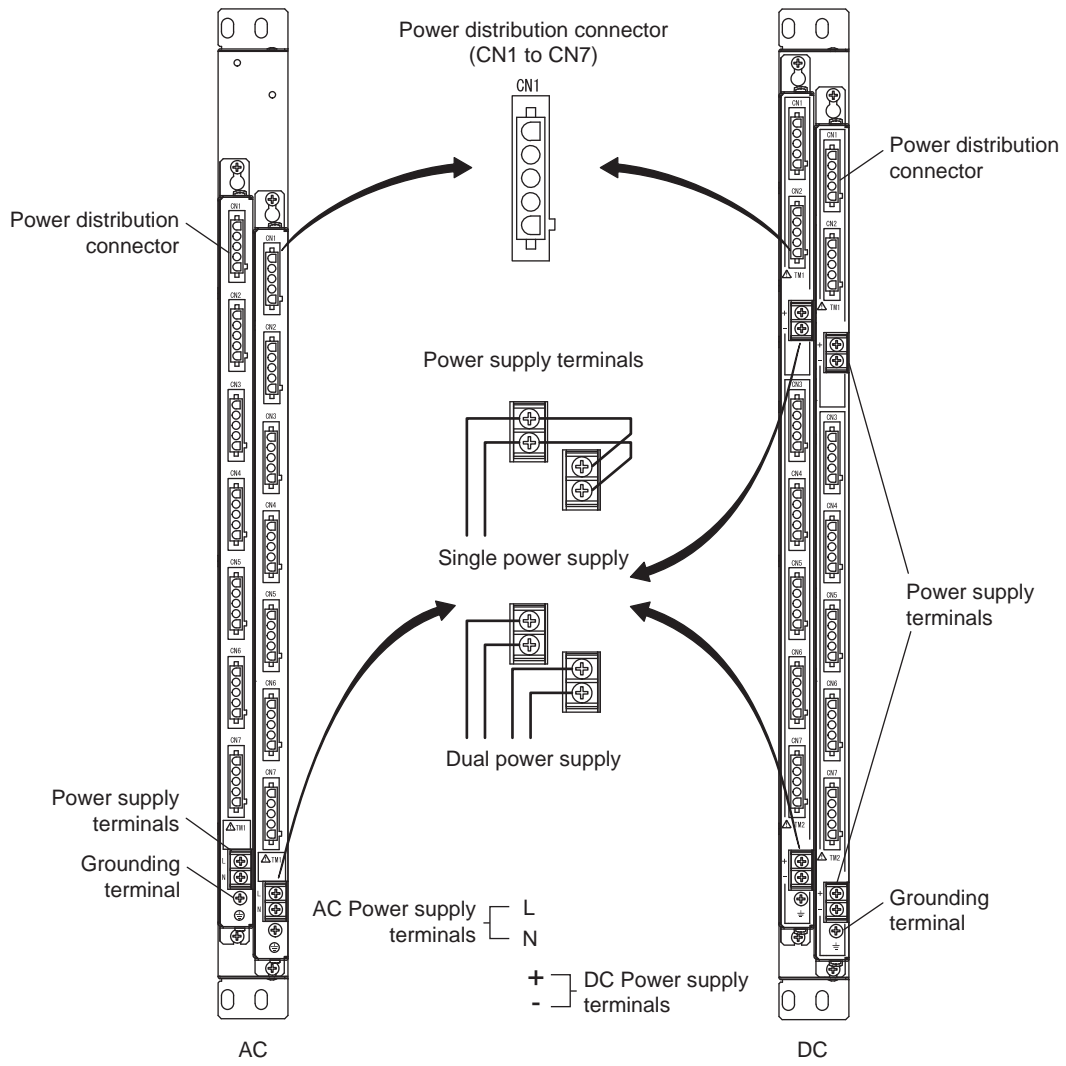


Figure 4.9-2 Power Distribution Unit

5. Signal Cable Connection to Input/Output Modules

The connections between the I/O modules and the field devices can be established by directly wiring the cables from the field devices to the terminals of I/O modules, connecting through the terminal boards using signal cables and connectors or using the user-prepared MIL cables.

This chapter describes how to apply pressure clamp terminal blocks, connection cables, and other I/O module related peripherals.

5.1 Configuration of Input/Output Module Connections

How to connect field devices to the I/O modules is explained.

■ Signal Cable Connection Methods

For saving the wiring space or for standardizing the instrumentation style, the following methods can be applied.

- Direct connection using pressure clamp terminals
When connecting field device signal cables directly to the I/O modules, use pressure clamp terminal blocks.
- Connector connection using signal cables via terminal boards
When connecting field devices to I/O modules via terminal boards, signal cable interface adapters are required.
- Connection via MIL connectors
Use MIL cables (prepared by user) to connect to I/O modules directly.

In the following figure, the parts within the dotted line are provided by Yokogawa.

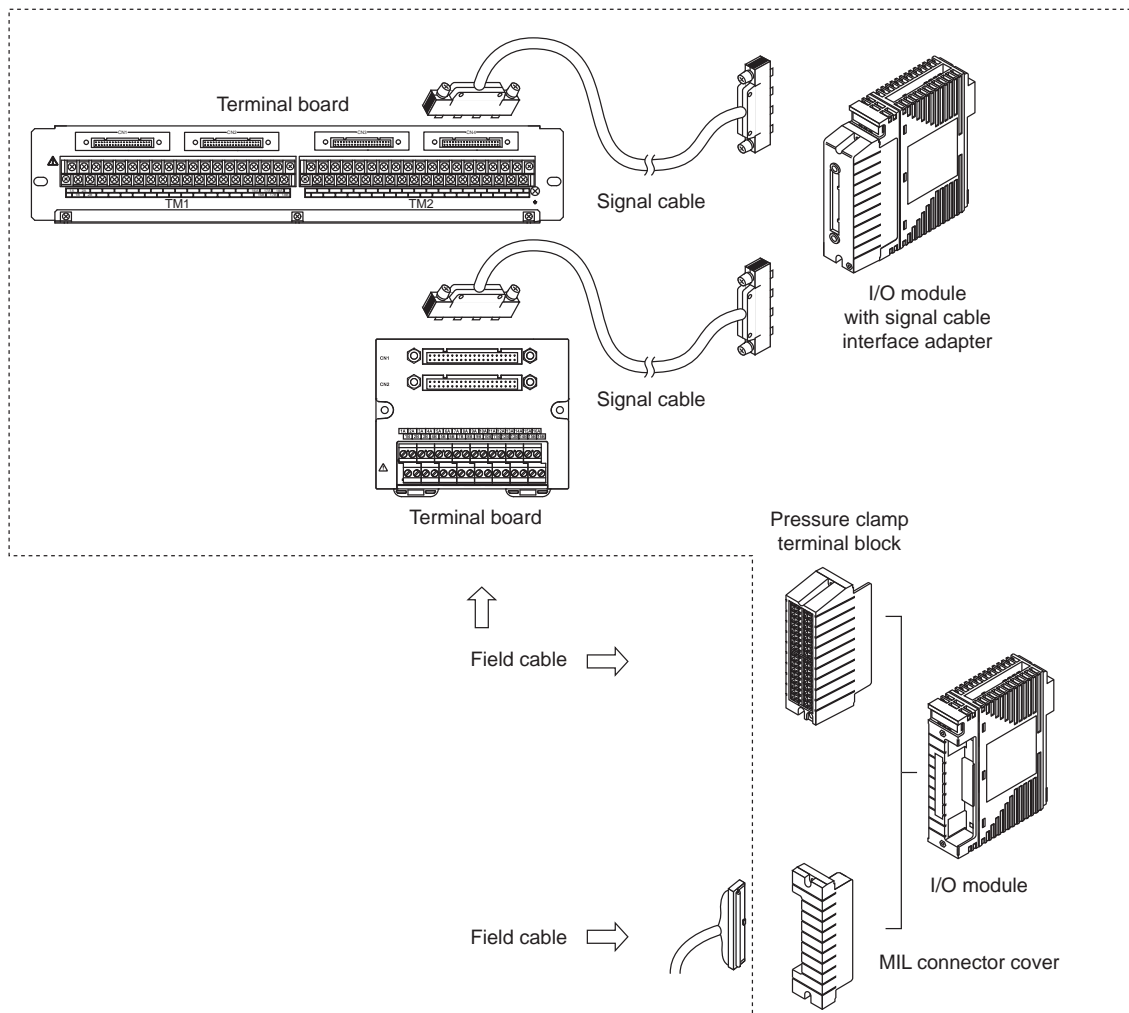


Figure 5.1-1 Signal Cable Connection Methods

■ Combinations of Input/Output Module and Terminal Block

When connecting the cables to I/O modules, the various types of connections can be applied for redundant or non-redundant connections, direct wiring or using terminal boards, and so on.

**SEE
ALSO**

For more information about combinations of I/O modules and terminal blocks, and combinations of communication modules and communication cables, refer to:

ProSafe-RS Outline of I/O Modules (GS 32Q06K20-31E)

5.2 How to Connect Signal Cables

The following methods for connecting signal cables are available:

- Direct connection using pressure clamp terminals
- Connector connection using signal cables via terminal boards
 - Connecting an input/output module to a terminal board
 - Connecting a terminal board to a field
- Connection via MIL connectors



IMPORTANT

- It is recommended to use twisted-pair batch shielded cables for analog inputs in order to prevent induced noise. A pitch of 50 mm or less for the twisted-pair cables is more effective. Grounding is required for the shielding. Twisted-pair cables are recommended for digital signals as well.
 - Fasten the cables securely to cable clamps, etc., so that the cables do not weigh on the terminals.
-

5.2.1 Direct Connection Using Pressure Clamp Terminals

The interface part of an I/O module basically consists of a connector (male). Connect the pressure clamp terminal block to the front section.

Pressure clamp terminals are available for single and dual-redundant operation.

■ Types of Pressure Clamp Terminal Blocks

Table 5.2.1-1 Types of Pressure Clamp Terminal Blocks

Configuration	Model	Name	I/O points
Single	STA4S	Pressure clamp terminal block for analog I/O	16-channel
	STB4S	Pressure clamp terminal block for digital I/O	16-channel
Dual-redundant	STA4D	Dual-redundant pressure clamp terminal block for analog I/O	16-channel
	STB4D	Dual-redundant pressure clamp terminal block for digital I/O	16-channel

■ External View of Terminal Blocks

One I/O module can be connected with one single-type pressure clamp terminal block.

Two adjacent I/O modules can be connected with one dual-type terminal block for dual-redundant configuration. The width of the dual-type terminal block is two times of a single-type terminal block.

The two flat cables at the back of the dual-type terminal block are connected to two I/O modules.

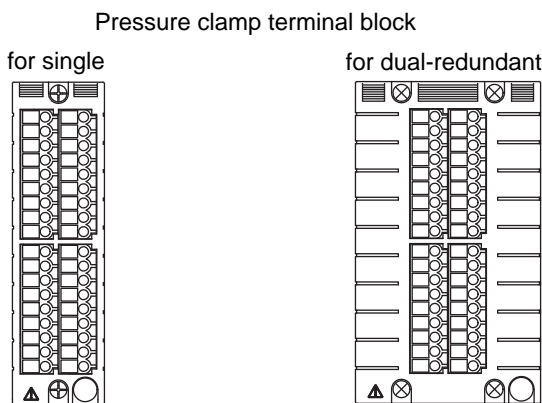


Figure 5.2.1-1 Pressure Clamp Terminal Blocks

■ Signal Cables for Pressure Clamp Terminal

The following figure shows the signal cable that connects to the pressure clamp terminals of the input/output module.

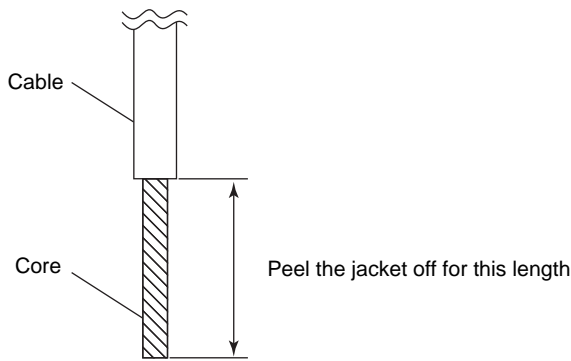


Figure 5.2.1-2 Cable

● **Cables Used**

- 600 V polyvinyl chloride insulated wires (IV): JIS C 3307/IEC 60227-3
- Polyvinyl chloride insulated wires for electrical apparatus (KIV): JIS C 3316/IEC 60227-3
- 600 V grade heat-resistant polyvinyl chloride insulated wires (HIV): JIS C 3317/IEC 60227-3
- Heat-proof vinyl insulated wires VW-1 (UL1015/UL1007)
- Control cables (vinyl insulated vinyl sheath cable) (CVV): JIS C 3401

● **Recommended Cable Thickness**

- Without sleeve : 0.5 mm² to 2 mm² (AWG20 to 14)
- With sleeve : 0.5 mm² to 1.5 mm² (AWG20 to 16)

● **Wiring to Pressure Clamp Terminals (without Sleeves)**

Table 5.2.1-2 Wiring to Pressure Clamp Terminals without Sleeves

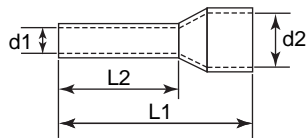
Cable thickness (mm ²)	Peel-off length (mm)
0.5 to 2 (AWG20 to 14)	11

● **Wiring to Pressure Clamp Terminals (with Sleeves)**

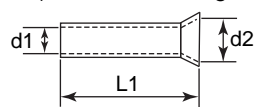
Table 5.2.1-3 Wiring to Pressure Clamp Terminals with Sleeves

Cable thickness (mm ²)	When using a sleeve with insulating cover						When using a sleeve (without insulating cover)					
	Peel-off length (mm)	Sleeve dimension (mm)				Weidmuller model	Peel-off length (mm)	Sleeve dimension (mm)			Weidmuller model	
		L1	L2	d1	d2			L1	d1	d2		
0.5	11	16	10	1.0	2.6	H0.5/16	11	10	1.0	2.1	H0.5/10	
0.75	11	16	10	1.2	2.8	H0.75/16	11	10	1.2	2.3	H0.75/10	
1.0	11	16	10	1.4	3.0	H1/16	11	10	1.4	2.5	H1/10	
1.25 to 1.5	11	16	10	1.7	3.5	H1.5/16	11	10	1.7	2.8	H1.5/10	

Sleeve with insulating cover



Sleeve (without insulating cover)

**IMPORTANT**

- Use pressure clamp terminal sleeves and tools from the same manufacturer.
- Use pressure clamp terminal sleeve tools suitable for the thickness of the wires.
- Plug the cables to be connected deep into the pressure clamp terminals and make sure they are securely installed.
- It is recommended to use a driver that conforms to the DIN 5264B standard. The standard requires a screwdriver with a thickness of 0.6 mm at the tip and a body shaft diameter of 3.5 mm for the cable connection.
- The tightening torque is 0.5 N•m
- Fasten the cables securely to cable clamps, etc., so that the cables do not weigh on the terminals.

5.2.2 Connecting an Input/Output Module to a Terminal Board

Use a signal cable to connect an input/output module to a terminal board.

■ Signal Cable Interface Adapters

The following figures show examples of external view of the I/O modules connected via signal cable interface adapters. By an optional order for the signal cable, the cable connector with a prevention pin of false insertion is available.

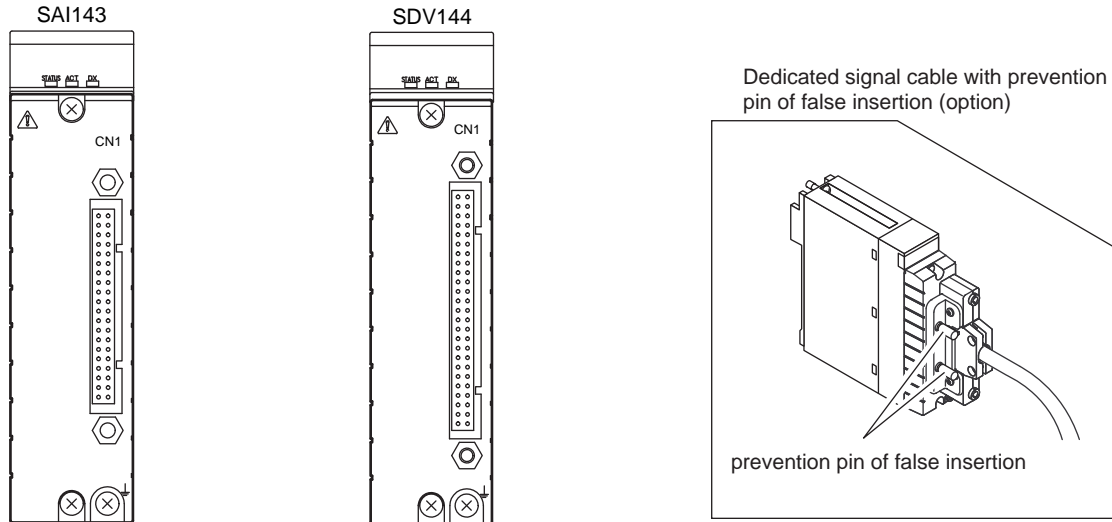


Figure 5.2.2-1 Input/Output Modules Connected via Signal Cable Interface Adapters

● Type of Signal Cable

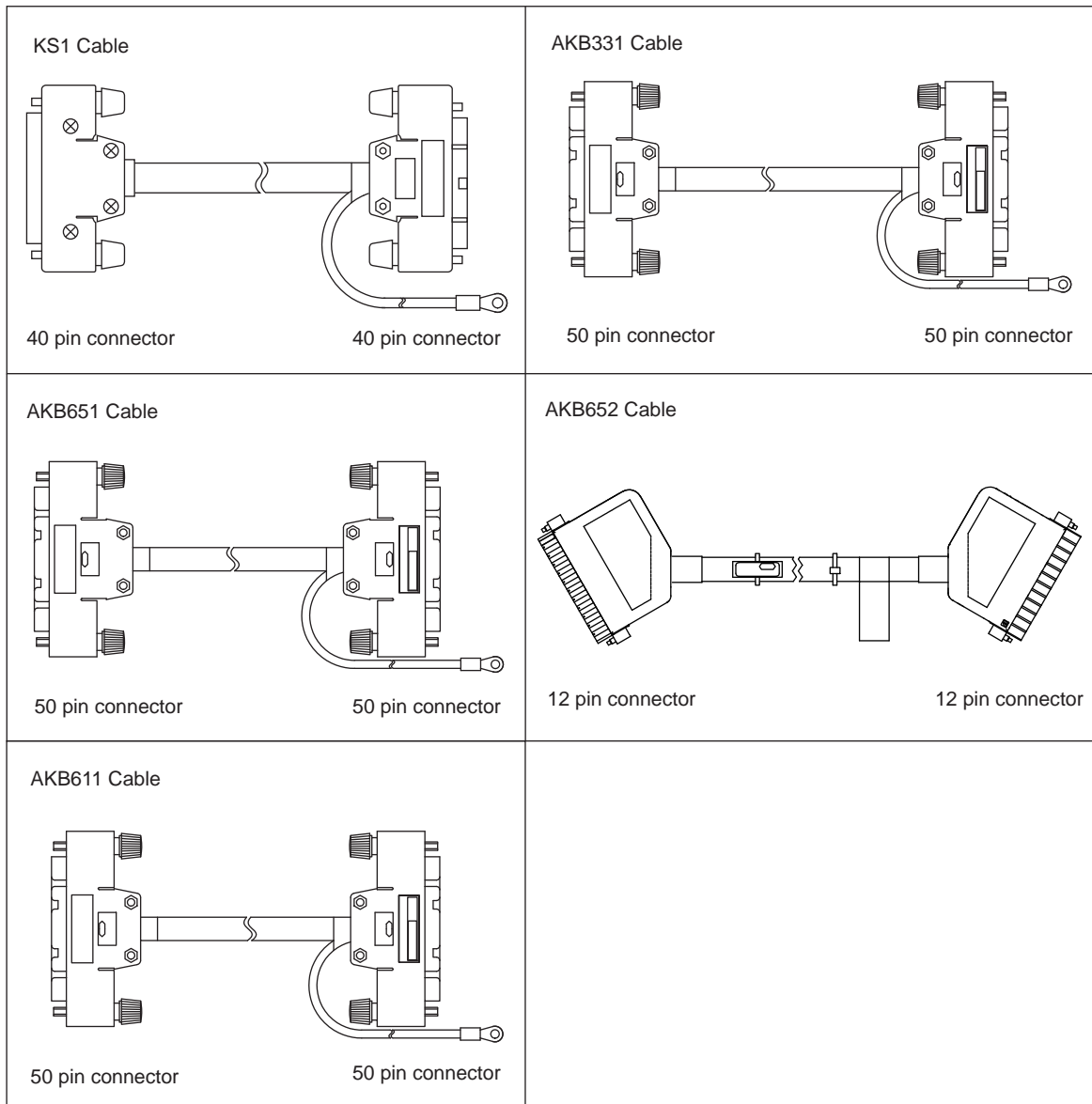


Figure 5.2.2-2 Type of Signal Cable

5.2.3 Connecting a Terminal Board to the Field

The field connection terminal depends on the type of terminal board.

■ Screw Terminal Wiring for Terminal Boards

M4 screws are used for the connection terminals between 19-inch rack mountable terminal board and the field.

● Cables and Ring Terminals

For more information about cables, see the installation guidance.

Make sure to use ring terminals with insulation covers at the ends of the wires. The ring terminals and crimping tool should be from the same vendor.

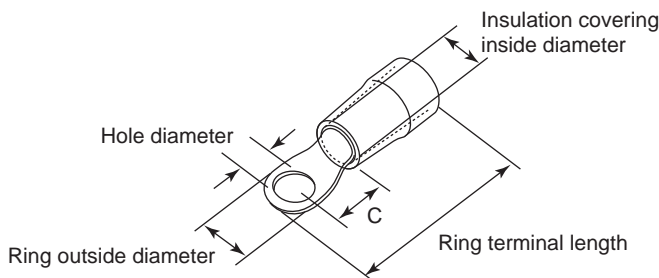


Figure 5.2.3-1 Ring Terminal

Table 5.2.3-1 Ring Terminal Dimensions

Nominal cross sectional area (mm ²)	Screw (mm)	Hole diameter (mm)	Ring outside diameter (mm)	Ring terminal length (mm)	Insulation covering inside diameter (mm)	Dimension "C" (mm)	Remarks
1.25(*1)	4	4.3 or more	8.2 or less	About 21	3.6 or more	7.0 or more	
2.0(*2)	4	4.3 or more	8.7 or less	About 21	4.3 or more	7.1 or more	
5.5(*3)	4	4.3 or more	8.7 or less	About 25	5.8 or more	5.9 or more	Only SED2D

*1: This type of ring terminals are mainly applied for the cables in the range of 0.25 to 1.65 mm². It is necessary to check the specifications from the vender to select the appropriate terminals.

*2: This type of ring terminals are mainly applied for the cables in the range of 1.0 to 2.6 mm². It is necessary to check the specifications from the vender to select the appropriate terminals.

*3: This type of ring terminals are mainly applied for the cables in the range of 2.6 to 6.6 mm². It is necessary to check the specifications from the vender to select the appropriate terminals.

SEE ALSO For more information about choosing cables, refer to:

ProSafe-RS Installation Guidance (TI 32S01J10-01E)

■ Pressure Clamp Terminal Wiring for the Terminal Board

When connecting the field devices to DIN rail mountable terminal board, the wires of the cable are connected to the pressure clamp terminals. A wire of the cable connected to a pressure clamp terminal of DIN rail mountable terminal board is shown as follows.

TIP If SBT4D is used, the wire size and the length of sleeve to be peeled are different.

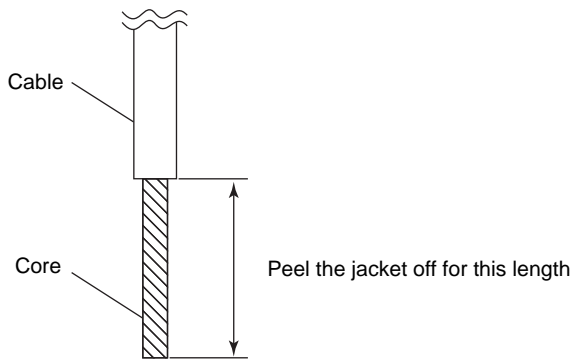


Figure 5.2.3-2 Cable

SEE ALSO

For more information about cables for connecting SBT4D, refer to:

“■ Signal Cables for Pressure Clamp Terminal” on page 5-5

● **Cables Used**

- 600 V polyvinyl chloride insulated wires (IV): JIS C 3307/IEC 60227-3
- Polyvinyl chloride insulated wires for electrical apparatus (KIV): JIS C 3316/IEC 60227-3
- 600 V grade heat-resistant polyvinyl chloride insulated wires (HIV): JIS C 3317/IEC 60227-3
- Heat-proof vinyl insulated wires VW-1 (UL1015/UL1007)
- Control cables (vinyl insulated vinyl sheath cable) (CVV): JIS C 3401

● **Recommended Cable Thickness**

- 0.5 mm² to 2.5 mm² (AWG20 to 14)

● **Wiring to Pressure Clamp Terminals (without Sleeves)**

Table 5.2.3-2 Wiring to Pressure Clamp Terminals without Sleeves

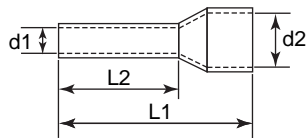
Cable thickness (mm ²)	Peel-off length (mm)
0.5 to 2.5 (AWG20 to 14)	8

● **Wiring to Pressure Clamp Terminals (with Sleeves)**

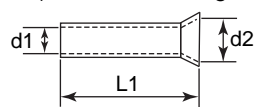
Table 5.2.3-3 Wiring to Pressure Clamp Terminals with Sleeves

Cable thickness (mm ²)	When using a sleeve with insulating cover						When using a sleeve (without insulating cover)					
	Peel-off length (mm)	Sleeve dimension (mm)				Weidmuller model	Peel-off length (mm)	Sleeve dimension (mm)			Weidmuller model	
		L1	L2	d1	d2			L1	d1	d2		
0.5	8	14	8	1.0	2.6	H0.5/14	8	6	1.0	2.1	H0.5/6	
0.75	8	14	8	1.2	2.8	H0.75/14	8	6	1.2	2.3	H0.75/6	
1.0	8	14	8	1.4	3.0	H1/14	8	6	1.4	2.5	H1/6	
1.5	8	14	8	1.7	3.5	H1.5/14	8	7	1.7	2.8	H1.5/7	
2.5	8	14	8	2.2	4.2	H1.5/14 D	8	7	2.2	3.4	H2.5/7	

Sleeve with insulating cover



Sleeve (without insulating cover)

**IMPORTANT**

- Use pressure clamp terminal sleeves and tools from the same manufacturer.
- Use pressure clamp terminal sleeve tools suitable for the thickness of the wires.
- Plug the cables to be connected deep into the pressure clamp terminals and make sure they are securely installed.
- Using a driver which conforms to the DIN 5264B standard (a screwdriver with a thickness at the tip of 0.6 mm and a body shaft diameter of 3.5 mm) is recommended for cable connection.
- The tightening torque is 0.5 N•m
- Fasten the cables securely to cable clamps etc., so that the cables do not weigh on the terminals.

5.2.4 Connection via MIL Connectors

It is possible to connect a MIL cable to an I/O module directly without using a terminal block.

■ MIL Cable Connection

To prevent the MIL cable from being disconnected, a cable connector cover is required. The cable connector cover is sold separately.

- SCCC01: for flat ribbon cable
- SCCC02: for discrete wire cables (DI, DO cables)

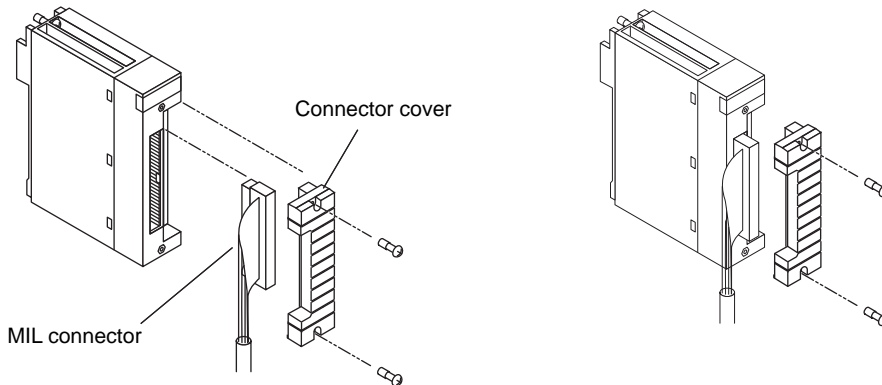


Figure 5.2.4-1 MIL Cable Connection

If the MIL cable has a shield wire, this wire needs to be fastened to the screw at the lower part of the MIL cable connector cover.

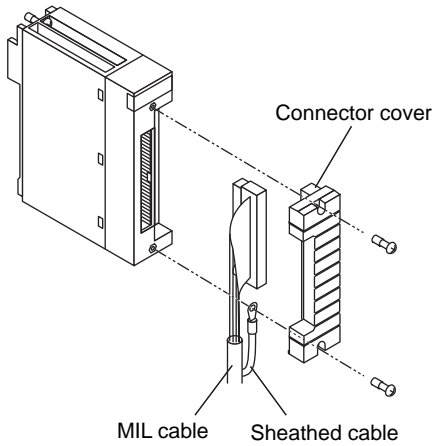


Figure 5.2.4-2 Shield Wire Connection

5.3 Signal Cable Connection to Analog Input/Output Modules

This section contains the wire connection diagrams and tables showing the I/O channel numbers.

There are three ways of connecting input signal cables to analog I/O modules: by connecting via a pressure clamp terminal block, by using a signal cable to connect to the connectors via a terminal board, or by direct connection using a MIL cable.

The following table shows the relationship between the analog input/output module and the field wiring connection methods.

Table 5.3-1 Analog Input/Output Module and Field Wiring Connection Methods

Analog input/output module (type)	Field wiring connection methods (*1)		
	Pressure clamp terminal	Terminal board	MIL cable
SAI143	Yes	Yes	Yes
SAV144	Yes	Yes	Yes
SAT145	-	Yes	-
SAR145	-	Yes	-
SAI533	Yes	Yes	Yes

*1: Yes: Connection possible

■ Terminal Numbers and Pin Numbers

● Pressure Clamp Terminal Blocks

The terminal numbers of a pressure clamp terminal block are arranged in the order from A1, A2 and so on to A18 starting from the top of the left column and from B1, B2 and so on to B18 from the top of the right column on the front of the terminal block.

The terminal number layout of a dual-redundant type pressure clamp terminal is the same.

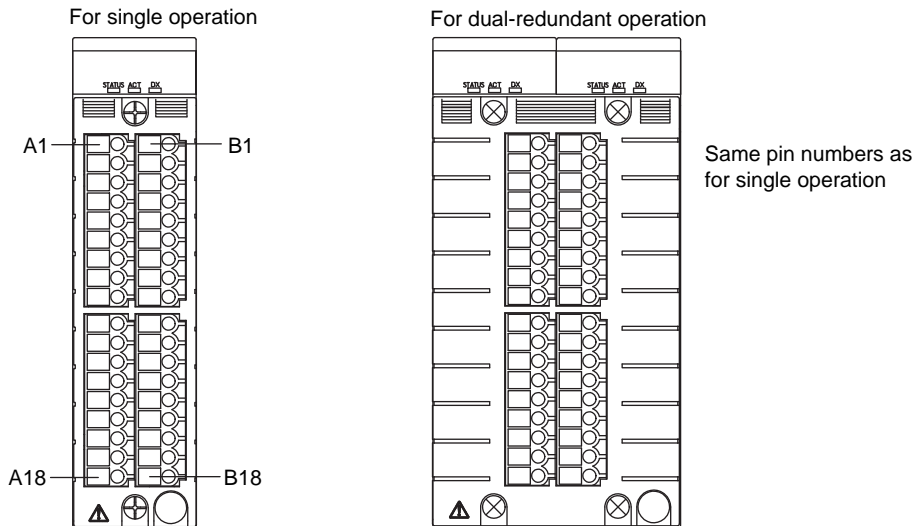


Figure 5.3-1 Terminal Numbers of Pressure Clamp Terminal Blocks

● MIL Connector

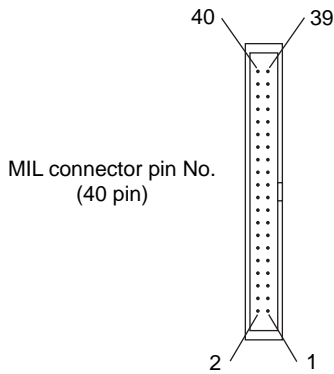


Figure 5.3-2 Pin Numbers of a MIL Connector

■ Correspondence Between I/O Channel Numbers and Terminal Numbers or Pin Numbers

The following figure shows how the I/O channel numbers correspond to the terminal numbers of a pressure clamp terminal block and the pin numbers of a MIL connector.

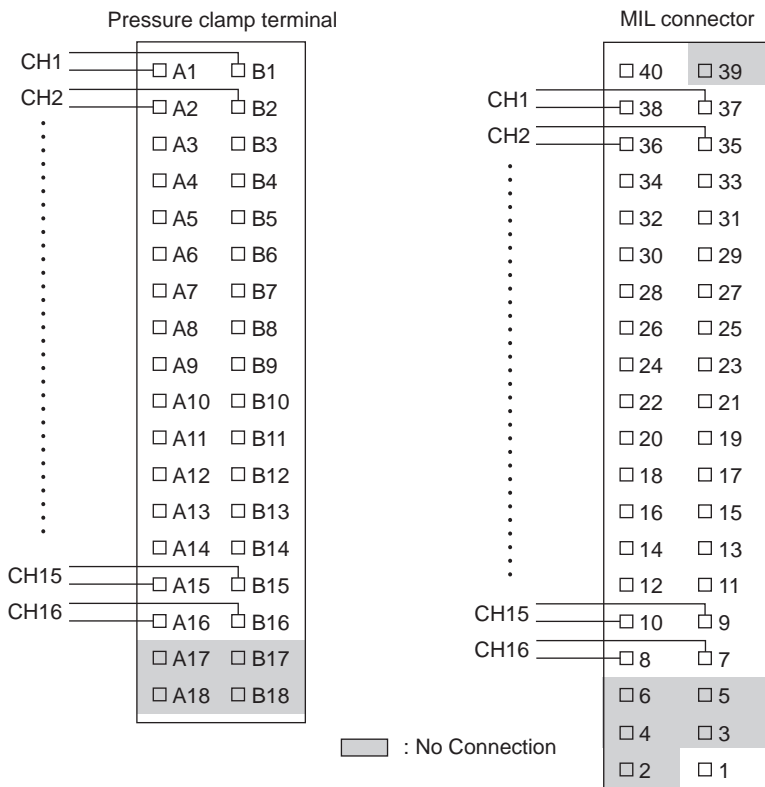
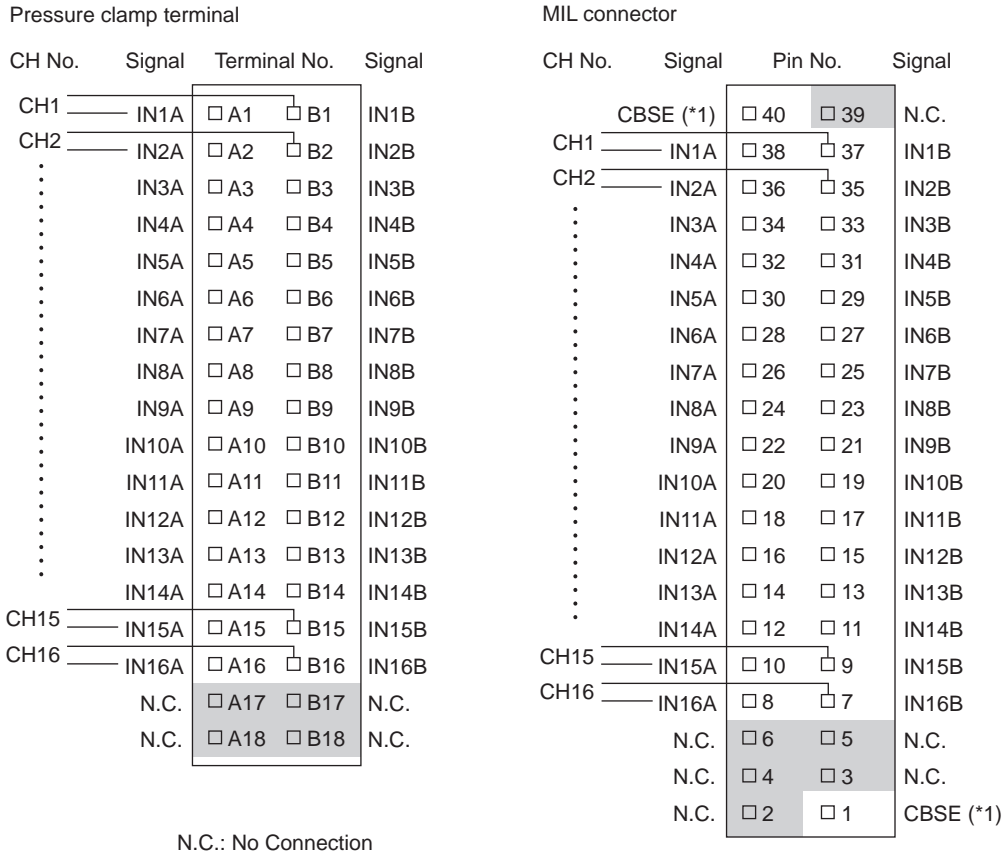


Figure 5.3-3 Correspondence Between I/O Channel Numbers and Pressure Clamp Terminal Numbers or MIL Connector Pin Numbers

5.3.1 Analog Input Module, 16-Channel (SAI143)



*1: Short circuit CBSE externally for MIL connectors in order to detect unconnected external cables.

Figure 5.3.1-1 SAI143 External Connection

■ Cable Connection of SAI143 Analog Input Module

Cable connection of SAI143 analog input module varies with the pin settings and input terminals shown as follows.

Table 5.3.1-1 SAI143 Analog Input Module Pin Settings and Input Terminals

SAI143 Setting	Signal ("n" is channel number)	Signal and Polarization
Pin Setting: 2-Wire(*1)	INnA	2-wire transmitter input +
	INnB	2-wire transmitter input -
Pin Setting: 4-Wire(*1)	INnA	Current input -
	INnB	Current input +

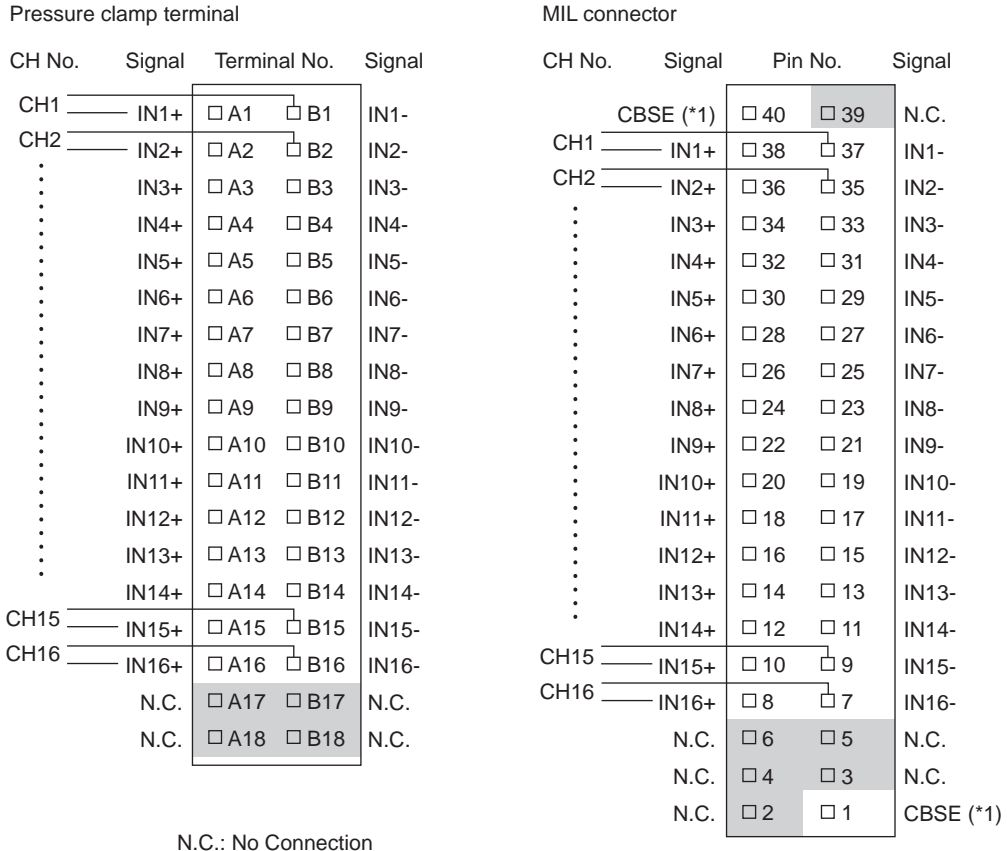
*1: When power failure or other abnormality occurs in SAI143, the current input loop becomes open. Thus, the current input signal should not be connected in parallel with other device.

SEE ALSO

For more information about analog input/output module circuit diagrams, refer to:

■ [Analog Input/Output Modules](#) on page 5-47

5.3.2 Analog Input Module, 16-Channel (SAV144)



*1: Short circuit CBSE externally for MIL connectors in order to detect unconnected external cables.

Figure 5.3.2-1 SAV144 External Connection

5.3.3 Analog Output Module, 8-Channel (SAI533)

Pressure clamp terminal

CH No.	Signal	Terminal No.	Signal
CH1	OUT1+	□ A1 □ B1	OUT1-
	N.C.	□ A2 □ B2	N.C.
CH2	OUT2+	□ A3 □ B3	OUT2-
	N.C.	□ A4 □ B4	N.C.
...	OUT3+	□ A5 □ B5	OUT3-
	N.C.	□ A6 □ B6	N.C.
...	OUT4+	□ A7 □ B7	OUT4-
	N.C.	□ A8 □ B8	N.C.
...	OUT5+	□ A9 □ B9	OUT5-
	N.C.	□ A10 □ B10	N.C.
...	OUT6+	□ A11 □ B11	OUT6-
	N.C.	□ A12 □ B12	N.C.
CH7	OUT7+	□ A13 □ B13	OUT7-
	N.C.	□ A14 □ B14	N.C.
CH8	OUT8+	□ A15 □ B15	OUT8-
	N.C.	□ A16 □ B16	N.C.
	N.C.	□ A17 □ B17	N.C.
	N.C.	□ A18 □ B18	N.C.

N.C.: No Connection

MIL connector

CH No.	Signal	Pin No.	Signal
CH1	CBSE (*1)	□ 40 □ 39	N.C.
	OUT1+	□ 38 □ 37	OUT1-
...	N.C.	□ 36 □ 35	N.C.
	OUT2+	□ 34 □ 33	OUT2-
...	N.C.	□ 32 □ 31	N.C.
	OUT3+	□ 30 □ 29	OUT3-
...	N.C.	□ 28 □ 27	N.C.
	OUT4+	□ 26 □ 25	OUT4-
...	N.C.	□ 24 □ 23	N.C.
	OUT5+	□ 22 □ 21	OUT5-
...	N.C.	□ 20 □ 19	N.C.
	OUT6+	□ 18 □ 17	OUT6-
...	N.C.	□ 16 □ 15	N.C.
	CH7	OUT7+	□ 14 □ 13
...	N.C.	□ 12 □ 11	N.C.
	CH8	OUT8+	□ 10 □ 9
...	N.C.	□ 8 □ 7	N.C.
	N.C.	□ 6 □ 5	N.C.
...	N.C.	□ 4 □ 3	N.C.
	N.C.	□ 2 □ 1	CBSE (*1)

*1: Short circuit CBSE externally for MIL connectors in order to detect unconnected external cables.

Figure 5.3.3-1 SAI533 External Connection

5.3.4 Connection with a Terminal Board (Analog Input/Output Module)

The following table shows the relationship between analog input/output modules and terminal boards.

Table 5.3.4-1 Relationship Between Terminal Boards and Analog Input/Output Modules

Terminal board (type)	Connectable analog input/output module (type)
SEA4D	SAI143, SAI533, SAV144
SBA4D	SAI143, SAI533, SAV144
SBT4D	SAT145
SBR4D	SAR145

The following figure shows the relationship between the terminal numbers on each terminal board and the signal names for the analog I/O modules that connect to the terminal board.

■ Connection Between SEA4D and an Input/Output Module

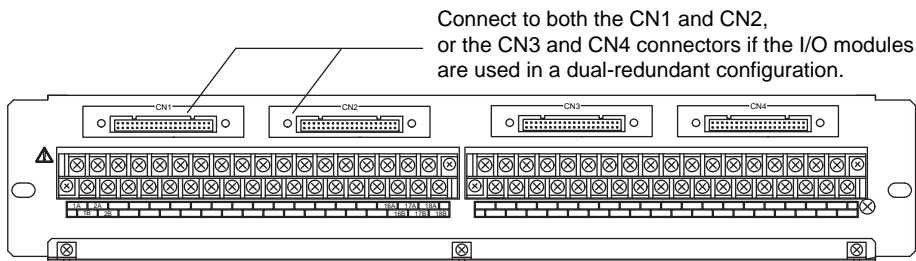


Figure 5.3.4-1 SEA4D Terminal Board

● When Connecting SAI143

Signal Name	IN1A	IN2A	IN3A	IN4A	IN5A	IN6A	IN7A	IN8A	IN9A	IN10A	IN11A	IN12A	IN13A	IN14A	IN15A	IN16A	N.C.	N.C.
TM1, TM2	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A	17A	18A
Terminal No.	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B	17B	18B
Signal Name	IN1B	IN2B	IN3B	IN4B	IN5B	IN6B	IN7B	IN8B	IN9B	IN10B	IN11B	IN12B	IN13B	IN14B	IN15B	IN16B	N.C.	N.C.

N.C. : No Connection

Figure 5.3.4-2 SAI143 Signal Name and Terminal Number

● When Connecting SAV144

Signal Name	IN1+	IN2+	IN3+	IN4+	IN5+	IN6+	IN7+	IN8+	IN9+	IN10+	IN11+	IN12+	IN13+	IN14+	IN15+	IN16+	N.C.	N.C.
TM1, TM2	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A	17A	18A
Terminal No.	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B	17B	18B
Signal Name	IN1-	IN2-	IN3-	IN4-	IN5-	IN6-	IN7-	IN8-	IN9-	IN10-	IN11-	IN12-	IN13-	IN14-	IN15-	IN16-	N.C.	N.C.

N.C. : No Connection

Figure 5.3.4-3 SAV144 Signal Name and Terminal Number

● **When Connecting SAI533**

Signal Name	OUT1+	N.C.	OUT2+	N.C.	OUT3+	N.C.	OUT4+	N.C.	OUT5+	N.C.	OUT6+	N.C.	OUT7+	N.C.	OUT8+	N.C.	N.C.	N.C.
TM1, TM2	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A	17A	18A
Terminal No.	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B	17B	18B
Signal Name	OUT1-	N.C.	OUT2-	N.C.	OUT3-	N.C.	OUT4-	N.C.	OUT5-	N.C.	OUT6-	N.C.	OUT7-	N.C.	OUT8-	N.C.	N.C.	N.C.

N.C. : No Connection

Figure 5.3.4-4 SAI533 Signal Name and Terminal Number

■ **Connection Between SBA4D and an Input/Output Module**

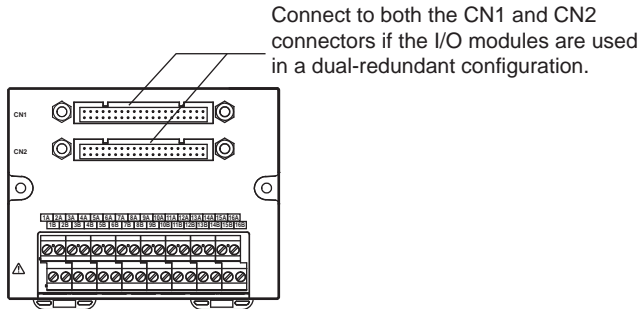


Figure 5.3.4-5 SBA4D Terminal Board

● **When Connecting SAI143**

Signal Name	IN1A	IN2A	IN3A	IN4A	IN5A	IN6A	IN7A	IN8A	IN9A	IN10A	IN11A	IN12A	IN13A	IN14A	IN15A	IN16A
Terminal No.	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A
	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B
Signal Name	IN1B	IN2B	IN3B	IN4B	IN5B	IN6B	IN7B	IN8B	IN9B	IN10B	IN11B	IN12B	IN13B	IN14B	IN15B	IN16B

Figure 5.3.4-6 SAI143 Signal Name and Terminal Number

● **When Connecting SAV144**

Signal Name	IN1+	IN2+	IN3+	IN4+	IN5+	IN6+	IN7+	IN8+	IN9+	IN10+	IN11+	IN12+	IN13+	IN14+	IN15+	IN16+
Terminal No.	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A
	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B
Signal Name	IN1-	IN2-	IN3-	IN4-	IN5-	IN6-	IN7-	IN8-	IN9-	IN10-	IN11-	IN12-	IN13-	IN14-	IN15-	IN16-

Figure 5.3.4-7 SAV144 Signal Name and Terminal Number

● **When Connecting SAI533**

Signal Name	OUT1+	N.C.	OUT2+	N.C.	OUT3+	N.C.	OUT4+	N.C.	OUT5+	N.C.	OUT6+	N.C.	OUT7+	N.C.	OUT8+	N.C.
Terminal No.	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A
	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B
Signal Name	OUT1-	N.C.	OUT2-	N.C.	OUT3-	N.C.	OUT4-	N.C.	OUT5-	N.C.	OUT6-	N.C.	OUT7-	N.C.	OUT8-	N.C.

N.C. : No Connection

Figure 5.3.4-8 SAI533 Signal Name and Terminal Number

■ Connection Between SBT4D and an Input Module

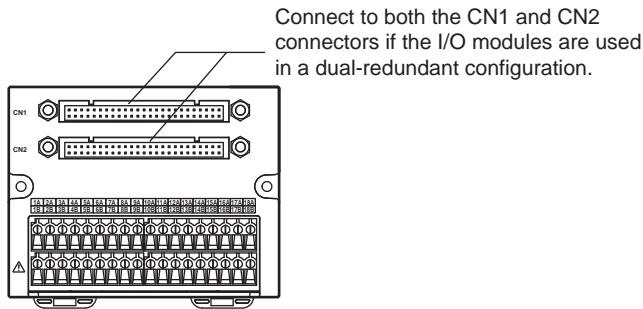


Figure 5.3.4-9 SBT4D Terminal Board

● When Connecting SAT145

Signal Name	IN1+	IN2+	IN3+	IN4+	IN5+	IN6+	IN7+	IN8+	IN9+	IN10+	IN11+	IN12+	IN13+	IN14+	IN15+	IN16+	N.C.	N.C.
Terminal No.	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A	17A	18A
Terminal No.	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B	17B	18B
Signal Name	IN1-	IN2-	IN3-	IN4-	IN5-	IN6-	IN7-	IN8-	IN9-	IN10-	IN11-	IN12-	IN13-	IN14-	IN15-	IN16-	N.C.	N.C.

N.C. : No Connection

Figure 5.3.4-10 SAT145 Signal Names and Terminal Numbers

■ Connection Between SBR4D and an Input Module

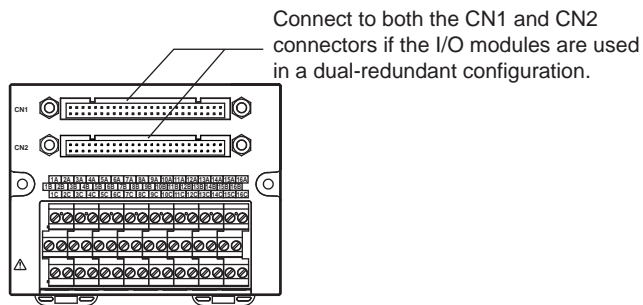


Figure 5.3.4-11 SBR4D Terminal Board

● When Connecting SAR145

Signal Name	IN1A	IN2A	IN3A	IN4A	IN5A	IN6A	IN7A	IN8A	IN9A	IN10A	IN11A	IN12A	IN13A	IN14A	IN15A	IN16A
Terminal No.	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A
Terminal No.	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B
Terminal No.	1C	2C	3C	4C	5C	6C	7C	8C	9C	10C	11C	12C	13C	14C	15C	16C
Signal Name	IN1C	IN2C	IN3C	IN4C	IN5C	IN6C	IN7C	IN8C	IN9C	IN10C	IN11C	IN12C	IN13C	IN14C	IN15C	IN16C
Signal Name	IN1B	IN2B	IN3B	IN4B	IN5B	IN6B	IN7B	IN8B	IN9B	IN10B	IN11B	IN12B	IN13B	IN14B	IN15B	IN16B

Figure 5.3.4-12 SAR145 Signal Names and Terminal Numbers

5.4 Signal Cable Connection to Digital Input/Output Modules

This section contains wire connection diagrams and tables with the I/O channel numbers.

There are three ways of connecting input signal cables to digital I/O modules: by connecting via a pressure clamp terminal block, by using a signal cable to connect to the connectors via a terminal board, or by direct connection using a MIL cable.

The following table shows the relationship between the digital input/output module and the field wiring connection methods.

Table 5.4-1 Digital Input/Output Module and Field Wiring Connection Methods

Digital input/output module	Field wiring connection methods (*1)		
	Pressure clamp terminal	Terminal board	MIL cable
SDV144	Yes	Yes	Yes
SDV521	-	Yes	-
SDV526	-	Yes	-
SDV531-S/SDV531-L	Yes	Yes	Yes
SDV53A	-	Yes	-
SDV541	Yes	Yes	Yes

*1: Yes: connection possible

■ Terminal Numbers and Pin Numbers

● Pressure Clamp Terminal Block

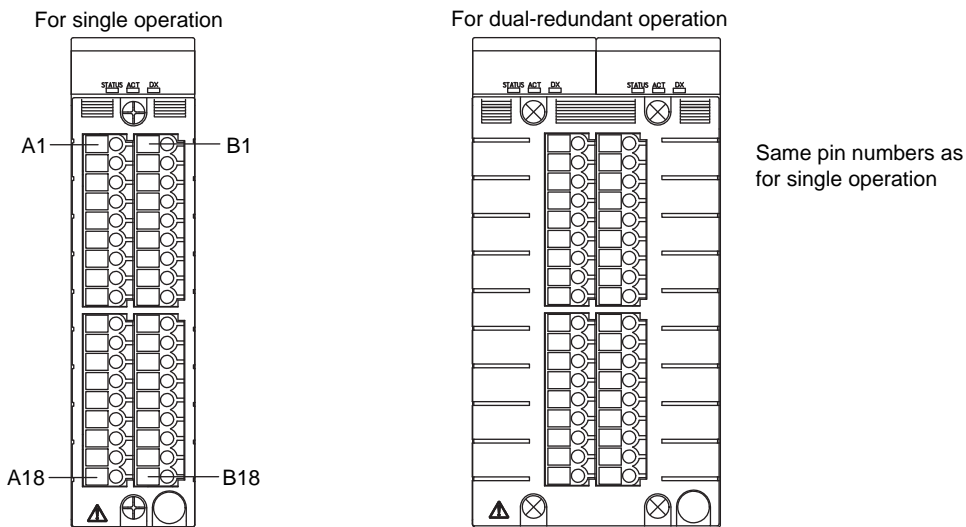


Figure 5.4-1 Terminal Number of Pressure Clamp Terminal Block

● MIL Connectors

MIL connectors for digital input/output have 50 pins.

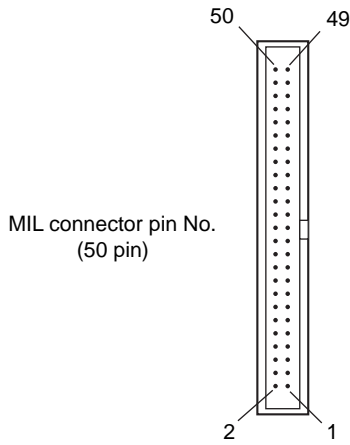


Figure 5.4-2 Pin Number of MIL Connector

■ Correspondence Between I/O Channel Numbers and Terminal Numbers or Pin Numbers

The following figure shows how the I/O channel numbers correspond to the terminal numbers of a pressure clamp terminal block and the pin numbers of a MIL connector.

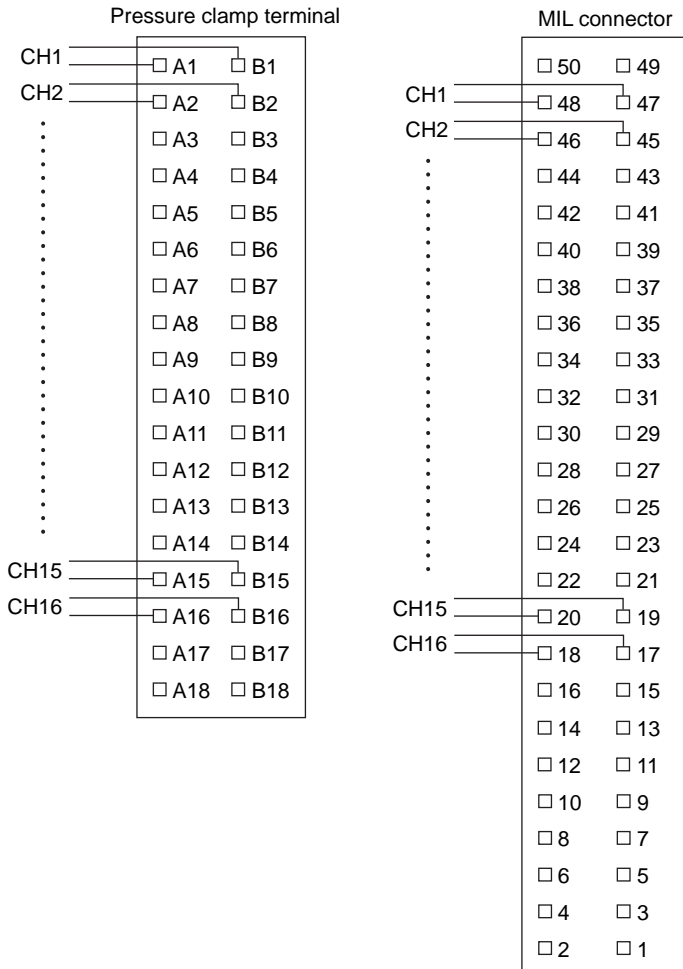


Figure 5.4-3 Correspondence Between I/O Channel Numbers and Pressure Clamp Terminal Numbers or MIL Connector Pin Numbers

**SEE
ALSO**

For more information about digital input/output module circuit diagrams, refer to:

“■ Digital Input/Output Modules” on page 5-49

5.4.1 Digital Input Module, 16-Channel (SDV144)

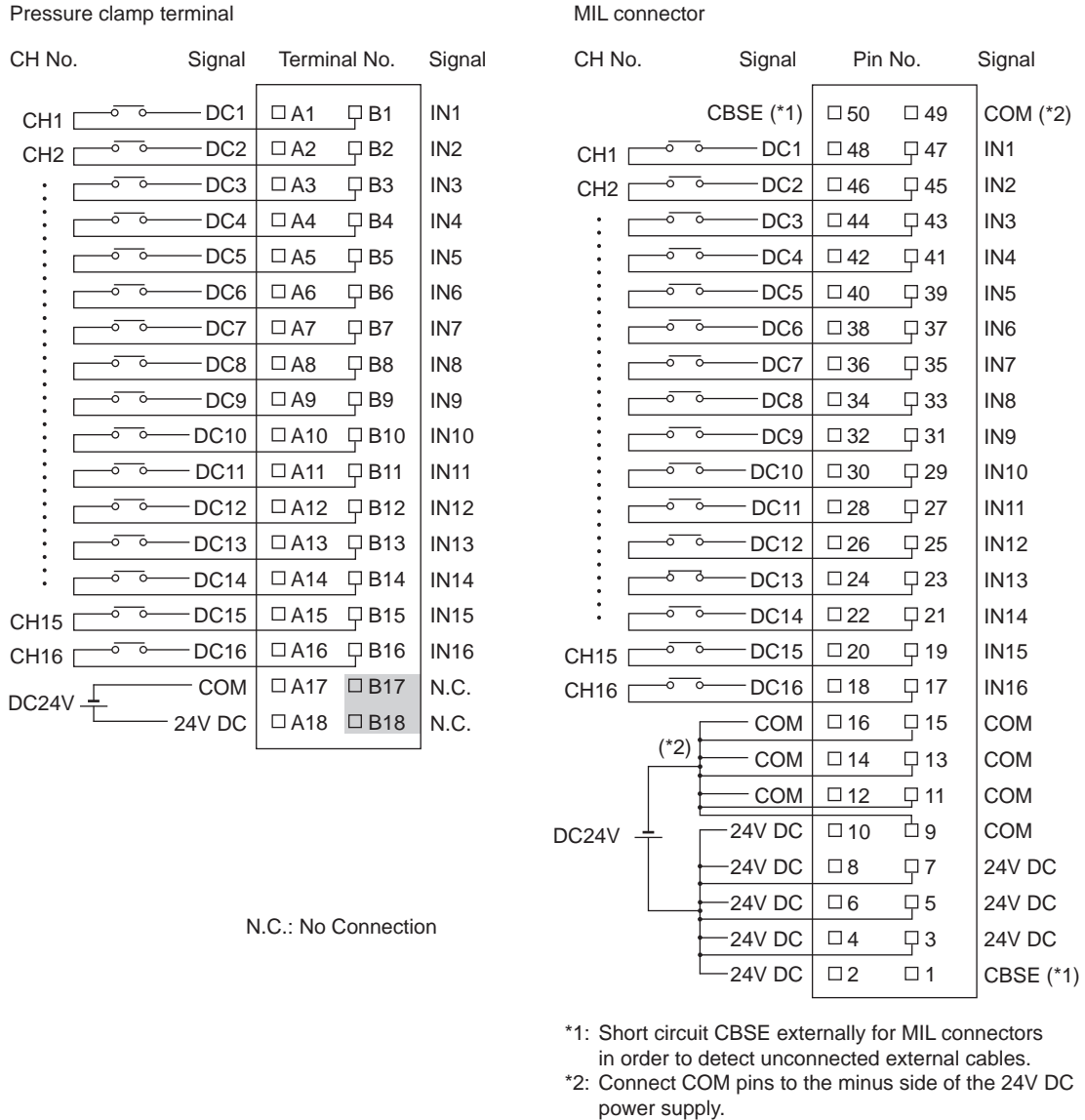


Figure 5.4.1-1 SDV144 External Connection

5.4.2 Digital Output Module, 8-Channel (SDV531)

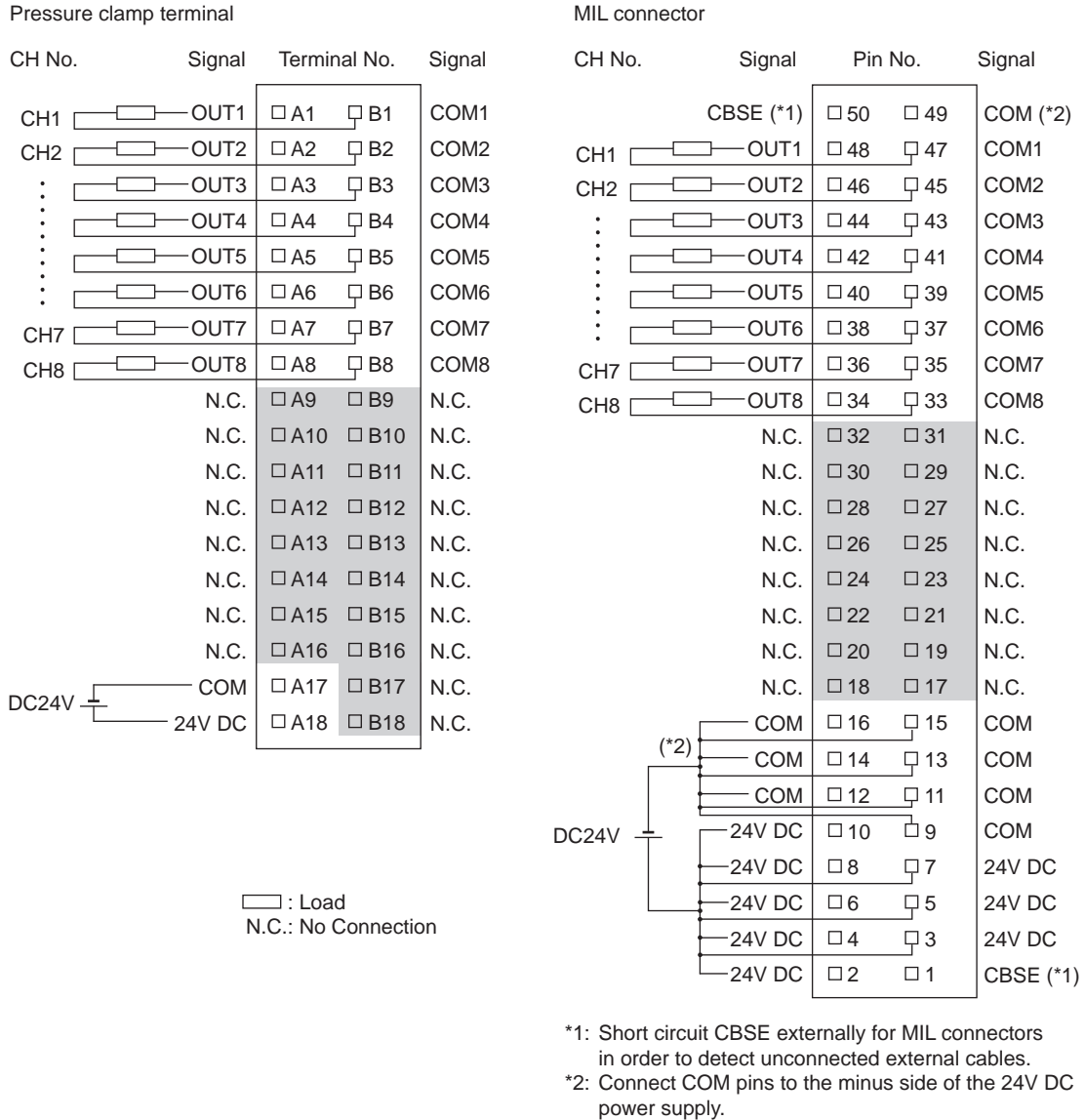


Figure 5.4.2-1 SDV531 External Connection

5.4.3 Digital Output Module, 16-Channel (SDV541)

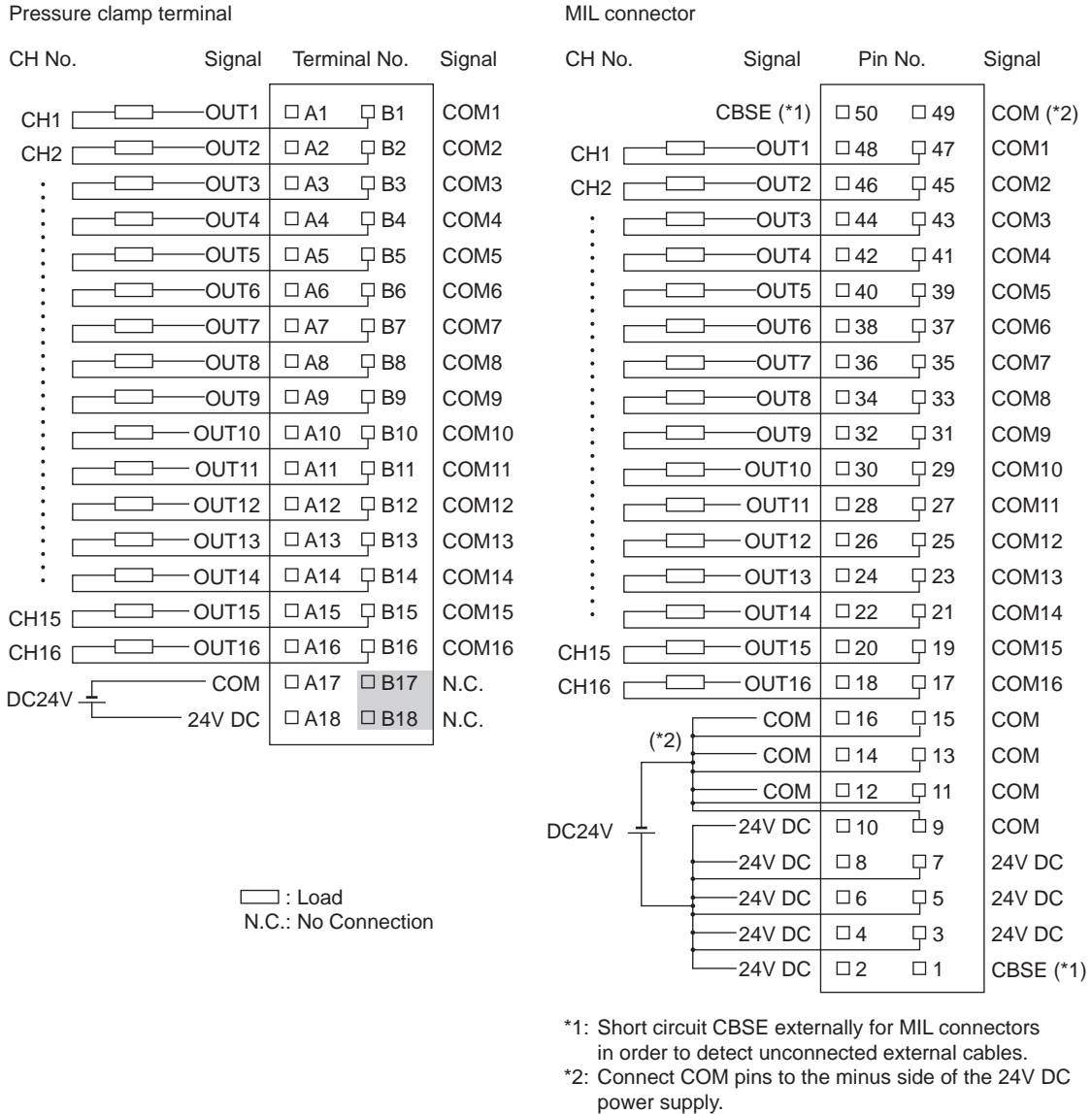


Figure 5.4.3-1 SDV541 External Connection

5.4.4 Connection with a Terminal Board (Digital Input/Output Module)

The following table shows the relationship between digital input/output modules and terminal boards.

Table 5.4.4-1 Relationship Between Terminal Boards and Digital Input/Output Modules

Terminal board (type)	Connectable digital input/output module (type)
SED2D	SDV521
SED3D	SDV53A
SED4D	SDV144, SDV531, SDV541
SWD2D	SDV526
SBD2D	SDV521
SBD3D	SDV531, SDV53A
SBD4D	SDV144, SDV541

The following figure shows the relationship between the terminal numbers on each terminal board and the signal names for the digital I/O modules that connect to the terminal board.

■ Connection Between SED2D and an Output Module

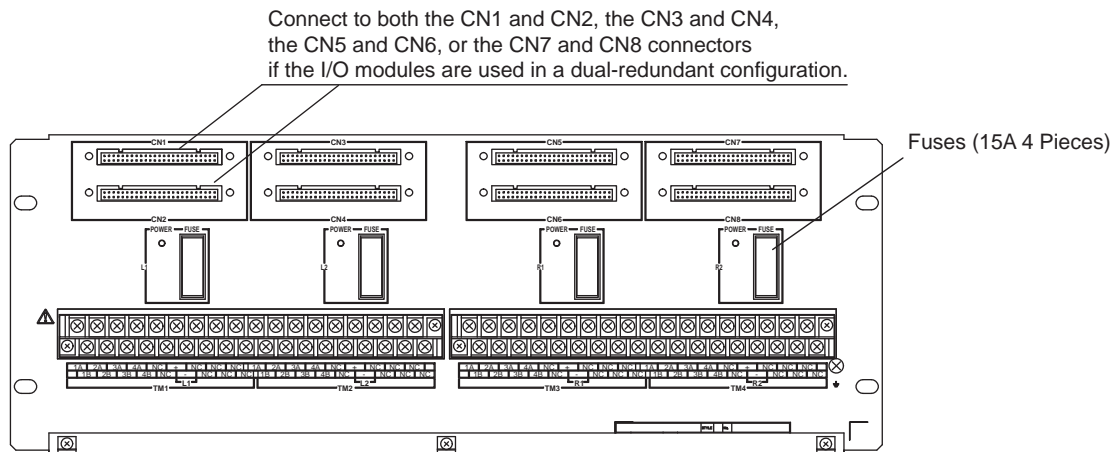


Figure 5.4.4-1 SED2D Terminal Board

● When Connecting SDV521 (24 V DC Power Supply Required)

Signal Name	OUT1	OUT2	OUT3	OUT4	N.C.	+	N.C.	N.C.	N.C.
TM1, TM2, TM3, TM4	1A	2A	3A	4A					
Terminal No.	1B	2B	3B	4B					
Signal Name	COM1	COM2	COM3	COM4	N.C.	-	N.C.	N.C.	N.C.

N.C. : No Connection

Figure 5.4.4-2 SDV521 Signal Name and Terminal Number

■ Connection Between SED3D and an Output Module

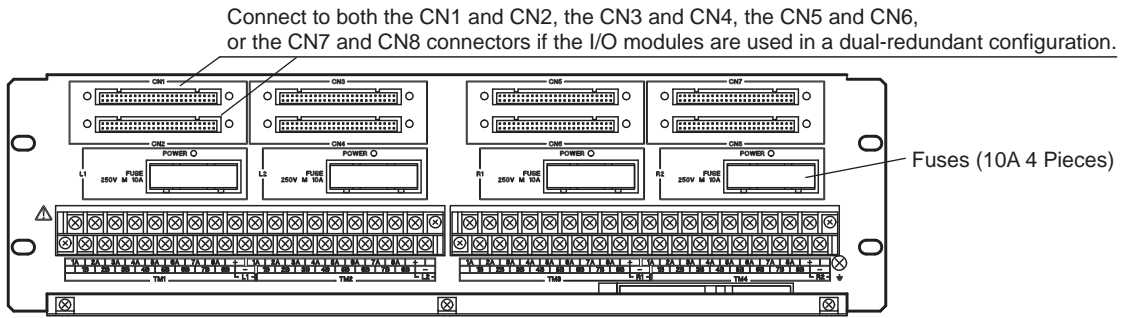


Figure 5.4.4-3 SED3D Terminal Board

● When Connecting SDV53A (48 V DC Power Supply Required)

Signal Name	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7	OUT8	48 V DC
TM1, TM2, TM3, TM4	1A	2A	3A	4A	5A	6A	7A	8A	+
Terminal No.	1B	2B	3B	4B	5B	6B	7B	8B	-
Signal Name	COM1	COM2	COM3	COM4	COM5	COM6	COM7	COM8	COM

Figure 5.4.4-4 SDV53A Signal Name and Terminal Number

■ Connection Between SED4D and an Input/Output Module

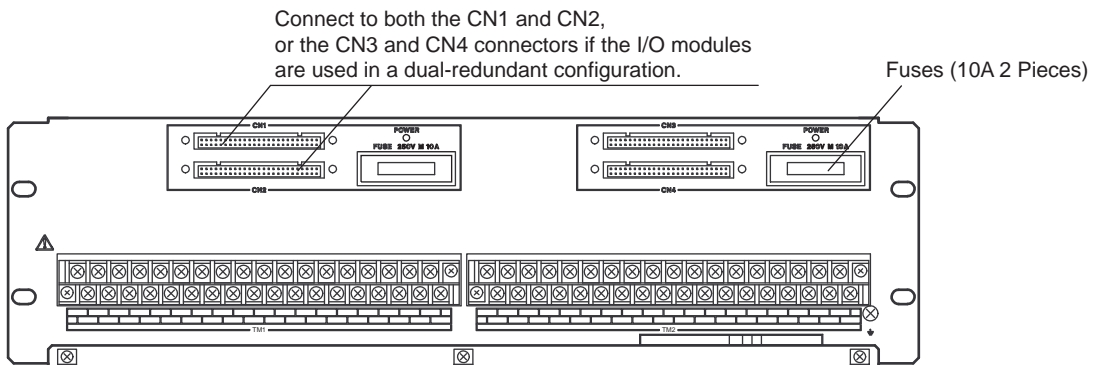


Figure 5.4.4-5 SED4D Terminal Board

● When Connecting SDV144 (Voltage-free Contact Input) (24 V DC power supply required)

Signal Name	DC1	DC2	DC3	DC4	DC5	DC6	DC7	DC8	DC9	DC10	DC11	DC12	DC13	DC14	DC15	DC16	N.C.	24 VDC
TM1, TM2	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A	17A	+
Terminal No.	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B	17B	-
Signal Name	IN1	IN2	IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12	IN13	IN14	IN15	IN16	N.C.	COM

N.C. : No Connection

Figure 5.4.4-6 SDV144 Signal Name and Terminal Number

● **When Connecting SDV531 (24 V DC Power Supply Required)**

Signal Name	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7	OUT8	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	COM	24 VDC
TM1, TM2	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A	17A	+
Terminal No.	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B	17B	-
Signal Name	COM1	COM2	COM3	COM4	COM5	COM6	COM7	COM8	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	COM

N.C. : No Connection

Figure 5.4.4-7 SDV531 Signal Name and Terminal Number

● **When Connecting SDV541 (24 V DC Power Supply Required)**

Signal Name	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7	OUT8	OUT9	OUT10	OUT11	OUT12	OUT13	OUT14	OUT15	OUT16	COM	24 VDC
TM1, TM2	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A	17A	+
Terminal No.	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B	17B	-
Signal Name	COM1	COM2	COM3	COM4	COM5	COM6	COM7	COM8	COM9	COM10	COM11	COM12	COM13	COM14	COM15	COM16	N.C.	COM

N.C. : No Connection

Figure 5.4.4-8 SDV541 Signal Name and Terminal Number

■ **Connection Between SWD2D and an Output Module**

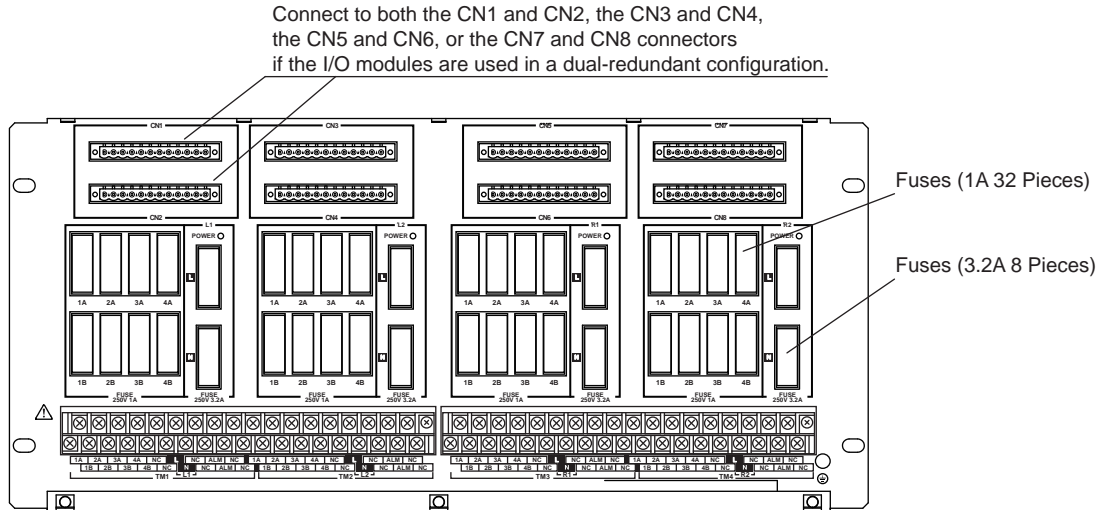


Figure 5.4.4-9 SWD2D Terminal Board

● **When Connecting SDV526 (100-120 V AC Power Supply Required)**

Signal Name	OUT1	OUT2	OUT3	OUT4	N.C.	L	N.C.	ALM	N.C.
TM1, TM2, TM3, TM4	1A	2A	3A	4A					
Terminal No.	1B	2B	3B	4B					
Single Name	COM1	COM2	COM3	COM4	N.C.	N	N.C.	ALM	N.C.

N.C. : No Connection

Figure 5.4.4-10 SDV526 Signal Name and Terminal Number

● **Signals of SWD2D**

- External power supply voltage/current (between L and N)
4 points; 100-120 V AC, 50/60Hz; 8.8 A (2.2 A per point)
- Output voltage/current (between OUTn and COMn) (*1)(*2)
4 points x 4 (total 16 points); 100-120 V AC, 50/60Hz; 8 A (0.5 A per point)

- *1: Outputs are in accord with the specification of SDV526.
- *2: SWD2D is supplied from external power supply and outputs voltage via SDV526.

SEE ALSO

For more information about the specifications of the outputs of SDV526, refer to:
Digital I/O modules (for ProSafe-RS) (GS 32Q06K40-31E)

● **ALM Terminals on SWD2D**

Each terminal group has a pair of ALM terminals for sending a contact signal when fuse is broken. When any fuse (1A to 4A, 1B to 4B, L and N) of a terminal group is broken, the contact of the ALM terminals becomes closed. When all the fuses of the terminal group are normal, the contact of the ALM terminals stays open.

When the external relays are connected, a surge absorber should be used for inhibiting the noises.

■ **Connection Between SBD2D and an Output Module**

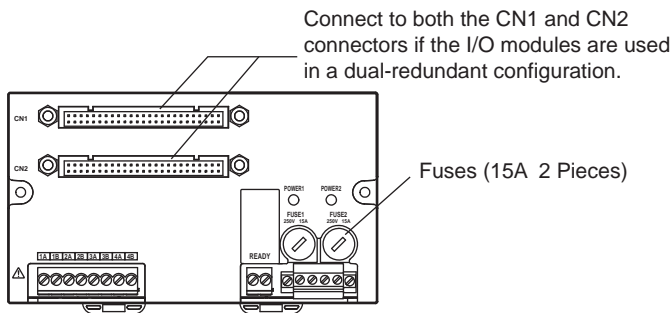


Figure 5.4.4-11 SBD2D Terminal Board

● **When Connecting SDV521 (24 V DC Power Supply Required)**

Signal Name	OUT1	COM1	OUT2	COM2	OUT3	COM3	OUT4	COM4
Terminal No.	1A	1B	2A	2B	3A	3B	4A	4B

Signal Name	READY	Signal Name	24V DC	COM	24V DC	COM
Terminal No.	READY	Terminal No.	1+	1-	2+	2-

Figure 5.4.4-12 SDV521 Signal Name and Terminal Number

● **READY Terminals on the SBD2D**

When statuses of power supply and fuses are all normal, the output from READY terminals will be energized, i.e., the contact becomes closed. When power supply fails or any of the fuses fails, the output from READY terminals will be de-energized, i.e., the contact becomes opened.

If an external relay is used, a surge absorber should be used for noise prevention.

● **LED Status**

When the power supply is normal, the LED is on. Otherwise, the LED is off.

■ Connection Between SBD3D and an Output Module

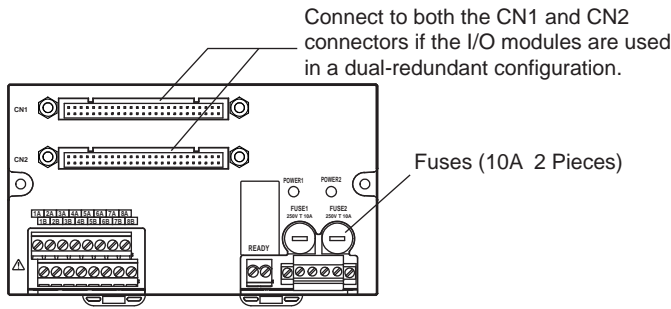


Figure 5.4.4-13 SBD3D Terminal Board

● When Connecting SDV531 (24 V DC Power Supply Required)

Use the SBD3D-01 (24 V DC)

Signal Name	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7	OUT8
Terminal No.	1A	2A	3A	4A	5A	6A	7A	8A
Terminal No.	1B	2B	3B	4B	5B	6B	7B	8B
Signal Name	COM1	COM2	COM3	COM4	COM5	COM6	COM7	COM8

Signal Name	READY	Signal Name	24V DC	COM	24V DC	COM
Terminal No.	READY	Terminal No.	1+	1-	2+	2-

Figure 5.4.4-14 SDV531 Signal Name and Terminal Number

● When Connecting SDV53A (48 V DC Power Supply Required)

Use the SBD3D-A1 (48 V DC).

Signal Name	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7	OUT8
Terminal No.	1A	2A	3A	4A	5A	6A	7A	8A
Terminal No.	1B	2B	3B	4B	5B	6B	7B	8B
Signal Name	COM1	COM2	COM3	COM4	COM5	COM6	COM7	COM8

Signal Name	READY	Signal Name	48V DC	COM	48V DC	COM
Terminal No.	READY	Terminal No.	1+	1-	2+	2-

Figure 5.4.4-15 SDV53A Signal Name and Terminal Number

● READY Terminals on the SBD3D

When statuses of power supply and fuses are all normal, the output from READY terminals will be energized, i.e., the contact becomes closed. When power supply fails or any of the fuses fails, the output from READY terminals will be de-energized, i.e., the contact becomes opened.

If an external relay is used, a surge absorber should be used for noise prevention.

● LED Status

When the power supply is normal, the LED is on. Otherwise the LED is off.

■ Connection Between SBD4D and an Input/Output Module

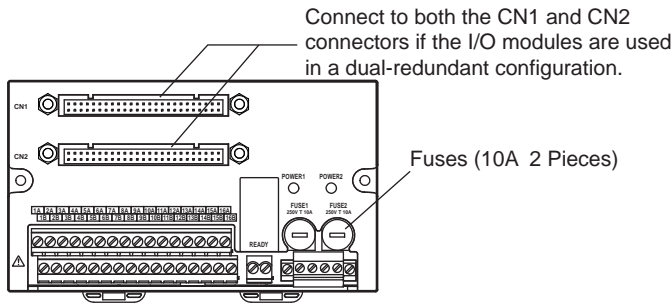


Figure 5.4.4-16 SBD4D Terminal Board

● When Connecting SDV144 (Voltage-Free Contact Input) (24 V DC Power Supply Required)

Signal Name	DC1	DC2	DC3	DC4	DC5	DC6	DC7	DC8	DC9	DC10	DC11	DC12	DC13	DC14	DC15	DC16
Terminal No.	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A
	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B
Signal Name	IN1	IN2	IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12	IN13	IN14	IN15	IN16

Signal Name	READY	Signal Name	24V DC	COM	24 V DC	COM
Terminal No.	READY	Terminal No.	1+	1-	2+	2-

Figure 5.4.4-17 SDV144 Signal Name and Terminal Number

● When Connecting SDV541 (24 V DC Power Supply Required)

Signal Name	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7	OUT8	OUT9	OUT10	OUT11	OUT12	OUT13	OUT14	OUT15	OUT16
Terminal No.	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A
	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B
Signal Name	COM1	COM2	COM3	COM4	COM5	COM6	COM7	COM8	COM9	COM10	COM11	COM12	COM13	COM14	COM15	COM16

Signal Name	READY	Signal Name	24V DC	COM	24 V DC	COM
Terminal No.	READY	Terminal No.	1+	1-	2+	2-

Figure 5.4.4-18 SDV541 Signal Name and Terminal Number

● READY Terminals on the SBD4D

When statuses of power supply and fuses are all normal, the output from READY terminals will be energized, i.e., the contact becomes closed. When power supply fails or any of the fuses fails, the output from READY terminals will be de-energized, i.e., the contact becomes opened.

If an external relay is used, a surge absorber should be used for noise prevention.

● LED Status

When the power supply is normal, the LED is on. Otherwise the LED is off.

5.5 Connection of Communication Modules

Communication modules are used for communication between the SCS and external devices. ProSafe-RS provides the Modbus slave communication and the subsystem communication. An external device acts as a Modbus master and SCS acts as a Modbus slave in the former, while external devices act as Modbus slaves and SCS acts as a Modbus master in the latter.

This section explains how to connect ALR111 and ALR121 serial communication modules, and ALE111 Ethernet communication module to external devices.

5.5.1 Connection of RS-232C Communication Module

Use an ALR111 serial communication module for RS-232C communication. This section explains the signal connections for this module.

■ ALR111: RS-232C Interface

The connectors on ALR111 module are the 9-pin D-sub connectors.

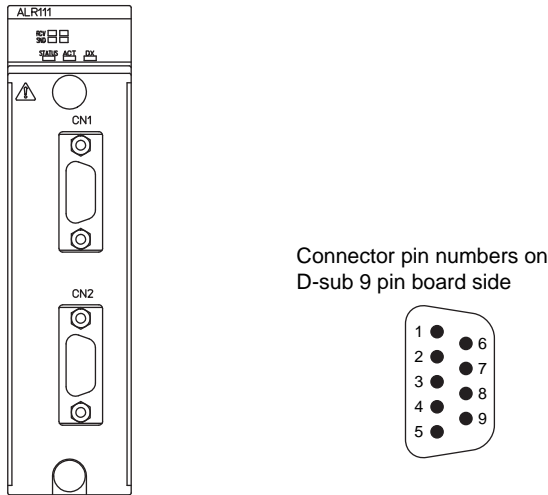


Figure 5.5.1-1 ALR111 Communication Module and Connector Pin Numbers

Table 5.5.1-1 RS-232C Interface Connector Pin Position

CN1 and CN2 pin position	Ab-brev.	Signal name	Signal direction at ALR111 side
1	CD	Carrier Detect	Input
2	RD	Receive Data	Input
3	SD	Send Data	Output
4	ER	Equipment Ready	Output
5	SG	Signal Ground	Signal ground
6	DR	Dataset Ready	Input
7	RS	Request to Send	Output
8	CS	Clear to Send	Input
9	-	N.C.	-

● RS-232C Cable and Modem

Although the connection between the ALR111 module and an external device is recommended to go through the modems, if the distance between the two is less than 15 meters and both the ALR111 module and the external device are sharing the same grounding levels, they can be directly connected using a cable without modems.

■ Modbus Connection

The following types of Modbus connection are available:

- Connection with modem
- Connecting to an external device using an RS-232C D-sub 25-pin connector (direct connection)

- Connecting to an external device using an RS-232C D-sub 9-pin connector (direct connection)

● **Connection with Modem**

The following figure shows the cable between the ALR111 and the modem for communicating with the external device.

The length of the cable for connecting ALR111 and the modem should be less than 15 meters.

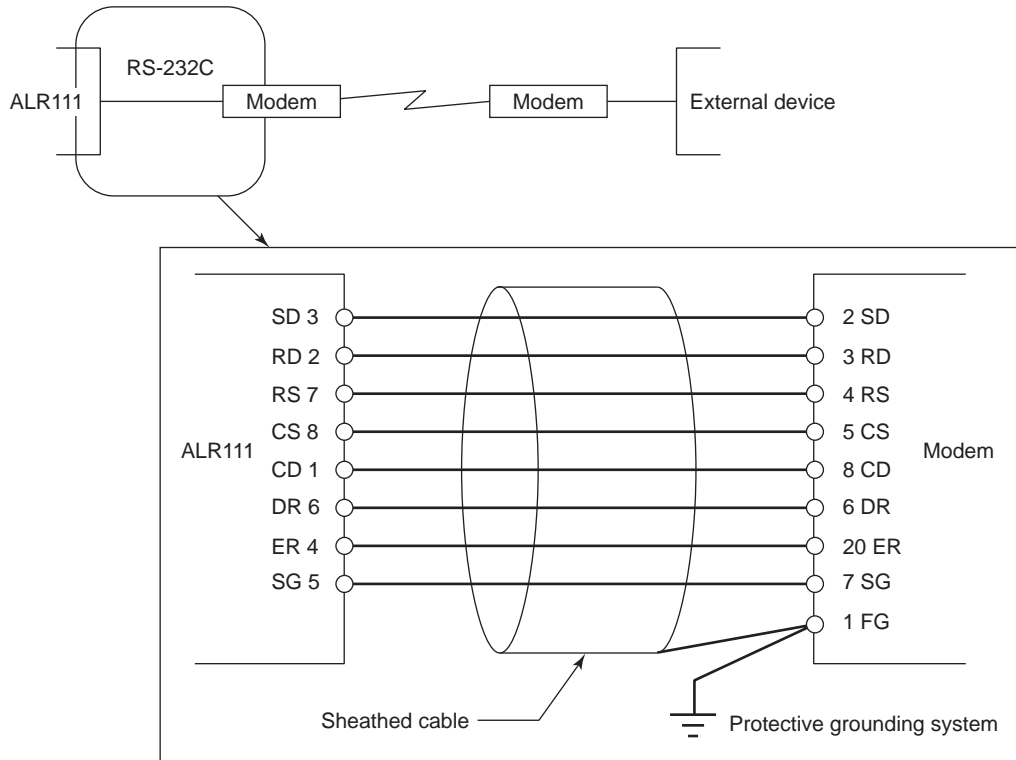


Figure 5.5.1-2 Cable Connection when the ALR111 and the External Device are Connected Using Modems

● **Connecting to the External Device with RS-232C D-Sub 25-Pin Connector (Direct Connection)**

The following figure shows the cable between the ALR111 and a external device with RS-232C D-Sub 25-Pin connector. This connection requires a 9-pin connector at one end of the cable and a 25-pin connector at the other end.

The length of the cable for connecting ALR111 and the external device should be less than 15 meters.

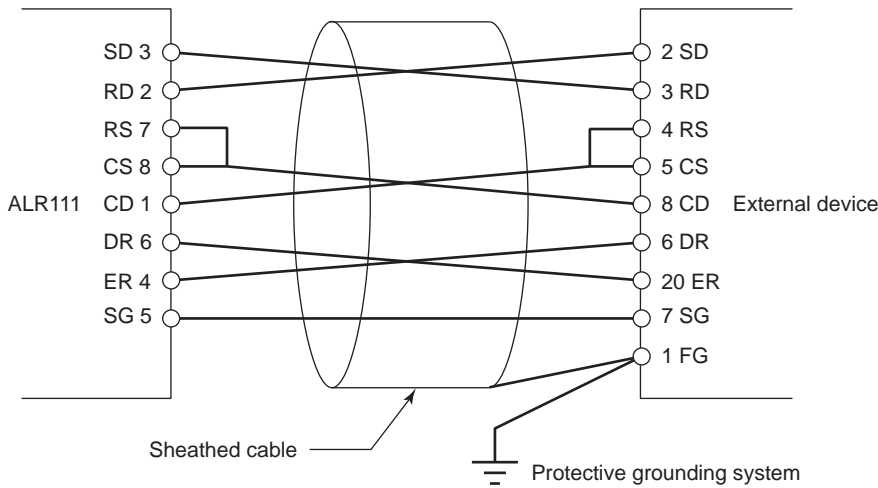


Figure 5.5.1-3 Cable Connection when Directly Connecting the ALR111 and the External Device (RS-232C D-Sub 25-Pin)

● **Connecting to the External Device with RS-232C D-Sub 9-Pin Connector (Direct Connection)**

The following figure shows the cable between the ALR111 and a external device with RS-232C D-Sub 9-Pin connector. This connection requires two 9-pin connectors at both ends of the cable.

The length of the cable for connecting ALR111 and the external device should be less than 15 meters.

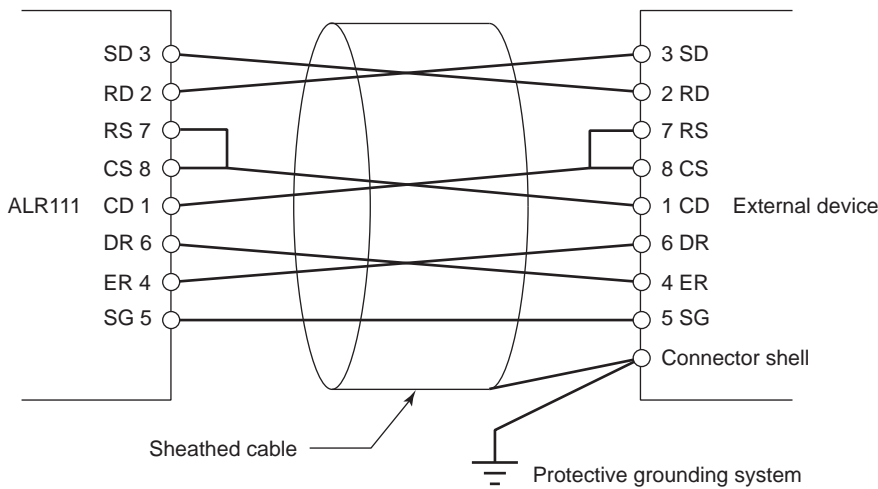


Figure 5.5.1-4 Cable Connection when Directly Connecting the ALR111 and the External Device (RS-232C D-Sub 9-Pin)

● **Cables for Communication Modules**

Yokogawa Electric Corporation provides RS-232C cables shown in the following table. Any necessary cables other than these should be prepared by the user.

Table 5.5.1-2 List of Communication Cables

Model	Cable Name	Remarks
AKB131	RS-232C Modem cable	Between ALR111 to modem (for RS circuit insulation) (9-25pin)
AKB132	RS-232C Null modem cable	Between ALR111 to RS-232C equipment (for RS circuit insulation) (9-25pin)

Continues on the next page

Table 5.5.1-2 List of Communication Cables (Table continued)

Model	Cable Name	Remarks
AKB135	RS-232C Modem cable	Between ALR111 to modem (9-25pin)
AKB136	RS-232C Null modem cable	Between ALR111 to RS-232C equipment (9-25pin)

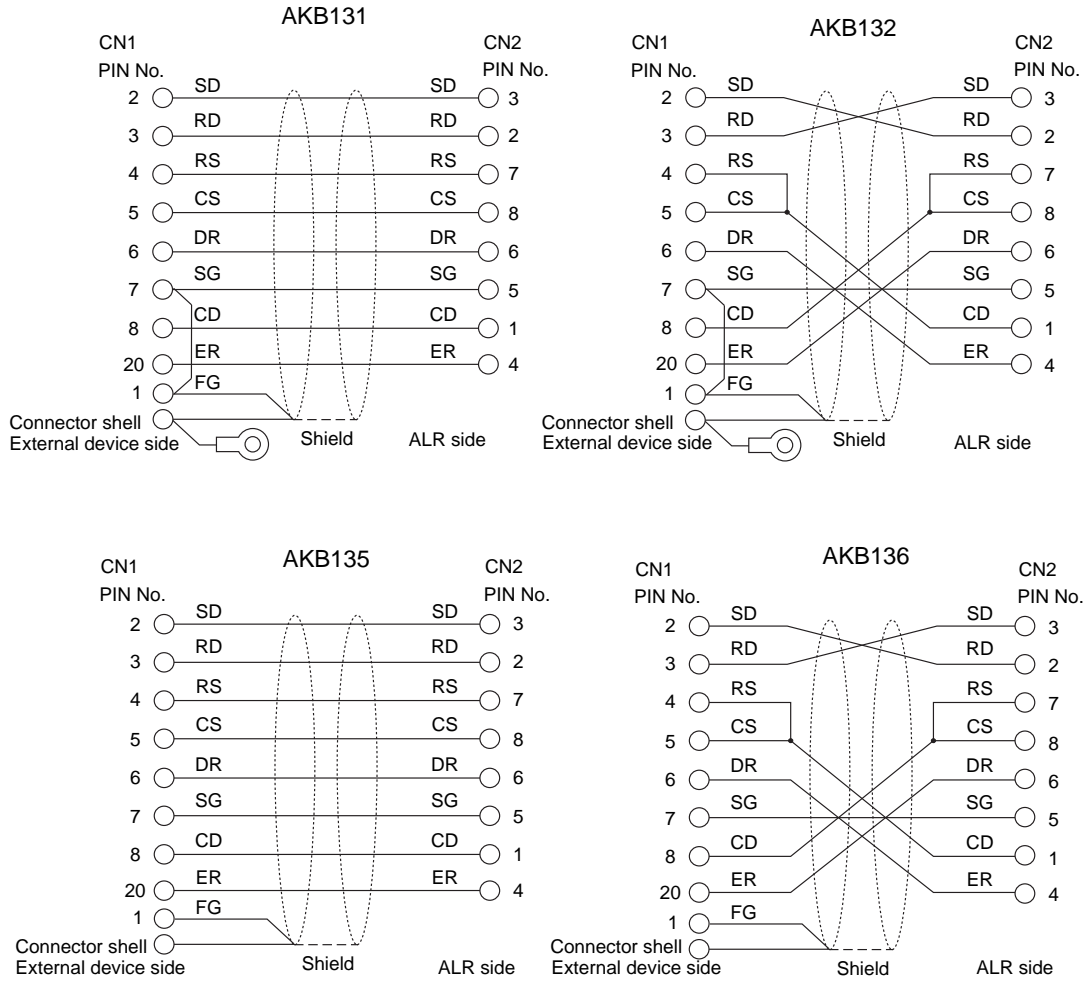


Figure 5.5.1-5 Internal Connection of the RS-232C Interface Cable

■ Communication Module Signal Circuits

The ALR111 communication module effectively insulate the communication circuit signal lines, so that the noises from the external device AC line, frame ground (FG) connecting cables and communication cables do not flow into the safety control station. For this reason, it is necessary that cable shielding wires shall be connected to the FG at the external device side.

Also at the external device side, that FG and signal ground (SG) need to be connected to each other, to keep the same potential between them.

■ ALR111 FG Connection

The ALR111 communication module effectively insulate the RS-232C interface circuit, so that the noises from the external device side do not flow into the safety control station, thereby improving noise resistance. To use this function effectively, satisfy the following requirements:



IMPORTANT

- Be sure to ground the FG at the external device. Ground the grounding terminal to the protective grounding system.
- Connect the FG to the SG of the RS-232C circuit (pin No. 7 for D-sub25, and pin No. 5 for D-sub9) at the external device.
- Ground the cable shielding wires at the external device side.
- If the signal cable is prepared by users, make sure the cable is the type of twisted pair cable in which a signal wire and a ground wire are paired.

Connect the shielding wires of the RS-232C communications cable to the FG at the external device as follows:

Ground the FG at the external device. Ground the grounding terminal to the protective grounding system.

Check that the FG (pin No. 1 for D-sub25) and the SG (pin No. 7 for D-sub25) are connected to each other at the RS-232C communications connector on the external device side. Also, check that the FG is connected to the grounding terminal at the external device.

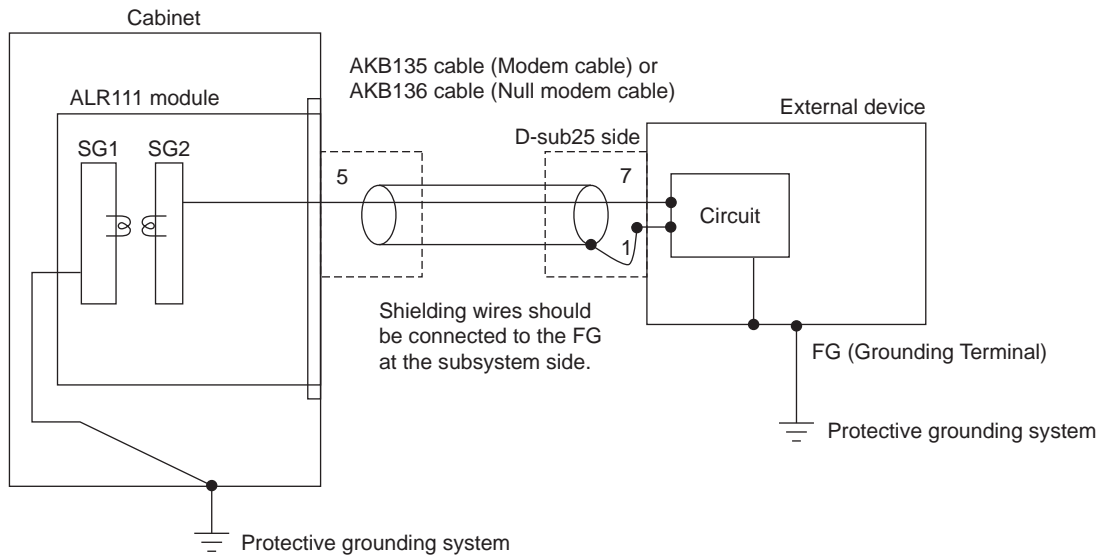


Figure 5.5.1-6 FG Connection

■ **AKB136 Cable Connection**

Usually in the external devices, as shown in the following figure, SG and FG are short-circuited by a jumper-pin (J1) (see the figure bellow) upon shipment. (If it is not, short-circuit J1.) To meet the above requirement, the FG and SG may be connected directly.

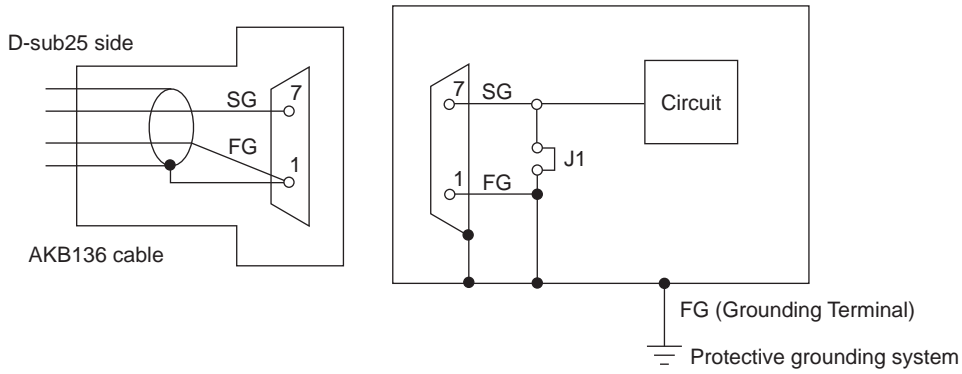


Figure 5.5.1-7 Example of Using AKB136 Cable

If the external device is insulating the RS-232C communication circuit, communication circuits at both the ALR111 and external device are floating, and thereby lowering noise resistance severely.

To prevent this, use an AKB131 or AKB132 cable.

Connect pin No. 1 (for the frame ground) and pin No. 7 (for the signal ground) together at the external device side. In addition, as a means of grounding the shielding wires of this cable, the following figure shows that the shielding wires can be connected to the FG terminal at the external device in cases where pin No. 1 is floating (open) at the external device.

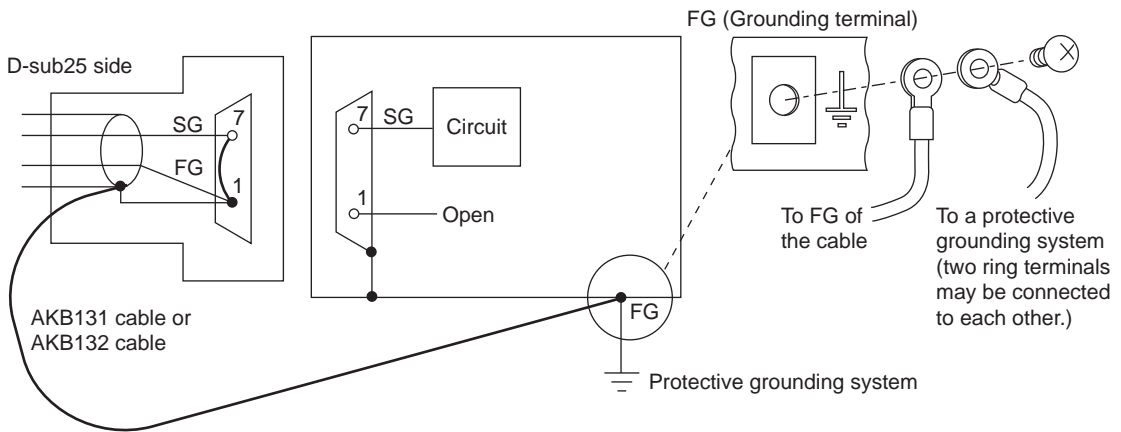


Figure 5.5.1-8 Cable Connection for Insulated Communications Circuit

■ Connection to External Device

The ALR111 and external device are connected by a cable up to 15 meters in length.

If the ALR111 is directly connected to an external device, be sure to connect the FG at the external device to the protective grounding system.

If the cable is longer than 15 meters, always use a modem. Be sure to ground the FG of the modem to the protective grounding system.

5.5.2 Connection of RS-422/RS-485 Communication Module

Use an ALR121 serial communication module for RS-422/RS-485 communication. This section explains the signal connections for this module.

■ ALR121: RS-422/RS-485 Interface

The following figure shows the terminals on front panel of ALR121 module.

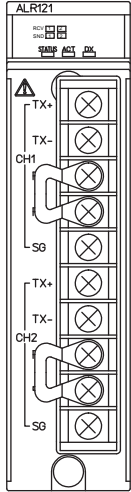


Figure 5.5.2-1 Terminal of Communication Module (ALR121)

Table 5.5.2-1 RS-422/RS485 Interface Terminal

Terminal name	Signal name	Remarks
TX+	Send Data	Non-inverted
TX-	Send Data	Inverted
RX+	Receive Data	Non-inverted
RX-	Receive Data	Inverted
SG	Signal Ground	-

Cable wiring for an external device varies with the model of the device.

SEE ALSO

For more information about connections for each external device model when connecting to the ALR121, refer to:

The instruction manuals of the corresponding devices

■ ALR121 External Connection

When connecting the external device with ALR121, two methods for 1 to 1 and 1 to n (n: up to 32) are available. The following figure shows the configuration.

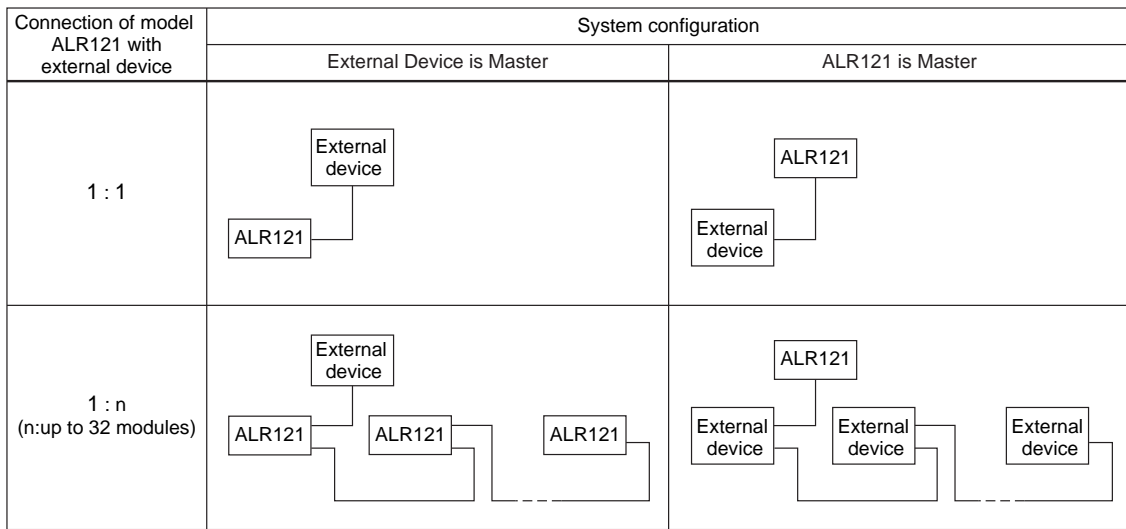


Figure 5.5.2-2 System Configuration When Connecting External Device with Model ALR121

● **Cables for Communication Modules**

Yokogawa Electric Corporation provides RS-422/RS-485 cables shown in the following table. If other type of cables is required, user needs to prepare separately.

Table 5.5.2-2 RS-422/RS-485 Communication Cables

Model	Cable Name	Remarks
AKB161	RS-422/RS-485 cable	Between ALR (M4 terminal) to external device (M3 terminal)
AKB162	RS-422/RS-485 cable	Between ALR (M4 terminal) to external device (M4 terminal)

■ **FG Connection**

Set up the RS-422/RS-485 shield as follows:

Ground the FG to the protective grounding system on the external device side.

The cable shield between ALR121 and the external device side must be connected to the FG on the external device side. FG is not available on ALR121.

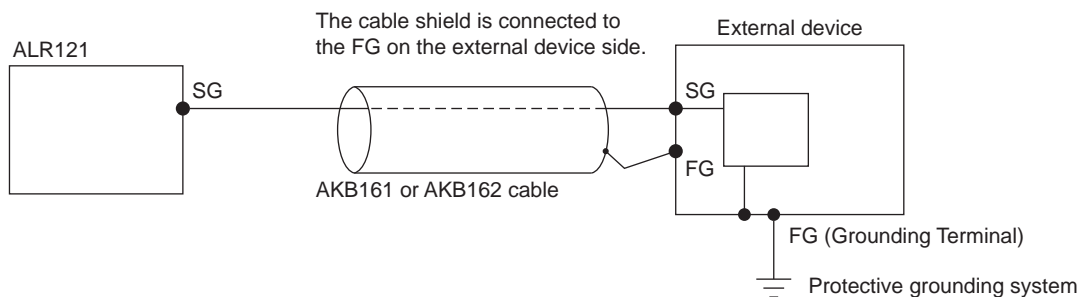


Figure 5.5.2-3 FG Connection

■ **Connection with External Device**

In the case that the external device is communication master, the four-wire type cable should be used for connecting ALR121 and the external device. It has 1 to 1 and 1 to n connections.

● 1 to 1 Connection in 4-wire Type

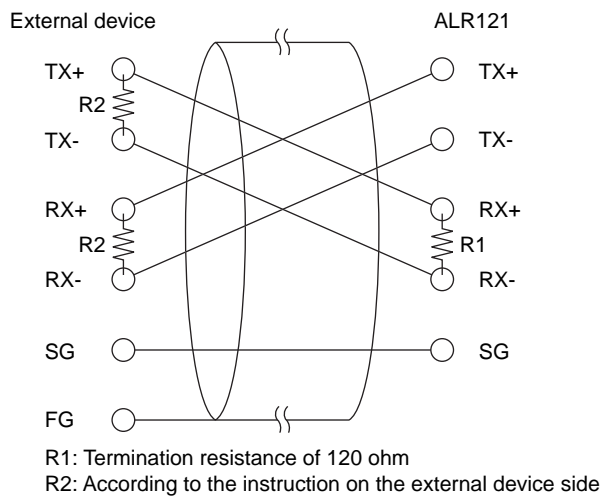


Figure 5.5.2-4 1 to 1 Connection in 4-wire Type

● 1 to n Connection in 4-wire Type

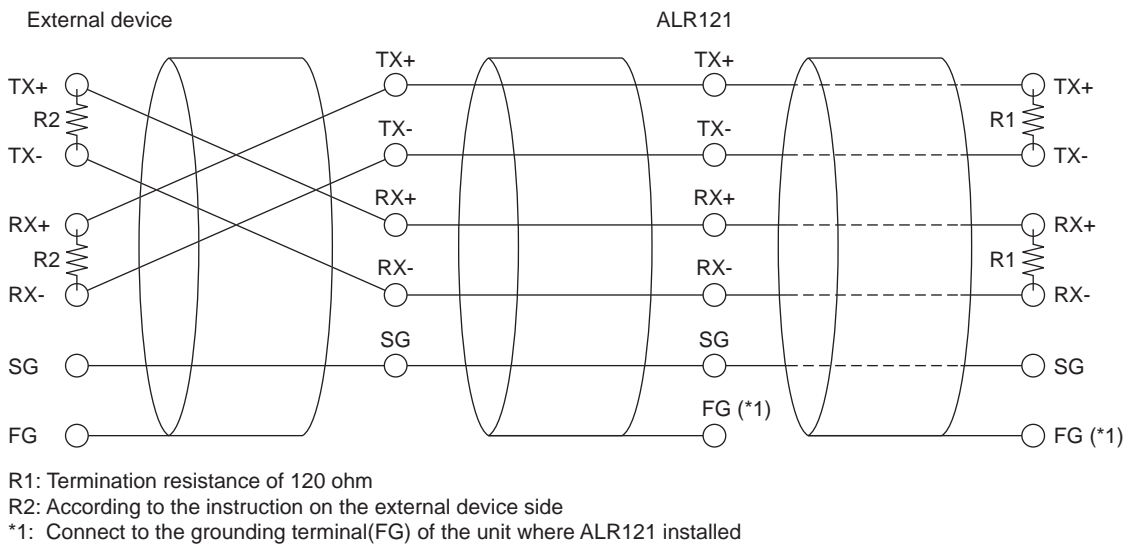
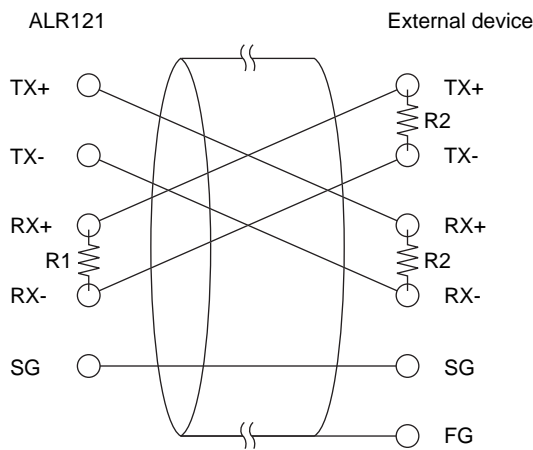


Figure 5.5.2-5 1 to n Connection in 4-wire Type

In the case that the ALR121 is a communication master, both the four-wire type cable and two-wire cable can be used for connecting ALR121 and the external device with either 1 to 1 or 1 to n connection.

In the case that the external device is a communication master, only the four-wire type cable can be used.

● **1 to 1 Connection in 4-wire Type**

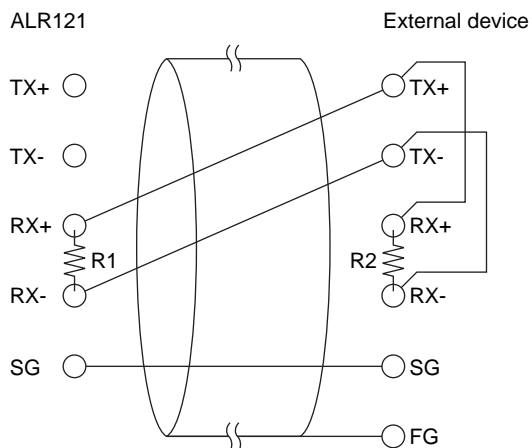


R1: Termination resistance of 120 ohm
R2: According to the instruction on the subsystem side

Figure 5.5.2-6 1 to 1 Connection in 4-wire Type

● **1 to 1 Connection in 2-wire Type**

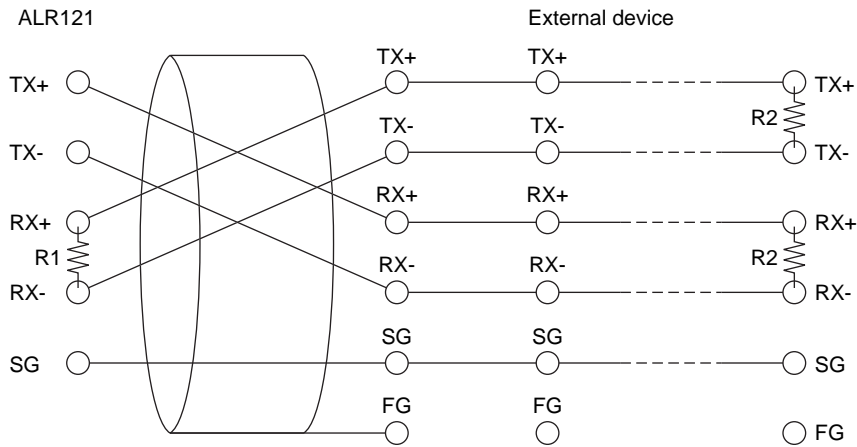
When ALR121 is specified for 2-wire connection by the builder, “TX+ and RX+”, “TX- and RX-” are automatically connected within the module.



R1: Termination resistance of 120 ohm
R2: According to the instruction on the subsystem side

Figure 5.5.2-7 1 to 1 Connection in 2-wire Type

● 1 to n Connection in 4-wire Type

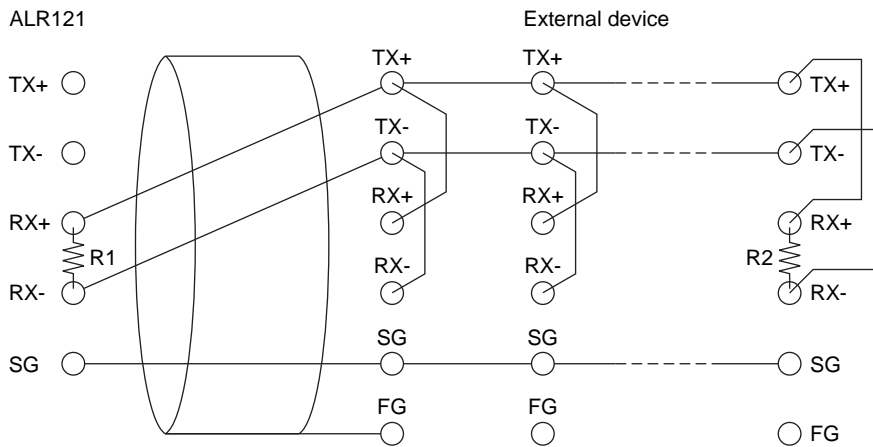


R1: Termination resistance of 120 ohm
R2: According to the instruction on the subsystem side

Figure 5.5.2-8 1 to n Connection in 4-wire Type

● 1 to n Connection in 2-wire Type

When ALR121 is specified for 2-wire connection by the builder, “TX+ and RX+”, “TX- and RX-” are automatically connected within the module.



R1: Termination resistance of 120 ohm
R2: According to the instruction on the subsystem side

Figure 5.5.2-9 1 to n Connection in 2-wire Type

5.5.3 Connection of Ethernet Communication Module

The signal cables used for connecting Ethernet communication modules are 10BASE-T twisted-pair cables. The connector type is RJ45.

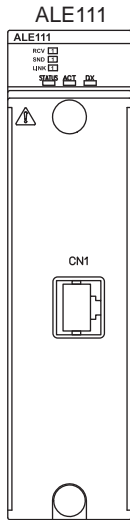


Figure 5.5.3-1 Ethernet Communication Module

5.6 Circuit Diagrams of Input/Output Modules

A circuit diagram of the connections between an I/O module and a terminal board is shown as follows.

■ Analog Input/Output Modules

The following table shows the relationship between analog input/output modules and terminal boards.

Table 5.6-1 Relationship Between analog input/output modules and terminal boards

Analog input/output module (type)	Connectable terminal board (type)
SAI143	SEA4D/SBA4D
SAV144	SEA4D/SBA4D
SAT145	SBT4D
SAR145	SBR4D
SAI533	SEA4D/SBA4D

● Analog Input Module (Current Input) : SAI143

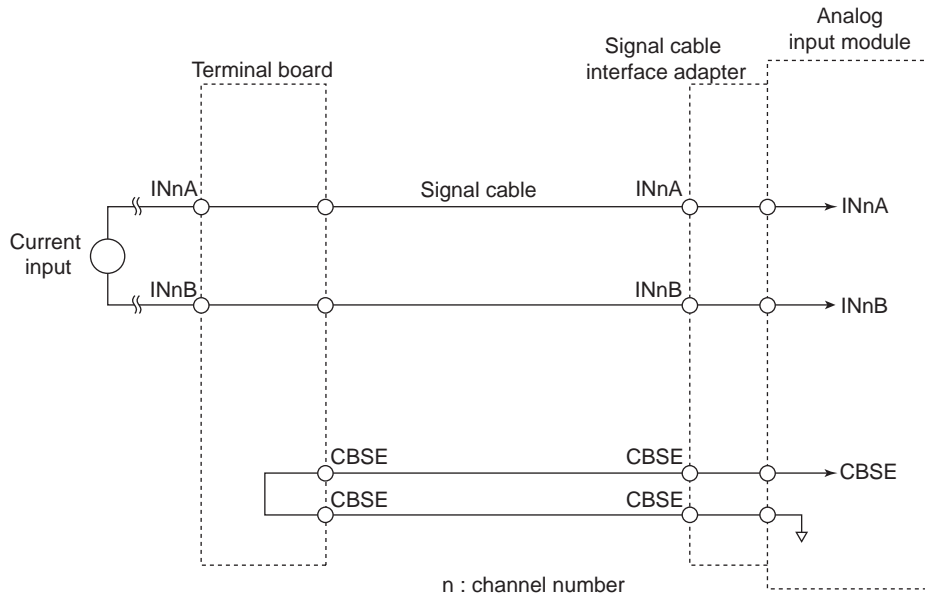


Figure 5.6-1 SAI143 Circuit Diagram

● Analog Input Module (Voltage Input) : SAV144

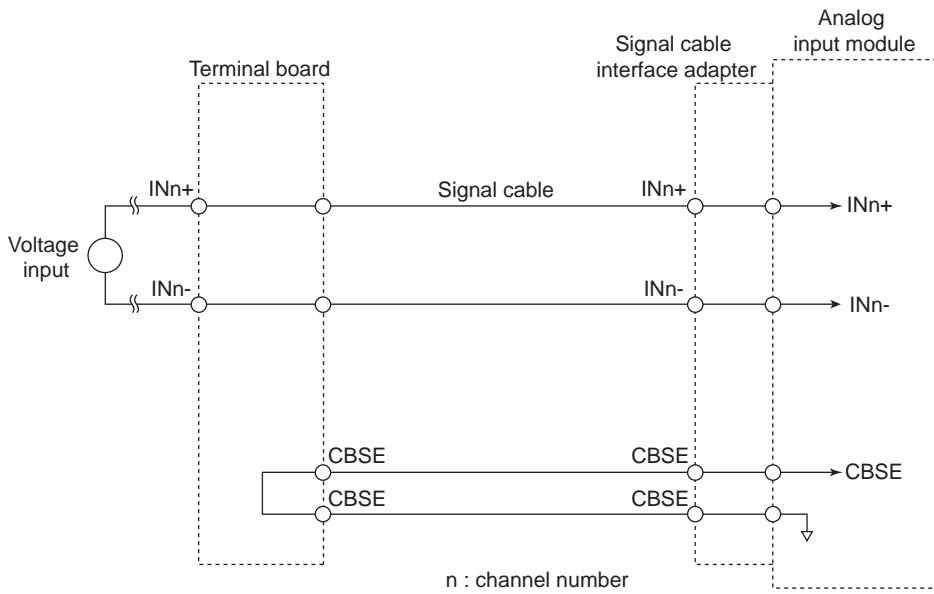


Figure 5.6-2 SAV144 Circuit Diagram

● Analog Input Module SAT145

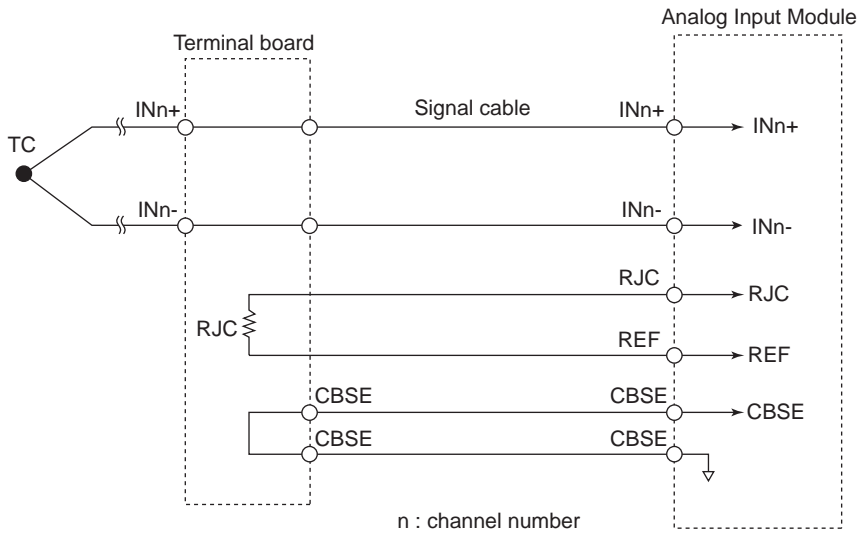


Figure 5.6-3 SAT145 Circuit Diagram

● **Analog Input Module SAR145**

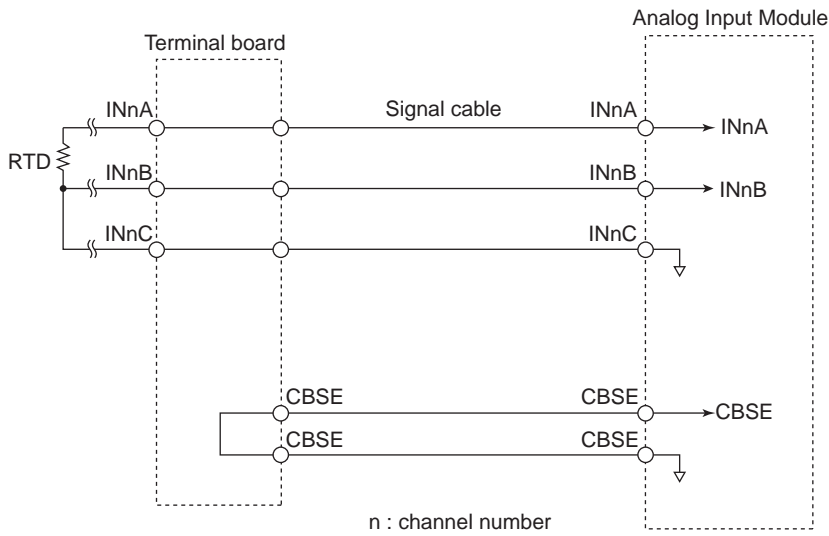


Figure 5.6-4 SAR145 Circuit Diagram

● **Analog Output Module : SAI533**

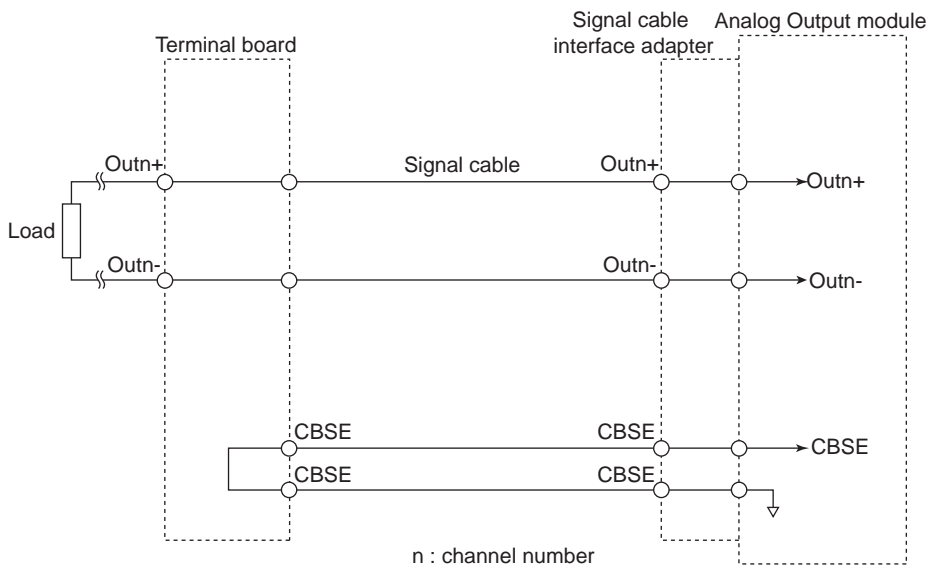


Figure 5.6-5 SAI533 Circuit Diagram

■ **Digital Input/Output Modules**

The following table shows the relationship between digital input/output modules and terminal boards.

Table 5.6-2 Relationship Between Digital Input/Output Modules and Terminal Boards

Digital input/output module (type)	Connectable terminal board (type)
SDV144	SED4D/SBD4D
SDV521	SED2D/SBD2D
SDV526	SWD2D
SDV531	SED4D/SBD3D

Continues on the next page

Table 5.6-2 Relationship Between Digital Input/Output Modules and Terminal Boards (Table continued)

Digital input/output module (type)	Connectable terminal board (type)
SDV53A	SED3D/SBD3D
SDV541	SED4D/SBD4D

● **Digital Input Module : SDV144**

The following figure shows a connection to a 19-inch rack mountable terminal board.

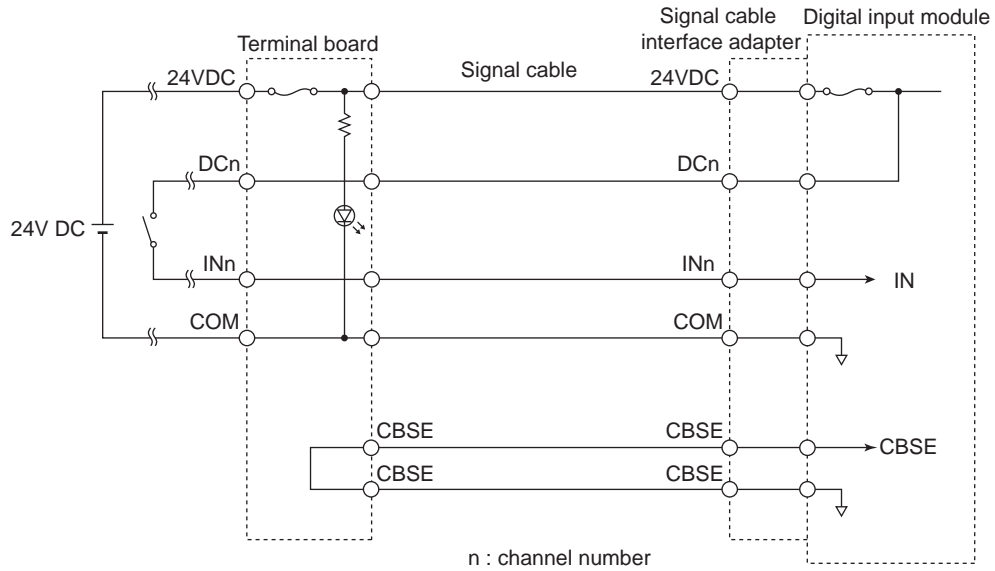


Figure 5.6-6 SDV144 Circuit Diagram

The following figure shows a connection to a DIN rail mountable terminal board.

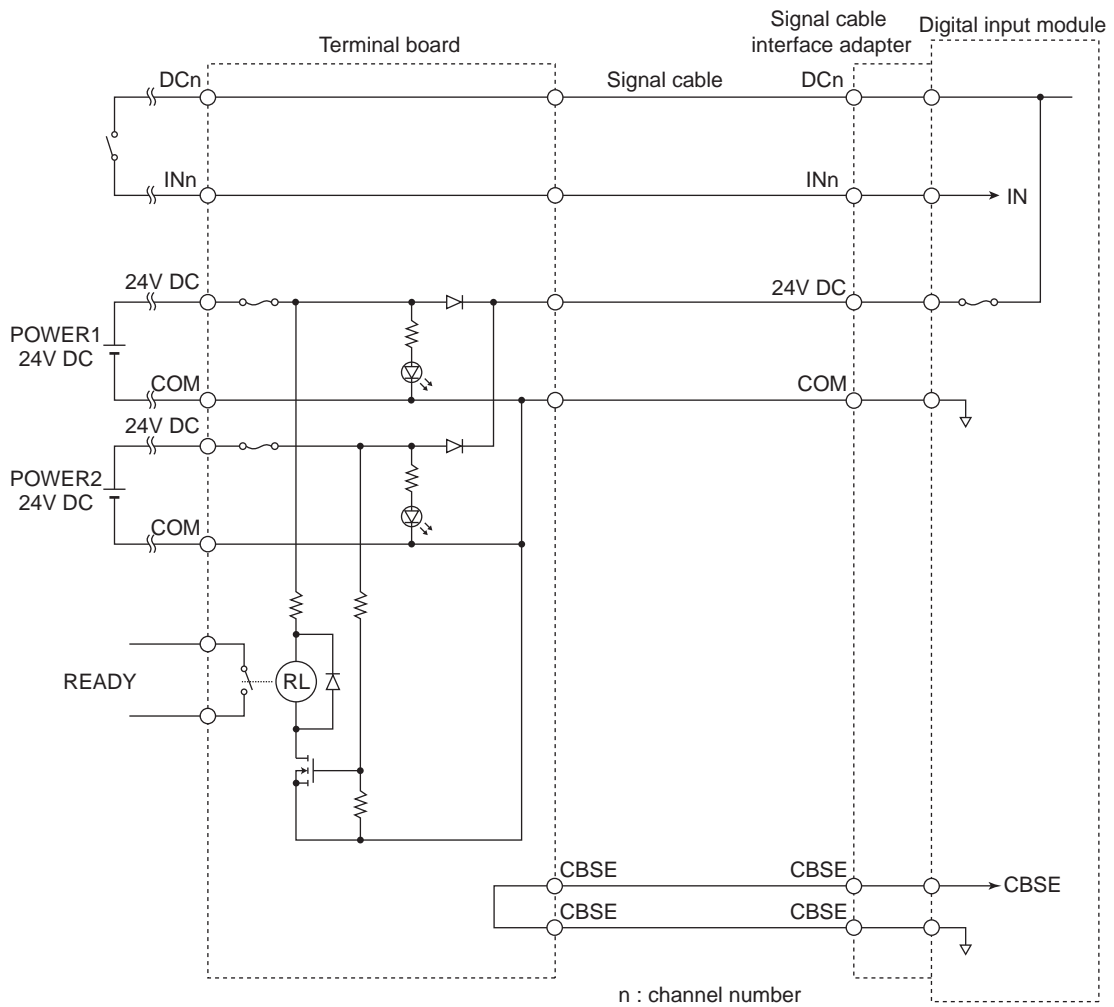


Figure 5.6-7 SDV144 Circuit Diagram

● Digital Output Modules SDV521, SDV531, and SDV541

SDV521 has a built-in signal cable interface adapter.

The following figure shows a connection to a 19-inch rack mountable terminal board.

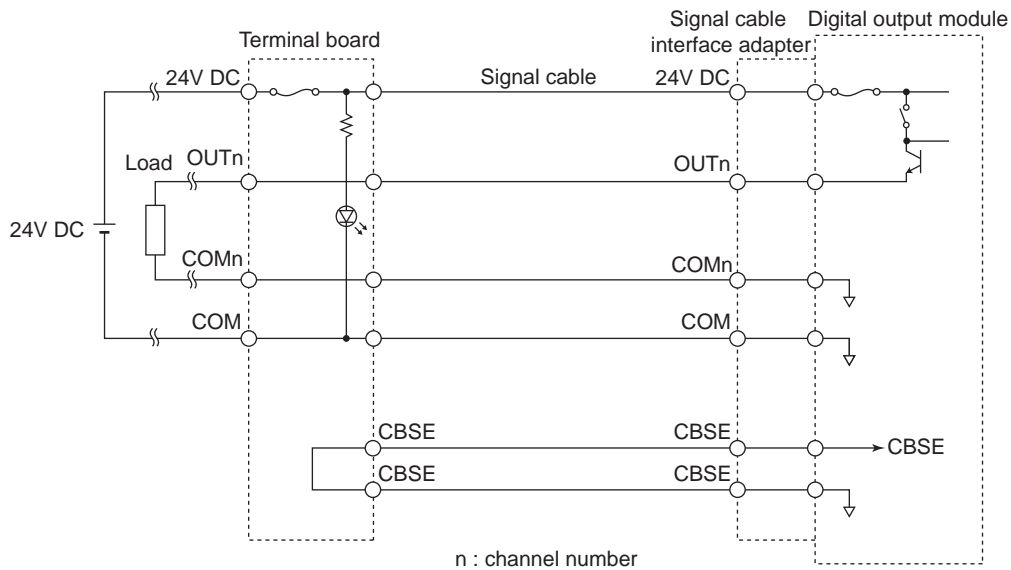


Figure 5.6-8 SDV521, SDV531, and SDV541 Circuit Diagram

The following figure shows a connection to a DIN rail mountable terminal board.

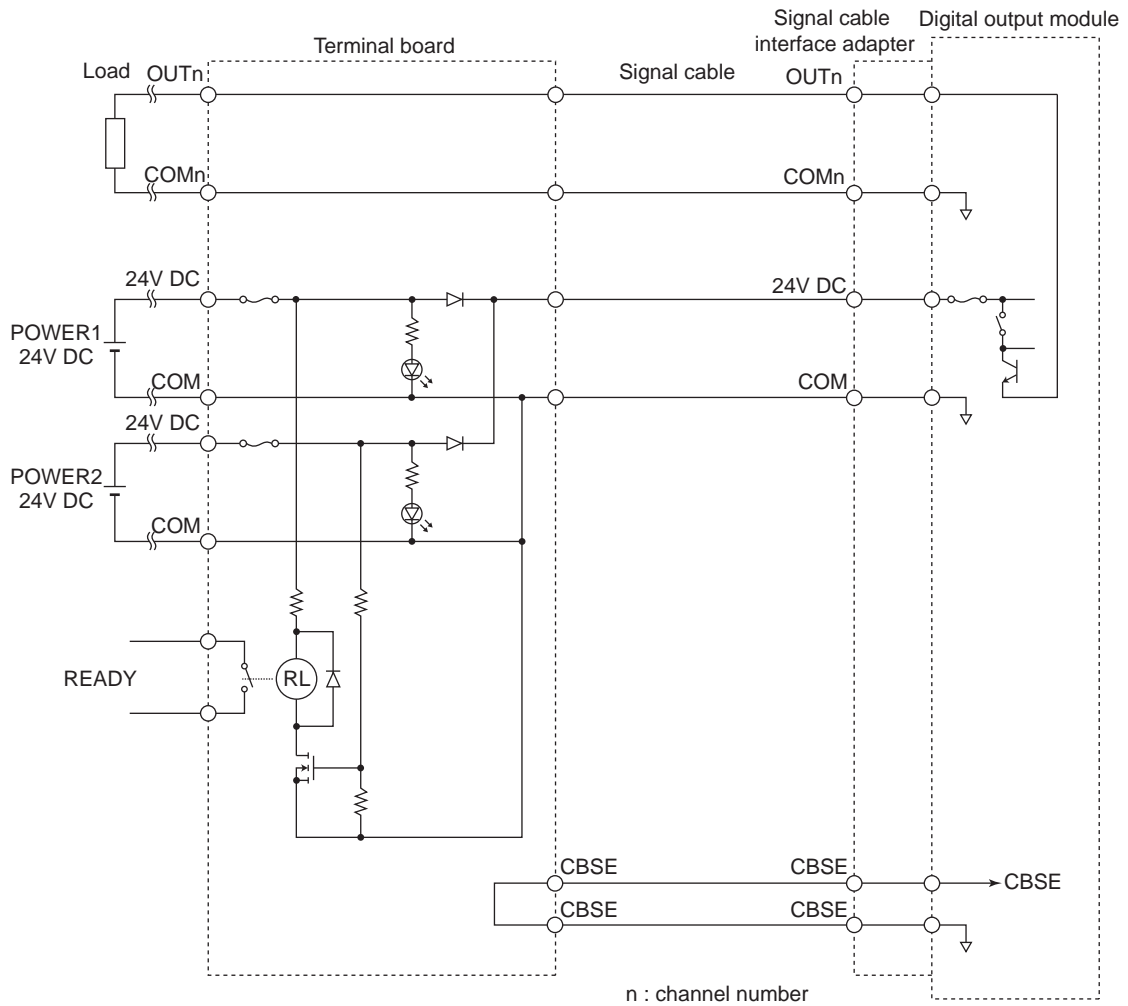


Figure 5.6-9 SDV521, SDV531, and SDV541 Circuit Diagram

● Digital Output Module : SDV526

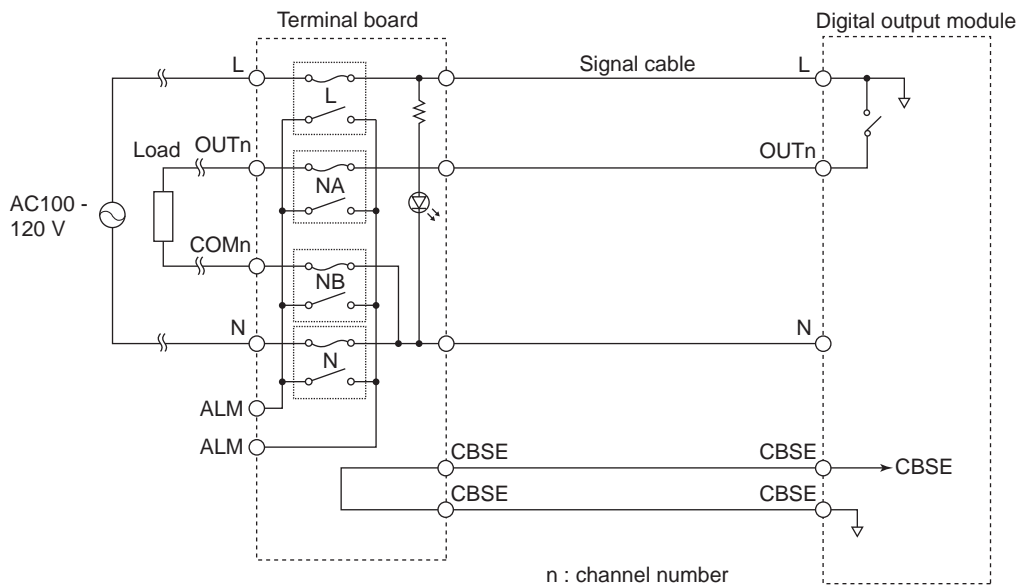


Figure 5.6-10 SDV526 Circuit Diagram

● **Digital Output Module : SDV53A**

The following figure shows a connection to a 19-inch rack mountable terminal board.

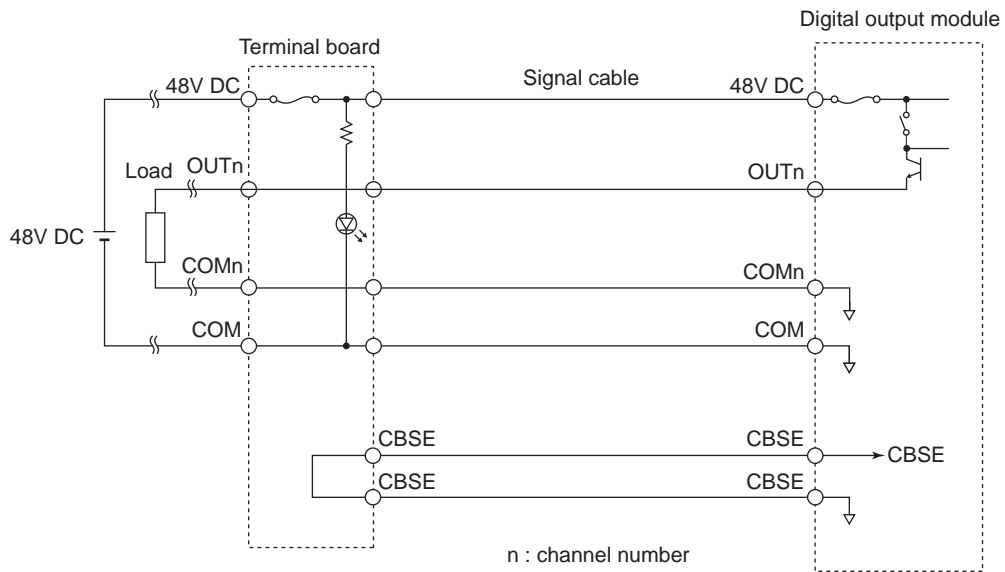


Figure 5.6-11 SDV53A Circuit Diagram

The following figure shows a connection to a DIN rail mountable terminal board.

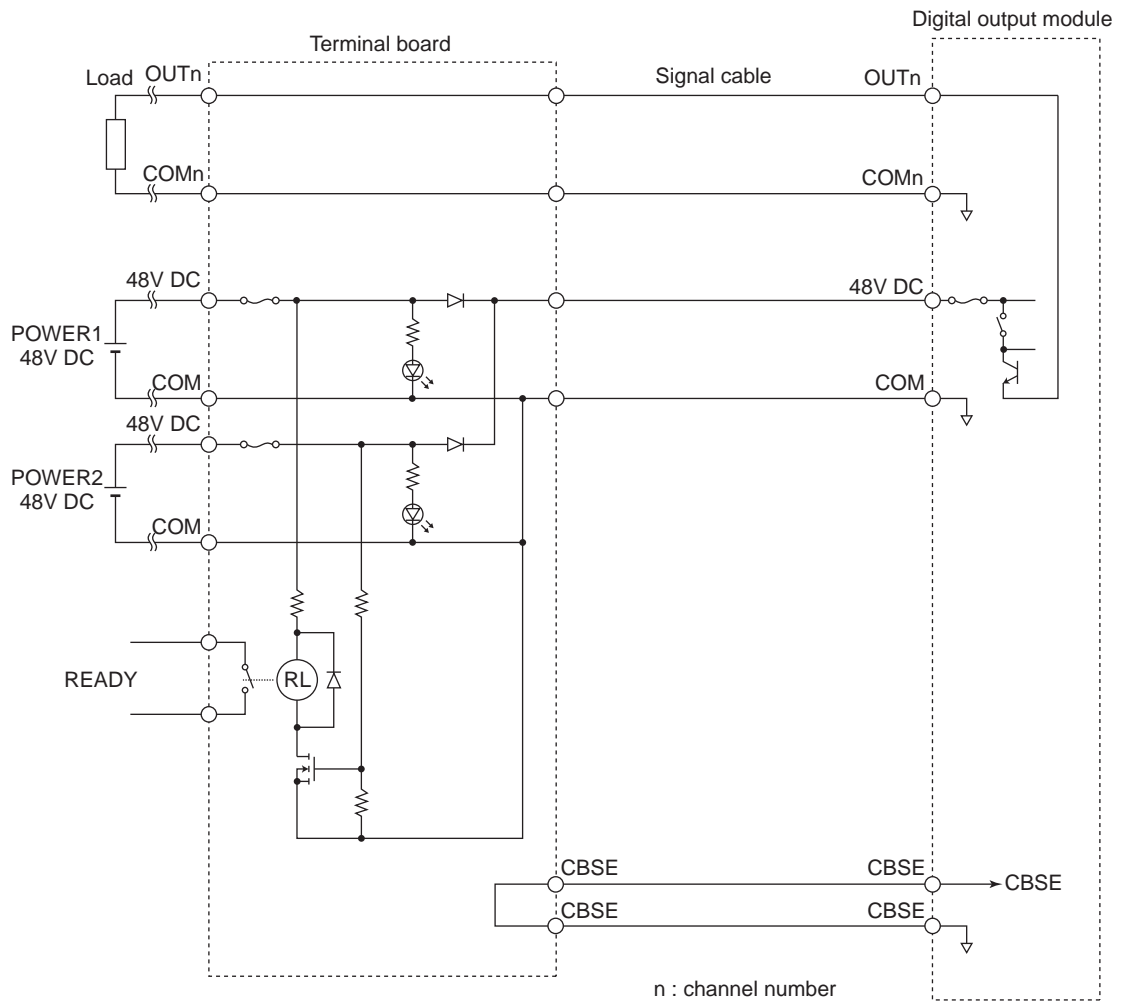


Figure 5.6-12 SDV53A Circuit Diagram

6. Control Bus Interface Card

In a ProSafe-RS system, a safety engineering PC (SENG) is connected to safety control stations (SCSs) via the control bus interface card installed in the SENG. A control bus interface card is a communication card that is installed in PC/AT-compatible PCs.

- For V net, use a control bus interface card (Model: VF702/VF701) that supports connections to V net. The VF701 is supported in a PCI bus and the VF702 is supported in a PCI Express. The VF701 and the VF702 have the same functions so the following explanation is based on the VF702. The VF702 has two ports to support V net dual-redundancy. To perform engineering and maintenance tasks for SCSs from a SENG via V net, install a VF702 in the slot of a PC installed with SENG software, and connect V net cables (Model: YCB141) to the VF702.
- For Vnet/IP, use a Vnet/IP interface card (Model: VI702/VI701) that supports connections to Vnet/IP. The VI701 is supported in a PCI bus and the VI702 is supported in a PCI Express. The VI701 and the VI702 have the same functions so the following explanation is based on the VI702. The VI702 has two ports to support Vnet/IP dual-redundancy. To perform engineering and maintenance tasks for SCSs from a SENG via Vnet/IP, install a VI702 in the slot of a PC installed with SENG software, and connect cables to the VI702.

6.1 Front Panel of the Control Bus Interface Card

The control bus interface card (Model: VF702) can be used for control communication on V net.

- Control bus interface card VF702: PCI Express

■ Configuration

- RCV lamp
This lamp illuminates when a signal is received.
- SND lamp
This lamp illuminates when a signal is sent.
- BNC connector
This connector is used to connect the V net cable to the VF702
It is necessary to connect a T-type connector to this BNC connector.

The front panel of VF702 is shown as follows:

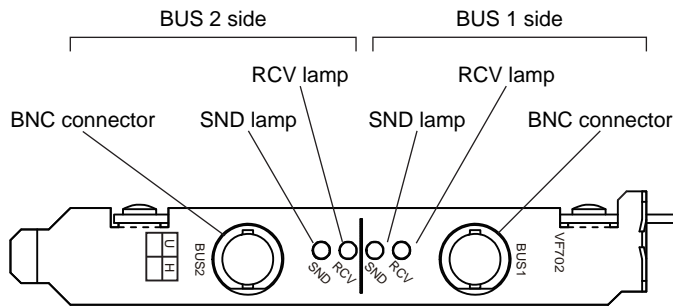


Figure 6.1-1 Control Bus Interface Card (VF702)

6.2 Setting Control Bus Interface Card Station Address

The station address is defined by a combination of a domain number and a station number. The DIP switches for setting the domain number and the station number are located at the same position on the printed circuit board of the VF702, as shown in the following figure.

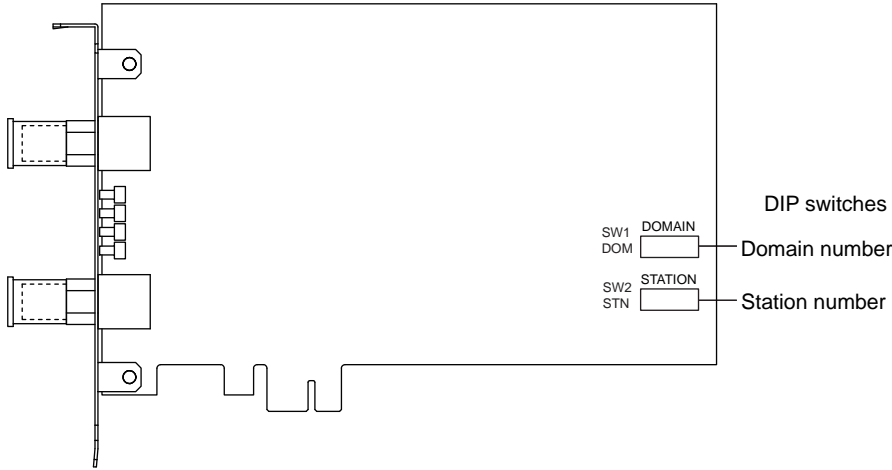


Figure 6.2-1 Location of DIP switches on VF702

Set the domain number and station number using the following DIP switches.

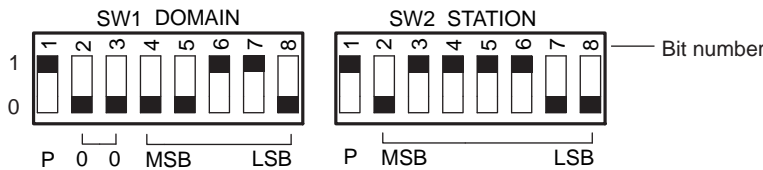


Figure 6.2-2 DIP Switches for Station Address Setting

■ Setting the Domain Number

Unless other specified, all bits are set to 0 (OFF) at shipment from the factory.

Domain is a range of stations connected by the single V net. Set the domain number in the range of 1 to 31. Set the DIP switches as shown in the following table to set the necessary domain number.

- Setting DIP switches
 - 0: The switch is flipped down in the following diagram.
 - 1: The switch is flipped up in the following diagram.

Bit 2 and 3 of the DIP switches are always 0.

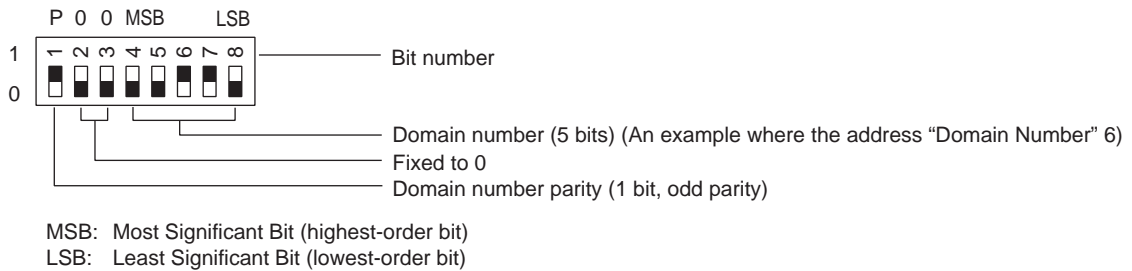


Figure 6.2-3 DIP Switches for Domain Number Setting

Table 6.2-1 Domain Numbers and Switch Positions

Domain number	DIP switch bit number							
	1	2	3	4	5	6	7	8
1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	1	0
3	1	0	0	0	0	0	1	1
4	0	0	0	0	0	1	0	0
5	1	0	0	0	0	1	0	1
6	1	0	0	0	0	1	1	0
7	0	0	0	0	0	1	1	1
8	0	0	0	0	1	0	0	0
9	1	0	0	0	1	0	0	1
10	1	0	0	0	1	0	1	0
11	0	0	0	0	1	0	1	1
12	1	0	0	0	1	1	0	0
13	0	0	0	0	1	1	0	1
14	0	0	0	0	1	1	1	0
15	1	0	0	0	1	1	1	1
16	0	0	0	1	0	0	0	0
17	1	0	0	1	0	0	0	1
18	1	0	0	1	0	0	1	0
19	0	0	0	1	0	0	1	1
20	1	0	0	1	0	1	0	0
21	0	0	0	1	0	1	0	1
22	0	0	0	1	0	1	1	0
23	1	0	0	1	0	1	1	1
24	1	0	0	1	1	0	0	0
25	0	0	0	1	1	0	0	1
26	0	0	0	1	1	0	1	0
27	1	0	0	1	1	0	1	1
28	0	0	0	1	1	1	0	0
29	1	0	0	1	1	1	0	1
30	1	0	0	1	1	1	1	0
31	0	0	0	1	1	1	1	1

■ Setting the Station Number

Set the station number in the range of 1 to 64. To set a station number, set the DIP switches as shown in the following table.

- Setting DIP switches
 - 0: The switch is flipped down in the following diagram.
 - 1: The switch is flipped up in the following diagram.

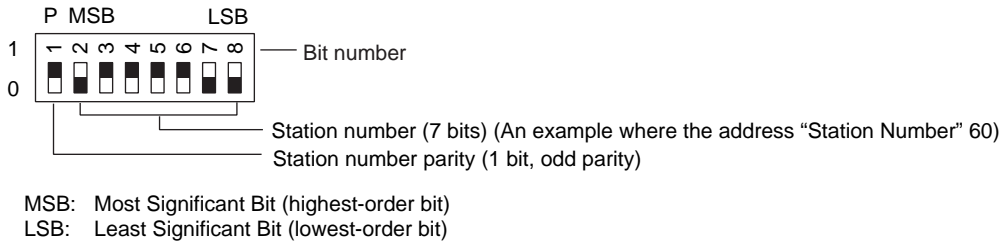


Figure 6.2-4 DIP Switches for Setting Station Numbers

Table 6.2-2 Station Numbers and Switch Positions

Station number	DIP switch bit number							
	1	2	3	4	5	6	7	8
1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	1	0
3	1	0	0	0	0	0	1	1
4	0	0	0	0	0	1	0	0
5	1	0	0	0	0	1	0	1
6	1	0	0	0	0	1	1	0
7	0	0	0	0	0	1	1	1
8	0	0	0	0	1	0	0	0
9	1	0	0	0	1	0	0	1
10	1	0	0	0	1	0	1	0
11	0	0	0	0	1	0	1	1
12	1	0	0	0	1	1	0	0
13	0	0	0	0	1	1	0	1
14	0	0	0	0	1	1	1	0
15	1	0	0	0	1	1	1	1
16	0	0	0	1	0	0	0	0
17	1	0	0	1	0	0	0	1
18	1	0	0	1	0	0	1	0
19	0	0	0	1	0	0	1	1
20	1	0	0	1	0	1	0	0
21	0	0	0	1	0	1	0	1
22	0	0	0	1	0	1	1	0
23	1	0	0	1	0	1	1	1
24	1	0	0	1	1	0	0	0
25	0	0	0	1	1	0	0	1
26	0	0	0	1	1	0	1	0
27	1	0	0	1	1	0	1	1
28	0	0	0	1	1	1	0	0
29	1	0	0	1	1	1	0	1
30	1	0	0	1	1	1	1	0
31	0	0	0	1	1	1	1	1
32	0	0	1	0	0	0	0	0

Continues on the next page

Table 6.2-2 Station Numbers and Switch Positions (Table continued)

Station number	DIP switch bit number							
	1	2	3	4	5	6	7	8
33	1	0	1	0	0	0	0	1
.					.			
.					.			
.					.			
60	1	0	1	1	1	1	0	0
61	0	0	1	1	1	1	0	1
62	0	0	1	1	1	1	1	0
63	1	0	1	1	1	1	1	1
64	0	1	0	0	0	0	0	0

6.3 Installing the Control Bus Interface Card to a PC

The VF702 is installed in a slot of a PC (PC/AT compatible). The card is used for connecting the computer to the V net. This section explains how to install the VF702 in a PC.

**SEE
ALSO**

For more information about how to treat PCs when installing VF702, refer to:

The instruction manuals of the target PCs

■ Installation Procedure

1. Turn off the power of the PC. For safety, remove the power plug from the outlet.
2. Set the station address for the VF702.
3. Remove the cover of the PC.
4. Insert the VF702 in the corresponding slot and fix it to the slot.
5. Put back the cover of the PC.
6. Write the station address on the label that comes with the VF702 and stick it on the front or another easy-to-see location of the PC.

**SEE
ALSO**

For more information about station address setting, refer to:

[6.2, "Setting Control Bus Interface Card Station Address" on page 6-3](#)

For more information about the label used to record the station address, refer to:

[6.5, "Attaching the V net Station Address Label" on page 6-10](#)

For more information about installing VF702 driver to the PC, refer to:

[B3.3, "Configuring Network Settings" in Installation \(IM 32Q01C50-31E\)](#)

6.4 Connecting V net Cables to the Control Bus Interface Card

This section explains how to connect a V net cable to the VF702.

■ Connecting V net Cable

V net is always dual-redundantly configured. Connect the optional T-type connectors (BNC coaxial connector: YCB146) to BUS1 and BUS2 terminals on VF702.

- Connect the V net cable from the previous station to one side of the T-type connector of the BUS1.
- Connect a V net cable for the next station to the other side. Connect a V net terminator (part number: YCB148) if this is a terminal station.

Perform the same procedure for bus 2.

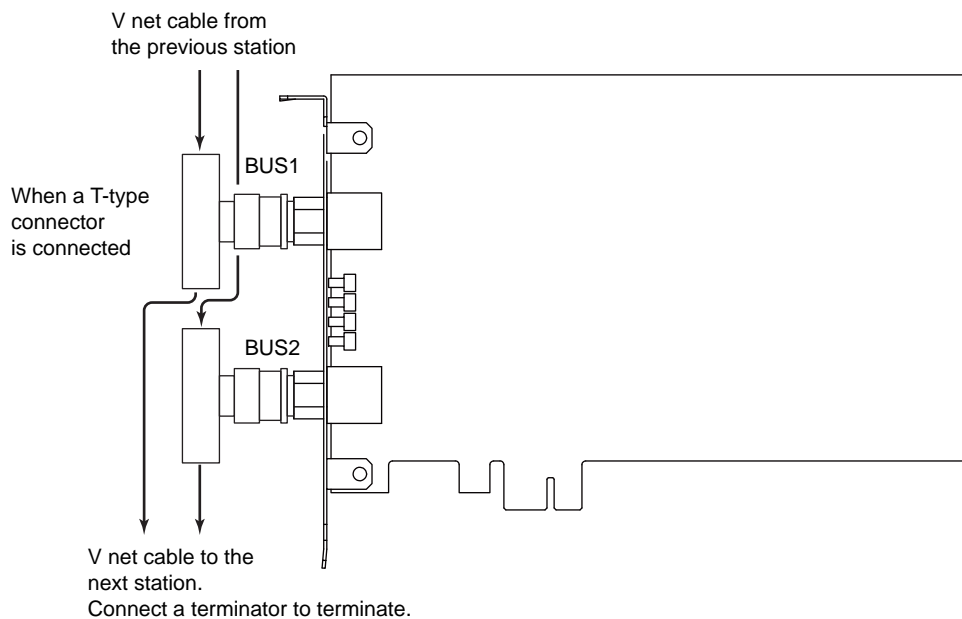


Figure 6.4-1 Connecting V net Cables (with T-type connectors: VF702)

■ Installing the Insulation Sheets

After the V net cable is connected to the VF702, cover the T-type connector with an insulation sheet so as to prevent damages in case the connector unintentionally contacts with other metal objects. The insulation sheet can be simply fastened since it has an adhesive surface. The following figure shows the steps to cover the T-type connector with insulation sheets. The insulation sheets are provided with the T-type connector (2 sheets).

- Sandwich the T-type connector with the insulation sheets with their adhesive surface facing each other.
- Make sure the metal part of the T-type connector is not exposed, then press the two insulation sheets firmly so there are no space in between.

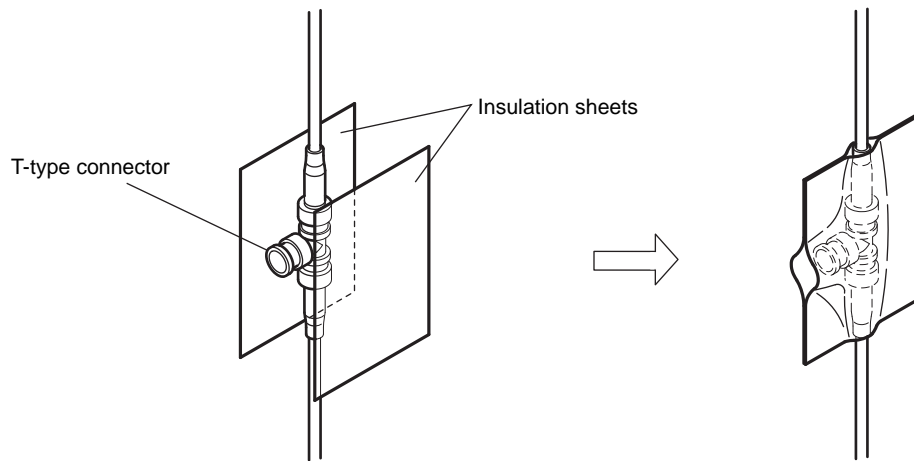


Figure 6.4-2 Installing Insulation Sheets

6.5 Attaching the V net Station Address Label

You need to write the decided domain number and the station number to the station address seal attached to the VF702. Stick the seal at the front side of the computer where the VF702 is installed or any other place that can be easily noticed.

STATION ADDRESS	
DOMAIN NO.	STATION NO.

Figure 6.5-1 Station Address Label

6.6 Front Panel of the Vnet/IP Interface Card

The Vnet/IP interface card (Model: VI702) can be used for control communication and open communication on Vnet/IP network.

- Vnet/IP interface card VI702: PCI Express

■ Configuration

- RDY lamp
This lamp illuminates to indicate that the card is working properly as the result of the periodic diagnosis.
- RCV lamp
This lamp illuminates when a signal is received.
- SND lamp
This lamp illuminates when a signal is sent.
- Vnet/IP connector
These connectors are used for connecting with the Layer2 Switch.
The connector type is RJ45.

The front panel of VI702 is shown as follows:

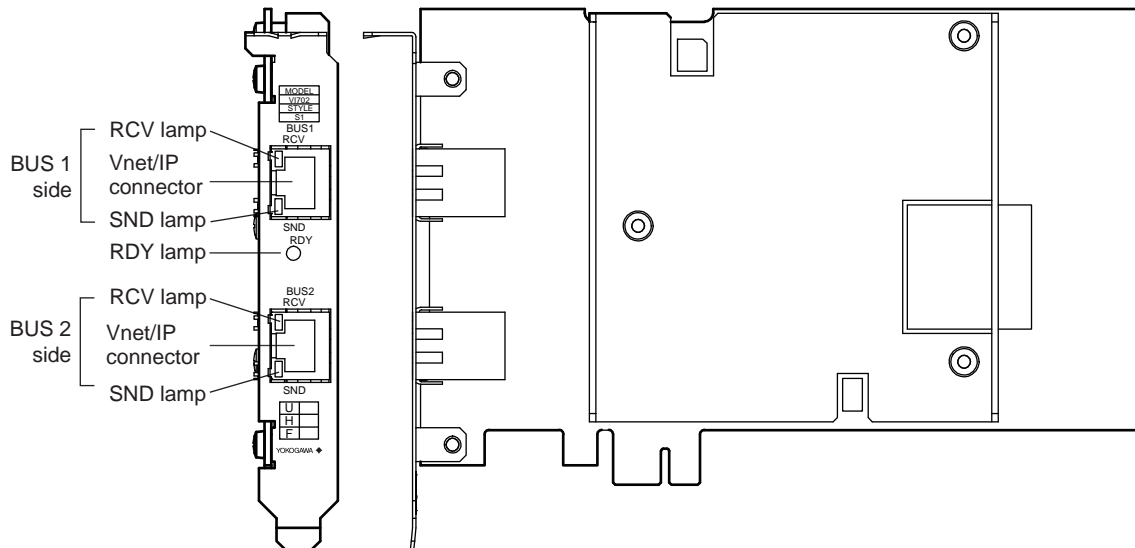


Figure 6.6-1 Vnet/IP Interface Card (VI702)



IMPORTANT

Note the following points when installing and uninstalling the VI702.

- Always install the VI702 before installing the control bus driver and Vnet/IP open communication driver.
If the VI702 is installed after the control bus driver, the VI702 is not recognized. In this case, delete the driver, install the VI702, and then install the driver again.
- If the control bus driver and Vnet/IP driver are installed and you want to uninstall the VI702, delete these drivers first. If this procedure is not followed, an error dialog box will be displayed after restarting the PC and communication might not be possible.

6.7 Setting the Vnet/IP Interface Card Station Address

The station address is defined by a combination of a domain number and a station number.

■ Setting the Station Number

The DIP switches for setting the domain number and the station number are located at the same position on the printed circuit board of the VI702 as shown in the following figure.

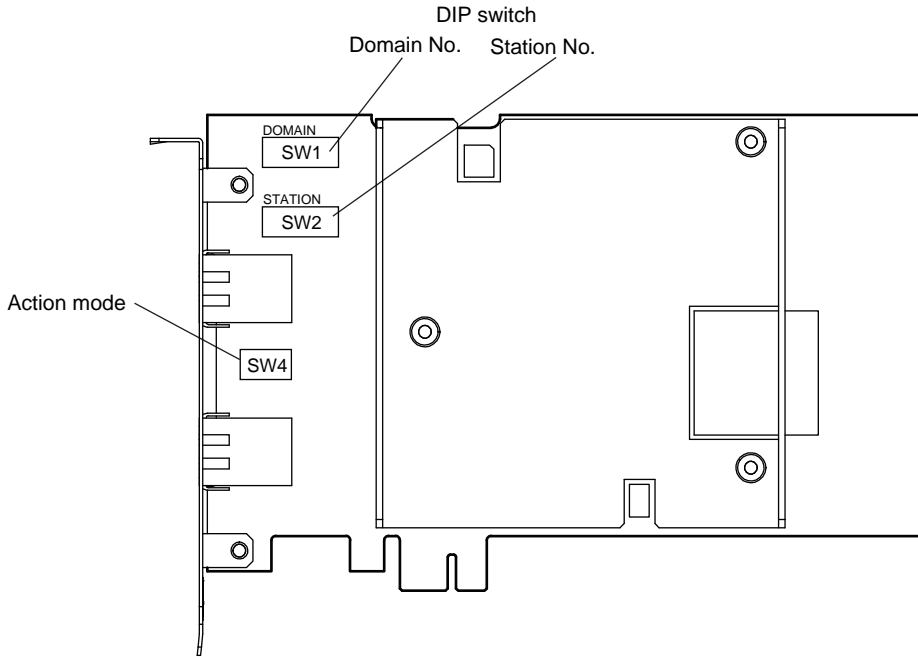


Figure 6.7-1 Location of DIP Switches (VI702)

Set the domain number and station number with the following DIP switches.

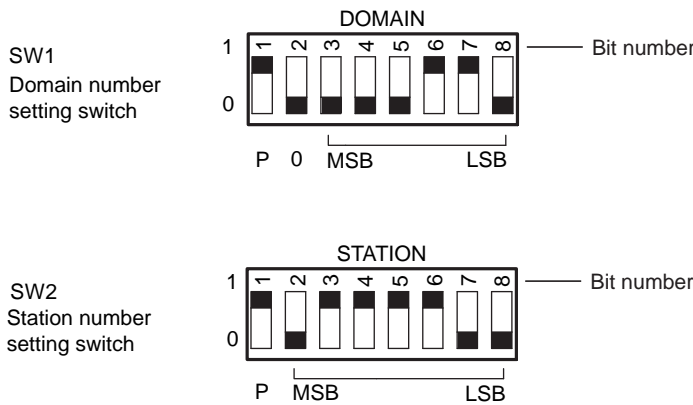


Figure 6.7-2 DIP Switches for Station Address Setting

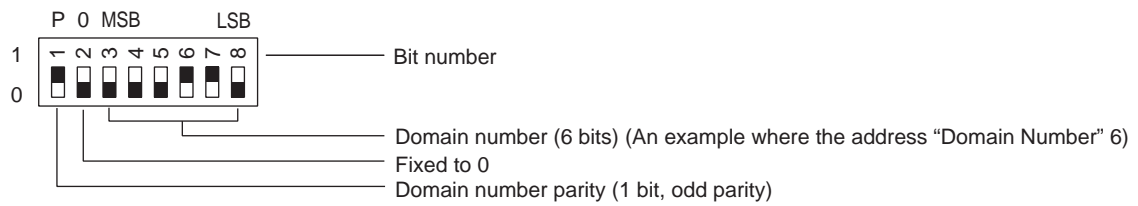
● Setting the Domain Number

Unless otherwise specified, all bits are set to 0 (OFF) at shipment from the factory.

Domain is a range of stations connected by a single Vnet/IP. Set the domain number in the range of 1 to 31. Set the DIP switches as shown in the following table to set the necessary domain number.

- Setting DIP switches
 - 0: The switch is flipped down in the following diagram.
 - 1: The switch is flipped up in the following diagram.

Bit 2 of the DIP switch is always 0.



MSB : Most Significant Bit (highest-order bit)
 LSB : Least Significant Bit (lowest-order bit)

Figure 6.7-3 DIP Switches for Domain Number Setting

Table 6.7-1 Domain Numbers and Switch Positions

Domain number	DIP switch bit number							
	1	2	3	4	5	6	7	8
1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	1	0
3	1	0	0	0	0	0	1	1
4	0	0	0	0	0	1	0	0
5	1	0	0	0	0	1	0	1
6	1	0	0	0	0	1	1	0
7	0	0	0	0	0	1	1	1
8	0	0	0	0	1	0	0	0
9	1	0	0	0	1	0	0	1
10	1	0	0	0	1	0	1	0
11	0	0	0	0	1	0	1	1
12	1	0	0	0	1	1	0	0
13	0	0	0	0	1	1	0	1
14	0	0	0	0	1	1	1	0
15	1	0	0	0	1	1	1	1
16	0	0	0	1	0	0	0	0
17	1	0	0	1	0	0	0	1
18	1	0	0	1	0	0	1	0
19	0	0	0	1	0	0	1	1
20	1	0	0	1	0	1	0	0
21	0	0	0	1	0	1	0	1
22	0	0	0	1	0	1	1	0
23	1	0	0	1	0	1	1	1
24	1	0	0	1	1	0	0	0
25	0	0	0	1	1	0	0	1
26	0	0	0	1	1	0	1	0
27	1	0	0	1	1	0	1	1

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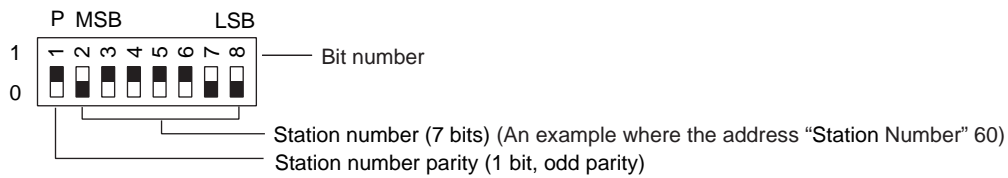
Table 6.7-1 Domain Numbers and Switch Positions (Table continued)

Domain number	DIP switch bit number							
	1	2	3	4	5	6	7	8
28	0	0	0	1	1	1	0	0
29	1	0	0	1	1	1	0	1
30	1	0	0	1	1	1	1	0
31	0	0	0	1	1	1	1	1

● **Setting the Station Number**

Set the station number in the range of 1 to 64. To set a station number, set the DIP switches as shown in the following table.

- Setting DIP switches
 0: The switch is flipped down in the following diagram.
 1: The switch is flipped up in the following diagram.



MSB : Most Significant Bit (highest-order bit)
 LSB : Least Significant Bit (lowest-order bit)

Figure 6.7-4 DIP Switches for Setting Station Numbers

Table 6.7-2 Station Number and DIP Switch Positions

Station number	DIP switch bit number							
	1	2	3	4	5	6	7	8
1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	1	0
3	1	0	0	0	0	0	1	1
4	0	0	0	0	0	1	0	0
5	1	0	0	0	0	1	0	1
6	1	0	0	0	0	1	1	0
7	0	0	0	0	0	1	1	1
8	0	0	0	0	1	0	0	0
9	1	0	0	0	1	0	0	1
10	1	0	0	0	1	0	1	0
11	0	0	0	0	1	0	1	1
12	1	0	0	0	1	1	0	0
13	0	0	0	0	1	1	0	1
14	0	0	0	0	1	1	1	0
15	1	0	0	0	1	1	1	1
16	0	0	0	1	0	0	0	0
17	1	0	0	1	0	0	0	1
18	1	0	0	1	0	0	1	0

Continues on the next page

Table 6.7-2 Station Number and DIP Switch Positions (Table continued)

Station number	DIP switch bit number							
	1	2	3	4	5	6	7	8
.	.							
.	.							
.	.							
30	1	0	0	1	1	1	1	0
31	0	0	0	1	1	1	1	1
32	0	0	1	0	0	0	0	0
33	1	0	1	0	0	0	0	1
.	.							
.	.							
.	.							
60	1	0	1	1	1	1	0	0
61	0	0	1	1	1	1	0	1
62	0	0	1	1	1	1	1	0
63	1	0	1	1	1	1	1	1
64	0	1	0	0	0	0	0	0

Action Mode Switch

SW4 on the printed circuit board is the action mode switch.

Use the card with all the bits of this DIP switch set to OFF (factory set defaults). The meaning of DIP switch bits are as follows:

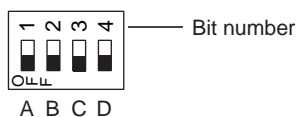


Figure 6.7-5 Action Mode Switch

Table 6.7-3 DIP Switch Usage

	DIP switch ON	DIP switch OFF	Remarks
A (bit 1)	-	Always OFF	Reserved
B (bit 2)	100 Mbps	1 Gbps	Communication speed (Default : OFF)
C (bit 3)	Force	Auto	Negotiation (Default : OFF)
D (bit 4)	-	Always OFF	Reserved

6.8 Installing the Vnet/IP Interface Card in a PC

The VI702 is installed in a slot of a PC (PC/AT compatible).

This section explains how to install the VI702 in a PC.



IMPORTANT

- Do not turn on the power of the PC until the cables for Vnet/IP are connected.
- Turn off the power of the PC before disconnecting the cables for Vnet/IP.
- For a ProSafe-RS system that is not integrated with other systems, before installing the VI702 to the PC, all internal settings in the VI702 should be erased in accordance with the procedure for erasing VI702 internal settings.
For a ProSafe-RS system that is integrated with CENTUM system, there is no need to erase the internal settings of the VI702.

SEE ALSO

For more information about how to treat PCs when installing VI702, refer to:

The instruction manuals of the target PCs

■ Installation Procedure

TIP

For ProSafe-RS systems that are not integrated with other systems, follow the procedure for erasing VI702 card internal settings, and then start the installation according to the following procedure.

1. Turn off the power of the PC. For safety, remove the power plug from the outlet.
2. Correctly set the DIP switches for the domain number, station number, and Action Mode (DIP SW4).
3. Remove the cover of the PC.
4. Insert the VI702 in the corresponding slot and fix the card.
5. Put back the cover of the PC.
6. Connect the cables to both ports of BUS1 and BUS2. There is no need to turn off the power of the Layer2 Switch.
7. Put back the power cord of the PC.
8. Turn on the power of the PC.
9. Make sure that the RDY lamp on VI702 is ON.
10. Write the station address to the sticker that comes with the VI702 and stick it on the front or another easy-to-see location of the PC.

● Procedure for Erasing VI702 Internal Settings

If you intend to use a VI702 card used in another system for a system configured with Pro-Safe-RS only, delete the settings within the card using the following procedure.

1. Turn off the power of the computer. For safety, remove the power plug from the outlet.
2. Set the DIP switches (SW1) for the domain number on the VI702 as follows:

Table 6.8-1 Setting of DIP Switches for Domain Number Setting (SW1)

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

3. Set the DIP switches (SW2) for the station number on the VI702 as follows:

Table 6.8-2 Setting of DIP Switches for Station Number Setting (SW2)

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

4. Check that Bit 1 through Bit 4 of the DIP switches (SW4) for the Action Mode are all set to the off position on the VI702.
5. Remove the cover of the computer.
6. Insert the VI702 in the corresponding slot and fix the card.
7. Put back the cover of the computer.
8. Do not connect the cable to either BUS1 or BUS2.
9. Put back the power cord of the computer.
10. Start the computer, and then go to BIOS setting panel instead of starting Windows. If the Windows started, it is necessary to shutdown and switch off the computer, and start the computer for BIOS setting again.
11. Wait for about a minute after BIOS setting panel appears.
12. Turn off the power of the computer. For safety, remove the power plug from the outlet.
13. Remove the VI702 from the slot.

SEE ALSO

For more information about DIP switches , refer to:

[6.7, "Setting the Vnet/IP Interface Card Station Address" on page 6-12](#)

For more information about going to BIOS setting panel, refer to:

The instruction manual of the PC

■ Removal Procedure

1. Turn off the power of the PC. For safety, remove the power plug from the outlet.
2. Disconnect the cables for both BUS1 and BUS2. There is no need to disconnect the cables from the Layer2 switch.
3. Remove the VI702 from the slot.

SEE ALSO

For more information about installing Vnet/IP driver to the PC, refer to:

[B3.3, "Configuring Network Settings" in Installation \(IM 32Q01C50-31E\)](#)

6.9 Attaching the Vnet/IP Station Address Label

You need to write the decided domain number and the station number to the station address seal attached to the VI702. And then stick the seal at the front side of the computer where the VI702 is installed or any other place that can be easily noticed.

STATION ADDRESS	
DOMAIN NO.	STATION NO.

Figure 6.9-1 Station Address Label

7. Maintenance of ProSafe-RS Hardware

The maintenance of the ProSafe-RS hardware and parts replacement procedures such as installing and removing the common modules or node units are explained in this chapter.



CAUTION

You can perform hot replacing, connecting or disconnecting the cards, cables or connectors only if it is described in this document. In general, you must switch off the power before replacing, connecting or disconnecting the cards, cables or connectors.



WARNING

- Use a vacuum cleaner or dry soft cloth to clean the devices.
 - During maintenance, use a wrist strap for ESD (Electrostatic Discharge) measures.
-

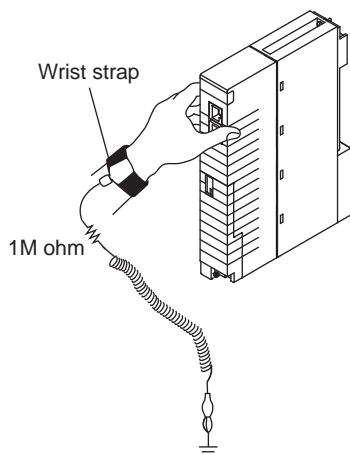
7.1 Routine Maintenance of Safety Control Unit

There are two ways of inspecting safety control unit. The status of whether the each module status display LEDs are turned on or off, (can be checked visually), or the system status can be checked in the SCS state management window at SENG.

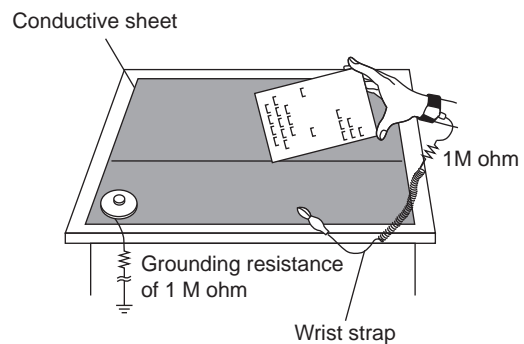
■ Antistatic Precautions

When doing maintenance work, take the following full precautions to avoid electrostatic problems.

- When storing or carrying parts for maintenance, put them in an antistatic bag. (When shipped, they are placed in an antistatic bag labeled with cautions against electrostatic problems.)
- Wear a wrist strap with a 1M ohm grounding resistor then ground the wrist strap.
- When working on the bench, place the parts on a conductive sheet grounded via a 1 M ohm resistor and wear wrist strap. Keep static-chargeable plastic materials away from the parts.
- Never touch the parts with bare hands, without using a wrist strap and a conductive sheet.



Connect the wrist strap to the grounding terminal or unpainted part of the frame (grounded).



When working with a product with battery on a conductive sheet, set the battery ON/OFF switch to the OFF position or remove the battery.

Figure 7.1-1 Using a Wrist Strap

The wrist strap and conductive sheet are available from Yokogawa's sales agents.

7.1.1 Inspection by Status Display LEDs

This section explains how to inspect modules installable on safety control units, safety node units, and unit for optical bus repeater module.

■ Inspection of LEDs

Power supply modules, processor modules, bus interface modules, and I/O modules have status display LEDs. It can easily be identified whether or not a module is operating normally by checking whether these LEDs are turned on or off.

Table 7.1.1-1 Types and Functions of Status Display LEDs of Common Modules

Modules name	Indicator	Meaning of ON		Meaning of OFF	
Power supply module	SYS	+5 V output normal		+5 V output abnormal	
	FLD	+24 V output normal		+24 V output abnormal	
Processor module	HRDY	Hardware normal		Hardware abnormal	
	RDY	Ready for control		Module abnormal	
	CTRL	Module is operating normally		Module stand-by	
	COPY	Copying		Not copying	
	RCV-1, 2	Control bus1/bus2 in reception (*1)		Not receiving	
	SND-1, 2	Control bus1/bus2 send status(*1)		Not sending	
	SYNC	SCP401	Synchronizes with V net clock or IRIG-B clock		Cannot synchronize with V net clock or IRIG-B clock
		SCP461/SCP451	Synchronizes with Vnet/IP clock		Cannot synchronize with Vnet/IP clock
	SCTY	SCS Security: Online level		SCS Security: Offline level	
STATUS-1 to 8	Action mode/error status; domain and station numbers		-		
ESB bus coupler module SEC401	RCV	Receiving ESB bus frames from node units		Not receiving	
	SND	Sending ESB bus frames to node units		Not sending	
ESB bus coupler module SEC402	RCVL	Receiving responses from node units through ESB Bus lower port		Not receiving	
	RCVU	Receiving responses from node units through ESB Bus upper port		Not receiving	
	SND	Sending commands to node units through ESB Bus lower or upper port		Not sending	
ESB bus interface module	STATUS	Hardware normal		Hardware abnormal	
	SEL	In data transmission to I/O module		Not sending	
	RSP	In data reception from I/O module		Not receiving	

Continues on the next page

Table 7.1.1-1 Types and Functions of Status Display LEDs of Common Modules (Table continued)

Modules name	Indicator	Meaning of ON	Meaning of OFF
ESB bus bus repeater module	STATUS	Hardware normal	Hardware abnormal
	RCV	Receiving ESB bus frames	Not receiving
	SND	Sending ESB bus frames	Not sending
	OPT RCV-1	Optical transmission frame is now being received.	Not receiving
	OPT SND-1	Optical transmission frame is now being sent.	Not sending
	NODE-1	DIP switch is set to 1.	DIP switch is set to 0.

*1: On SCP461/SCP451 processor module, when the LED turns on, it flashes.

Table 7.1.1-2 Types and Functions of Status Display LEDs of I/O Modules and Communication Modules

Modules name	Indicator	Meaning of ON	Meaning of OFF
Analog input/output modules Digital input/output modules	STATUS	Hardware normal	Hardware abnormal
	ACT	Performing input/output	Not performing
	DX	Set to dual-redundant operation	Set to single operation
Digital input/output modules	1 to 16 ch	Input/output ON	Input/output OFF
	1 to 8 ch	Output ON	Output OFF
	1 to 4 ch	Output ON	Output OFF
Communication module ALR111 ALR121	STATUS	Hardware normal	Hardware abnormal
	ACT	Controlling status / ready for communication	Standby status / communication stopped
	DX	Dual-redundant operation normal	Single operation/ Dual-redundant operation abnormal
	RCV-1	Receiving RS1.	Standby status
	SND-1	Sending RS1.	Standby status
	RCV-2	Receiving RS2.	Standby status
	SND-2	Sending RS2.	Standby status
Ethernet communication module ALE111	STATUS	Hardware normal	Hardware abnormal
	ACT	Controlling status / ready for communication	Standby status / communication stopped
	DX	Always off	
	RCV	Receiving data	Standby status
	SND	Sending data	Standby status
	LINK	Link established	Link not established

7.1.2 Inspection by SCS State Management Window

The SCS state management window can be opened from the SCS Maintenance Support Tool on SENG. On the SCS state management window, the safety control unit status, I/O module status and control bus status can be inspected.

It is recommended to periodically check the running states of the SCS components and I/O modules other than checking the running states only when trouble occurs.

The following figure shows the SCS state management window.

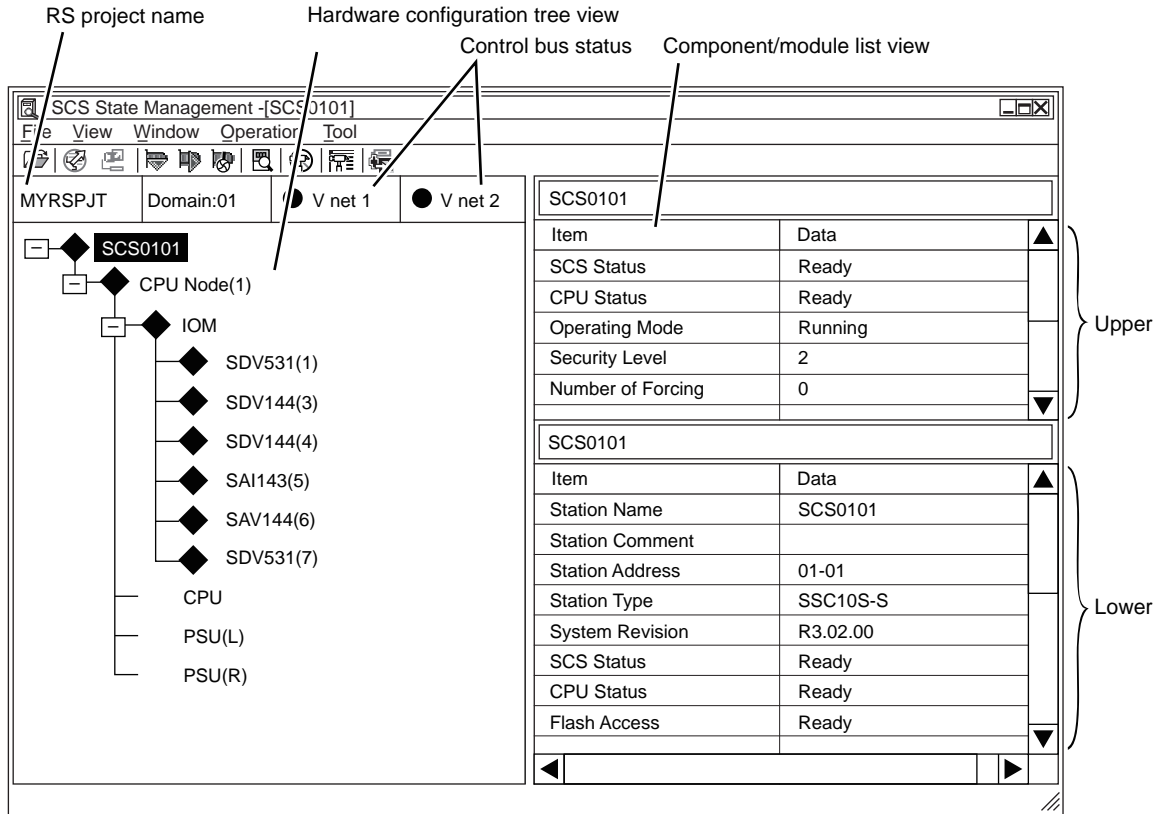


Figure 7.1.2-1 SCS State Management Window (In Case the V net is Connected)

SEE ALSO For more information about SCS state management window, refer to:

3.1.2, "Management of SCS States" in Utilities and Maintenance Reference (IM 32Q04B20-31E)

7.2 Replacing Common Modules

This section explains how to remove or install the common modules of the safety control unit. The dual-redundantly configured modules can be removed and installed without turning off the power supply to the safety control unit.

The detailed procedures for the following modules are explained.

- V net Coupler Unit
- Power Supply Module
- Processor Module
- ESB Bus Coupler Module
- ESB Bus Interface Module
- Optical ESB Bus Repeater Module

7.2.1 Replacing V net Coupler Unit

V net coupler unit is to be replaced according to the following procedure.

■ Removal Procedure

1. Make sure the V net coupler not to be replaced is working normally and the communication switch (ENBL/DSBL) is at ENBL position.
2. Turn the communication switch (ENBL/DSBL) of the V net coupler to be replaced to DSBL position.
3. Remove the branch connectors with the connected V net cables from the V net coupler unit.
4. Remove the V net coupler cables from the V net coupler unit.
5. Loosen the two screws that fixing the V net coupler unit to utility unit.
6. Pull out the V net coupler unit straight.

SEE ALSO

For more information about connecting and disconnecting the V net cable, refer to:

[3.3.1, "Connecting V net Cable" on page 3-9](#)

■ Procedure for Installing V net Coupler Unit

1. Turn the communication switch (ENBL/DSBL) on the coupler to be installed to DSBL position.
2. Put the branch connector to the V net coupler unit with V net cable connected.
3. Connect the V net coupler cable to the V net coupler unit.
4. Insert the V net coupler unit into the deep end of the utility unit and make sure the unit is firmly connected to the slot at the backboard. And then fasten the screws in order to fix the V net coupler unit.
5. Turn the communication switch (ENBL/DSBL) on the coupler to ENBL position.
6. Check the front lamps of processor module or the SCS state management window to make sure that the V net coupler unit is at normal state.

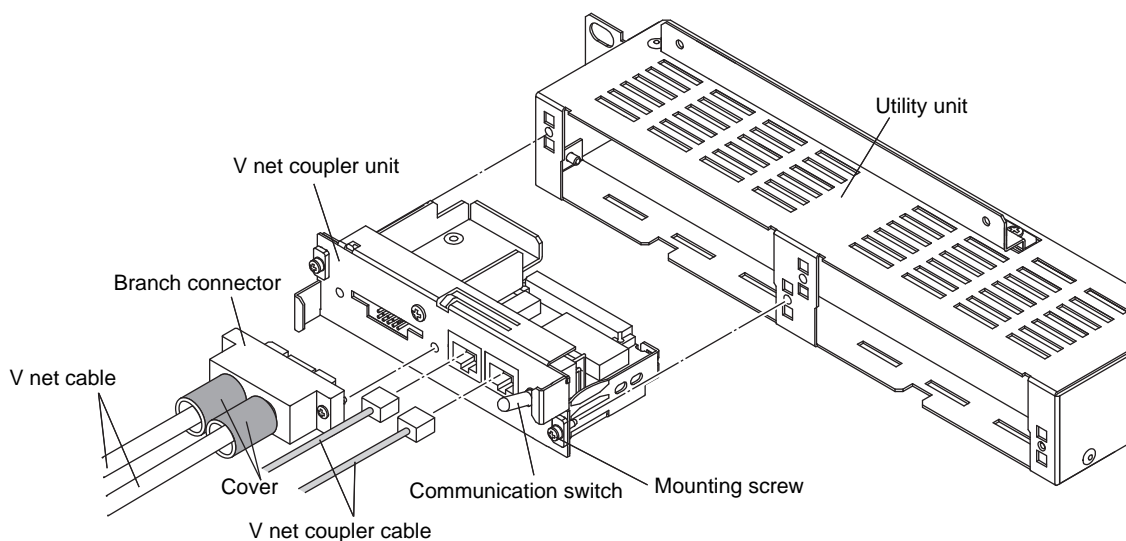


Figure 7.2.1-1 Replacement of V net Coupler Unit

7.2.2 Replacing Power Supply Module

This section describes how to replace the power supply modules.



IMPORTANT

It is necessary to switch off the power supply before removing the power supply modules and make sure that the power status indication LED is off.

If the power distribution unit of Yokogawa is used, the power supply of the power supply module can be cut by disconnecting the power cable from the power distribution unit.

TIP

The specifications for the power supply module for ProSafe-RS I/O nodes are based on using a dual-redundant configuration. You must observe this note if the processor module of the non-redundant safety control unit or at least one of the processor modules of the dual-redundant safety control unit is as follows:

SCP401 of unit version "U:5" or earlier

SCP451 of unit version "U:4" or earlier

If an error occurs and only one of the paired modules powers up, or a power failure occurs on one module, and you have no choice but to continue in the non-redundant state, the diagnostic information message (No. 0065) for the ESB bus interface module (SSB401) error might be generated for that node. After about one second the system recovers. This phenomenon occurs very rarely and it does not indicate the abnormality of SSB401 module and the related ESB bus and devices. It does not harm communication either.

Prevention:

The power supply modules should be kept in dual-redundant configuration.

Restoration:

If the abnormality indication disappears in a second, there is no need to do anything about it.

When one of the paired power supply modules fails, the failed module should be replaced with a good one as soon as possible so as to return to the normal state (dual-redundant power supply configuration).

■ Procedure for Removing Power Supply Modules

1. Shut off the power supply of the power supply module to be removed.
2. Disconnect the power cable from the power supply input terminals.
3. Remove the fixing screws of the power supply module. There is one at the upper part and two at the bottom part.
4. Pull the power supply module forward and remove it from the base unit.

■ Procedure for Installing Power Supply Modules



IMPORTANT

Use a phillips screwdriver or screwdriver to tighten the screws for fixing the power supply module. As a guideline, the screw tightening torque should be approximately 0.5 N•m.

Install the power supply module following the steps of the "Procedure for Removing Power Supply Modules" in the reverse order.

1. Install the power supply module on the base unit.
2. Fix screws in one place at the upper part and two places at the bottom part of the power supply module.

3. Connect the power cable to the power supply input terminals.
4. Switch on the power supply.
If the power distribution unit of Yokogawa is used, the power of the power supply module can be supplied by connecting the power cable to the power distribution unit.

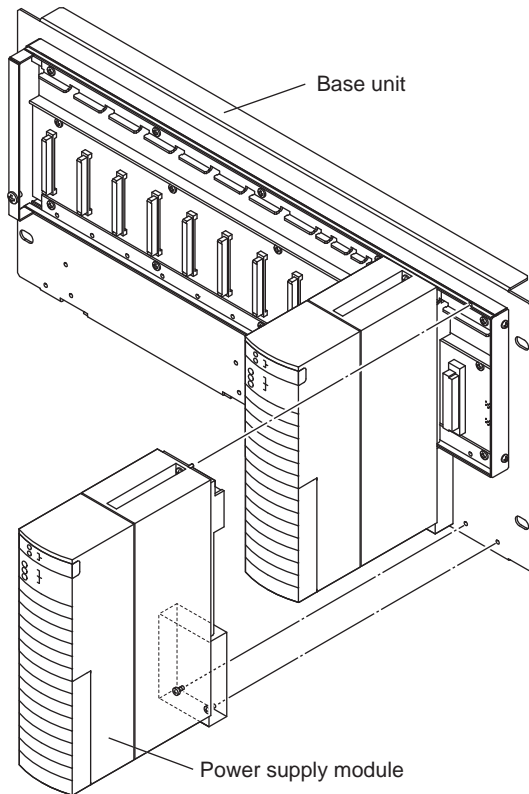


Figure 7.2.2-1 Replacing Power Supply Module

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.

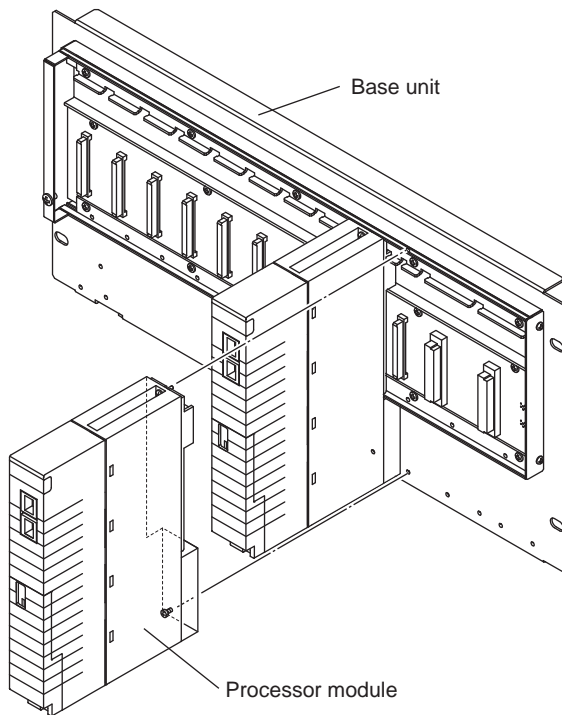


Figure 7.2.3-1 Replacing the Processor Module

**SEE
ALSO**

For more information about DIP switches, refer to:

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

7.2.4 Replacing ESB Bus Coupler Module

Replace ESB bus coupler module according to the following procedure.

■ Procedure for Removing ESB Bus Coupler Module

1. Remove the fixing screws of the ESB bus coupler module. There is one at the upper part and one at the bottom part.
2. Pull the ESB bus coupler module forward and remove it from the base unit.
3. Remove the upper and lower part screws of the cable connector thus to remove the ESB bus coupler module.

■ Procedure for Installing ESB Bus Coupler Module



IMPORTANT

Use a Phillips screwdriver to tighten the screws to secure the ESB bus coupler module. As a guideline, the screw tightening torque should be approximately 0.5 N•m.

Install the ESB bus coupler module following the steps of the "Procedure for Removing ESB Bus Coupler Module" in the reverse order.

1. Install the cable connector on the ESB bus coupler module to be installed.
2. Use the screws at the upper and lower part of the connector to fasten the cable connector.
The torque to fasten the screws on ESB bus connector is about 0.3 N•m.
3. Install the ESB bus coupler module into the base unit.
4. Fix screws in one place at the upper part and one place at the bottom part of the ESB bus coupler module.

You can check the status of hardware in the SCS State Management Window.

7.2.5 Replacing ESB Bus Interface Module

Replace ESB bus interface module according to the following procedure.

■ Procedure for Removing ESB Bus Interface Module

1. Remove the fixing screws of the ESB bus interface module. There is one at the upper part and one at the bottom part.
2. Pull the ESB bus interface module forward and remove it from the base unit.
3. Remove the upper and lower part screws of the connector unit for ESB bus thus to remove the ESB bus interface module.
4. Remove the connector unit for ESB bus. But do not disconnect the ESB bus cable connected to the connector unit for ESB bus.

■ Procedure for Installing ESB Bus Interface Module



IMPORTANT

Use a phillips screwdriver to tighten the screws for fixing the ESB bus interface module. As a guideline, the screw tightening torque should be approximately 0.5 N·m.

Install the ESB bus interface module following the steps of the "Procedure for Removing ESB Bus Interface Module" in the reverse order.

1. Set the ESB address of the ESB bus interface module to be installed to the same address as the removed ESB bus interface module.
2. Install the connector unit for ESB bus on the ESB bus interface module to be installed.
3. Fix the upper and lower part screws on the installed connector unit for ESB bus.
4. Pinch the upper and lower parts of the ESB bus interface module and install it on the base unit.
5. Fix screws in one place at the upper part and one place at the bottom part of the ESB bus interface module.
6. Make sure that the replaced hardware is working properly.

Whether the ESB bus interface module is working properly or not can be figured out by checking the front indication lamp or checking the status on the SCS state management window.

7.2.6 Replacing Optical ESB Bus Repeater Module

Replace Optical ESB bus repeater module according to the following procedure.

■ Procedure for Removing Optical ESB Bus Repeater Master Module

1. Remove the fiber-optic cable connected from the optical ESB bus repeater master module.
Cap the cable to prevent dust infiltration.
2. Remove the fixing screws of the optical ESB bus repeater master module. There is one at the upper part and one at the bottom part.
3. Pull the optical ESB bus repeater master module forward and remove it from the base unit.
4. Remove the upper and lower screws on the connector unit for ESB bus on the optical ESB bus repeater master module.
5. Remove the connector unit for ESB bus. But do not disconnect the ESB bus cable connected to the connector unit for ESB bus.

■ Procedure for Installing Optical ESB Bus Repeater Master Module



IMPORTANT

Use a phillips screwdriver to tighten the screws for fixing the optical ESB bus repeater master module. As a guideline, the screw tightening torque should be approximately 0.5 N•m.

Install the optical ESB bus repeater master module following the steps of the "Procedure for Removing Optical ESB Bus Repeater Master Module" in the reverse order.

1. Screw the connector unit for ESB bus to the optical ESB bus repeater master module.
2. Fix the upper and lower part screws on the installed connector unit for ESB bus.
3. Install the optical ESB bus repeater master module into the base unit.
4. Use two screws at the upper and lower part of the connector to fasten the optical ESB bus repeater master module.
5. Uncap the fiber-optic cable and connect it to the optical ESB bus repeater master module. The fiber-optic cable has an IN end and an OUT end. Be sure you connect the correct end.
6. Check the diagnostic information window on the SENG for any errors.

■ Procedure for Removing Optical ESB Bus Repeater Slave Module

1. Remove the fiber-optic cable connected from the optical ESB bus repeater slave module.
Cap the cable to prevent dust infiltration.
2. Remove the fixing screws of the optical ESB bus repeater slave module. There is one at the upper part and one at the bottom part.
3. Pull the optical ESB bus repeater slave module forward and remove it from the base unit.
4. Remove the upper and lower screws on the cable connector on the optical ESB bus repeater slave module.

■ Procedure for Installing Optical ESB Bus Repeater Slave Module



IMPORTANT

Use a phillips screwdriver to tighten the screws for fixing the optical ESB bus repeater slave module. As a guideline, the screw tightening torque should be approximately 0.5 N•m.

Install the optical ESB bus repeater slave module following the steps of the "Procedure for Removing Optical ESB Bus Repeater Slave Module" in the reverse order.

1. Screw the cable connector to the optical ESB bus repeater slave module.
2. Use the screws at the upper and lower part of the connector to fasten the cable connector.
The torque to fasten the screws on ESB bus connector is about 0.3 N•m.
3. Install the optical ESB bus repeater slave module into the base unit.
4. Use the two screws at the upper and lower part of the connector to fasten the optical ESB bus repeater master module.
5. Uncap the fiber-optic cable and connect it to the optical ESB bus repeater slave module. The fiber-optic cable has an IN end and an OUT end. Be sure you connect the correct end.
6. Check the diagnostic information window on the SENG for any errors.

7.2.7 Exchange ESB Bus Cables

Replace the ESB bus cable according to the following procedure.

■ Procedure of Exchanging ESB Bus Cables

1. When exchanging a bus cable, the corresponding bus becomes the abnormal status. For an instance, before changing the Bus 1 cable, make sure that the communication to all the nodes and I/O modules by Bus 2 is working properly.
2. Disconnect the ESB bus cable from the ESB bus coupler module (SEC402/SEC401) or ESB bus interface module (SSB401) of Bus 1.
3. Exchange the ESB bus cables.
4. Connect the ESB bus cable to the ESB bus coupler module or ESB bus interface module. The torque to fasten the screws on ESB bus connector is about 0.3 N·m.
5. Make sure that the replaced hardware is working properly.

7.2.8 Exchange Fiber-Optic Cables

Replace Fiber-optic cable according to the following procedure.

■ Procedure of Exchanging Fiber-Optic Cables

1. Disconnect the fiber-optic cable from the optical ESB bus repeater module. Cap the cable to prevent dust infiltration.
2. Exchange the fiber-optic cables.
3. Uncap the fiber-optic cable and connect it to the optical ESB bus repeater module. The connector that connects the fiber optic cable has an IN end and an OUT end. Be sure you connect the correct end.
4. Check the diagnostic information window on the SENG for any errors.

7.3 Replacing Input/Output Modules

In this section, installation and maintenance as well as replacement of the I/O modules are explained.

7.3.1 Notices on Maintenance of Input/Output Modules

Notices on maintenance of I/O modules are explained in this section. LED indications are explained as follows:

LED= [STATUS, ---, ---] only the STATUS lamp is lit, ACT and DX are unlit.

LED= [STATUS, ACT, DX] all lamps are lit.

■ Replacing Modules

SEE ALSO

For more information about how to replace input/output modules, refer to:

7.3.2, "How to Replace Input/Output Modules" on page 7-23

For more information about operations and recovery procedures when an error occurs, refer to:

B6., "Actions taken at error occurrence and recovery procedure" in Safety Control Station Reference (IM 32Q03B10-31E)

● Replacing a Module in Single Configuration



IMPORTANT

When replacing a digital output module, pay attention to the followings:

If the output signal status is ON, you should not remove the front cable or terminal block since sparks may occur at connectors. (Sparks may damage the connectors or worsen the connection quality.)

1. If you are replacing a digital output module, set the outputs on all channels to OFF. (To set the outputs to OFF, lock the module from the I/O Lock Window or set the output value by application logic.)
2. Remove the front cable or the terminal block.
3. Loosen the screws that fix the module, then pull out the module from the base unit.
4. Install a new module into the base unit, then tighten the screws to fix the module.
5. For the replaced module, perform IOM downloading from the SCS State Management window of SCS Maintenance Support Tool.
6. Restore the front cable or the terminal block.
7. Make sure that the replaced hardware is working properly.

● Replacing the Standby Module of a Pair of Dual-Redundantly Configured Module

1. Remove the front cable or the terminal block.
2. Loosen the screws that fix the module, then pull out the module from the base unit.
3. Install a new module into the base unit, then tighten the screws to fix the module.
4. You will need to perform an IOM download for the replaced module. However, for an SCS that has the SCS system program R2.03 or higher, if Automatic IOM Download is set to [Enable] in the SCS Constants Builder, the IOM download will be performed automatically. (*1)
5. Make sure that the LED status is LED= [STATUS, ---, DX]
6. Attach the cable or terminal block.

7. Make sure that the replaced hardware is working properly.

*1: If it is not set to download automatically, execute the IOM download in the SCS State Management window for the SCS Maintenance Support Tool.

**SEE
ALSO**

For more information about SCS Constants Builder, refer to:

[3.1.3, "SCS Constants Builder" in Engineering Reference \(IM 32Q04B10-31E\)](#)

● Replacing the Active Module of a Pair of Dual-Redundantly Configured Modules

It is necessary to switch the control right from the running module to the standby module adjacent to it. Thus replacing the module can be performed with the following two steps.

- Step 1. : Switch the control right of the dual-redundantly configured module. (As described in the following section, "Switching Control Right ")
- Step 2. : Replace the module using the same procedure as replacing a standby module. (As described in previous section, "Replacing the Standby Module of a Pair of Dual-Redundantly Configured Modules")



IMPORTANT

When the I/O modules are dual-redundantly configured, if the active I/O module is severed from the field connections, the related safety loop maybe affected.

■ Switching Control Right

The control right can be switched from the active module to the standby module.

- A tool for switching the control right of the dual-redundantly configured I/O modules is available on SENG,
- To use this tool, the security level "1" is required



WARNING

Do not remove the cables or terminal blocks from the active modules. Though removing the cable or terminal block may force the control right to be switched to standby modules, IOP occurs and the relevant loops may be shutdown.

7.3.2 How to Replace Input/Output Modules

This section explains how to install an I/O module in a safety control unit or safety node unit (hereafter referred to as a node), and how to remove the module from a node. I/O modules can be removed and installed without turning off the power supply of the node.

■ Removing from and Installing on Base Units

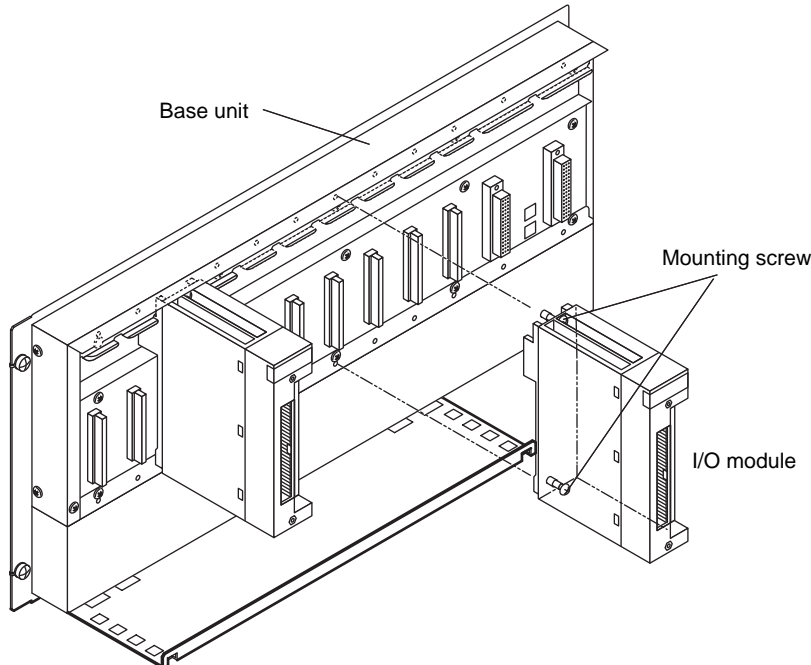


Figure 7.3.2-1 Removing I/O Modules

● Removal Procedure

1. Remove the cables for external wiring and terminal block.
2. Remove the fixing screws in one place at the upper part and one place at the lower part of the I/O module.
3. Pull the I/O module forward and remove it from the base unit.

● Installation Procedure

1. Install the I/O module following the steps of the "Removal Procedure" in the reverse order.
2. The tightening torque of the fixing screws should be approximately 0.5 N•m.
3. Install the cables for external wiring and terminal block.

■ Procedures for Removing and Installing Terminal Blocks

Remove the connector cover part of the external connection cable (if connecting via a MIL connector) or the terminal block (if connecting via a pressure clamp terminal block) before replacing the I/O module.

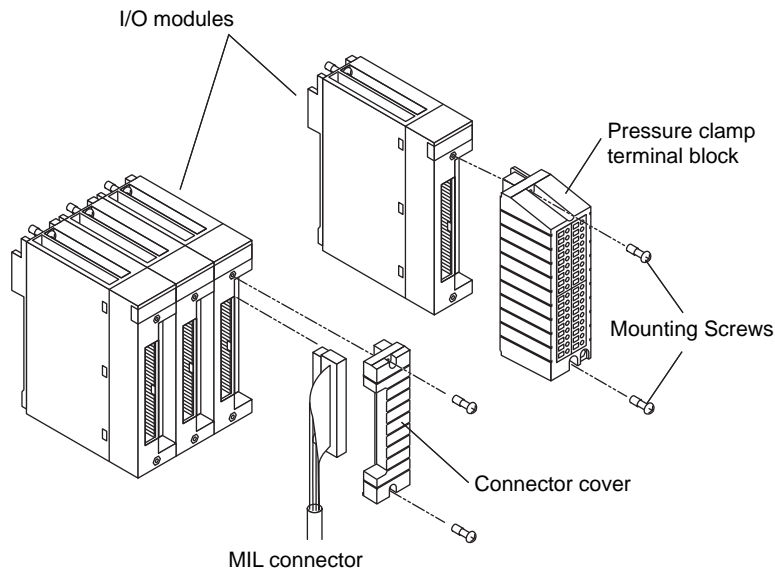


Figure 7.3.2-2 Removing Terminal Blocks

● Removal Procedure

1. Remove the fixing screws. There are two screws in the case of a terminal block or a MIL connector cover.
2. Pull the terminal block forward and remove it from the I/O module.

● Installation Procedure

1. Install the terminal block following the steps of the "Removal Procedure" in the reverse order.
2. The tightening torque of the fixing screws should be approximately 0.5 N•m.

■ Replacing Input/Output Modules in Dual-Redundant Connection

I/O modules in dual-redundant connection must be connected to consecutive slots beginning from an odd number.

● Removal and Installation Procedure

1. Check the LED displays of the pair of I/O modules in dual-redundant connection to see that the STATUS and DX LEDs are lit for both modules and ACT is lit for only one of them.
2. Remove the four screws at the upper and lower parts of the terminal block.
3. Remove the terminal block while supporting it so as not to apply too much stress to the flat cable.
4. While supporting the terminal block, remove the connector connected to the I/O module whose ACT LED is not lit.
5. Remove the two screws of the I/O module whose ACT LED is not lit, and replace it with an adjusted I/O module. Fix the screws of the replaced I/O module.
6. Download the setting information to the replaced I/O module. In SCS Constants Builder, if Automatic IOM Download is set to [Enable], the IOM download will be performed automatically.(*1)
7. Reinstall the flat cable connector.

8. Fix the screws of the terminal block.

*1: Automatic IOM Download feature is available for the R2.03 or newer version SCS System Programs.

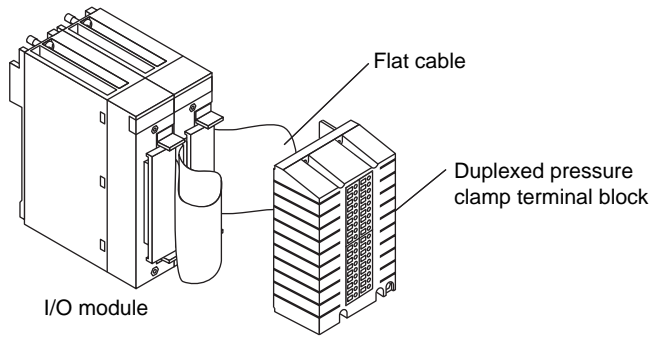


Figure 7.3.2-3 Connection of Dual-Redundant Connection Cables

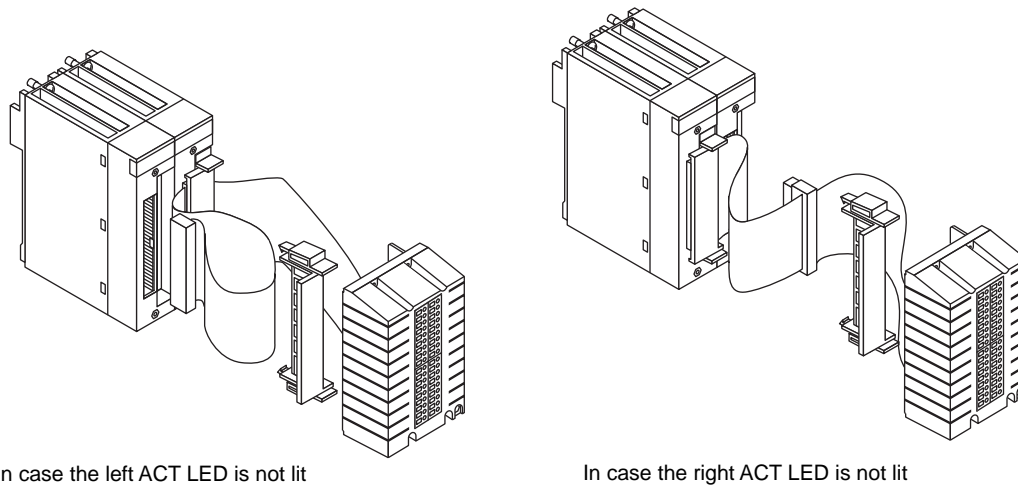


Figure 7.3.2-4 Removing Dual-Redundant Connection Cables

SEE ALSO For more information about SCS Constants Builder, refer to:

[3.1.3, "SCS Constants Builder" in Engineering Reference \(IM 32Q04B10-31E\)](#)

7.3.3 How to Change Fuse of Contact Digital Input Module (SDV144 Style S1, S2, and S3)

In order to protect the module from the over current damage caused by short circuit between the input channel and the ground, a fuse is placed in front of the module styles S1 to S3. When the fuse is blown up by the short circuit, the fuse can be changed online without pulling the whole module out from its slot. The part number of the fuse is A1327EF and it is not the part with specified life span.

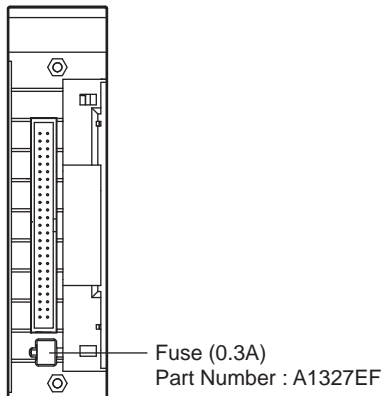


Figure 7.3.3-1 Front Side of the SDV144 Style S1, S2, and S3

The procedure for replacing the fuse is as follows:

■ Procedure

1. Make sure that the contact input does not have short circuit.
2. Pull out the fuse to be replaced. Using a long-nose pliers can easily pull out the fuse.
3. Before putting the new fuse, make sure it has the same nominal current as the replaced one.
4. Insert the fuse with the imprints facing up.
5. Connect the signal cable to the module connector, and then check if the module is working properly.



IMPORTANT

When replacing the fuses of dual-redundantly configured modules, pay attention to the following:

When both fuses on controlling side module and standby side module are blown, alarm messages for both modules recovers at the same time even if only one fuse is changed. Please make sure to change both fuses.

7.4 Replacing Safety Node Unit

For replacing a safety node unit, satisfy the following requirements:

- Switch off the power supply of the node
- The safety node unit can be replaced while the Safety Control Unit is running

When the SCS is running (online), it is necessary to be very careful to proceed according to the following procedures.

■ Procedure of Replacing Safety Node Unit

1. Check the Bus1 and Bus2 status on the SCS state management window beforehand.
2. Switch off the power supply of the safety node unit to be replaced.
3. While the ESB bus cable is connected, remove the branch connector unit for ESB bus from the SSB401 for ESB bus 1.
4. Make sure on the SCS state management window that there is no abnormality occurred other than in the node to be replaced.
5. While the ESB bus cable is connected, remove the branch connector unit for ESB bus from the SSB401 for ESB bus 2.
6. Replace the node. And make sure that the SSB401 address is correct.
7. Connect branch connector unit for ESB bus to the new SSB401.
8. Switch on the node power supply.
9. Make sure that the replaced node is running properly on the SCS state management window.

7.5 Adding Safety Node Unit

This chapter explains how to add a safety node unit at the end of the ESB bus.



IMPORTANT

After adding a new safety node unit, offline download is necessary if the version of SCS system programs is earlier than R2.03.

When adding a safety node unit, satisfy the following requirements:

- Work on one side of the ESB bus first, work on the other side only when the first side is completed.
- Adding safety node unit can be done while the Safety Control Unit is running.

When the SCS is running (online), it is necessary to be very careful to proceed according to the following procedures.

■ Adding a Safety Node Unit at the End of ESB Bus

1. Check the Bus1 and Bus2 status on the SCS state management window beforehand.
2. Work on Bus 1 of the safety control unit; pull the ESB bus coupler module (SEC402/ SEC401) forward and remove it from the base unit. ESB Bus1 will then be indicated as FAIL. At this moment, make sure that Bus 2 is normal.
3. Find the last node of Bus 1, and then separate the ESB bus branch connector (with built-in terminator) from the ESB bus interface module (SSB401) without disconnecting the cable. How to separate is illustrated in the figure of "Procedure of Separating ESB bus branch connector from ESB bus interface module."

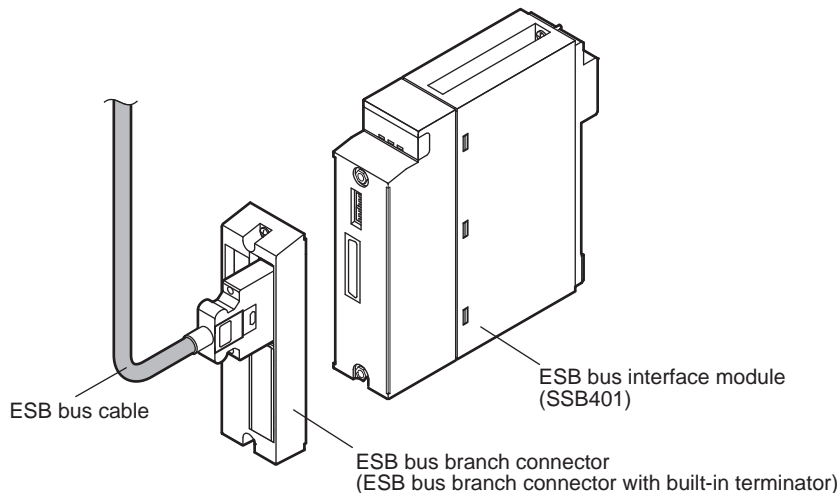


Figure 7.5-1 Separating ESB Bus Branch Connector from ESB Bus Interface Module

4. Disconnect cable from the ESB bus branch connector (with built-in terminator) that was separated from the ESB bus interface module (SSB401) on step 3.
5. Connect the cable disconnected on step 4 to an ESB bus branch connector (without built-in terminator), and then fasten the connector screws for about 0.3 N•m torque.
6. Use an ESB bus cable to connect the ESB bus branch connector (with built-in terminator) you worked on step 4 and the ESB bus branch connector (without built-in terminator) you worked on step 5.

7. Make sure that the new node unit to be added has already defined with a proper node address.
8. Connect the ESB bus branch connector (without built-in terminator) you worked on step 5 to the existing node.
9. Connect the ESB bus branch connector (with built-in terminator) you worked on step 4 to the newly added node.
10. Put back the ESB bus coupler module (SEC402/SEC401) to the base unit where you removed it from on step 2.
11. On the SCS State Management window, make sure that both ESB buses are working properly.
12. Repeat step 3 to 9 to work on Bus 2 of the ESB bus.
13. On the SCS State Management window, make sure that both ESB buses are working properly.
14. Install the I/O modules to the added node and then turn on the power supply for the added node unit.
15. Run online downloading to the I/O modules installed in the added node unit.
16. Connect the cables or terminal blocks to the I/O modules installed in the added node unit.
17. On SCS State Management window, make sure that all added hardware components are working properly.

**SEE
ALSO**

For more information about installing I/O modules and mounting the terminal blocks, refer to:

[7.3.2, "How to Replace Input/Output Modules" on page 7-23](#)

7.6 Removing Safety Node Unit

This chapter explains how to remove a safety node unit from the end of the ESB bus.

When removing a safety node unit, satisfy the following requirements:

- Work on one side of the ESB bus first, work on the other side only when the first side is completed.
- The safety node unit can be replaced while the Safety Control Unit is running

When the SCS is running (online), it is necessary to be very careful to proceed according to the following procedures.

■ Removing a Safety Node Unit from the End of ESB Bus

1. Check the Bus1 and Bus2 status on the SCS state management window beforehand.
2. Delete (online) all the definitions related to the I/O modules installed in the node to be removed. This will also delete the definition of the node.
3. Disconnect the cables of the I/O modules installed in the node, or remove the terminal blocks.
4. Loosen the two mounting screws in the upper and lower parts of the I/O module.
5. Pull the I/O module forward and remove it from the base unit.
6. Repeat step 3 to step 5 to remove all the I/O modules from the node.
7. Turn off the power supply to the node to be removed.
8. Work on Bus 1 of the safety control unit; pull the ESB bus coupler module (SEC402/ SEC401) forward and remove it from the base unit. ESB Bus1 will then be indicated as FAIL. At this moment, make sure that Bus 2 is normal.
9. Find the last node of Bus 1, and then separate the ESB bus branch connector (with built-in terminator) from the ESB bus interface module (SSB401) without disconnecting the cable.
10. Find the new last node of Bus 1, and then separate the ESB bus branch connector (without built-in terminator) from the ESB bus interface module (SSB401) without disconnecting the cable.
11. Disconnect cable from the ESB bus branch connector (with built-in terminator) that was separated from the ESB bus interface module (SSB401) on step 9.
12. Disconnect the cable that is attached to the other end of the ESB bus branch connector (without built-in terminator) that was separated from the ESB bus interface module (SSB401) on step 10.
13. Connect the cable that was disconnected on step 12 to an ESB bus branch connector (with built-in terminator), and then fasten the connector screws for about 0.3 N•m torque.
14. Connect the ESB bus branch connector (the same one mentioned in step 13) to the ESB bus interface module (SSB401) on the new last node and this node becomes the end of the bus.
15. Put back the ESB bus coupler module (SEC402/SEC401) to the base unit where you removed it from on step 8.
16. On the SCS State Management window, make sure that no abnormality occurs on the ESB bus.
17. Repeat step 9 to 14 to work on Bus 2 of the ESB bus.
18. On the SCS State Management window, make sure that no abnormality occurs on either Bus 1 or Bus 2.

**SEE
ALSO**

For more information about installing I/O modules and mounting the terminal blocks, refer to:

[7.3.2, "How to Replace Input/Output Modules" on page 7-23](#)

7.7 Parts Requiring Periodical Replacement

Read the following important points thoroughly and carry out the periodical replacement.

The parts having defined life spans, which can be replaced by the user are available as spare parts and consumables. Purchase and replace as necessary.



IMPORTANT

Precautions for parts having defined life spans

- The term “Parts having defined life spans” refers to parts that are expected to wear out or break down within 10 years from initial use under normal conditions of usage and storage. Therefore, parts with expected life spans of 10 years from more are excluded here.
- The recommended replacement cycle is the cycle estimated for preventive maintenance. It provides no guarantee against the accidental failures.
- The recommended replacement cycle is merely a reference, and varies depending on the usage conditions.
- The recommended replacement cycle is subject to change according to actual field results.

■ Periodic Replacement Parts Having Defined Life Spans

A safety control unit and safety node unit include parts having defined life spans, which require periodical replacement. The following table shows the recommended part replacement cycles for preventive maintenance.

Table 7.7-1 Periodic Replacement Parts Having Defined Life Spans

Part name	Part number	Recommended replacement cycle	Replacement by user	Remarks
Power supply module (100-120 V AC)	SPW481	8 years	Yes	At the ambient temperature of 40 deg. C or lower on average
Power supply module (220-240 V AC)	SPW482	8 years	Yes	At the ambient temperature of 40 deg. C or lower on average
Power supply module (24 V DC)	SPW484	8 years	Yes	At the ambient temperature of 40 deg. C or lower on average
Battery pack	S9185FA	3 years(*1)	Yes	At the ambient temperature of 30 deg. C or lower on average
		1.5 years (*1)	Yes	At the ambient temperature of 40 deg. C or lower on average
		9 months (*1)	Yes	At the ambient temperature of 50 deg. C or lower on average
Aluminum electrolytic capacitor	-	8 years	No(*2)	For SPW481,SPW482,SPW484 At the ambient temperature of 40 deg. C or lower on average
Fuse built in power supply unit	S9109VK	8 years	No(*2)	SPW481
	S9109VK	8 years	No(*2)	SPW482
	A1546EF	8 years	No(*2)	SPW484
Fan unit	AIP602	4 years	Yes	At the ambient temperature of 60 deg. C or lower on average

Continues on the next page

Table 7.7-1 Periodic Replacement Parts Having Defined Life Spans (Table continued)

Part name	Part number	Recommended replacement cycle	Replacement by user	Remarks
Power supply unit for fan unit	S9159FA	8 years	Yes	100-120 V AC, 220-240 V AC At the ambient temperature of 40 deg. C or lower on average
	S9160FA	8 years	Yes	24 V DC At the ambient temperature of 40 deg. C or lower on average
SFP optical module (*3)	-	-	No(*2)	Recommended replacement period: Every four years if in a G3 environment

*1: The replacement cycle for batteries includes the period during which the batteries remain unused in the battery unit.

*2: Parts indicated by a "No" in the "Replacement by user" column cannot be replaced by the user, so please contact the service department to request replacement work.

*3: Applies to SNT401, SNT411, SNT501, and SNT511.

7.7.1 Replacing Battery

This section describes replacement of battery placed in the processor module.



CAUTION

- Use only the battery specified by Yokogawa Electric Corporation.
- If the memory contents must not be cleared when replacing the battery, make sure you leave the power to the safety control unit turned on. Turning OFF the battery switch when the power is off results in the loss of all the memory contents in the processor module.

■ Expiration Date Label

On the front cover of the processor module, a label is stuck to indicate the expiration date of the battery.

The expiration date of the battery varies with the ambient temperatures.

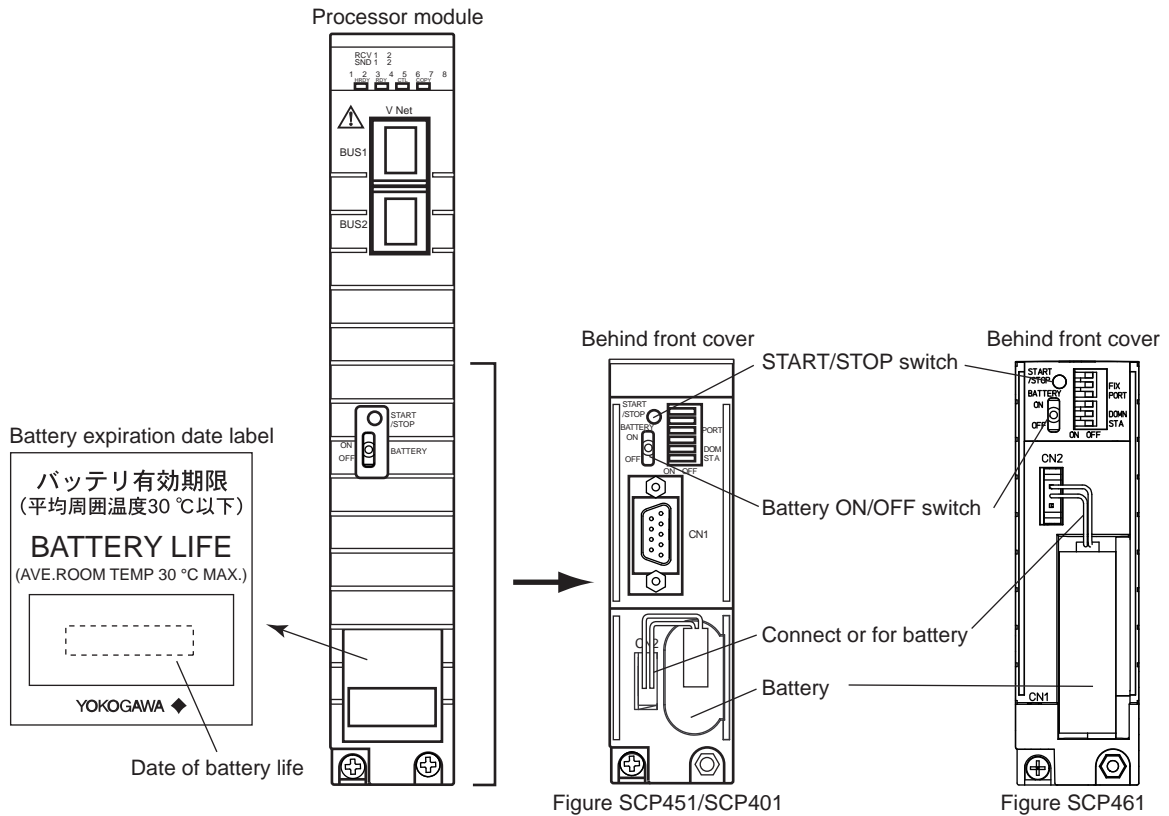


Figure 7.7.1-1 Battery Expiration Date Label

SEE ALSO For more information about battery replacement, refer to:

7.7, "Parts Requiring Periodical Replacement" on page 7-32

■ Replacing Battery

How to replace the battery is explained as follows.



WARNING

- Replace a battery pack when the validity period expires.
- Order a new battery at least one month before the validity period expires.
- Wear a wrist strap when handling a battery pack.
- Do not short-circuit the battery terminals.
- Do not heat the battery or throw a battery pack in a fire. The problems of leaking, overheating or breaking may occur.
- Do not disassemble or modify the battery pack.
- Do not use this type of battery pack to the products other than Yokogawa designated devices.
- When discarding the battery packs, they should be handled very carefully to avoid polluting environment.

● Procedure for Removing Battery

1. Open the front cover of the processor module.
2. Turn the battery ON/OFF switch to OFF position.
A stick of insulation material should be used to toggle the battery switch.
3. Disconnect the battery cable from the connector (displayed as CN2).
The battery cable connector has a self-locking elastic clip. When pulling out the connector, it is necessary to push the clip to unlock it.
4. Pull out the battery starlight.

TIP

This is an explanation about the new EU Battery Directive(DIRECTIVE 2006/66/EC).This directive is only valid in the EU.

The batteries are used in the processor modules. When you remove batteries from the processor modules, you should dispose the batteries in accordance with the domestic law concerning waste battery disposal. Take a right action on waste batteries, because the collection system in the EU on waste batteries are regulated.

Battery type: Lithium Thionyl Chloride Batteries



Figure 7.7.1-2 The Symbol Marked on Battery

The symbol marked on the battery means the battery must be separately collected as regulated by ANNEX II in DIRECTIVE 2006/66/EC.

● Procedure for Installing Battery

1. Place the battery to the specified position on the processor module.
The following figure shows the SCP451/SCP401 battery. When using the SCP461, store in a vertical position.

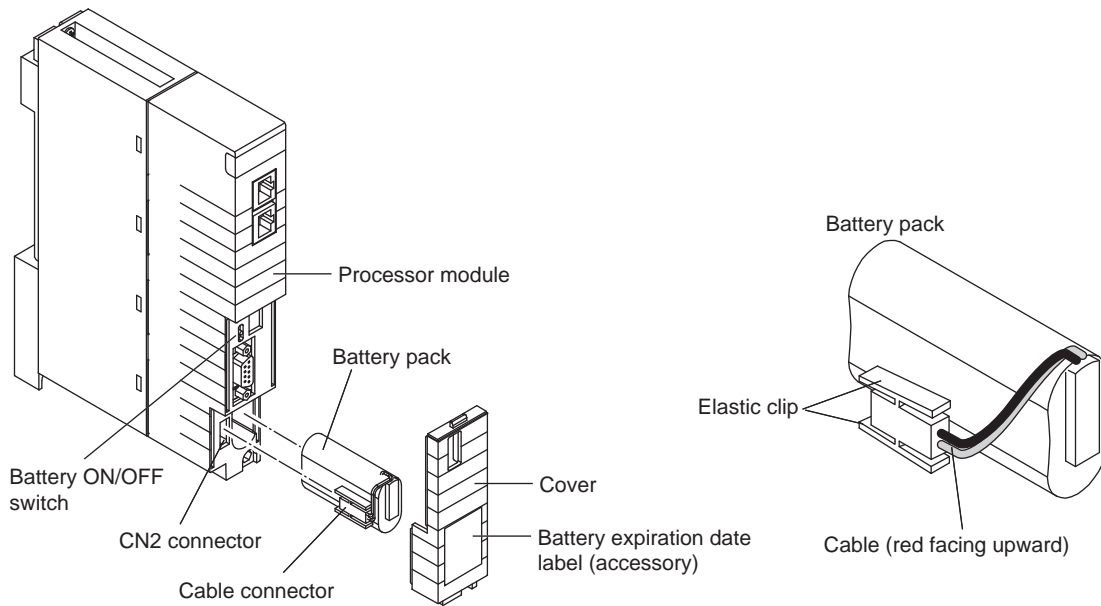


Figure 7.7.1-3 Replacement of Battery

2. Connect the battery cable to the connector.
Make sure the connection is firm and the red wire is facing upward.
3. Turn the battery ON/OFF switch to ON position. Put the front cover back.
4. Stick the battery expiration date label to the front cover.

7.7.2 Replacing Node Fan Unit

For the wide range temperature type safety control unit, there are two node fan units placed at the lower part.

The procedure to replace the fan unit is as follows.



WARNING

When a fan revolves at an abnormally very low speed or encounters other errors, the abnormality can be monitored through the SCS state management window. The fan units are on-line-replaceable. In this case, the fan unit should be replaced one by one, do not stop the two units at the same time. The fan unit should be cautiously installed, make sure that there is no impact on the other unit.

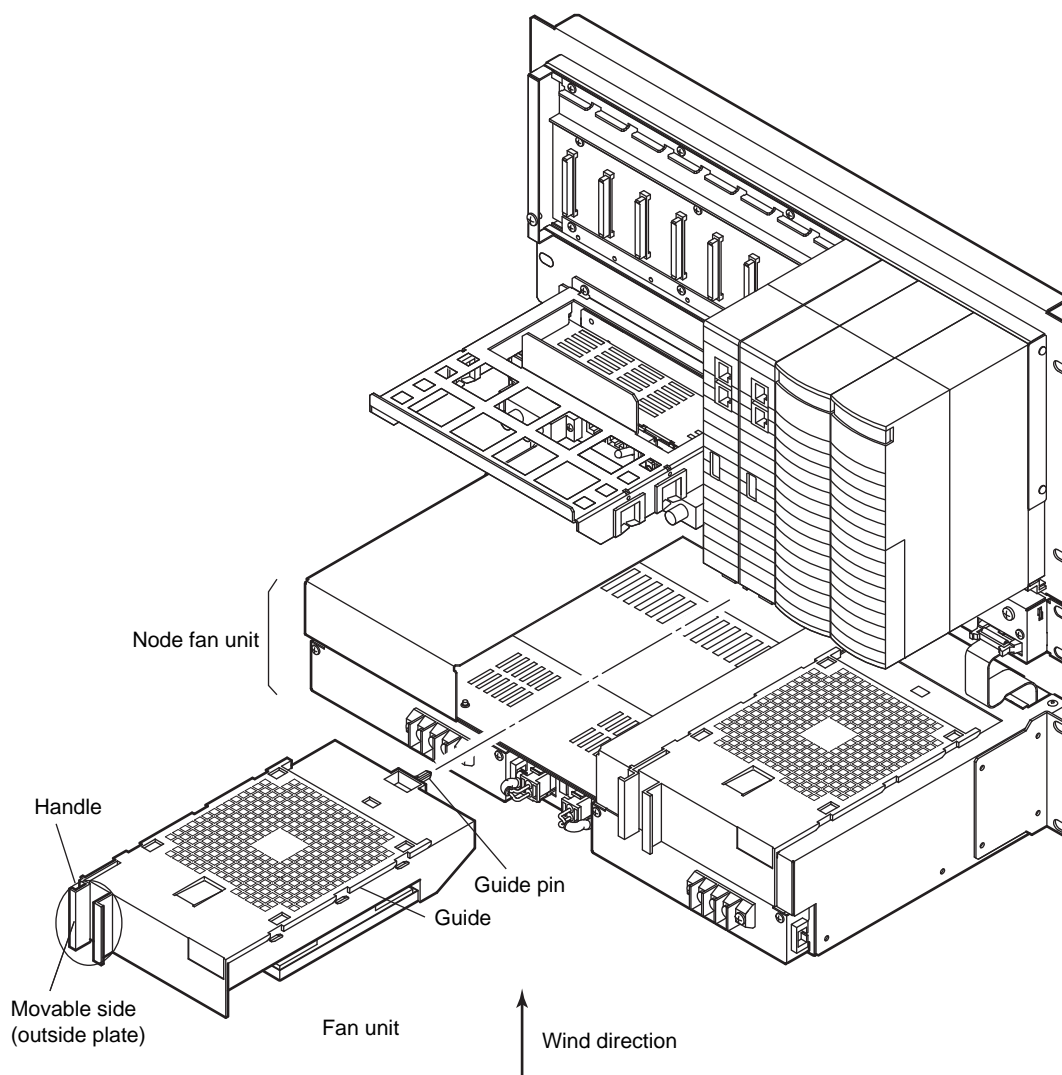


Figure 7.7.2-1 Replacing Fan Unit

■ Replacing Fan Unit

When changing the fan unit, the fan, the power supply output connector and the bracket for installation should be changed together.

1. Unlock the unit (outside plate of the handle).

2. Pull to remove the fan unit.
3. When installing the fan unit, match the fan unit guide to the fan unit rail and push the fan unit into the nest along the rail. And then connect the node fan unit connector. The fan unit should be cautiously installed, make sure that there is no impact on the unit.
4. Make sure that the fan starts revolving when the plug and socket of the fan unit and the print circuit board of the nest are connected.

■ Replacing Fuse for Fan Power Supply Unit

Although the fuse for fan power supply unit is not defined as the parts with a life span, how to change the fuse is explained as follows.

The fuse on the external interface unit is illustrated as follows.

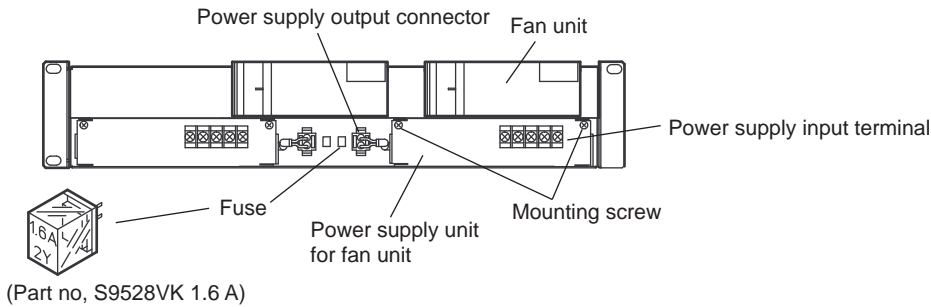


Figure 7.7.2-2 Fuse for Fan Power Supply Unit

● Procedure for Replacing Fan Power Fuses

The fuse for fan power supply unit should be changed according to the following procedure. The fuse for power supply unit can be changed without stopping the system.

1. Pull out the fuse to be replaced. It may not be easy to remove by a hand, however, with a radio pliers, the fuse can be easily removed.
2. Before putting the new fuse, make sure it has the same nominal current as the replaced one. Insert the fuse with the imprints facing up.
3. Check if the fan is working properly.

■ Replacing Power Supply Unit for Fan Unit

The route of the power cable inside the power supply unit for fan unit and the position of power cable outlet varies with the slot in which the power supply unit for fan unit is installed.

The power supply output connector N1 is located at the right-hand side of the power supply unit for fan unit N1.

And the power supply output connector N2 is located at the left-hand side of the power supply unit for fan unit N2 as shown in the following figure.

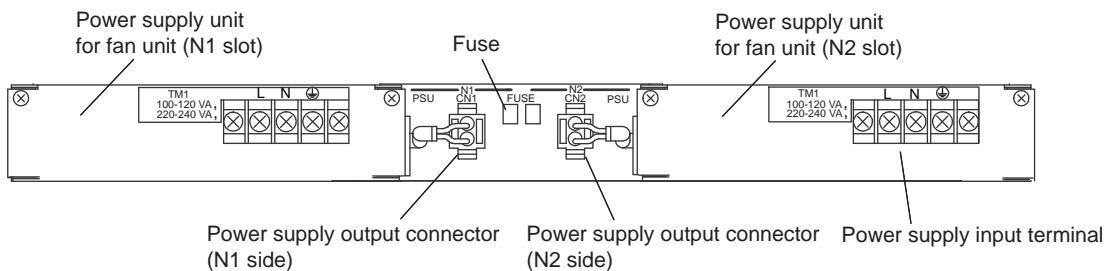


Figure 7.7.2-3 Power Supply Unit for Fan Unit

On factory delivery, the route of the power cable inside the power supply unit for fan unit, ordered as maintenance parts, is standardized for power supply unit for fan unit (N1) as illustrated in the following figure (shaded area). When the power supply unit for fan unit is used for N2 side, it is necessary to change the route of the internal power cable for N2 shown in the following figure.

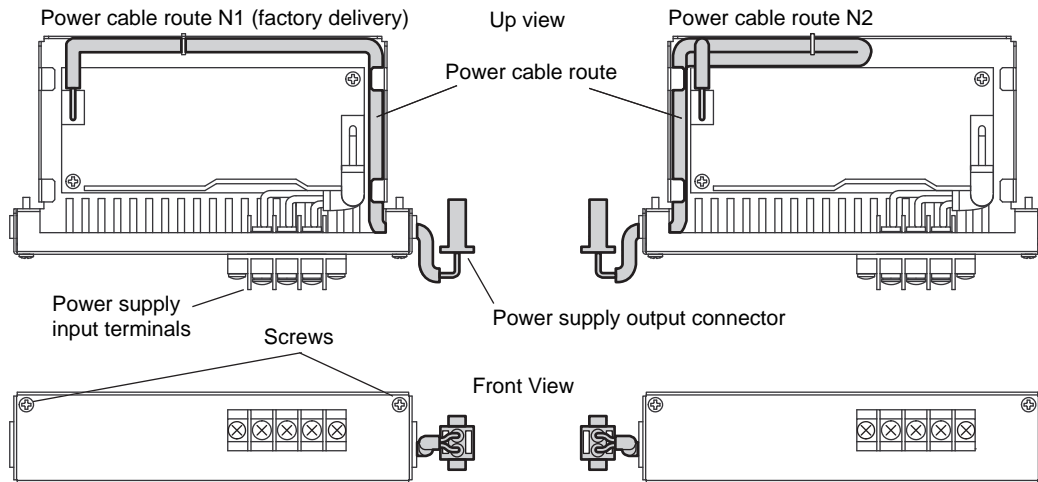


Figure 7.7.2-4 Power Cable Route of Power Supply Unit for Fan Unit

● Procedure of Replacing Power Supply Unit for Fan Unit

1. Disconnect the power supply to the power supply unit for fan unit to be replaced.
2. Remove the power supply output connector from the node fan unit.
3. Remove the screws for fixing the power supply unit for fan unit.
4. Install a new power supply unit for fan unit.
5. Connect the power supply output connector to the node fan unit.
6. Supply the power.
7. Check if the new hardware is working properly.

7.8 Replacing Parts on Terminal Board

Some terminal board parts need to be replaced.



CAUTION

- Do not put any tool on the terminal board during maintenance so as to prevent electric shock or other abnormalities.
- Do not insert or remove fuses while voltage is applied or current is conducted to terminals so as to prevent electric shock. When power is ON, necessary to insert or remove, user should contact the service department of Yokogawa.

■ Replacement Parts on Terminal Board

The following table shows the replacement parts on terminal board.

Table 7.8-1 Replacement Parts on Terminal Board

Model	Part Name	Part Number(*1)	Remark
SED2D	Fuse	A1583EF	250 V/15 A
SED3D SED4D	Fuse	A1618EF or A1034EF	250 V/10 A
SWD2D	Fuse	S9536VK	250 V/3.2 A
		S9533VK	250 V/1 A
SBD2D	Fuse	A1602EF	250V/15A for style S1
		S9504VK	250V/15A for style S2 or later
SBD3D	Fuse	A1603EF	250V/10A
SBD4D	Fuse	A1603EF	250V/10A

*1: Parts must be purchased and replaced in accordance with the laws and regulations of each country or region.

■ Replacing Fuses

Use the following procedure to replace fuses for the SBD2D, SBD3D, and SBD4D.

● Removal Procedure

1. Insert a flathead screwdriver into the groove in the fuse holder cap.
2. Turn the screwdriver anti-clockwise.
The fuse holder cap comes out.
3. Remove the fuse from the fuse holder cap.

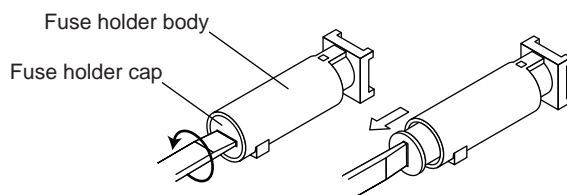


Figure 7.8-1 Removing a Fuse

● **Installation Procedure**

1. Insert a fuse into the fuse holder cap.
2. Insert the fuse holder cap into the fuse holder.
3. Press the fuse holder cap into the fuse holder while rotating it clockwise with a flathead screwdriver.

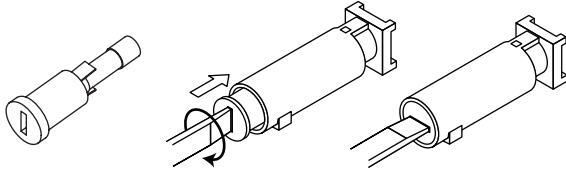


Figure 7.8-2 Installing Fuses

8. Relay Board

This section explains the parts, cable connections and maintenance of the relay board for ProSafe-RS.

■ Overview

The status output signal sent from the digital output module is received by the relay, amplified through the terminals, and output to the field device. The relays, operational display lights, and terminals on the relay output board correspond with the number of outputs. The 19-inch rack mountable relay board has a readback interface. The relay output status can be read back by connecting the digital input module (SDV144).

● Specifications

**SEE
ALSO**

For more information about relay board specifications, refer to:

Terminal Boards/Relay Board (for ProSafe-RS) (GS 32Q06L20-31E)

8.1 Handling Relay Board

When handling a relay board, pay attention to the following precautions.



IMPORTANT

- Prepare a 24 V DC power supply in order to drive the relays.
- When connecting signal wires to the adjacent terminals, the insulation covers of the ring terminals should not overlap.

8.2 Names of Parts

The following figure shows the names of the parts on the relay board. If you are not using a connector to connect to a digital input/output module, install the connector cover.

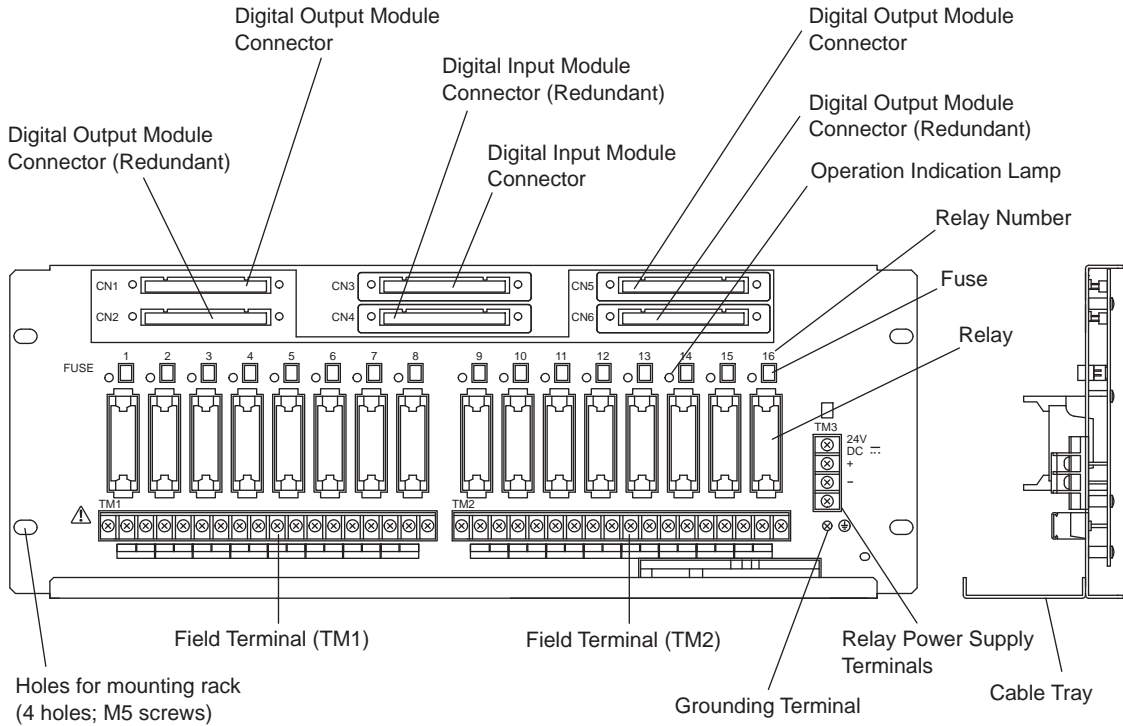


Figure 8.2-1 Parts and Names on the 19-Inch Rack Mountable Relay Board (SRM53D)

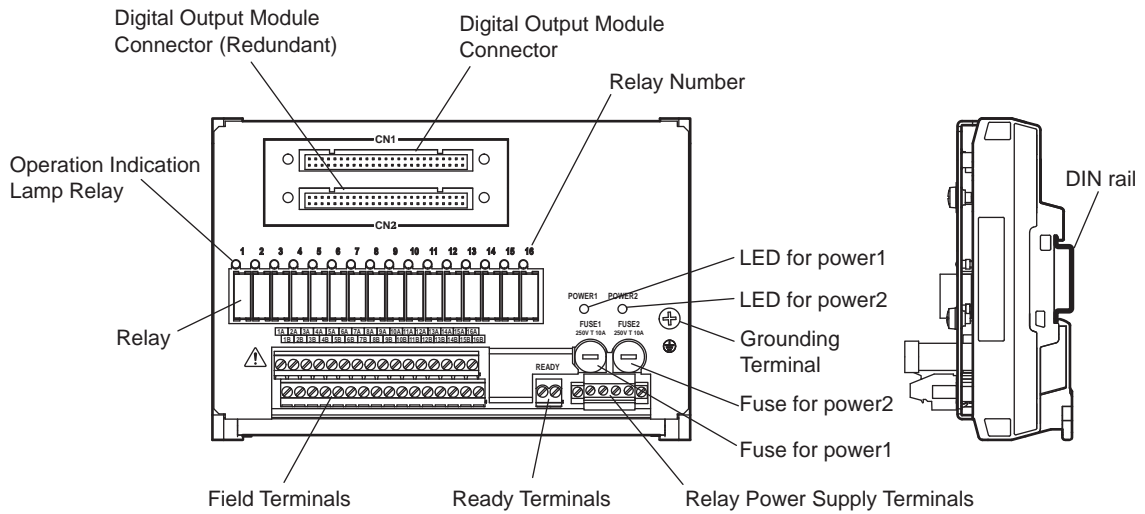


Figure 8.2-2 Parts and Names on the DIN Rail Mountable Relay Board (SBM54D)

8.3 Cable Connection

This section explains how to connect cables from a digital I/O module to the field equipment.

8.3.1 Connecting to Digital I/O Modules

SEE ALSO For more information about cables for connecting to digital I/O modules, refer to:
“■ Combinations of Input/Output Module and Terminal Block” on page 5-3

■ Cable Connection

A connection example is shown in the following figure.

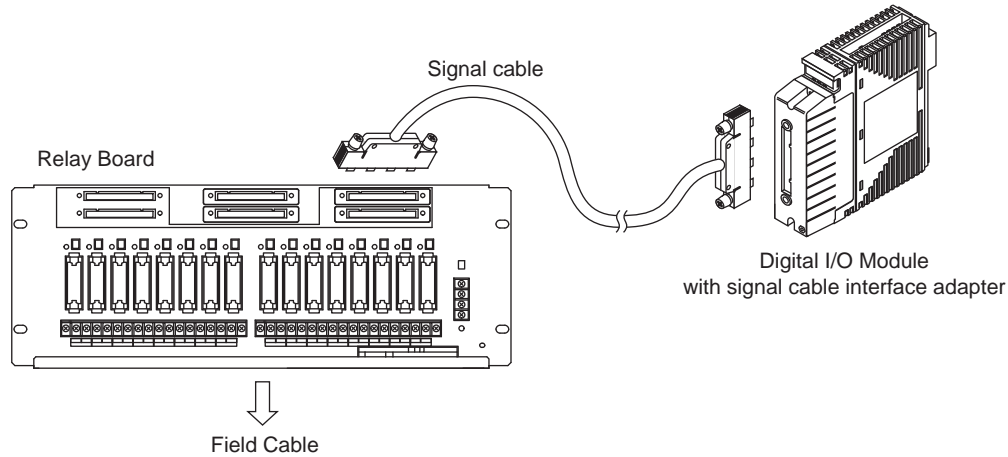


Figure 8.3.1-1 Cable Connection



IMPORTANT

For the connectors with no cable connected, it is necessary to put the connector caps so as to protect the pins of the connectors from the dust pollution.

■ Fixing Signal Cables

Secure the signal cables, connected to the relay board, to the supporting frames using the binding bands at the top of the relay board. The following figure shows an example of a 19-inch rack mountable relay board.

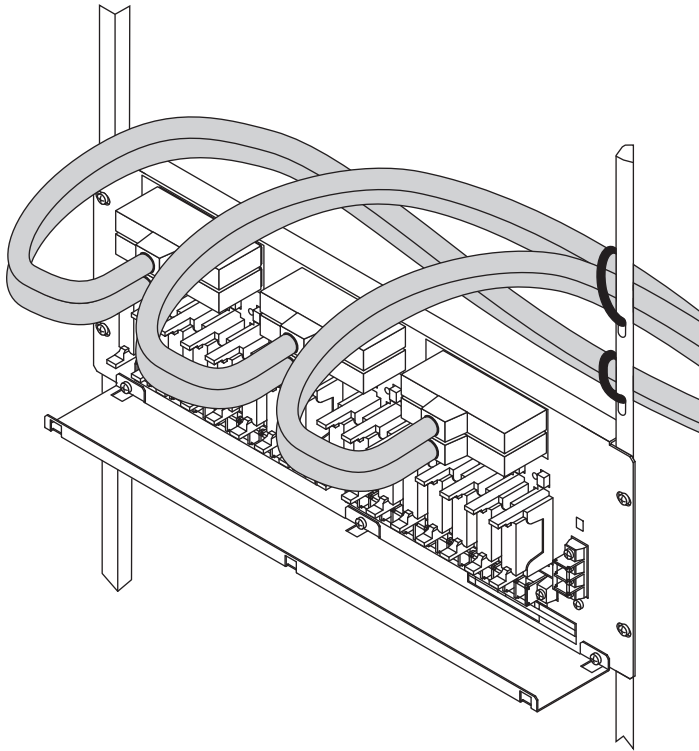


Figure 8.3.1-2 Example of Fixing the Signal Cables to the Right Pole

■ Connecting SRM53D to Digital I/O Modules

The following table shows the relations of the digital I/O modules connector numbers and the connected field terminal numbers.

Table 8.3.1-1 Connector Numbers and Connected Field Terminal Numbers

Connector number	Connection	Field terminal number	Remarks
CN1	SDV531	TM1 (1-8)	CN1/CN2 redundancy
CN2			
CN3	SDV144	TM1 (1-8), TM2 (1-8)	Readback; CN3/CN4 redundancy
CN4			
CN5	SDV531	TM2 (1-8)	CN5/CN6 redundancy
CN6			

The following table shows the relations among the relay numbers, the field terminals, the digital output module connectors and the SDV531/SDV144 channel numbers.

Table 8.3.1-2 Relay Numbers/ Field Terminals/ Channel Numbers

Relay number (*1)	Field terminal		CN1	CN2	CN3	CN4	CN5	CN6		
			SDV531/SDV144 Channel number							
			SDV531		SDV144		SDV531			
1	TM1	1A/1B	ch1	ch1	ch1	ch1	-	-		
2	TM1	2A/2B	ch2	ch2	ch2	ch2	-	-		
3	TM1	3A/3B	ch3	ch3	ch3	ch3	-	-		
4	TM1	4A/4B	ch4	ch4	ch4	ch4	-	-		

Continues on the next page

Table 8.3.1-2 Relay Numbers/ Field Terminals/ Channel Numbers (Table continued)

Relay number (*1)	Field terminal		CN1	CN2	CN3	CN4	CN5	CN6
			SDV531/SDV144 Channel number					
			SDV531		SDV144		SDV531	
5	TM1	5A/5B	ch5	ch5	ch5	ch5	-	-
6	TM1	6A/6B	ch6	ch6	ch6	ch6	-	-
7	TM1	7A/7B	ch7	ch7	ch7	ch7	-	-
8	TM1	8A/8B	ch8	ch8	ch8	ch8	-	-
9	TM2	1A/1B	-	-	ch9	ch9	ch1	ch1
10	TM2	2A/2B	-	-	ch10	ch10	ch2	ch2
11	TM2	3A/3B	-	-	ch11	ch11	ch3	ch3
12	TM2	4A/4B	-	-	ch12	ch12	ch4	ch4
13	TM2	5A/5B	-	-	ch13	ch13	ch5	ch5
14	TM2	6A/6B	-	-	ch14	ch14	ch6	ch6
15	TM2	7A/7B	-	-	ch15	ch15	ch7	ch7
16	TM2	8A/8B	-	-	ch16	ch16	ch8	ch8

*1: The relay number is the number printed on the SRM53D metal body above each relay.

The output status, the LED status and the SDV144 readback status are shown in the following table.

Table 8.3.1-3 Output Status, LED status and SDV144 Readback Status

SDV531 Output status (*1)	LED status	Field terminal status	SDV144 readback status(*1)
OFF	OFF (*2)	OFF (Open)	ON (Close)
ON	ON	ON (Close)	OFF (Open)

*1: The output contacts are A type (NO: Normally Open), and SDV144 status contacts are B type (NC: Normally Close).

*2: If the ON pulse diagnosis for SDV531 is enabled and the SDV531 output status is set to OFF, the LED goes ON for each ON pulse output.



IMPORTANT

When SDV144 is connected to SRM53D, Detect Disconnection and Detect Short Circuit should be disabled on I/O Parameter Builder.

SEE ALSO

For more information about settings on I/O Parameter Builder, refer to:

[A4.6, "Items set for discrete inputs" in Safety Control Station Reference \(IM 32Q03B10-31E\)](#)

■ Connecting SRM54D to Digital I/O Modules

The following table shows the relations of the digital I/O modules connector numbers and the connected field terminal numbers.

Table 8.3.1-4 Connector Numbers and Connected Field Terminal Numbers

Connector number	Connection	Field terminal number	Remarks
CN1	SDV541	TM1 (1-8), TM2 (9-16)	CN1/CN2 redundancy
CN2			

Continues on the next page

Table 8.3.1-4 Connector Numbers and Connected Field Terminal Numbers (Table continued)

Connector number	Connection	Field terminal number	Remarks
CN3	SDV144	TM1 (1-8), TM2 (9-16)	Readback; CN3/CN4 redundancy
CN4			

The following table shows the relations among the relay numbers, the field terminals, the digital output module connectors, and the SDV541/SDV144 channel numbers.

Table 8.3.1-5 Relay Numbers/ Field Terminals/ Channel Numbers

Relay number (*1)	Field terminal		CN1	CN2	CN3	CN4
			SDV541/SDV144 Channel number			
			SDV541		SDV144	
1	TM1	1A/1B	ch1	ch1	ch1	ch1
2	TM1	2A/2B	ch2	ch2	ch2	ch2
3	TM1	3A/3B	ch3	ch3	ch3	ch3
4	TM1	4A/4B	ch4	ch4	ch4	ch4
5	TM1	5A/5B	ch5	ch5	ch5	ch5
6	TM1	6A/6B	ch6	ch6	ch6	ch6
7	TM1	7A/7B	ch7	ch7	ch7	ch7
8	TM1	8A/8B	ch8	ch8	ch8	ch8
9	TM2	9A/9B	ch9	ch9	ch9	ch9
10	TM2	10A/10B	ch10	ch10	ch10	ch10
11	TM2	11A/11B	ch11	ch11	ch11	ch11
12	TM2	12A/12B	ch12	ch12	ch12	ch12
13	TM2	13A/13B	ch13	ch13	ch13	ch13
14	TM2	14A/14B	ch14	ch14	ch14	ch14
15	TM2	15A/15B	ch15	ch15	ch15	ch15
16	TM2	16A/16B	ch16	ch16	ch16	ch16

*1: The relay number is the number printed on the SRM54D metal body above each relay.

The output status, the LED status and the SDV144 readback status are shown in the following table.

Table 8.3.1-6 Output Status, LED status, and SDV144 Readback Status

SDV541 Output status (*1)	LED status	Field terminal status	SDV144 readback status(*1)
OFF	OFF(*2)	OFF (Open)	ON (Close)
ON	ON	ON (Close)	OFF (Open)

*1: The output contacts are A type (NO: Normally Open), and SDV144 status contacts are B type (NC: Normally Close).

*2: If the ON pulse diagnosis for SDV541 is enabled and the SDV541 output status is set to OFF, the LED goes ON for each ON pulse output.



IMPORTANT

When SDV144 is connected to SRM54D, Detect Disconnection and Detect Short Circuit should be disabled on I/O Parameter Builder.

SEE ALSO For more information about settings on I/O Parameter Builder, refer to:

A4.6, "Items set for discrete inputs" in Safety Control Station Reference (IM 32Q03B10-31E)

■ Connecting the SBM54D to a Digital I/O Module

The following table shows the relations of the digital I/O modules connector numbers and the connected field terminal numbers.

Table 8.3.1-7 Connector Numbers and Connected Field Terminal Numbers

Connector number	Connection	Field terminal number	Remarks
CN1	SDV541	1 to 16	CN1/CN2 redundancy
CN2			

The following table shows the relations among the relay numbers, the field terminals, the digital output module connectors, and the SDV541/SDV144 channel numbers.

Table 8.3.1-8 Relay Numbers/Field Terminals/Channel Numbers

Relay number (*1)	Field terminal	CN1	CN2
		SDV541 channel number	
		SDV541	
1	1A/1B	ch1	ch1
2	2A/2B	ch2	ch2
3	3A/3B	ch3	ch3
4	4A/4B	ch4	ch4
5	5A/5B	ch5	ch5
6	6A/6B	ch6	ch6
7	7A/7B	ch7	ch7
8	8A/8B	ch8	ch8
9	9A/9B	ch9	ch9
10	10A/10B	ch10	ch10
11	11A/11B	ch11	ch11
12	12A/12B	ch12	ch12
13	13A/13B	ch13	ch13
14	14A/14B	ch14	ch14
15	15A/15B	ch15	ch15
16	16A/16B	ch16	ch16

*1: The relay number is the number printed on the SRM54D metal body above each relay.



IMPORTANT

When SDV541 is connected to SBM54D, Detect Disconnection, Pulse Test (OFF) and Pulse Test (ON) should be disabled on I/O Parameter Builder.

SEE ALSO For more information about settings on I/O Parameter Builder, refer to:

A4.7, "Items set for discrete outputs" in Safety Control Station Reference (IM 32Q03B10-31E)

8.3.2 Contact Output Wiring and Ground Wiring

This section describes contact output wiring and ground wiring.

■ Contact Output Wiring

If an inductive load is connected to the contact output, a spark quenching circuit (AC: with a RC series; DC: with a diode) needs to be put in parallel with the inductive load for protection.

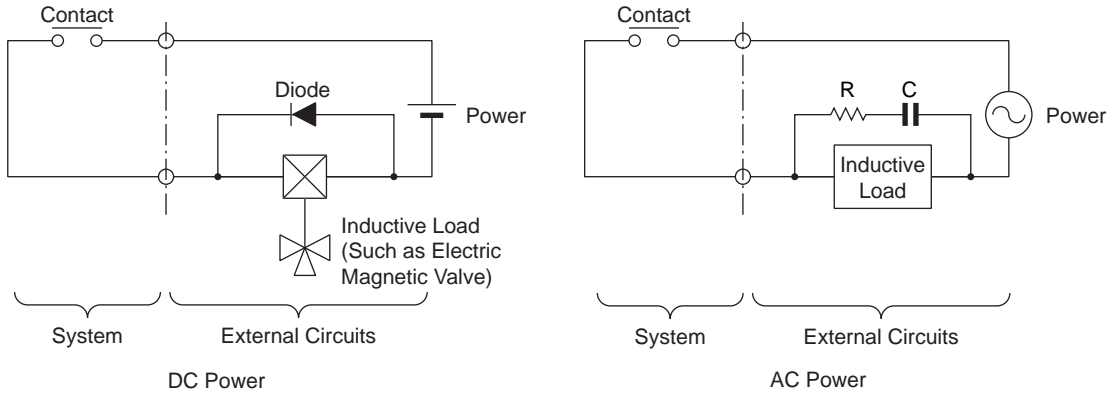


Figure 8.3.2-1 Spark Quenching Circuit

■ Ground Wiring



CAUTION

Ground the grounding terminal to the protective grounding system.

SEE ALSO

For more information about power cable wiring and grounding, refer to:
ProSafe-RS Installation Guidance (TI 32S01J10-01E)

8.3.3 Wiring Field Equipment

This section explains the signal names and terminal numbers on the relay board and how to connect to the digital I/O modules.

■ Terminals to Wire Field Equipment

The connection terminals or power connection terminals for 19-inch rack mountable relay board and the field are using M4 screws.

● Wires and Ring Terminals

The wires should conform the equivalent specification of JIS C 3312.

Make sure to use ring terminals with insulation covers at the ends of the wires. The ring terminals and crimping tool should be from the same vendor.

Table 8.3.3-1 Ring Terminal Dimensions

Nominal cross sectional area (mm ²)	Screw (mm)	Hole diameter (mm)	Ring outside diameter (mm)	Ring terminal length (mm)	Insulation covering inside diameter (mm)	Dimension "C" (mm)
1.25	4	4.3 or more	8.2 or less	About 21	3.6 or more	7.0 or more
2.0	4	4.3 or more	8.7 or less	About 21	4.3 or more	7.1 or more

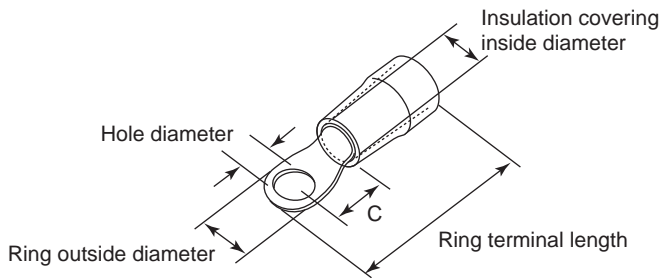


Figure 8.3.3-1 Ring Terminal

■ Terminals to Wire Field Equipment

Pressure clamp terminals are used for connections between DIN rail mountable relay boards and the field, and for connecting power.

SEE ALSO

For more information about cables for pressure clamp terminals, refer to:

- “■ Pressure Clamp Terminal Wiring for the Terminal Board” on page 5-10
- “● Connecting a Power Cable to a DIN Rail Mountable Terminal Board” on page 3-3

■ SRM53D Terminal Numbers and Signal Names

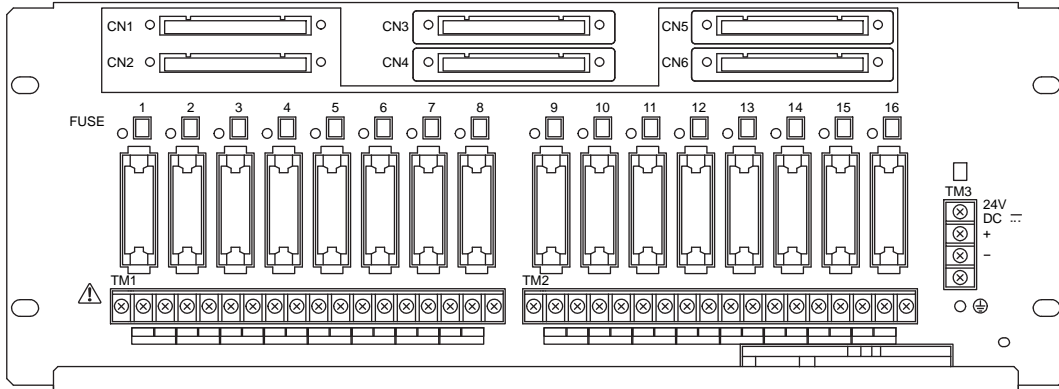


Figure 8.3.3-2 SRM53D Relay Board

Signal Name	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7	OUT8
TM1	1	2	3	4	5	6	7	8
Terminal No.	A B	A B	A B	A B	A B	A B	A B	A B

Signal Name	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7	OUT8
TM2	1	2	3	4	5	6	7	8
Terminal No.	A B	A B	A B	A B	A B	A B	A B	A B

Figure 8.3.3-3 SRM53D Terminal Numbers and Signal Names



CAUTION

- The “+” and “-” of TM3 terminals are used for connecting the power supply.
- Before wiring is started, the protective cover for the terminals needs to be removed. And the cover should be put back after the wiring is completed.
- It is recommended to place mediate switches or breakers in the power supply wirings so that the power supply of each circuit can be shutoff individually during maintenance.

■ SRM54D Terminal Numbers and Signal Names

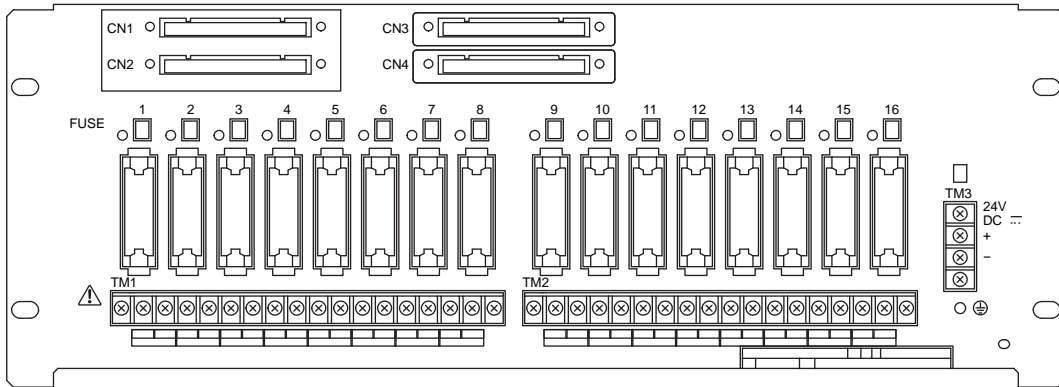


Figure 8.3.3-4 SRM54D Relay Board

Signal Name	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7	OUT8
TM1	1	2	3	4	5	6	7	8
Terminal No.	A B	A B	A B	A B	A B	A B	A B	A B

Signal Name	OUT9	OUT10	OUT11	OUT12	OUT13	OUT14	OUT15	OUT16
TM2	9	10	11	12	13	14	15	16
Terminal No.	A B	A B	A B	A B	A B	A B	A B	A B

Figure 8.3.3-5 SRM54D Terminal Numbers and Signal Names



CAUTION

- The “+” and “-” of TM3 terminals are used for connecting the power supply.
- Before wiring is started, the protective cover for the terminals needs to be removed. And the cover should be put back after the wiring is completed.
- It is recommended to place mediate switches or breakers in the power supply wirings so that the power supply of each circuit can be shutoff individually during maintenance.

■ SBM54D Terminal Numbers and Signal Names

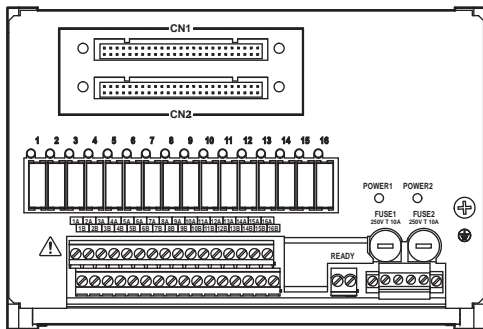


Figure 8.3.3-6 SBM54D relay board

Signal Name	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7	OUT8	OUT9	OUT10	OUT11	OUT12	OUT13	OUT14	OUT15	OUT16
Terminal No.	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A
	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B	16B
Signal Name	COM1	COM2	COM3	COM4	COM5	COM6	COM7	COM8	COM9	COM10	COM11	COM12	COM13	COM14	COM15	COM16
Signal Name	READY	Signal Name	24V DC	COM	24V DC	COM										
Terminal No.	READY	Terminal No.	1+	1-	2+	2-										

Figure 8.3.3-7 SBM54D Terminal Numbers and Signal Names



CAUTION

- You can use dual power supply. The "1+" "1-" and "2+" "2-" of TM3 terminals are used for connecting the power supply.
- It is recommended to place mediate switches or breakers in the power supply wirings so that the power supply of each circuit can be shutoff individually during maintenance.

- **READY Terminals on the SBM54D**

When statuses of power supply and fuses are all normal, the output from READY terminals will be energized, i.e., the contact becomes closed. When power supply fails or any of the fuses fails, the output from READY terminals will be de-energized, i.e., the contact becomes opened.

If an external relay is used, a surge absorber should be used for noise prevention.

- **LED Status**

When the power supply is normal, the LED is on. Otherwise the LED is off.

8.4 Circuit Diagram

The circuit diagram of the relay board is shown as follows:

■ SRM53D

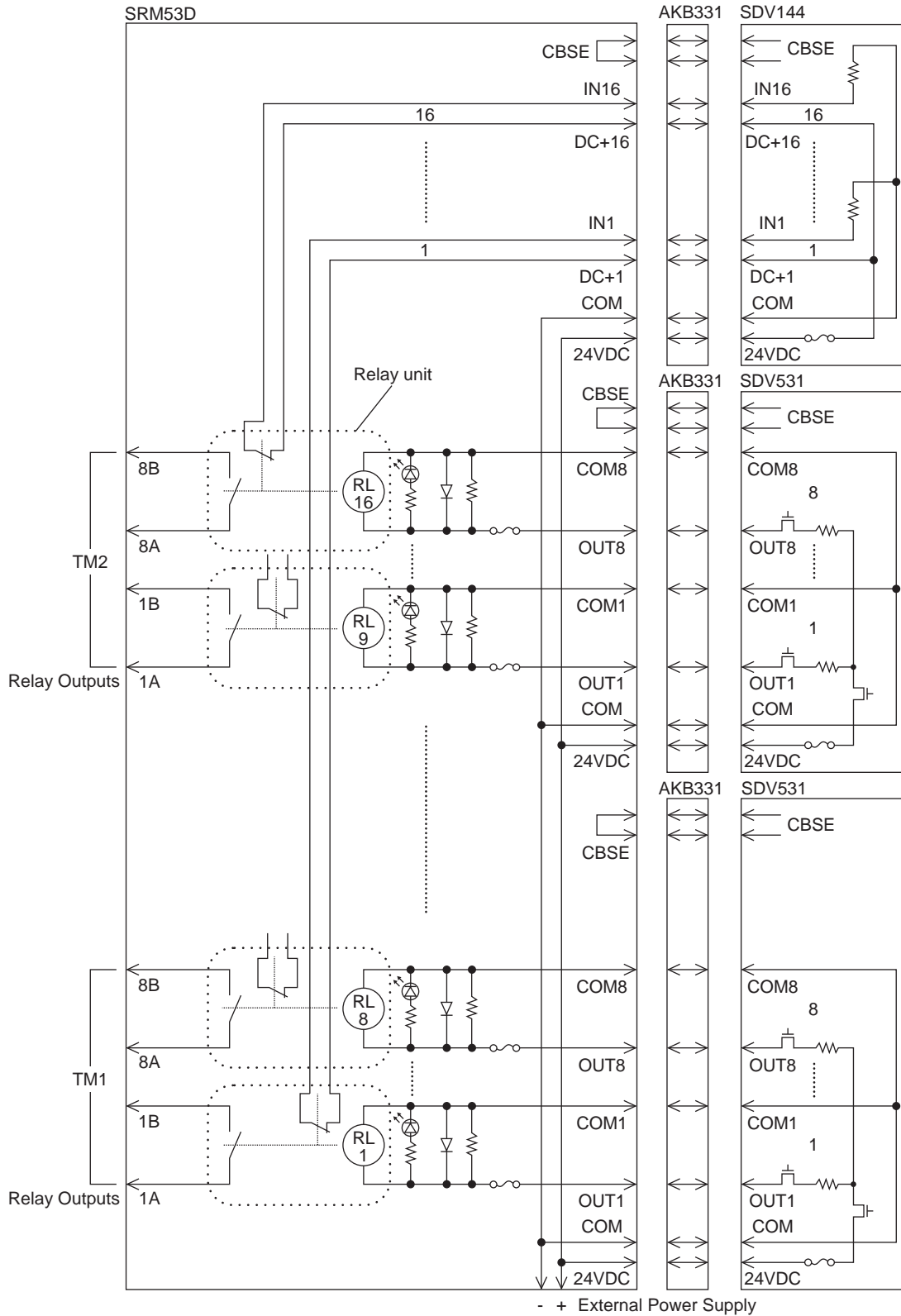


Figure 8.4-1 SRM53D Circuit Diagram

■ SRM54D

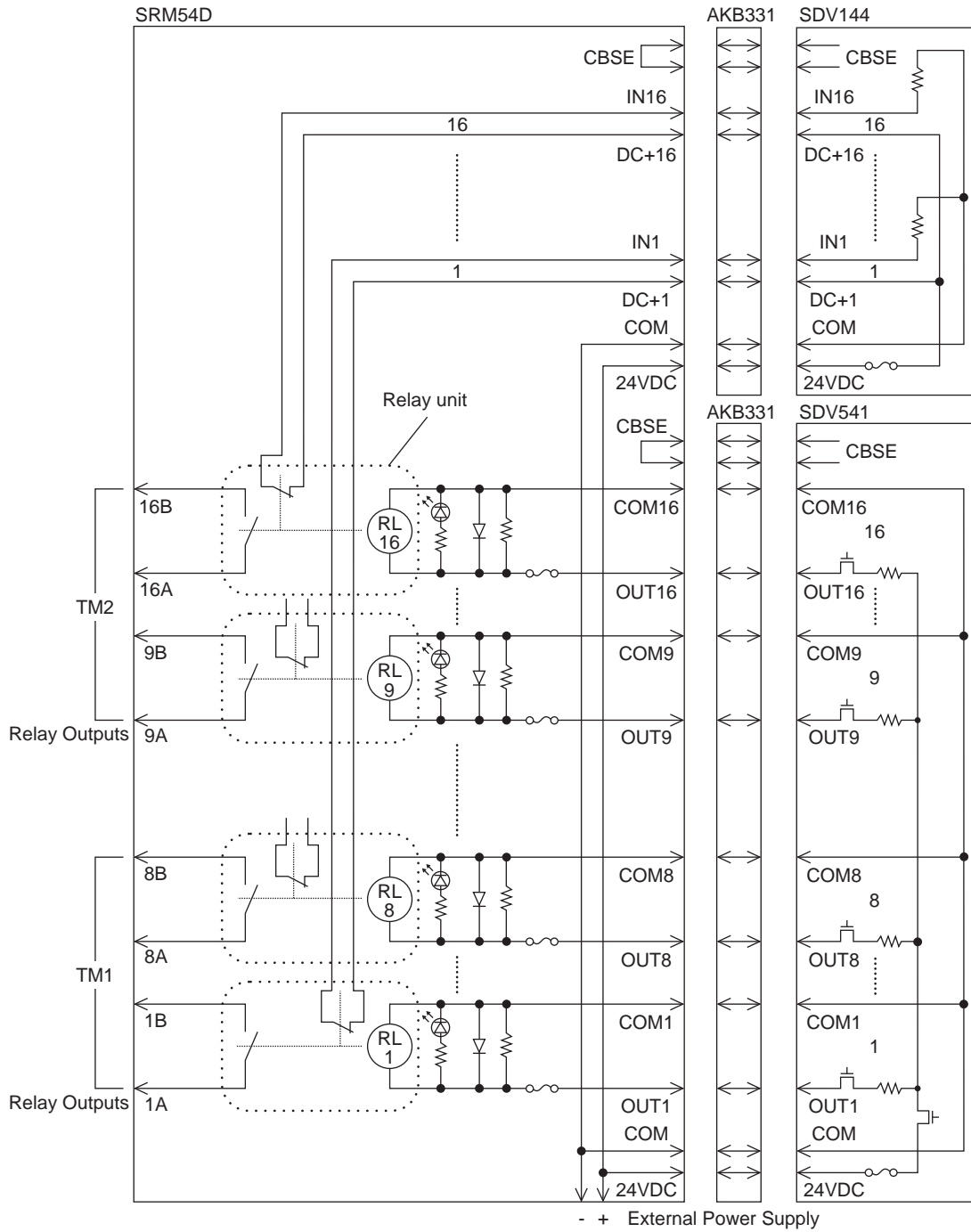


Figure 8.4-2 SRM54D Circuit Diagram

■ SBM54D

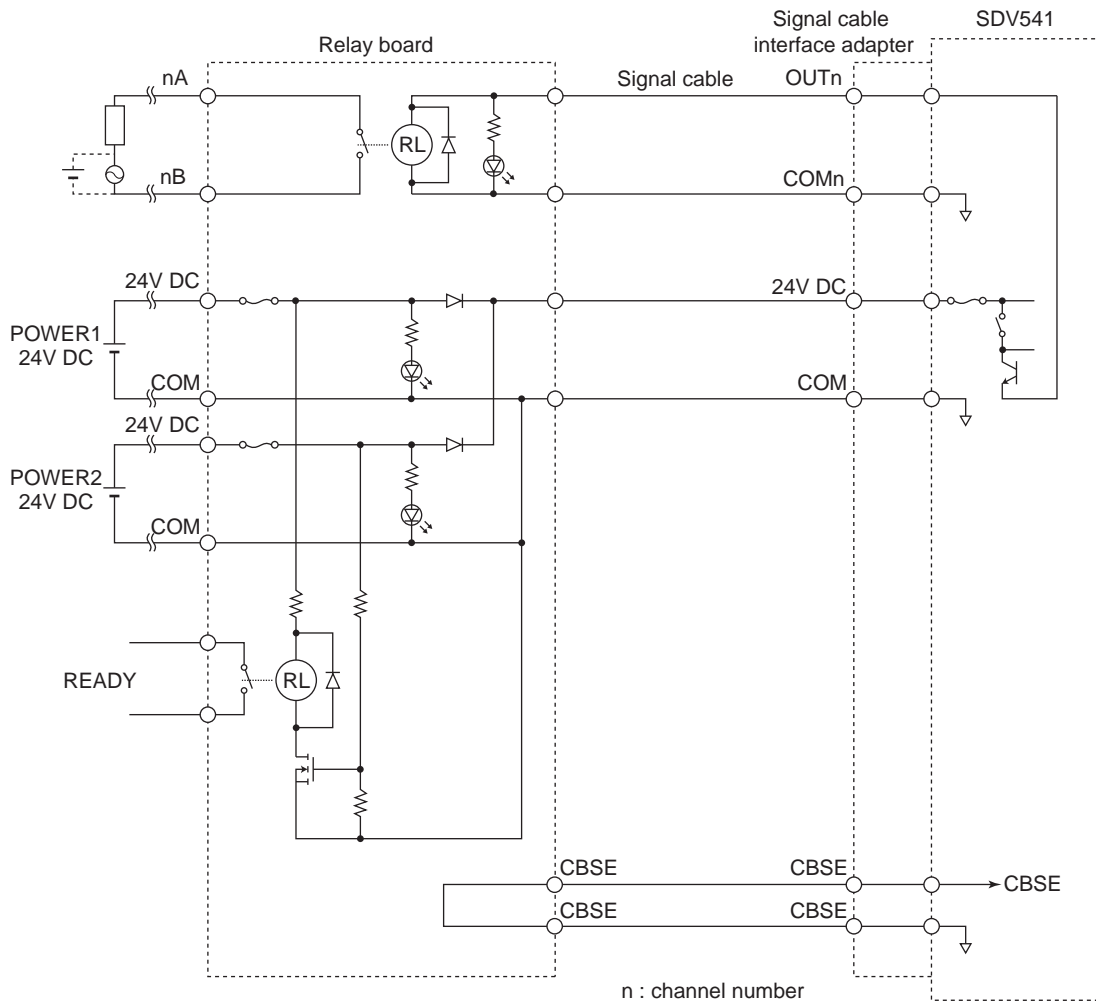


Figure 8.4-3 SBM54D Circuit Diagram

8.5 Maintenance

This section explains how to mount a relay board and replace parts.



CAUTION

You can perform hot replacing, connecting or disconnecting the cards, cables or connectors only if it is described in this document. In general, you must switch off the power before replacing, connecting or disconnecting the cards, cables or connectors.



WARNING

- Use a vacuum cleaner or dry soft cloth to clean the devices.
 - During maintenance, use a wrist strap for ESD (Electrostatic Discharge) measures.
-

SEE ALSO

For more information about static electricity, refer to:

[7.1, "Routine Maintenance of Safety Control Unit" on page 7-2](#)

8.5.1 Mounting Relay Boards

Relay boards can be installed on a rack, on a wall, or on a DIN rail.

■ Reserve Cable Area

Make sure to reserve an area for laying system cables shown in the following figures in all the mounting methods.

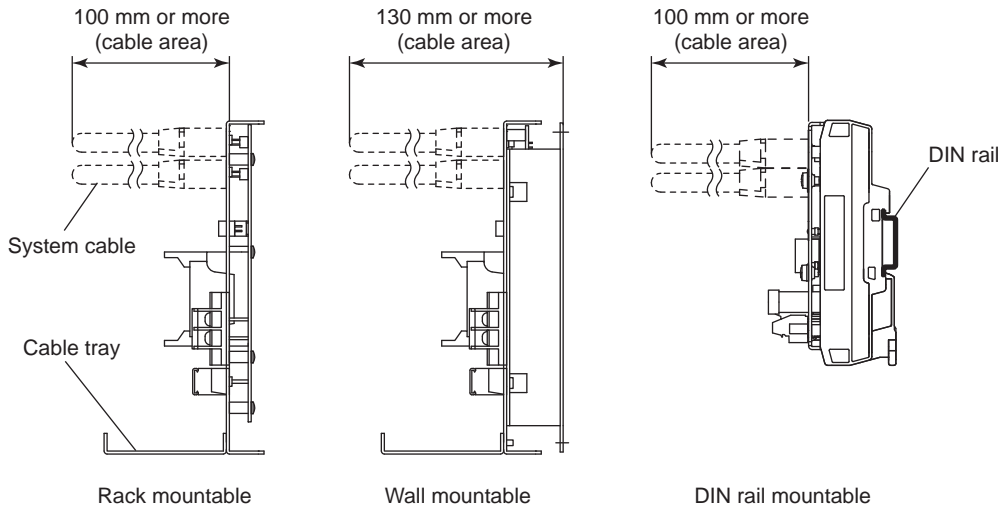


Figure 8.5.1-1 System Cable Area

■ Mounting on a Rack

A relay board can be mounted on a 19-inch-width rack and then placed in a cabinet or on an instrument board.

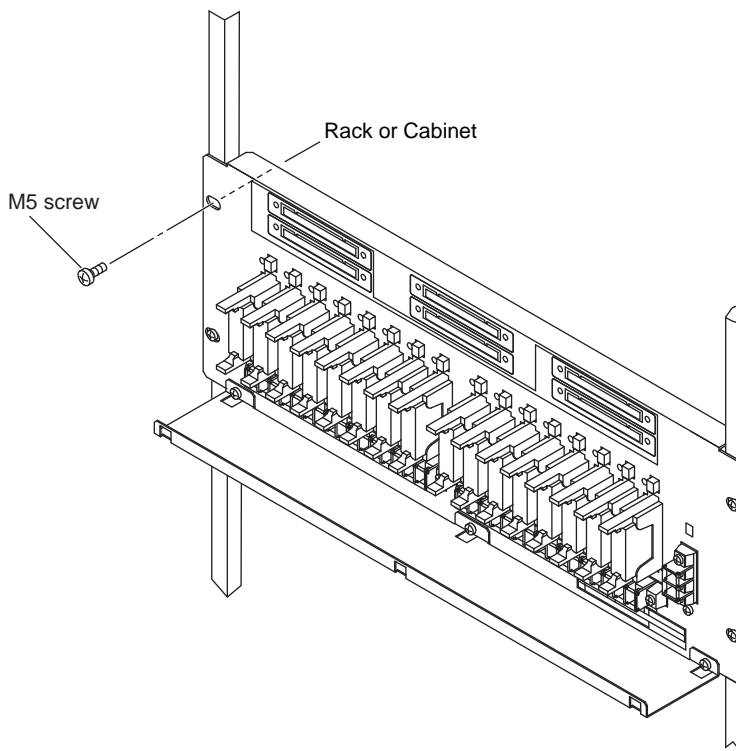


Figure 8.5.1-2 Mounting on a Rack

■ Mounting on a Wall Surface

A 19-inch rack mountable relay board can be mounted on a wall surface. When installing on a wall, it should be installed on a flat wall surface. However, when ordering the relay board, it is necessary to specify that the relay board needs to be mounted on a wall surface. The holes on the wall surface and the mounting fittings need to be prepared beforehand according to the actual dimensions shown in the following figure.

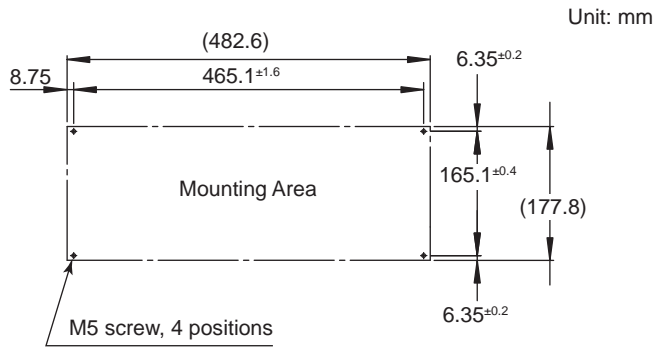


Figure 8.5.1-3 Wall Surface Mounting Dimensions

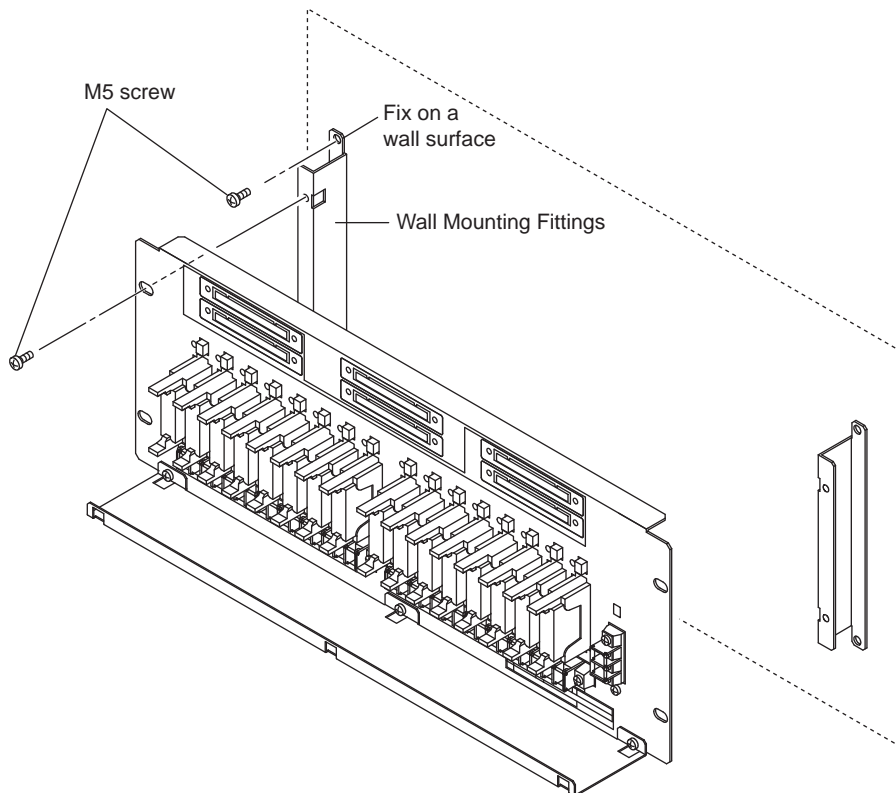


Figure 8.5.1-4 Mounting on a Wall Surface

● Installation Procedure

1. Use the M5 screws to fix the attached mounting fittings on the wall surface at the left and right locations (as shown in the previous figure).
2. Use the M5 screws to fix the relay board to the mounting fittings on the wall surface.

■ Installing and Uninstalling from a DIN Rail

● Procedure for Mounting onto a DIN Rail

1. Tilt the relay board so that you can lift the bottom part of the relay board up towards you. Align the three attachment grooves (groove a) with the upper part of the DIN rail.

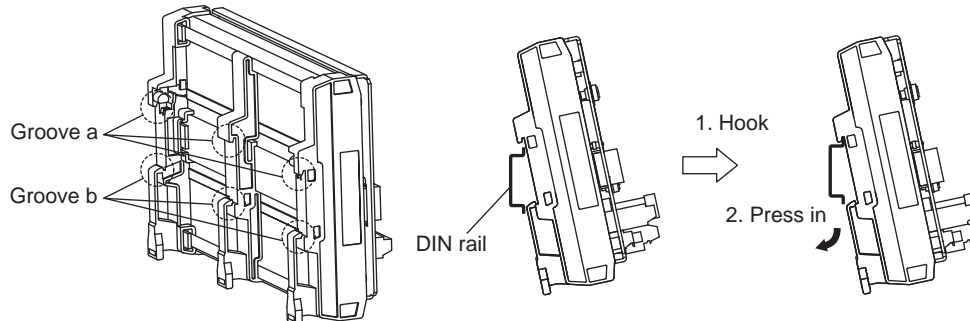


Figure 8.5.1-5 Mounting onto a DIN rail (1/2)

2. Push the tilted relay board until it becomes vertical. The grooves of attachment b will hook onto the lower part of the DIN rail. Once mounted onto the DIN rail, the unit should look like the following figure.

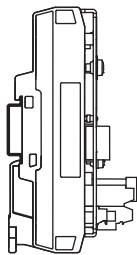


Figure 8.5.1-6 Mounting onto a DIN rail (2/2)

**SEE
ALSO**

For more information about installation direction for DIN rail mountable terminal boards, refer to:

“■ Terminal Board Installation Direction” on page 2-10

● Procedure for Uninstalling from a DIN Rail

1. Place your finger into the gap at the back of the relay board and push part A in the following figure in the direction shown in the figure. The hook on part B in the figure moves downward and a gap is created between the bottom of the DIN rail and groove b.
2. Gently pull the bottom of the relay board forward. The attachment separates from the DIN rail.
3. Repeat this procedure to detach the three attachments in order and remove the relay board.

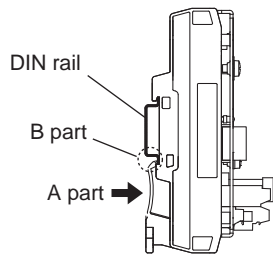


Figure 8.5.1-7 Uninstalling from a DIN Rail

- **Fasteners**

When installing a relay board onto a DIN rail, you can use fasteners to hold it in place. These fasteners are not supplied and should be purchased separately. Mount the relay board on the DIN rail first and then secure it in place with the fasteners. To remove the board, take the fasteners off and then remove the relay board from the DIN rail.

8.5.2 Parts Replacement

Some relay board parts have defined life spans or need to be replaced.



CAUTION

- Do not put any tool into the relay board during maintenance so as to prevent electric shock or other abnormalities.
- Do not insert or remove fuses while voltage is applied or current is conducted to terminals so as to prevent electric shock. If it is necessary to insert or remove, user should contact the service department of Yokogawa.

■ Parts Having Defined Life Spans

The following table shows the parts with defined life span used on the relay board.

Table 8.5.2-1 Parts Having Defined Life Spans

Model	Part name	Part number	Life span
SRM53D SRM54D	Relay	A1772MR	100000 Times ON/OFF
SBM54D	Relay	A1589MR	100000 Times ON/OFF

■ Replacement Parts

The following table shows the replacement parts used on the relay boards.

Table 8.5.2-2 List of Relay Board Replacement Parts

Model	Part name	Part number	Remarks
SRM53D SRM54D	Fuse	A1327EF	125 V/0.3 A, 16
SBM54D	Fuse	A1603EF	250 V/10 A, 2

**SEE
ALSO**

For more information about replacing fuses in SBM54D, refer to:

“■ Replacing Fuses” on page 7-40

■ Dismounting Cable Trays

Each 19-inch rack mountable relay board comes with a cable tray where the wiring to the field equipment can be stored.

If the cable tray is not necessary, it can be dismantled according to the following procedure.

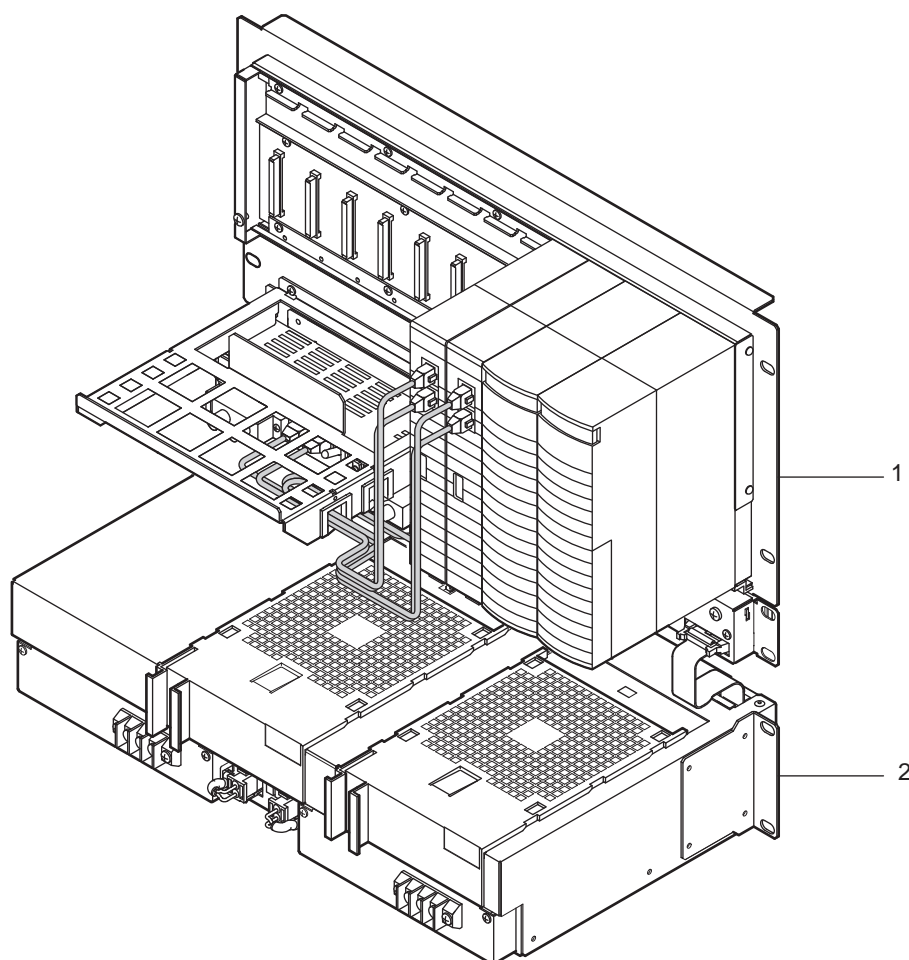
1. Locate the three square-holes in the cable tray. Loosen the screws in the square holes using a screwdriver in all three places.
2. Lift the cable tray approximately 5 mm up while the screws are still loosened.
3. The relay board and cable tray can be separated.

Customer Maintenance Parts List

CMPL 32S06C10-01E

Models SSC10S, SSC10D,
SSC50S and SSC50D
Safety Control Unit
Duplexed Safety Control Unit

ProSafe-RS



Item	Model or Part No.	Qty	Description
1	SSC10S	—	Safety Control Unit (with ISA standard G3)
	SSC10D	—	Duplexed Safety Control Unit (with ISA standard G3)
	SSC50S	—	Safety Control Unit for Vnet/IP (with ISA standard G3)
	SSC50D	—	Duplexed Safety Control Unit for Vnet/IP (with ISA standard G3)
2	—	—	Node Fan Unit (wide range temperature type, with fan unit and ISA standard G3)

Figure CMPL 1-1

CAUTION

- The Customer Maintenance Parts List (CMPL) is provided as a reference for ordering maintenance parts. Customers should not assemble or disassemble the products by themselves using this CMPL, but should contact Yokogawa's sales agents for parts replacement. YOKOGAWA assumes no liability to any party for damages caused through disassembly or assembly.
- Parts numbers on Parts Lists are subjected to change.

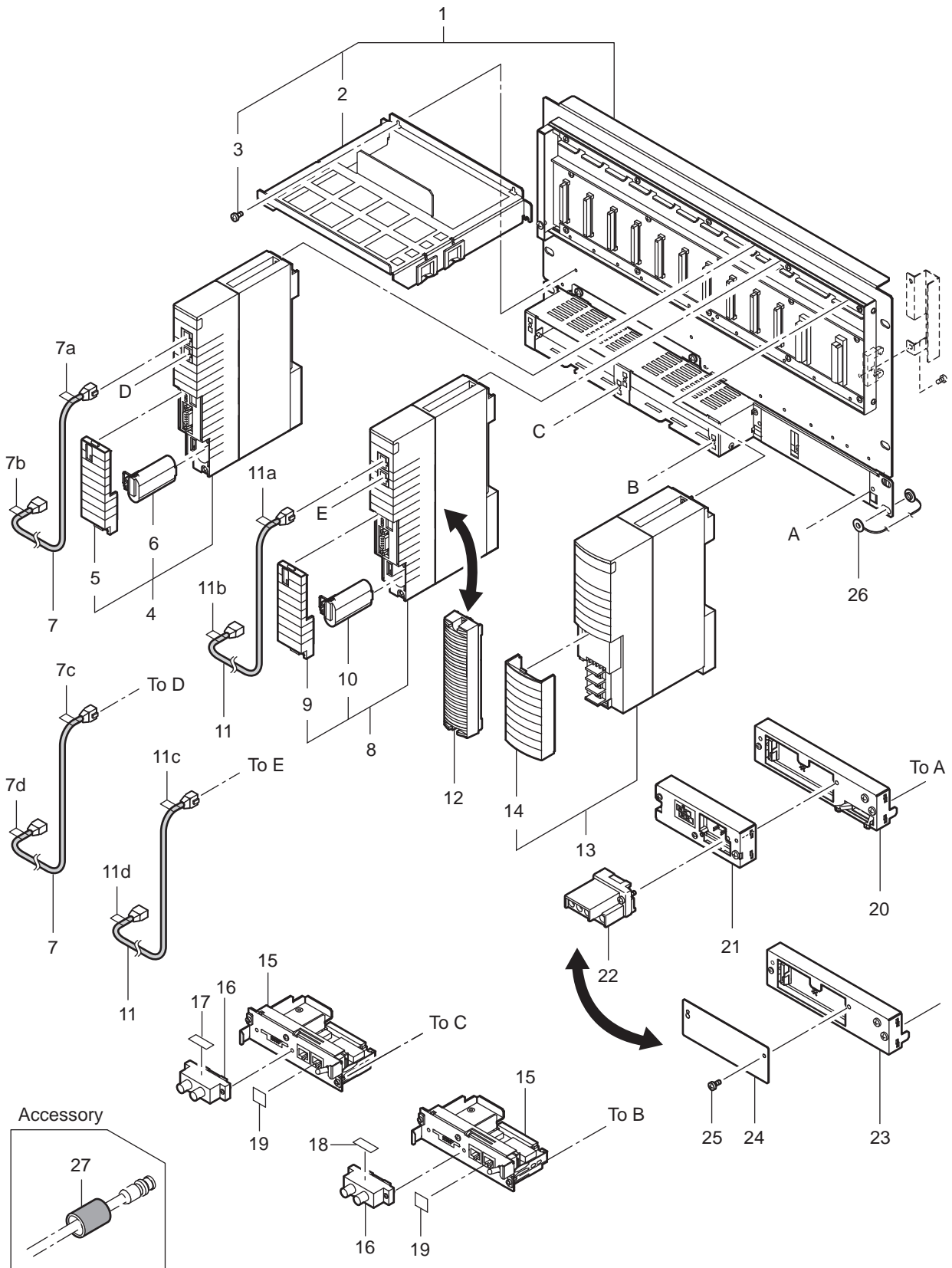
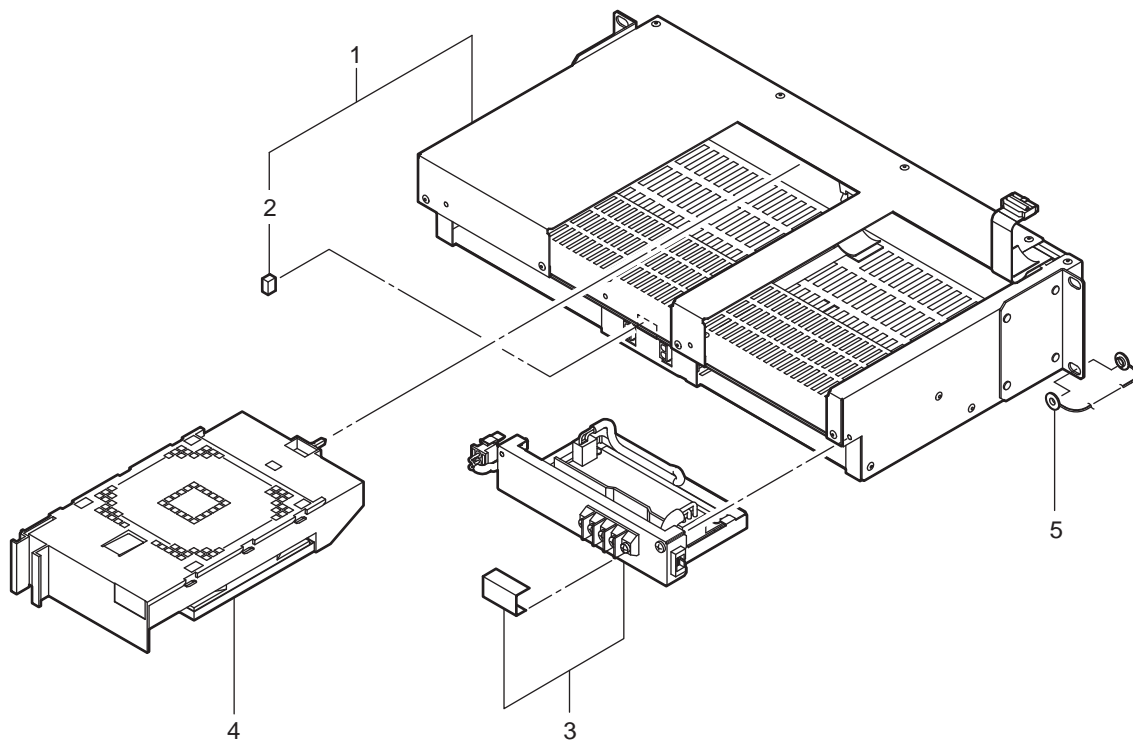


Figure CMPL 1-2

Item	Model or Part No.	Model	Qty				Description
			SSC10S	SSC10D	SSC50S	SSC50D	
1	—		1	1	1	1	CPU Node Unit
2	T9082QE		1	1	1	1	Cable Tray
3	Y9306LB		4	4	4	4	B.H.Screw, M3 x 6
4	SCP401		1	1			Processor Module
	SCP451				1	1	Processor Module
5	T9083UB		1	1	1	1	Cover
6	S9185FA		1	1	1	1	Battery Assembly
7	S9343UV		2	2			Cable Assembly
7a	T9042PS		1	1			Label (CPU-L BUS1)
7b	T9042PW		1	1			Label (V net BUS1 CN2)
7c	T9042PT		1	1			Label (CPU-L BUS2)
7d	T9042PX		1	1			Label (V net BUS2 CN2)
8	SCP401			1			Processor Module
	SCP451				1		Processor Module
9	T9083UB			1		1	Cover
10	S9185FA			1		1	Battery Assembly
11	S9343UV		2				Cable Assembly
11a	T9042PU		1				Label (CPU-R BUS1)
11b	T9042PY		1				Label (V net BUS1 CN3)
11c	T9042PV		1				Label (CPU-R BUS2)
11d	T9042PZ		1				Label (V net BUS2 CN3)
12	T9083VB		1		1		Dummy Cover
13	Below		2	2	2	2	Power Supply Module
	SPW481						for 100 to 120 V AC Power Supply
	SPW482						for 220 to 240 V AC Power Supply
	SPW484						for 24 V DC Power Supply
14	T9083UX		2	2	2	2	Cover
15	AIP504		2	2			V net Coupler Unit
16	S9112BL		2	2			V net Connector Unit
17	T9022RA		1	1			Label (BUS1)
18	T9022RT		2	2			Label (BUS2)
19	T9042PL		2				Dust Cover
20	S9156FA		1	1			CPU Node External Interface Unit (with fan)
	S9473FA				1	1	CPU Node External Interface Unit (with fan) for SSC50 style S2 or later
21	S9161FA		1	1			IRIG Interface Unit (option code : /GPS)
22	S9359UK		1	1			RIO T Assembly (option code : /GPS)
23	S9158FA		1	1			CPU Node External Interface Unit (without fan)
	S9474FA				1	1	CPU Node External Interface Unit (without fan) for SSC50 style S2 or later
24	T9083TR		1	1			Plate (without fan)
	T9083TR				1	1	Plate
25	Y9306LE		2	2			B.H.Screw, M3 x 6 (without fan)
	Y9306LE				2	2	B.H.Screw, M3 x 6
26	S9049PM		8	8	8	8	Insulating Bushing (accessory)
27	T9070UQ		4	4			Cover (for V net Cable : accessory)

Figure CMPL 1-3

Node Fan Unit (for wide range temperature type)



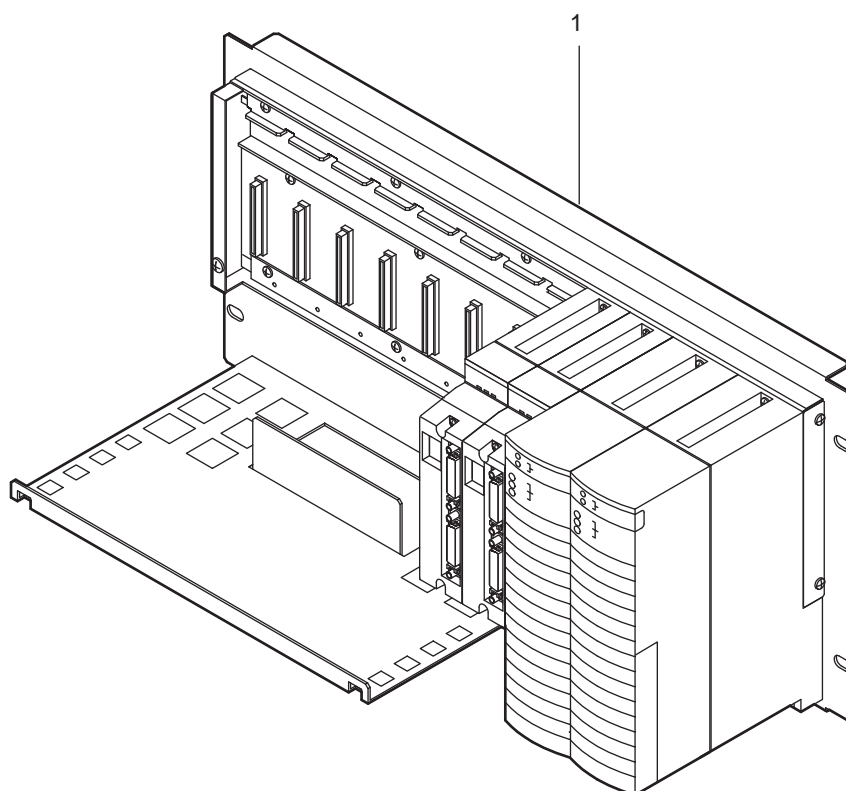
Item	Model or Part No.	Qty		Description
		SSC10	SSC50	
1	S9157FA S9475FA	1	1	Node Fan Unit Node Fan Unit for SSC50 style S2 or later
2	S9528VK	2	2	Fuse
3	Below S9159FA S9160FA	2	2	Fan Power Module for 100 to 120 V and 220 to 240 V AC Power Supply Unit for 24 V DC Power Supply Unit
4	AIP602	2	2	Fan Assembly
5	S9049PM	4	4	Insulating Bushing (accessory)

Figure CMPL 1-4

**Customer
Maintenance
Parts List**
CMPL 32S06K10-01E

Model SNB10D
Node Unit for
Dual-Redundant ESB Bus
(19-inch Rack Mountable)

ProSafe-RS

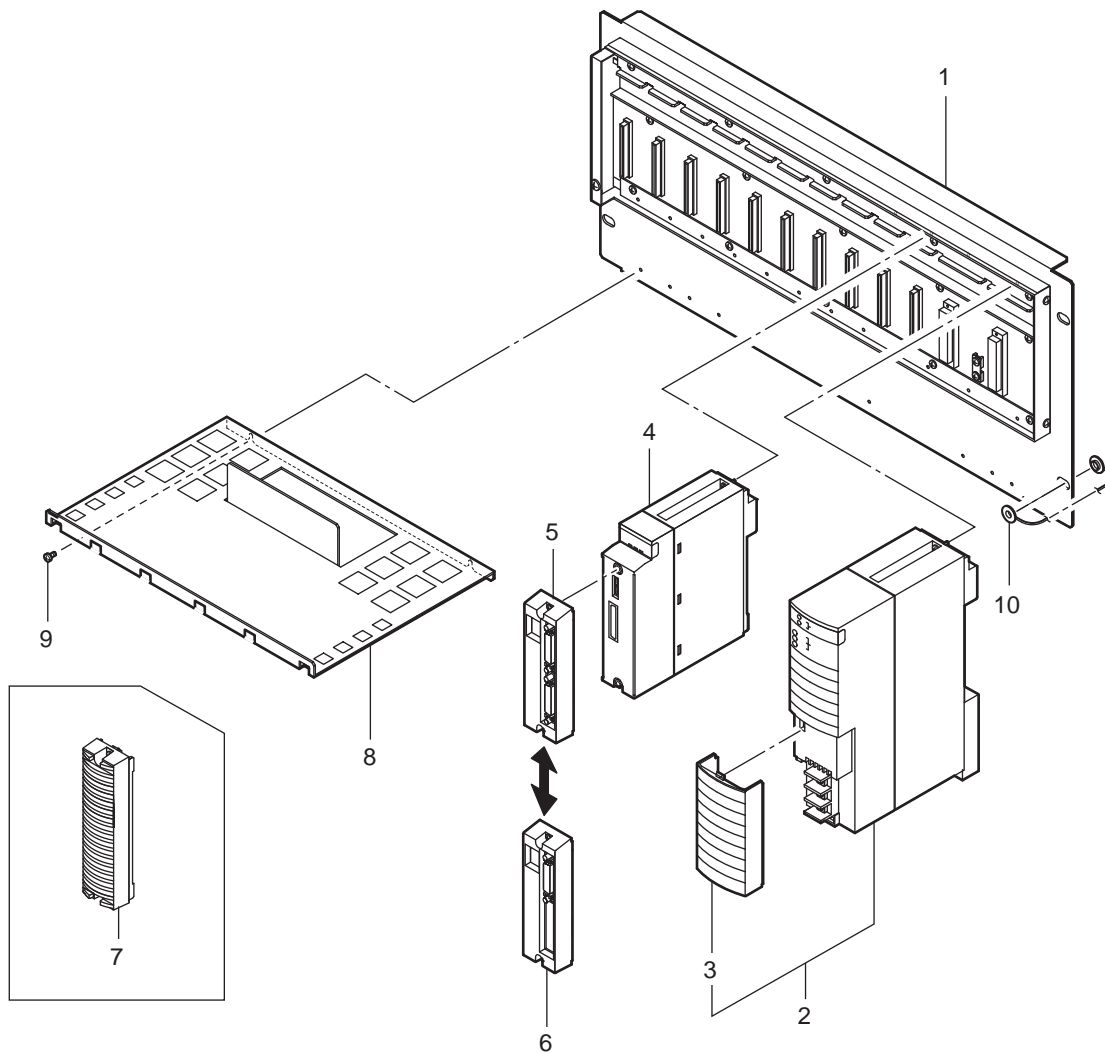


Item	Model	Qty	Description
1	SNB10D	-	Node Unit for Dual-Redundant ESB Bus

Figure CMPL 2-1

CAUTION

- The Customer Maintenance Parts List (CMPL) is provided as a reference for ordering maintenance parts. Customers should not assemble or disassemble the products by themselves using this CMPL, but should contact Yokogawa's sales agents for parts replacement. YOKOGAWA assumes no liability to any party for damages caused through disassembly or assembly.
- Parts numbers on Parts Lists are subjected to change.



Item	Model or Part No.	Qty	Description
1	-	1	Base Unit
2	Below SPW481 SPW482 SPW484	2	Power Supply Unit for 100 to 120 V AC Power Supply for 220 to 240 V AC Power Supply for 24 V DC Power Supply
3	T9083UX	2	Cover
4	SSB401	2	ESB Bus Interface Unit
5	-	2	Connector Unit for ESB Bus (option code : /CU2N)
6	-	2	Connector Unit with Terminator for ESB Bus (option code : /CU2T)
7	SDCV01	-	Dummy Cover (as required)
8	T9082QG	1	Cable Tray
9	Y9306LK	2	B. H. Screw with Lockwasher, M3 x 6
10	S9049PM	4	Insulating Bushing

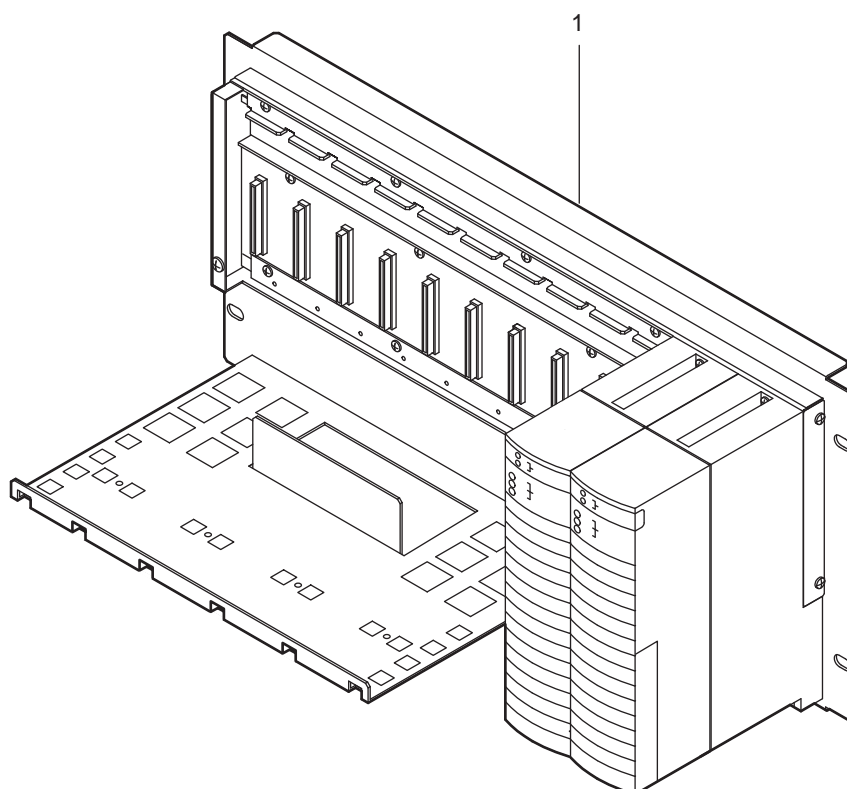
Figure CMPL 2-2

Customer Maintenance Parts List

CMPL 32S06K11-01E

Model SNT10D
Unit for
Optical Bus Repeater Module
(19-inch Rack Mountable)

ProSafe RS

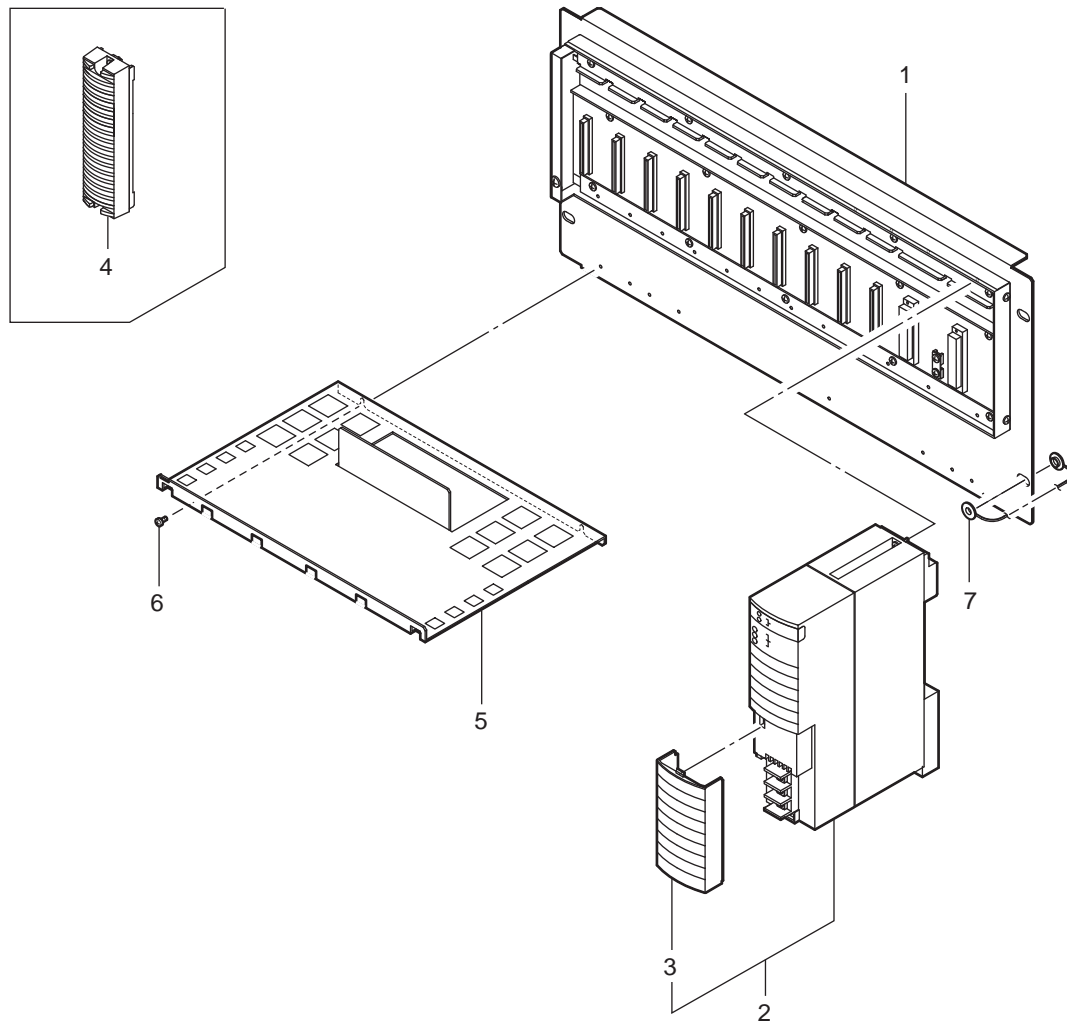


Item	Model	Qty	Description
1	SNT10D	-	Unit for Optical Bus Repeater Module

Figure CMPL 3-1

CAUTION

- The Customer Maintenance Parts List (CMPL) is provided as a reference for ordering maintenance parts. Customers should not assemble or disassemble the products by themselves using this CMPL, but should contact Yokogawa's sales agents for parts replacement. YOKOGAWA assumes no liability to any party for damages caused through disassembly or assembly.
- Parts numbers on Parts Lists are subjected to change.



Item	Model or Part No.	Qty	Description
1	—	1	Base Unit
2	Below	2	Power Supply Unit
	SPW481		for 100 to 120 V AC Power Supply
	SPW482		for 220 to 240 V AC Power Supply
	SPW484		for 24 V DC Power Supply
3	T9083UX	2	Cover
4	SDCV01	-	Dummy Cover (as required)
5	T9082QG	1	Cable Tray
6	Y9306LK	2	B. H. Screw with Lockwasher, M3 x 6
7	S9049PM	4	Insulating Bushing

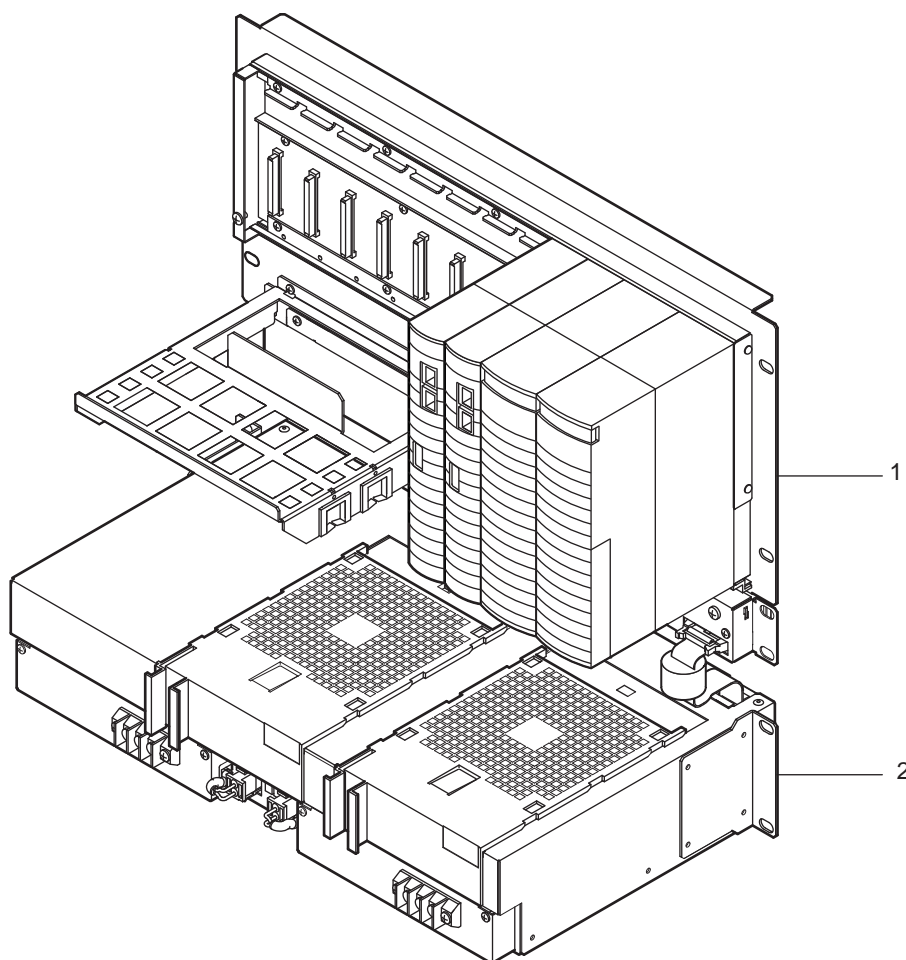
Figure CMPL 3-2

Customer Maintenance Parts List

CMPL 32R06D20-01E

Models SSC60S and
SSC60D
Safety Control Unit
Duplexed Safety Control Unit

ProSafe-RS



Item	Model or Part No.	Qty	Description
1	SSC60S SSC60D	—	Safety Control Unit for Vnet/IP (with ISA standard G3) Duplexed Safety Control Unit for Vnet/IP (with ISA standard G3)
2	—	—	Node Fan Unit (wide range temperature type, with fan unit and ISA standard G3)

Figure CMPL 4-1

CAUTION

- The Customer Maintenance Parts List (CMPL) is provided as a reference for ordering maintenance parts. Customers should not assemble or disassemble the products by themselves using this CMPL, but should contact Yokogawa's sales agents for parts replacement. YOKOGAWA assumes no liability to any party for damages caused through disassembly or assembly.
- Parts numbers on Parts Lists are subjected to change.

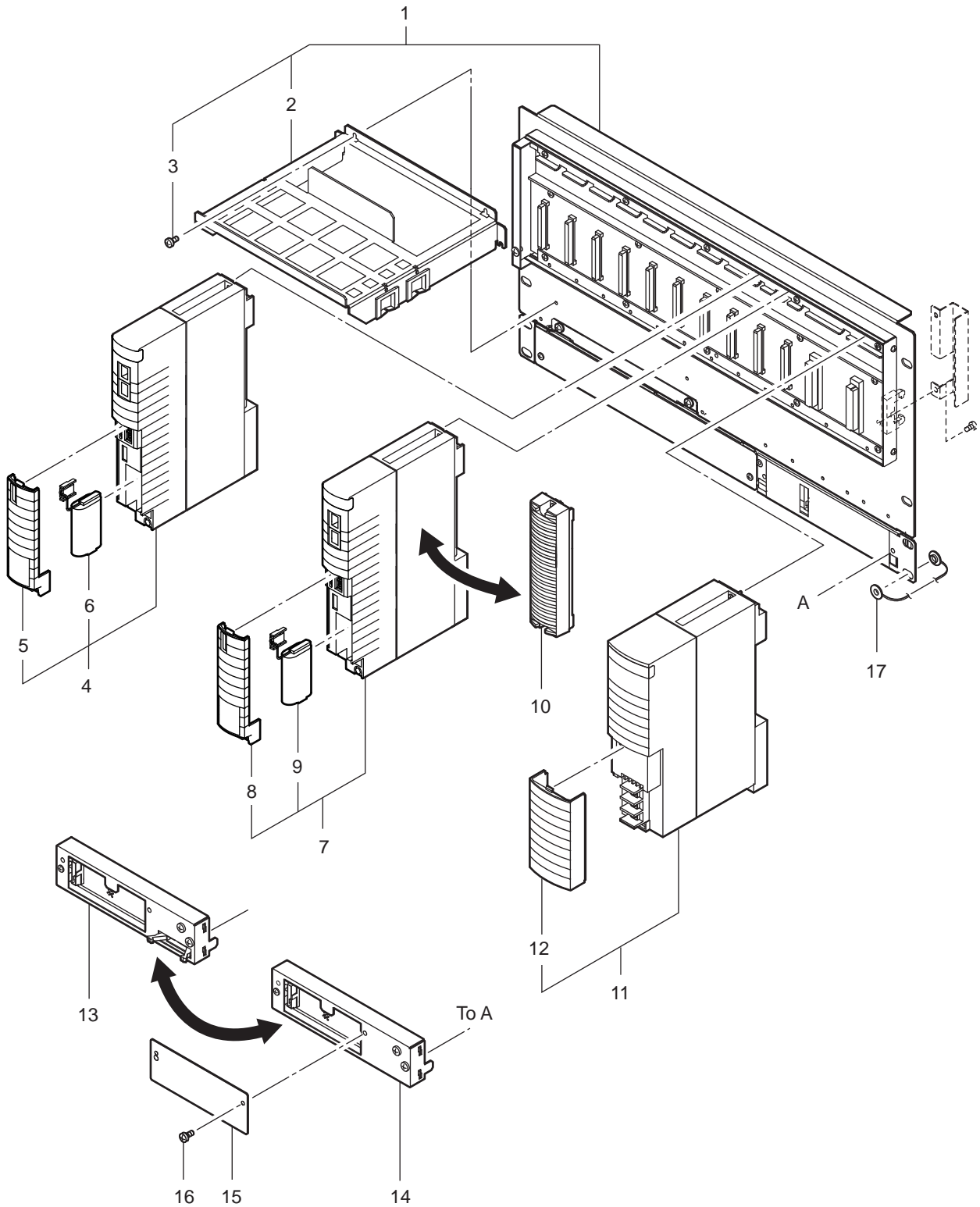
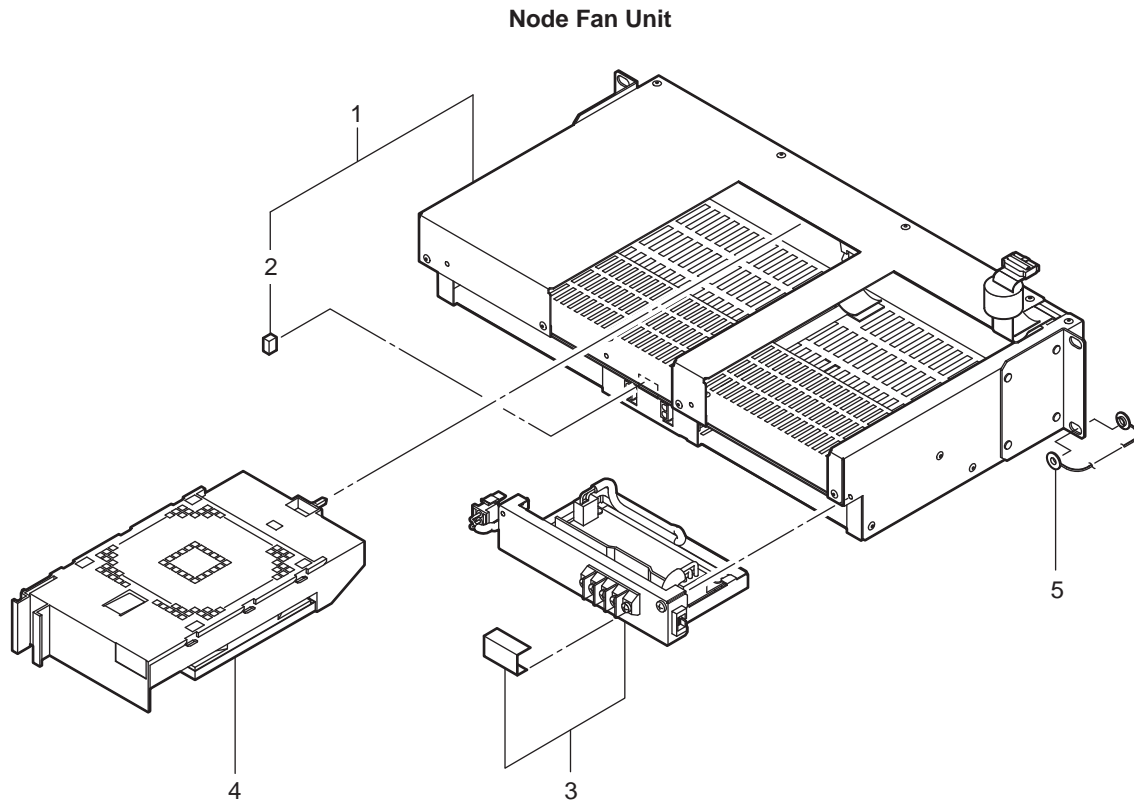


Figure CMPL 4-2

Item	Model or Part No.	Model	Qty		Description
			SSC60S	SSC60D	
1	-		1	1	CPU Node Unit
2	T9082QE		1	1	Cable Tray
3	Y9306LB		4	4	B.H.Screw, M3 × 6
4	SCP461		1	1	Processor Module
5	T9084EB		1	1	Cover
6	S9185FA		1	1	Battery Assembly
7	SCP461		1	1	Processor Module
8	T9084EB		1	1	Cover
9	S9185FA		1	1	Battery Assembly
10	T9083VB		1	1	Dummy Cover
11	Below SPW481 SPW482 SPW484		2	2	Power Supply Module for 100 to 120 V AC Power Supply for 220 to 240 V AC Power Supply for 24 V DC Power Supply
12	T9083UX		2	2	Cover
13	S9473FA		1	1	CPU Node External Interface Unit (with fan) for SSC60 style S2 or later
14	S9474FA		1	1	CPU Node External Interface Unit (without fan) for SSC60 style S2 or later
15	T9083TR		1	1	Plate
16	Y9306LE		2	2	B.H.Screw, M3 × 6
17	S9049PM		8	8	Insulating Bushing (accessory)

Figure CMPL 4-3



Item	Model or Part No.	Qty	Description
1	S9475FA	1	Node Fan Unit for SSC60 style S2 or later
2	S9528VK	2	Fuse
3	Below	2	Fan Power Module
	S9159FA		for 100 to 120 V and 220 to 240 V AC Power Supply Unit
	S9160FA		for 24 V DC Power Supply Unit
4	AIP602	2	Fan Assembly
5	S9049PM	4	Insulating Bushing (accessory)

Figure CMPL 4-4

Safety Control Stations (Hardware)

IM 32Q06C10-31E 4th Edition

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*: Denotes the release number of the Software Product corresponding to the contents of this Manual. The revised contents are valid until the next edition is issued.

Introduction Safety System Document Map has been deleted. Description in the Safety, Protection, and Modification of the Product section has been changed.

Description of the conformity standards has been changed.

All Description of the grounding has been changed.

5.3 Figures showing the signal cable connection to the analog input/output modules have been changed.

5.4 Figures showing the signal cable connection to the digital input/output modules have been changed.

Oct. 2013/3rd Edition/R3.02.10 or later

Introduction Description of station types has been changed.

Description of conformity standards has been modified.

Description of measurement categories has been modified.

3.3.1 Description of V net grounding unit components has been modified.

7.2.2 Description of replacing power supply module has been modified.

7.8 Description of replacing parts has been added.

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1.4.3 Ethernet communication module has been added.

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7.1.1 Explanation of status display LEDs of the Ethernet communication module has been added.

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■ For Questions and More Information

Online Query: A query form is available on the following URL for online query.

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