

Technical Information

ProSafe-RS
Installation Guidance

ProSafe-RS

TI 32S01J10-01E

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Introduction

ProSafe-RS is a safety control system aimed at protecting people, environment, and equipment from unexpected accidents or problems at a plant.

This manual describes the requirements for installation (control room size and power supply requirements), storage and transportation, and wiring.

Chapter 1 System Installation Requirements

This chapter describes the engineering specifications that cover the control room design/ environment, power supply system, grounding, noise prevention, corrosive-gas environment compatibility and compliance with marine standards for the ProSafe-RS system.

Chapter 2 Transportation, Storage and Installation

This chapter describes precautions for the transport, unpacking and storage of the ProSafe-RS system. This chapter also describes temperature and humidity changes when temporarily storing the ProSafe-RS system, and how to install cabinets and rack mounted devices.

Chapter 3 Cabling

This chapter describes how to connect power, ground, signal and bus cables to the installed devices, and how to connect optical fiber cables.

Chapter 4 Installation Specifications

This chapter covers the power consumption, power dissipation, in-rush current, and fuse and breaker ratings as well as the parts that need replacement within 10 years. Read this section when deciding the power supply capacity.

Chapter 5 Post-installation Inspection and Environmental Preservation

This chapter describes items that must be checked before turning on power and the precautions to be taken to safeguard the environment after installing the system.

Safety Precautions

■ Safety, Protection, and Modification of the Product

- In order to protect the system controlled by the product and the product itself and ensure safe operation, observe the safety precautions described in this Technical Information and the User's Manuals. We assume no liability for safety if users fail to observe these instructions when operating the product.
- If this product is used in a manner not specified in this Technical Information, the protection provided by this product may be impaired.
- If any protection or safety circuit is required for the system controlled by the product or for the product itself, prepare it separately.
- Be sure to use the spare parts approved by Yokogawa Electric Corporation (hereafter simply referred to as YOKOGAWA) when replacing parts or consumables.
- Do not use the accessories (Power supply cord set, etc.) that came with the product for any other products.
- Modification of the product is strictly prohibited.
- The following symbols are used in the product and this Technical Information to indicate that there are precautions for safety:



Indicates that a caution must be given for operation. This symbol is placed on the product where the user is recommended to refer to the instruction manual in order to protect the operator and the equipment against dangers such as electrical shocks. In the instruction manuals you will find precautions to avoid physical injury or death to the operator, including electrical shocks.



Indicates that caution is required for hot surface. Note that the devices with this symbol become hot. The risk of burn injury or some damages exists if the devices are touched or contacted.



Identifies a protective conductor terminal. Ensure to ground the protective conductor terminal to avoid electric shock before using the product.



Identifies a functional grounding terminal. A term "FG" is also used. This terminal is equipped with the same function and used for purposes other than the protective grounding. Before using the product, ground the terminal.



Indicates an AC supply.



Indicates a DC supply.



Indicates that the main switch is ON.



Indicates that the main switch is OFF.

■ Symbol Marks of this Technical Information

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



CAUTION

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



IMPORTANT

Identifies important information required to understand operations or functions.

TIP

Identifies additional information.

SEE ALSO

Identifies a source to be referred to.

■ Cautions for Safely Applying the Device

● Wiring Power Cable



CAUTION

Connect the power cables according to the procedure in this document.
Power cables must conform to the safety standards of the country where the device is installed.

**SEE
ALSO**

For Wiring Power Cable, refer to 3.2, "Connecting Power."

● Earth Wiring



CAUTION

This equipment requires a protective grounding defined by the safety standard.
Ground the device following the procedure in this document to prevent from electric shock and to minimize the noise.

**SEE
ALSO**

For Earth Wiring, refer to 3.3, "Connecting Ground Cable."

● Tightening Torque of Screws



CAUTION

The tightening torque that the Product recommends is showed 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 Table of 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

• Battery



CAUTION

- Must use Yokogawa designated batteries.
 - Mounting and changing batteries must follow the procedure in the hardware instruction manual for each device.
 - When changing batteries while the power supply is not shutdown, do not put hands inside of the device since it is danger of electric shock.
-

• Fan Unit



CAUTION

- When changing fan unit while the power supply is not shutdown, be careful not to touch other parts so as to avoid electric shock.

**SEE
ALSO**

For Fan Unit, refer to 4, "Installation Specifications, Parts Durability."

• Wiring I/O Cables



CAUTION

Wiring I/O cables must follow the procedure in this document.

**SEE
ALSO**

For Wiring I/O Cables, refer to 3.5, "Connecting Signal Cable."

• Connected Devices



CAUTION

To ensure this system's compliance with the CSA safety standards, all devices connected to this system shall be CSA certified devices.

● Fuse Replacement



CAUTION

- Be sure to use the specified fuses.
 - Switch off the power supply before exchanging the fuses.
-

● Maintenance



CAUTION

- The maintenance work for the devices described in this manual should be performed only by qualified personnel.
- When the device becomes dusty, use a vacuum cleaner or a soft cloth to clean it.
- During maintenance, put up wrist strap, and take other ESD (Electrostatic Discharge) measures.
- If the existing caution label is dirty and illegible, prepare a new label (part number: T9029BX) to replace it.

**SEE
ALSO**

For Maintenance, refer to 1.5.2, “Countermeasures against Static Electricity.”

■ Drawing Conventions

Some drawings may be partially emphasized, simplified, or omitted, for the convenience of description.

Trademark

■ Trademark

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**ProSafe-RS
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TI 32S01J10-01E 22nd Edition

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1. System Installation Requirements

This section describes installation requirements such as environmental conditions, required space and layout considerations, power consumption, cabling and grounding.

1.1 Control Room Design

Control rooms, in which the system control equipment is to be installed, should be designed in accordance with the following conditions:

■ General

In designing a control room, ensure adequate floor strength and air conditioning including dust- and moisture-proofing.

SEE ALSO

-
- 1.1 Control Room Design Air Conditioner
 - 1.2 Control Room Environment Air Purity
- Applied Standards (Table Installation Environment Specifications)
-

■ Floor Strength and Space

The floor should have adequate strength, and you should design the layout in accordance with the weight and size of equipment to be installed.

SEE ALSO

-
- For the maintenance space required, refer to 2.4, “Servicing Area.”
 - For the weight and dimensions of standard equipment, refer to applicable general specifications.
-

■ Floor Structure

To prevent damage to cables by operators and maintenance equipment, do not lay cables on the floor.

Lay cables under the floor as follows:

- Provide an “accessible” floor which also facilitates maintenance work.
- Make cable pits under the floor if it is concrete.

■ Flooding- & Dust-proof Floor

To protect equipment and cables, design a flooding-proof floor.

After the cabling is completed, seal all cable conduits using putty to prevent intrusion of dust, moisture, rats, and insects into the equipment.

■ Clearance From The Wall and The Floor Surface

There are ventilation holes on the front and rear doors of the cabinets. To ensure good air ventilation and easy maintenance, provide a clearance of at least 1000 mm (including the service areas) from the wall to the front and rear doors of the cabinets. Also make sure the height of the ceiling is at least 2400 mm from the floor.

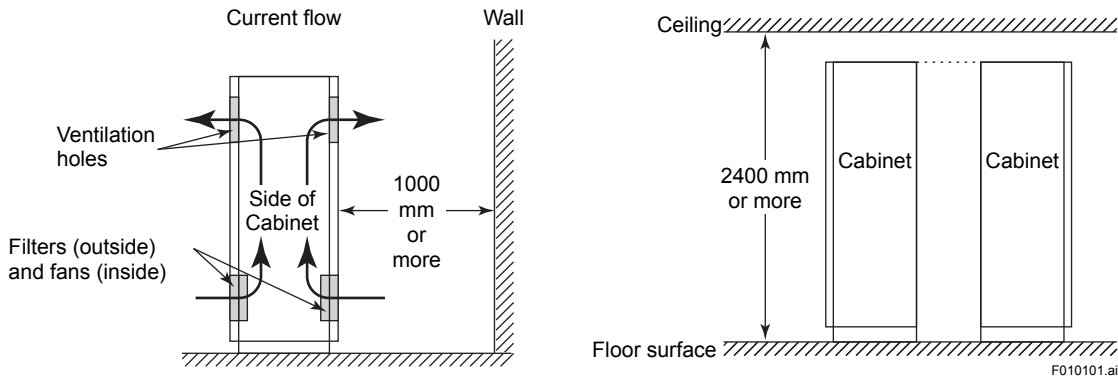


Figure Wall Clearance and Ceiling Height

■ Illumination

The illumination level around a display unit should be 700 to 1500 lx (target illumination level: 1000 lx). The illumination level inside the control room should be reasonably uniform.

Select proper light fixtures and install them in positions where they don't cause glare on the CRT displays and LCDs.

TIP

REFERENCE (Illumination standards):

For ultra-precision work:	1500 to 3000 lx (illumination level: 2000)
For precision work:	700 to 1500 lx (illumination level: 1000)
For ordinary work:	300 to 700 lx (illumination level: 500)
For non-detail work:	150 to 300 lx (illumination level: 200)
Passages, warehouses:	30 to 150 lx (illumination level: 50 to 100)

(Source: JIS Z9110)

■ Outlets for Maintenance

Outlets (approx. 1.5 kVA) for measurement devices should be provided near the installed equipment for maintenance.

■ Telephone

Telephones should be installed for communications with related stations.

■ Air Conditioner

The air conditioner should be operated according to the conditions below to prevent moisture condensation on the installed equipment.

- Keep changes in temperatures within $\pm 10^{\circ}\text{C}/\text{h}$.
- Install the air conditioner away from the equipment.
- Install substitute air conditioners to prevent moisture condensation as a result of the temperature rising or falling if an air conditioner fails.
- Set the air conditioner so that its air outlet is not above the equipment (to avoid water dropping on the equipment).

■ Windows

Close the windows of the control room. If a draft comes in around the windows, seal around the windows.

Opening the window while air conditioning is running may result in condensation forming, or let in dust or corrosive gas, adversely affecting the installed equipment. Windows on the sea side must be closed to keep out salt air.

Install blinds, if necessary, to prevent sunlight reflecting from CRT displays and LCDs.

1.2 Control Room Environment

This section describes environmental conditions of the control room to operate the system safely, and stably over a long period of time.

It is recommended that user have the control room environment assessment. For the assessment, contact Yokogawa if necessary.

■ Temperature and Humidity Limits

**SEE
ALSO**

See "Table of Equipment Installation Specifications" in this section, for the temperatures and humidity limits for operating and storing this equipment.

When bringing the equipment into a location where allowable operating temperature is set from another location where the temperature exceeds the allowable operating range, following precautions are necessary:

- The equipment should reach the ambient temperature according to the requirements for the temperature change rate, keeping it unpacked from its case. At that time, be careful not to let condensation form on the equipment.
- Once the equipment reaches the allowable operating temperature range, leave it for about three hours before operation.

Under normal operation, the rate of change of ambient temperatures should be within 10°C/h. All the equipment should be kept out of direct sunlight.

■ Condensation

Prevent condensation. If condensation occurs, or its trace is found on the control room, contact Yokogawa.

**SEE
ALSO**

See "Section 2.3 Storage" for more information.

■ Vibration

Vibration in the control room should be limited as follows:

- For vibration frequency up to 8.4 Hz: Limit displacement amplitude to 1.75 mm or less.
- For vibration frequency over 8.4 Hz: Limit acceleration to 4.9 m/s² or less.

The following is the relationship of the vibration frequency, displacement amplitude, and acceleration:

$$\text{Acceleration (m/s}^2\text{)} = 4\pi^2 \cdot A \cdot F^2 \cdot 10^{-3}$$

A: Displacement amplitude (mm)
F: Frequency (Hz)

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Consult Yokogawa if complex vibrations are involved.

■ Air Purity

The dust in the control room should be kept below 0.3 mg/m³. Minimize corrosive gas such as hydrogen sulfide (H₂S), sulfur dioxide (SO₂), chlorine, and conductive dust such as iron powder and carbon.

The allowable content of H₂S, SO₂, or any other corrosive gas varies with temperatures, humidity, or existence of other corrosive gas. Consult Yokogawa if corrosive gas exists.

■ Magnetic Field

Do not install the CRT near cables with heavy current flowing or in the magnetic field of a power supply. If installed in such locations, the display may be distorted or its colors may be affected by the magnetic fields.

■ Electric Field Strength (Electric Wave Condition)

For the proper and stable operation of this system, the field electric strength of the location for the equipment should be controlled as following:

10 V/m or less (26 MHz to 1.0 GHz)

10 V/m or less (1.4 to 2.0 GHz)

1 V/m or less (2.0 to 2.7 GHz)

In case of the usage of wireless equipment such as transceiver nearby this system, note as following:

- The door of this system should be closed.
- In case of the usage of transceiver with 10 W or less, the distance from this system should be kept 1 m or more.
- As for the usage of wireless equipment with 1 W or less such as mobile-telephone, PHS, wireless telephone or LAN equipment, the distance should be kept 1 m or more. Attention should be paid to the micro wave radiated from mobile-telephone or PHS even out of usage.

Following formula represents the electric field strength. However, the calculated value requests ideal environment. Worse conditioned environment should be taken into consideration. In case some wireless equipment is used nearby this system, this formula would be useless. The value calculated through this formula should be considered noting other than reference.

$$E = \frac{k \sqrt{P}}{d}$$

E : Electric field strength (V/m)

k : Coefficient (0.45 to 3.35; average 3.0)

P : Radiation power (W)

d : Distance (m)

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■ Installation Specification

Installation height: Altitude of up to 2000 m
 Installation category based on IEC 61010-1 (*1)

Category I

- For YOKOGAWA products, category I applies to the device that receives the electric power not more than 33 V AC, 70 V DC.

Category II

- For YOKOGAWA products, category II applies to the device that receives the electric power exceeding 33 V AC or 70 V DC.

Pollution degree based on IEC 61010-1: 2 (*2)

- *1: The installation category, also referred to as an overvoltage category, defines the standard for impulse voltage. The category number from I to IV applies the devices to determine the clearance required by this standard. Category I applies to the device intended to be connected to a power supply with impulse voltage reduced to the safe level. Category II applies to the device intended to be supplied from the building wiring.
- *2: Pollution degree indicates the adhesion level of foreign matter in a solid, liquid, or gaseous state that can reduce dielectric strength. Degree 2 refers to a pollution level equivalent to the general indoor environment.

SEE ALSO See "Installation Environment Specifications" at the end of this chapter.

■ Measurement Categories

Regarding the measurement inputs, the following requirements must be satisfied to meet the specifications for the device:

The category of the equipment applies to No.1 in the following table.

The rated transient overvoltage is 1500 V.

Note: Do not use the equipment for measurements within measurement categories II, III and IV.

Table Measurement category

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

■ Applied Standards

The ProSafe-RS complies with the standards shown below.



IMPORTANT

Different standards are applied according to the types of equipment.

For details, refer to the hardware General Specifications (GS) for each equipment.

● Functional Safety Standards

IEC 61508, IEC 61511-1 and IEC 62061

● Standard for Programmable Controllers (*1), (*2), (*3)

IEC 61131-2

● Applicable Standards (*1)

EN 54-2 (*5), EN 298 (*3), (*4), EN 50156-1, NFPA 85, NFPA 72

● Safety Standards (*6), (*8), (*9), (*10)

[CSA]

CAN/CSA-C22.2 No.61010-1 (100-120 V AC power supply)

[CE Marking] Low Voltage Directive

EN 61010-1, EN 61010-2-201, EN 61010-2-030, EN 60825-1 (100-120 V AC (*7), 220-240 V AC and 24 V DC power supply)

[EAC Marking]

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*1: A lightning arrester or the like is required to meet this surge immunity standard.

*2: 24 V DC and 48 V DC field power cables to DI and DO should be a maximum of 30 m in length.

*3: Where the system power uses 24 V DC (SPW484), use an external uninterruptible power supply (UPS).

*4: 24 V DC and 48 V DC field power cables to DI and DO should be a maximum of 10 m in length.

*5: A clamp filter (A1193MN) should be connected to the V net cable.

*6: For the rack mountable devices, DIN rail mountable devices, and wall mountable devices to meet the Safety Standards and EMC Standards, the devices must be installed in a lockable metal cabinet. The cabinet must conform to IEC/EN/CSA 61010-2-201 or provide degrees of protection IP3X or above and IK09 or above.

*7: SSC10□-□2□11 does not comply with CE Marking of 100 V AC.

*8: Measurement inputs of this equipment are applied to Measurement category I for IEC/EN/CSA 61010-1:2001 and O (Other) for EN 61010-2-030.

*9: For ensuring all the hardware devices to satisfy the safety standards, the dedicated breakers in the power supply distribution board must conform to the following specifications.

[CSA] CSA C22.2 No.5 or UL 489

[CE Marking] EN 60947-1 and EN 60947-3

[EAC Marking] EN 60947-1 and EN 60947-3

*10: The ground suitable for the power distribution system in the country or region has to be used for protective grounding system.

● EMC Conformity Standards (*2), (*3)

[CE Marking] EMC Directive

EN 55011 Class A Group1 (100-120 V AC (*4), 220-240 V AC and 24 V DC power supply) (*5)

EN 61000-6-2 (100-120 V AC (*4), 220-240 V AC and 24 V DC power supply) (*1)

EN 61000-3-2 (220-240 V AC power supply) (*6)

EN 61000-3-3 (220-240 V AC power supply)

[RCM]

EN 55011 Class A Group1 (220-240 V AC and 24 V DC power supply) (*5)

[KC Marking] (100-120 V AC (*4), 220-240 V AC and 24 V DC power supply)

Korea Electromagnetic Conformity Standard

[EAC Marking]

CU TR 020

[Functional Safety]

IEC 61326-3-1

*1: A lightning arrester or the like is required to meet this surge immunity standard.

*2: 24 V DC and 48 V DC field power cables to DI and DO should be a maximum of 30 m in length.

*3: For the rack mountable devices, DIN rail mountable devices, and wall mountable devices to meet the Safety Standards and EMC Standards, the devices must be installed in a lockable metal cabinet. The cabinet must conform to IEC/EN/CSA 61010-2-201 or provide degrees of protection IP3X or above and IK09 or above.

*4: SSC10□-□2□11 does not comply with CE Marking and KC Marking of 100 V AC.

*5: The analog inputs of this system fall into Measurement Category I of IEC 61010-1.

*6: A Class A hardware device is designed for use in the industrial environment. Please use this device in the industrial environment only.

● Standard for Hazardous (Classified) Locations

[FM Non-Incendive]

[Type "n"]

SEE ALSO

For more information about Standard for Hazardous Locations, refer to TI 32S01J30-01E "Explosion Protection (for ProSafe-RS)."

● Marine Standards

ABS (American Bureau of Shipping)

BV (Bureau Veritas)

Lloyd's Register

SEE ALSO

For more information about the components which comply with the marine standards and how to install those components, refer to 1.8, "Compliance with Marine Standards."

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

Manufacturer: YOKOGAWA Electric Corporation

(2-9-32 Nakacho, Musashino-shi, Tokyo 180-8750, Japan.)

Authorised representative in the EEA: Yokogawa Europe B.V.

(Euroweg 2, 3825 HD Amersfoort, The Netherlands.)

■ Installation Environment Specifications

The following table lists environmental requirements for the installation of the ProSafe-RS System.

**SEE
ALSO**

For details on each equipment, refer to the ProSafe-RS general specifications (GS).

Table Installation Environment Specifications

Item		Specifications	Remarks
Temperature	Normal operation	–20 to 50°C (basic safety control unit for V net) –20 to 40°C (basic safety control unit for Vnet/IP) –20 to 70°C (temperature-adaptive safety control unit and safety node unit)	(*1)
	Transportation/storage	–40 to 85°C	
Humidity	Normal operation	5 to 95% RH (non-condensing)	5 to 85 % RH when the SRM53D/RM54D/SBM54D is mounted.
	Transportation/storage	5 to 95% RH (non-condensing)	
Temperature change	During operation	Within ± 10°C/h	
	Transportation/storage	Within ± 20°C/h	
Power supply	Voltage range	100 to 120 V AC –15%, +10% 220 to 240 V AC –15%, +10% 24 V DC: –10% to +20%	
	Frequency	50/60 Hz ± 3Hz	
	Distortion factor	10% or less	
	Crest factor	100 V system: 118 V or larger 220 V system : 258 V or larger	
	Momentary failure	20 ms or less (when receiving the rated AC voltage)	
	DC power supply ripple rate	1% p-p maximum	
Withstanding voltage		1500 V AC for 1 minute (for 100-120/220-240 V AC) 500 V AC for 1 minute (for 24 V DC)	Between power & ground terminals
Insulation resistance		20 M ohms at 500 V DC	Between power & ground terminals
Grounding		Apply the grounding system which is defined by the rules and standards of the country or the region.	
Dust		Maximum of 0.3 mg/m ³	
Corrosive gas		ANSI/ISA S71.04 G3 (standard)	Excluding SRM53D/SRM54D/SBM54D
Noise	Electric field	10 V/m maximum (80 MHz to 1 GHz)	
	Static electricity	4 kV or less (direct discharge) 8 kV or less (aerial discharge)	
Vibration	Continuous vibration	Amplitude: 1.75 mm (5 Hz to 9 Hz) Acceleration: 4.9 m/s ² (9 Hz to 150 Hz)	
	Non-continuous vibration	Amplitude: 3.5 mm (5 Hz to 9 Hz) Acceleration: 9.8 m/s ² (9 Hz to 150 Hz)	
	Seismic	Acceleration: 4.9 m/s ² or less	
	Transportation	Horizontal: 4.9 m/s ² or less vertical: 9.8 m/s ² or less	When packaged
Impact		147 m/s ² , 11 ms	
Altitude		2000 m above sea level or less	

*1: When ALR111-S□1/ALR121-S□1 is installed, the ambient temperature should range from 0 to 60 °C. In case of ALR121-S□B, it should range from 0 to 70 °C. When ALE111-S□1 is installed, the ambient temperature should range from 0 to 60 °C. ALE111 supported in R3.02.00 or later can be mounted on SSC60□, SSC50□ or SSC57□.

**SEE
ALSO**

For the level of corrosive gases permitted in an ordinary office, refer to TI 33Q01J20-01E “Guidelines for Installation Environment.”

1.3 Power Supply System

The following conditions should be met:

- Voltage and frequency fluctuations are within the limits specified for each system component.
- Waveform distortion is within limits.
- High-frequency noise is not at a level that affects system operation.
- Use an UPS (uninterruptible power supply) if necessary.

■ AC Power Specification

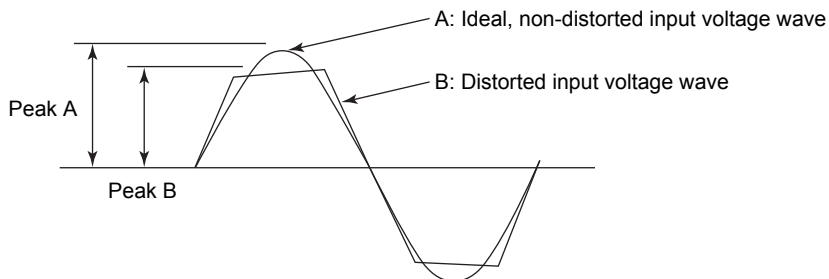
AC power used for the system must be within the specified rated voltage and the peak value must be greater than the minimum specified (see below). DC power must be within 24 V DC $-10\%/+20\%$ at the power supply terminals.



IMPORTANT

If the power unit has high output impedance or high wiring impedance, the resulting voltage drop flattens the input voltage wave, forming a distorted waveform with a low peak value ("B" in the chart below).

Even if the effective value of the distorted input voltage wave is the same as that specified for a non-distorted input voltage wave, the voltage across the terminals of the smoothing capacitor in the power circuit may be so low that the system detects power failure. Even if input voltage waves A and B shown below have the same effective value of 100 V AC, wave B will have a lower smoothing capacitor terminal voltage.



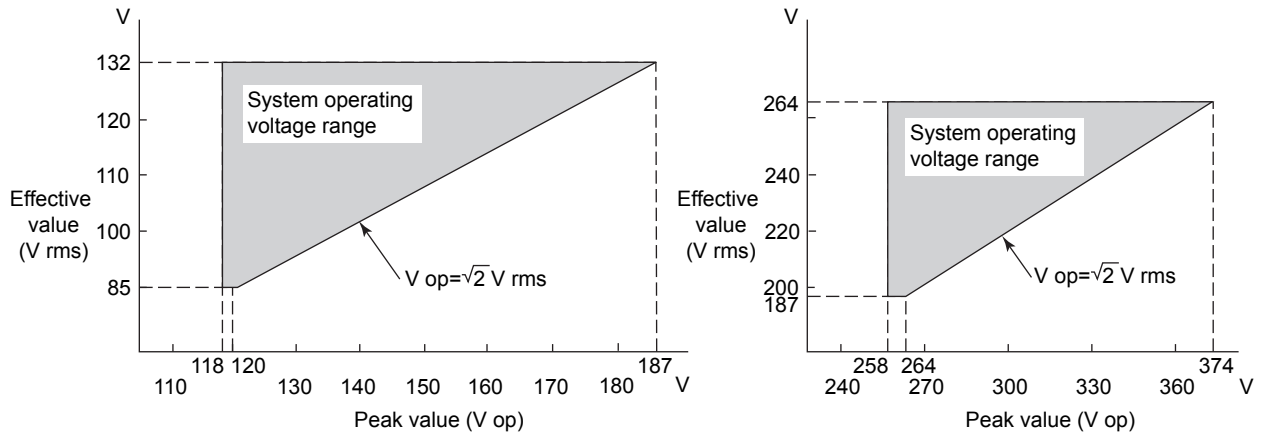
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Figure Distorted Input Voltage Waveform

The system operating voltage range is shown below based on the relationship between effective and peak values at the power input terminal of each system. Apply AC power within these ranges to operate the system.

TIP

Average-value rectifying measuring instruments such as general type digital voltmeters and testers cannot measure effective values accurately. Use Yokogawa's digital oscilloscope DL series, power analyzer WT series or equivalent device, which can measure effective values, peak values, and waveform distortion.

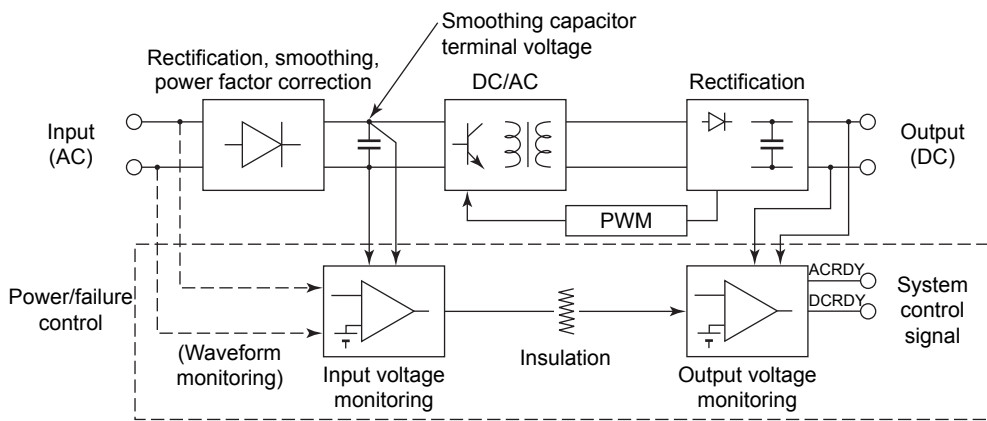


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Figure System Operating Voltage Range

The DC stabilized power supply for the ProSafe-RS (except PCs) uses a compact and efficient switching regulator circuit. In this circuit, output voltage cannot be maintained if the energy (terminal potential) of the smoothing capacitor falls below a predetermined value. The circuit monitors the capacitor terminal voltage and regards it as power failure if the voltage falls in the danger zone, causing the system to enter power fail mode (non-detected momentary power failure: up to 20 ms).

Current flows to the capacitor in this circuit when AC input voltage is higher than the capacitor terminal voltage. Since the capacitor is charged by the peak value of the input waveform, it is required that both the effective voltage value and the peak value conform to the specification requirements.



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Figure Power Circuit Diagram of Safety Control Unit

■ Selecting a Power System

The ProSafe-RS system requires a power supply that satisfies power requirements in accordance with EMC regulations. It is recommended that an external power supply unit be used in order to prevent disruptions due to momentary or extended power failure, line noise, or lightening surges, as well as to suppress harmonic current from various devices.

For selection of the power supply unit, consult with a power unit manufacturer taking the following points into consideration.

● Source Output Capacity

Take the following items into consideration when consulting with a power unit manufacturer to determine the output capacity.

Power consumption:	Both volt-ampere and watt data should be studied.
Device crest factor:	Ratio of the peak value to the effective value of the device input current.
Device in-rush current:	The method of turning on the power should also be studied.
Backup ready time after failure:	Time period required to backup the devices when power fails.
Reserve capacity:	An extra power capacity should be determined as reserve to meet any device additions.

**SEE
ALSO**

- Electrical Specifications Table for power consumption in Chapter 4
 - In-rush Current of Each Component in Chapter 4
-

● Crest factor

The crest factor is the ratio of the peak value to the effective value of the device input current.

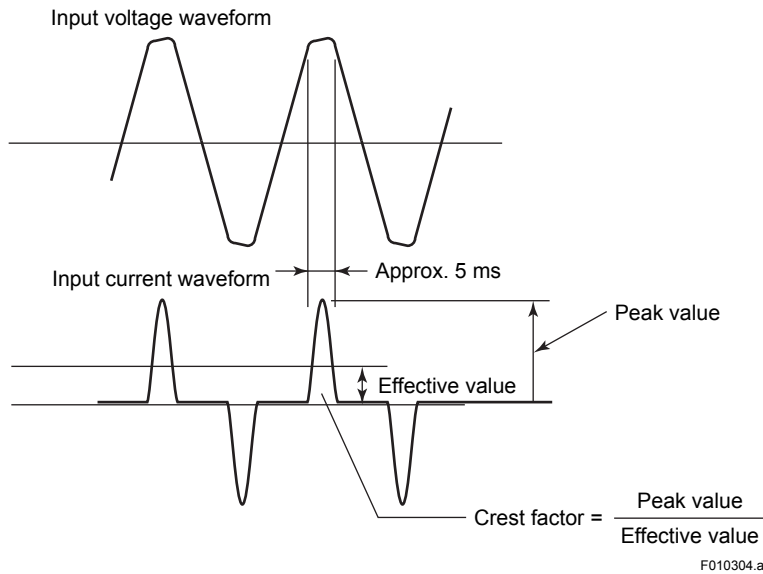


Figure Input Voltage and Input Current Waveforms

Crest factor = Peak value of device input current / Effective value of device input current

The crest factor must be considered for the input current supplied to every device connected to the system when estimating the power output capacity in selecting the power unit.

Approximate device crest factors should be as follows:

100-120 V supply voltage: Crest factor About 3.

220-240 V supply voltage: Crest factor About 6.

● Common Method to Determine Power Unit Capacity

The following shows the commonly used method used to determine the power unit capacity taking the crest factor into consideration - the final determination should be made in consultation with a power unit manufacturer:

- If the specification of power unit crest factor (the peak current value allowable for the effective current value) is larger than the above device crest factor, the power unit can be used for up to full rated capacity. However, in-rush current, backup time, reserve capacity, etc., must be separately taken into consideration.
- If the power unit crest factor is smaller than the device crest factor, the power unit capacity needs to be calculated in the expression shown below. In-rush current, backup time, reserve capacity, etc., must be separately taken into consideration.

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

Capacity coefficient = Device crest factor / Power unit crest factor specification

● In-Rush Current

When the equipment is turned on, a large in-rush current flows as the capacitor is instantaneously charged and the transformer is excited. When any equipment is turned on, this should not cause any voltage fluctuation that could adversely affect other equipment. Do not turn on all equipment at the same time. Start equipment one by one.

Power may be switched to backup or AC line power if in-rush current activates the overload protection circuit on power-up. After such an overload, select an uninterruptible power unit, with automatic-recovery.

● Suppressing Harmonic Current

In order to suppress harmonic current supplied to a low-voltage distribution system, it is necessary to install a power unit or an active harmonic suppressor, such as indicated below, between a device and the distribution system:

- Power unit equipped with the harmonic suppression function (a high power-factor inverter-type uninterruptible power unit, etc.)
- Active harmonic suppressor

In Europe, a power unit should be selected so that harmonic current emissions are within the limits specified by EMC regulations.

The capacity of the harmonic suppression unit should be determined in consultation with a power unit manufacturer in the same manner as the selection of power unit's output capacity previously discussed.

■ Cabling

Observe the following when cabling the power unit to the ProSafe-RS system equipment:

- Protect signal cables from induced noise.
- Protect signal cables from induction from high-voltage power lines.
- Separate the ProSafe-RS system power supply from other equipment power supplies. Use a separate power distribution board.
- Provide a dedicated breaker for each power supply.
- Install breakers and devices in the same room.
- Label the breakers with the name of the connected equipment.
- Install the breakers where they can be easily operated.
- The breaker, must not interrupt connection by wiring to protective grounding system.
- As far as possible install power supply cables and high-voltage power lines in metallic conduits.
- Use shielded cables if metallic conduits cannot be provided.

1.4 Grounding

To avoid electric shocks and minimize the influences of external noise, the installed devices must be grounded to the protective grounding system which complies with the safety standards, the electrical installations standard, and the power distribution system of the country or the region.

As for the protective grounding systems, the meshed grounding systems described in IEC 60364, IEC 62305 and IEC 61000-5-2 can be applied.

A protective device is to be installed in compliance with the rules and regulations, in order to prevent electric shocks caused by a ground fault.

A plug type power cable has to be connected to the receptacle connected to the protective grounding system.

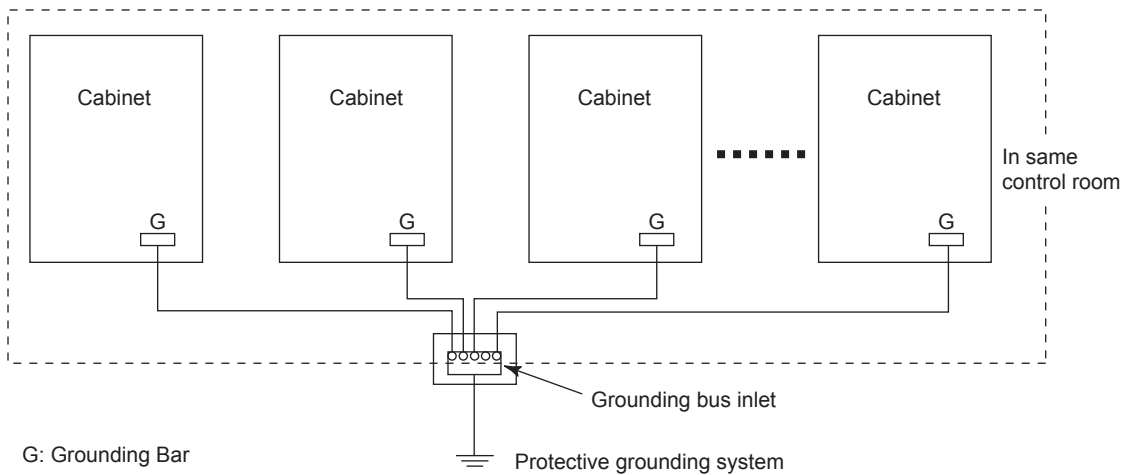
■ Grounding Circuit

Grounding examples are given below.

If ProSafe-RS systems are housed in a cabinet, the cabinet must be grounded according to the grounding network topology of the building or plant for installation.

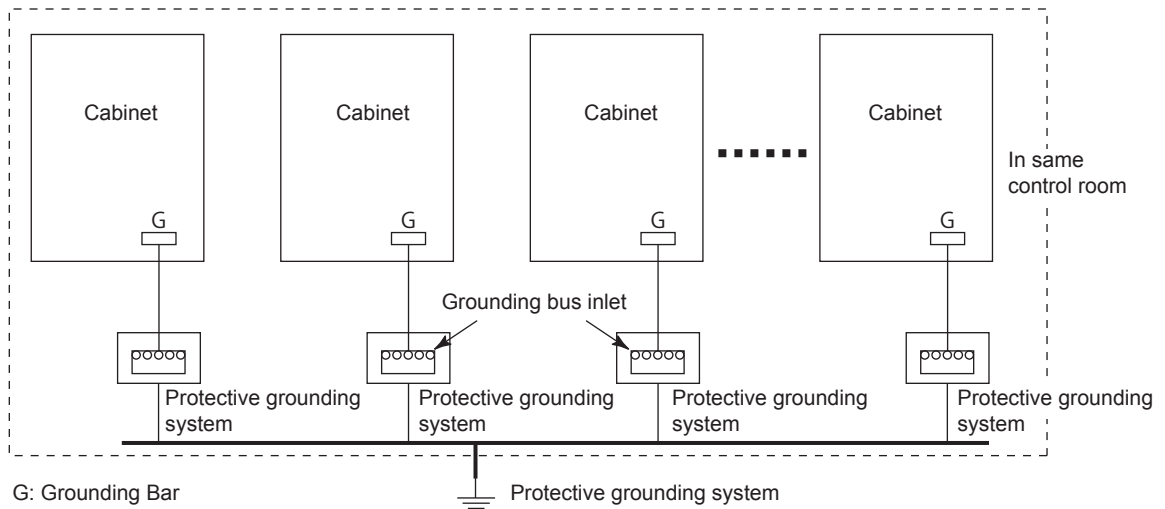
In order to connect a cabinet with a protective grounding system, the grounding topology shown in the figures “Grounding connected to a single grounding bus inlet” or “Grounding connected to each grounding bus inlet” can be used.

When providing lightning arresters on power and signal lines, those arresters need to be grounded to the same bus. For details, see Section 1.5, “Noise Countermeasures.”



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Figure Grounding connected to a single grounding bus inlet



F010402.ai

Figure Grounding connected to each grounding bus inlet

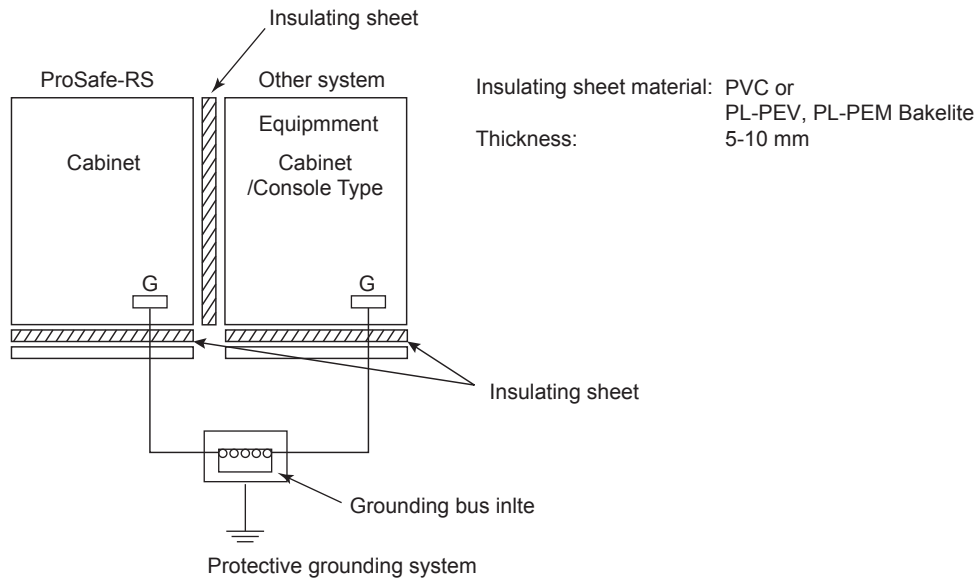
■ Grounding with Other System

Do not connect ProSafe-RS's cabinet with other system cabinets or consoles electrically using bolts or other connection mechanism in order to avoid unexpected electrical connection or interference.

When ProSafe-RS is joining side by side with other system cabinets or consoles, ensure to insert insulating sheets.

The cabinets or consoles other than ProSafe-RS must be insulated from a floor and connect it to a protective grounding system using a different grounding cable.

CENTUM VP can be treated as the ProSafe-RS system in this page.



G: Grounding Bar

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Figure Grounding Using Insulating Sheets



IMPORTANT

Do not install the following systems side-by-side with ProSafe-RS:

- Systems using power supply voltages over 300 V AC.
- Systems with current consumption over 50 A.
- System containing high frequency sources.

1.5 Noise Countermeasures

Noise may be induced by electromagnetic induction, electrostatic induction, or come from radio waves, lightning, inductive loads, static electricity and ground potential differences.

It can be picked up by power, signal and ground cables, and devices. With computerized control systems, noise-induced errors in A/D conversion or in an instruction word may lead to malfunction. Therefore, it is necessary to prevent the noise from being generated or coming too much from the outside.

To prevent noise and electrostatic buildup, take the measures described in this section when deciding cable type, cable routing, and grounding.

1.5.1 Noise Sources and Noise Countermeasures

It is not easy to identify the cause of any noise-triggered errors or failures due to their lack of reproducibility.

To prevent noise generation, it is necessary to consider the installation environments such as the external cable routing, cable types, and grounding.

The following table lists typical noise sources, symptoms of noise problems, and preventive countermeasures:

Table Noise Sources & Countermeasures

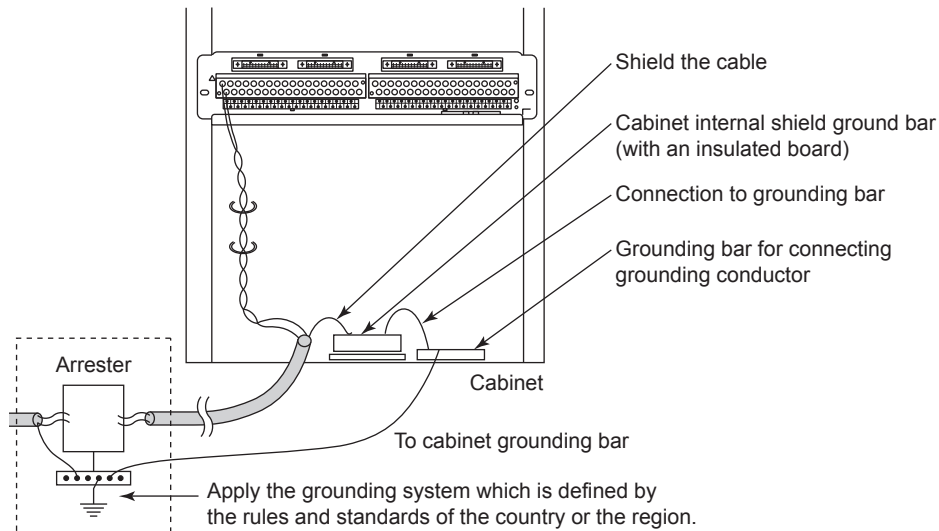
Noise sources	Effects	Countermeasures
Electromagnetic induction (magnetic field)	<ul style="list-style-type: none"> • CRT display instability, distortion, color shift, color fringing. • Destroys magnetic/flexible disk data. 	<ul style="list-style-type: none"> • Maintain separation from magnetic-field source. • Shield power cables with metallic conduits. • Shield magnetic field using ferromagnetic substance (e.g. Permalloy). Or use LCD. • Use twisted-pair cables.
Electrostatic induction	<ul style="list-style-type: none"> • Equipment maloperation. • Interference with signals. 	<ul style="list-style-type: none"> • Use shielded signal cables. • Electrically separate power and signal cables using metallic conduits and separators. • Lay power and signal cables which intersect at right angles.
Lightning	<ul style="list-style-type: none"> • Interference with signals. • Equipment maloperation. • Component damage. 	<ul style="list-style-type: none"> • Lay cables underground. • Use optical fiber cables. • Lay cables as close to ground as possible if the cables cannot be laid underground. • Install and ground arresters on field and system.
Electrostatic discharge	<ul style="list-style-type: none"> • Equipment maloperation. • Electronic component deterioration, damage. • Paper jam. 	<ul style="list-style-type: none"> • Discharge static electricity from operators. • Provide proper humidity. • Ground equipment properly. • Use antistatic floor material and clothing.
Inductive load open/close	<ul style="list-style-type: none"> • Spike noise interference to power and signal lines. 	<ul style="list-style-type: none"> • Add spark-killer to noise source. • Separate laying of cables.
Radio (electric field)	<ul style="list-style-type: none"> • CRT display disruption. • Equipment maloperation. • Interference with signals. 	<ul style="list-style-type: none"> • Keep at least 1 m away from devices to use a transceiver or a PHS or a cellular phone (max. output is 1W).
Ground potential difference	<ul style="list-style-type: none"> • Equipment Maloperation (noise imposed on signal lines) 	<ul style="list-style-type: none"> • Avoid multipoint grounding of signal cable.

■ Grounding with Lightning Arresters

Connect the protective conductor terminals of arresters and ProSare-RS equipment to the grounding pole as shown in the diagram below.

The grounding method must comply with the grounding system defined by rules and standards of the country or the region.

Concatenation grounding a lightning arrester and other equipment may cause high-tension in each equipment by the product of lightning current from arrester and grounding resistance. To prevent from electrification, overall connection should be equipotential including the floor and the case of other equipment.



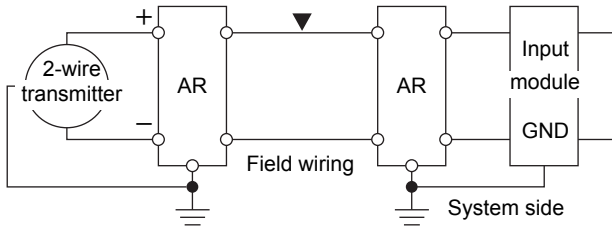
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Figure Grounding with Lightning Arresters

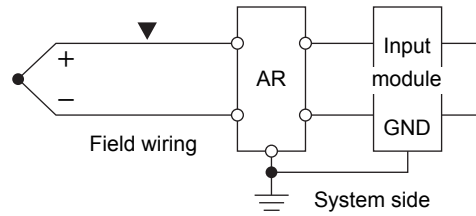
● **Examples of Arrester**

The following shows how to install an arrester as a countermeasure against lightning-Induced noise.

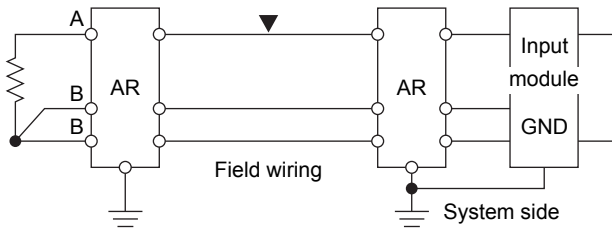
● 2-wire transmitter



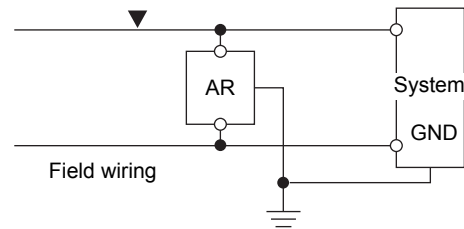
● Thermocouple



● Resistance temperature detector



● Power supply



▼ : Induced lightning strike point

AR: Arrester

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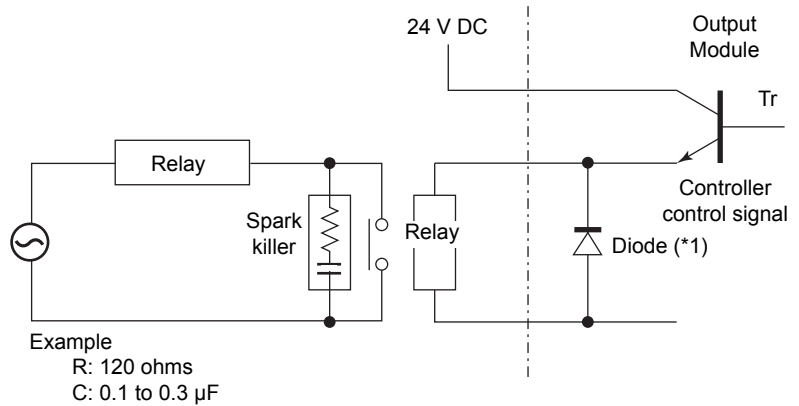
Figure Examples of Arrester Installation

● **Examples of Spark-killer Installation**

The following shows how to install a spark-killer as a countermeasure against inductive load-caused noise:

● **Relay contact**

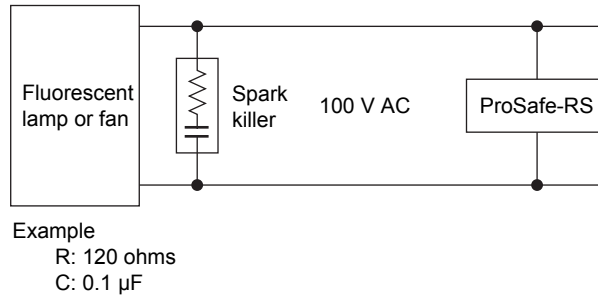
The spark killer protects relay contacts from noise occurring when inductive loads working under AC operation are turned off.



*1: A diode, which protects the output transistor from noise occurring during on-to off transition of the relay, is incorporated in the output module except SDV526.

● **Power supply**

The spark killer prevents noise-caused equipment failure when a fluorescent lamp or fan is turned on or off.



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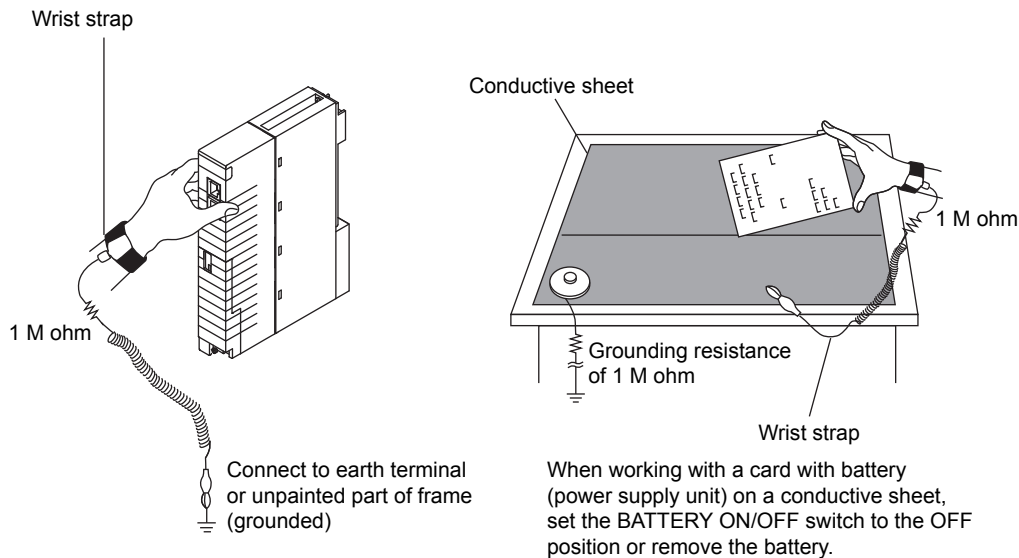
Figure Examples of Spark-killer Installation

1.5.2 Countermeasures against Static Electricity

Take countermeasures against electrostatic damage when handling cards with semi-conductor IC components, for maintenance or to change settings.

Observe the following to prevent electrostatic damage:

- When storing or carrying maintenance parts, keep them in a conductive bag (when delivered from the factory, they are packed in such bags with labels warning about static electricity).
- When doing maintenance work, wear a wrist strap connected to a ground wire with a grounding resistance of 1 M ohm. Be sure to ground the wrist strap.



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Figure Example of Use of A Wrist Strap and Conductive Sheet

- When working on cards: keep conductive sheets, grounded via a resistance of 1 M ohm, on the work bench. Wear a grounded wrist strap. Remove electrostatic plastics from the work bench.
- Be sure to wear a wrist strap and use a conductive sheet when handling maintenance parts.
- Wrist straps and conductive sheets are available from Yokogawa.

1.6 Cabling Requirements

The following requirements must be fulfilled to prevent an equipment malfunction when laying power and signal cables (these are shielded cables unless specified).

Signal cables used for high-voltage, high-frequency signals (inductive load ON/OFF) must be separated from other signal cables.

■ Separator

To prevent an equipment malfunction, provide a separator between power and signal cables as illustrated below:

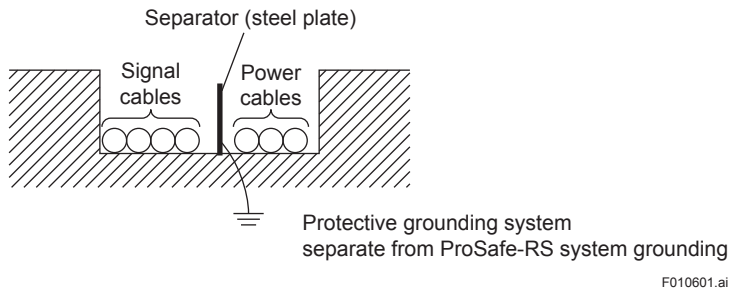


Figure Separator Used in Duct/Pit

■ Distance between Cables

If a separator cannot be used, keep a distance between signal cables and power cables. The distances between cables due to operating voltages and currents are shown below.

Table Required Distance between Power & Shielded Signal Cables

Operating	voltage Operating	current Distance
240 V AC max	10 A max	150 mm min
	10 A min	600 mm min
240 V AC min	10 A max	600 mm min
	10 A min	Cannot be laid together

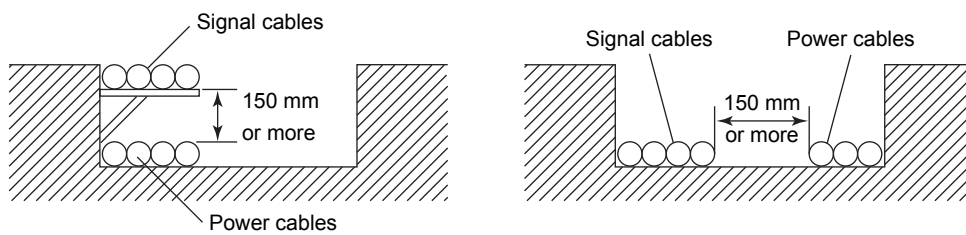
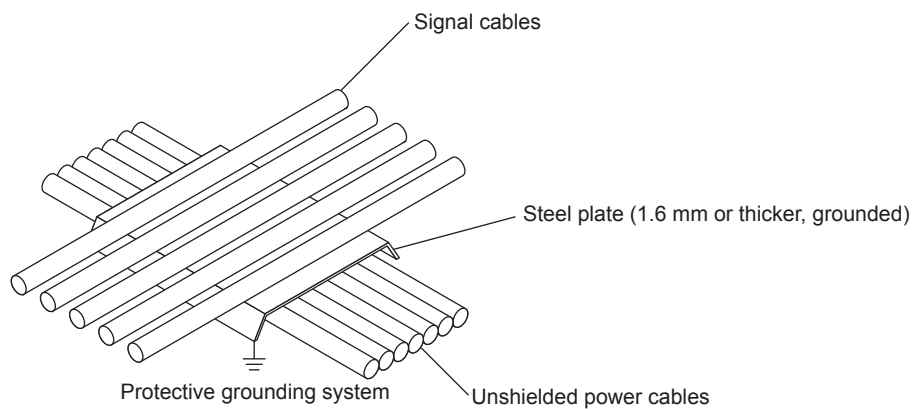


Figure Distance between Cables under Pit/Free-access Floor

■ Intersecting Cables

With unshielded power cables, place a grounded steel plate with a thickness of at least 1.6 mm over the cables where they intersect with signal cables.



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Figure Intersecting Cables under Pit/Free-access Floor

■ Ambient Temperature

The ambient temperature where signal and bus cables are laid must be within the limits specified for each cable.

■ Measures against EMI

As a rule, avoid laying the cables on the floor. However, lay them on the floor only if there are no duct and no pit. In that case, it is required to cover them with shield plates or take other measures to suit the EMC Directive.

1.7 Corrosive-gas Environment Compatibility

The ProSafe-RS system complies with the ANSI/ISA G3 environment requirements, allowing use in a corrosive gas-susceptible environment.

■ G3 Environment-compatible Products

Table G3 Environment-compatible Products (1/2)

No.	Product	Model	Description
1	Node unit	SSC60□	Safety control unit (rack mountable type, for Vnet/IP)
		SSC50□	Safety control unit (rack mountable type, for Vnet/IP)
		SSC57□	Safety control unit (rack mountable type, for Vnet/IP-Upstream)
		SSC10□	Safety control unit (rack mountable type)
		SNB10D	Safety node unit (rack mountable type)
2	Input/output module	SAI143-S	Analog input module (4 to 20 mA, 16-channel, Module isolation)
		SAI143-H	Analog input module (4 to 20 mA, 16-channel, Module isolation, HART Communication)
		SAV144	Analog input module (1 to 5 V/1 to 10 V, 16-channel, Module isolation)
		SAI533	Analog output module (4 to 20 mA, 8-channel, Module isolation, HART Communication)
		SAT145	TC/mV Input Module (16-channel, Isolated Channels)
		SAR145	RTD Input Module (16-channel, Isolated Channels)
		SDV144	Digital input module (no-voltage contact, 16-channel, Module isolation)
		SDV521	Digital output module (24 V DC/2 A, 4-channel, Module isolation)
		SDV526	Digital output module (100-120 V AC, 4-channel, Module isolation)
		SDV531	Digital output module (24 V DC, 8-channel, Module isolation)
		SDV53A	Digital output module (48 V DC, 8-channel, Module isolation)
SDV541	Digital output module (24 V DC, 16-channel, Module isolation)		
3	ESB Bus Interface Module	SEC402	ESB Bus Coupler Module (for SSC60□, 2-port)
		SEC401	ESB Bus Coupler Module
4	Unit for Optical Bus Repeater Module	SNT10D	Unit for Optical Bus Repeater Module
5	Optical ESB Bus Repeater Module	SNT401	Optical ESB Bus Repeater Master Module
		SNT501	Optical ESB Bus Repeater Slave Module
		SNT411	Optical ESB Bus Repeater Master Module 5 km - 50 km (for SSC60□, SSC50□, SSC57□)
		SNT511	Optical ESB Bus Repeater Slave Module 5 km - 50 km (for SSC60□, SSC50□, SSC57□)

Table G3 Environment-compatible Products (2/2)

No.	Product	Model	Description
6	Communication module	ALR111-□□1	Serial communication module (RS-232C, 2-port)
		ALR121-□□1 ALR121-□□B ALR121-□□3	Serial communication module (RS-422/RS-485, 2-port)
		ALE111-□□1 ALE111-□□3	Ethernet communication module (*1)
7	Wiring check adapter	SCB1□0	Wiring check adapter for digital input module
8	Power supply bus unit	AEPV7D-□□6 AEPV7D-□□F	Power Supply Bus Unit, Vertical Type
		AEP7D-□6 AEP7D-□F	Primary power supply bus unit
9	Terminal Board	SEA4D	Analog terminal board (Single and Dual-redundant, 16-channel x 2)
		SBA4D	Terminal board for Analog: DIN rail mount type (Single and Dual-redundant, 16-channel x 1)
		SBT4D	Terminal board for TC/mV: DIN rail mount type (Single and Dual-redundant, 16-channel x 1)
		SBR4D	Terminal board for RTD input: DIN rail mount type (Single and Dual-redundant, 16-channel x 1)
		SED2D	Digital terminal board (Single and Dual-redundant, 4-channel x 4)
		SED3D	Digital terminal board (Single and Dual-redundant, 8-channel x 4)
		SED4D	Digital terminal board (Single and Dual-redundant, 16-channel x 2)
		SWD2D	Digital terminal board (Single and Dual-redundant, 100 to 120 V AC, 4-channel x 4)
		SBD2D	Terminal board for Digital output: DIN rail mount type (Single and Dual-redundant, 4-channel x 1, for SDV521)
		SBD3D	Terminal board for Digital output: DIN rail mount type (Single and Dual-redundant, 8-channel x 1, for SDV53□)
SBD4D	Terminal board for Digital: DIN rail mount type (Single and Dual-redundant, 16-channel x 1, for SDV144/SDV541)		
10	Router	AVR10D-□□□□□1	Duplexed V net router

*1: ALE111 supported in R3.02.00 or later can be mounted on SSC60□, SSC50□ or SSC57□.

■ Outline of G3 Environment Compatibility

The classification of the environment in which the process control equipment is installed is determined by the ANSI/ISA S71.04 “Environmental Conditions for Process Control Systems” standard. The environment having an atmosphere which contains steams and mists (liquids, coded L), dusts (solids, coded S), or corrosive gases (gases, coded G) is classified into four categories according to the levels of these substances determined.

The four categories of the corrosive gas environment are defined as follows:

- G1 (Mild):** A well-controlled environment in which corrosive gas is not the major cause adversely affecting the reliability of plant equipment. The corrosion level on the copper test piece is below 0.03 μm (see note below).
- G2 (Moderate):** An environment in which corrosive gas can be detected and it could be determined that the gas is the major cause adversely affecting the reliability of plant equipment. The corrosion level on the copper test piece is below 0.1 μm (see note below).
- G3 (Harsh):** An environment in which corrosive gas is frequently generated to cause corrosion and that it is necessary to provide special measures or employ specially designed or packaged plant equipment. The corrosion level on the copper test piece is below 0.2 μm (see note below).
- GX (Severe):** A corrosive gas-polluted environment that demands special protective chassis for the plant equipment, specifications of which should be seriously determined by the user and a power unit manufacturer. The corrosion level on the copper test piece is 0.2 μm or more (see note below).

Note: Copper test pieces are used to determine the level of corrosion for the classification of the plant environment. The test piece is an oxygen-free copper sheet, which is 15 cm² in area, 0.635 mm in thickness, 1/2 to 3/4H in hardness. The test piece is placed in the plant site for one month and checked for any change before and after the test to determine the degree of corrosion (see table below). If the test period is shorter than one month, the result is calculated to obtain equivalent data using a expression defined by the standard.

Table Classification of Corrosive-gas Corrosion Levels

Environment category	G1 (Mild)	G2 (Moderate)	G3 (Harsh)	GX (Severe)	
Copper corrosion level	< 300 (< 0.03)	< 1000 (< 0.1)	< 2000 (< 0.2)	≥ 2000 (≥ 0.2)	[Å] ([μm])
Group A					[mm ³ /m ³]
H ₂ S	< 3	< 10	< 50	≥ 50	
SO ₂ , SO ₃	< 10	< 100	< 300	≥ 300	
Cl ₂	< 1	< 2	< 10	≥ 10	
NO _x	< 50	< 125	< 1250	≥ 1250	
Group B					
HF	< 1	< 2	< 10	≥ 10	
NH ₃	< 500	< 10000	< 25000	≥ 25000	
O ₃	< 2	< 25	< 100	≥ 100	

Note: The gas density data indicated in the table are for reference only, with the relative humidity of 50% RH or less. The category goes up one rank higher every time the humidity increases 10% exceeding the 50% RH or over 6% per hour.

The Group-A gases shown in the table may coexist and cause inter-reaction. Inter-reaction factors are not known for the Group-B gases.

Yokogawa Service Division will carry out environmental diagnosis in accordance with this standard.

1.8 Compliance with Marine Standards

The ProSafe-RS offers compliance with the following marine standards:

- American Bureau of Shipping (ABS)
- Bureau Veritas (BV)
- Lloyd's Register

This Section introduces the components of systems which comply with the marine standards, and precautions for installing those components.

■ Marine Standard-compliant ProSafe-RS Components

The table below shows the ProSafe-RS components which comply with the marine standards.

Table Marine Standard-compliant ProSafe-RS Components (1/3)

Product	Model	Module Type	Description
Node Unit	SSC60S-F	Safety control unit (19 inch rack mountable)	Including SCP461, SPW481, SPW482 and SPW484. SSC60S-S and SSC60D-S do not comply.
	SSC60D-F		
	SSC50S	Safety control unit (19 inch rack mountable)	Including SCP451, SPW481, SPW482 and SPW484.
	SSC50D		
	SSC57S		
	SSC57D		
	SSC10S	Safety control unit (19 inch rack mountable)	Including SCP401, SPW481, SPW482 and SPW484.
	SSC10D		
SNB10D	Node unit for dual-redundant ESB bus (19 inch rack mountable)	Including SSB401, SPW481, SPW482 and SPW484.	
Input/Output Module	SAI143	Analog input module (4 to 20 mA, 16-channel, and module isolation)	(*1) SAI143-H□□ does not comply.
	SAV144	Analog input module (1 to 5 V/1 to 10 V and module isolation)	Including SCCC01, STB4D, STB4S and STK4A.
	SAT145	TC/mV Input Module (16-channel, Isolated Channels)	
	SAR145	RTD Input Module (16-channel, Isolated Channels)	
	SAI533	Analog output module (4 to 20 mA, 8-channel and module isolation)	(*1)
	SDV144	Digital input module (16-channel, contact input and module isolation)	(*2) SDV144-S□□ does not comply.
	SDV521	Digital output module (4-channel, 24 V DC/2A, and module isolation)	SDV521-S3C does not comply.
	SDV531	Digital output module (8-channel, 24 V DC, and module isolation)	(*2) SDV531-L complies with Marine Standards from style code S3. SDV531-L□□ does not comply.
	SDV53A	Digital output module (8-channel, 48 V DC, and module isolation)	
	SDV541	Digital output module (16-channel, 24 V DC, and module isolation)	(*2) SDV541-S□□ does not comply.
	SDCV01	Dummy cover (for I/O modules)	
Wiring Check Adapter	SCB100	Wiring check adapter for digital input	
	SCB110		
Unit for Optical Bus Repeater Module	SNT10D	Unit for optical bus repeater module	Including SPW481, SPW482 and SPW484.

*1: Including SCCC01, STA4D, STA4S and STK4A.

*2: Including SCCC01, SCCC02, STB4D, STB4S and STD4A.

Table Marine Standard-compliant ProSafe-RS Components (2/3)

Product	Model	Module Type	Description
Optical ESB bus repeater module	SNT401	Optical ESB bus repeater master module	
	SNT411	Optical ESB bus repeater master module 5 km to 50 km	(*3)
	SNT501	Optical ESB bus repeater slave module	
	SNT511	Optical ESB bus repeater slave module 5 km to 50 km	(*3)
ESB Bus Interface Module	SEC402	ESB bus coupler module	
	SEC401		
Communication Module	ALR111	Serial communications module (RS-232C, 2-port)	
	ALR121	Serial communications module (RS-422/RS-485, 2-port)	ALR121-S□B does not comply.
	ALE111	Ethernet communication module	
Terminal Board	SEA4D	Analog terminal board (single and dual-redundant, 16-channel x 2)	
	SED2D	Digital terminal board (single and dual-redundant, 4-channel x 4)	
	SED3D	Digital terminal board (single and dual-redundant, 8-channel x 4)	
	SED4D	Digital terminal board (single and dual-redundant, 16-channel x 2)	
	SBT4D	Terminal board for TC/mV: DIN rail mount type (Single and Dual-redundant, 16-channel x 1)	
	SBR4D	Terminal board for RTD input: DIN rail mount type (Single and Dual-redundant, 16-channel x 1)	
	SBA4D	Terminal board for Analog: DIN rail mount type (Single and Dual-redundant, 16-channel x 1)	
	SBD2D	Terminal board for Digital output: DIN rail mount type (Single and Dual-redundant, 4-channel x 1, for SDV521)	
	SBD3D	Terminal board for Digital output: DIN rail mount type (Single and Dual-redundant, 8-channel x 1, for SDV53□)	
	SBD4D	Terminal board for Digital: DIN rail mount type (Single and Dual-redundant, 16-channel x 1, for SDV144/SDV541)	
Relay Board	SRM53D	8 × 2 dry contact output (safety relay built-in, M4 terminals)	
	SRM54D	16 × 1 dry contact output (safety relay built-in, M4 terminals)	
	SBM54D	Relay board for Digital output: DIN rail mount type (Single and Dual-redundant, 16-channel x 1, for SDV541)	
Control Bus Interface	VI702	Control bus interface card	(*4)
	VF702		(*4)
	VI701		
	VF701		
Vnet Router	AVR10D	Duplexed V net router	

*3: Only style code S1 complies with Marine Standards.

*4: Noisecut transformer shall be attached in the power-line cable of SENG.

Table Marine Standard-compliant ProSafe-RS Components (3/3)

Product	Model	Module Type	Description
Cable, etc.	YCB301	ESB bus cable	
	YCB141	V net cable (10BASE-2)	
	YCB111	V net cable (10BASE-5)	
	AKB651	Signal Cable (50 - 50 pins) (for connections between SDV521 and Terminal Board)	When AKB651 is connected to SDV531-L, SDV53A or SDV541, it does not comply.
	AKB331	Signal Cable (50 - 50 pins)	
	AKB136	RS-232C null modem cable (9 - 25 pins)	
	AKB161	RS-422/RS-485 cable	
	AKB611	Signal cable (for connections between SAR145 and Terminal Board)	
	KS1	Signal cable (40 - 40 pins)	
	YCB148	V net terminator	
	YCB146	T-shaped control bus connector	
	YCB128	Terminator for IRIG (GPS)	

■ Precaution on Selecting System Components

When building a system, use components which have already obtained type approval for marine standards. For the SENG and HISs too, use generic computers (including monitors, keyboards, mice, and other peripheral devices) which are accredited by the required marine standards.

■ Precaution on Installing Components

Each component shall be installed in accordance with its installation guidance. In addition, all components related with SSC60□-F, SSC50□, SSC57□, SSC10□, SNB10D, SNT10D and SENG shall be installed in a metal cabinet.

- The cabinets including their doors and side panels must be made of a metal.
- Securely connect the cabinet frames and ground bosses on doors and side panels to each other to ensure electric contacts.
- Attach noise suppression devices, such as noise filters and ferrite cores, to the cables connecting each component.

■ Installation of Power-line Noise Filter

Attach a noise filter on the power line for the following components:

- Safety Control Unit (SSC60□-F, SSC50□, SSC57□, SSC10□)
- Safety Node Unit (SNB10D)
- Unit for Optical Bus Repeater Module (SNT10D)
- Safety Control PC (SENG) installed control bus interface (VI702, VF702)

● **Power-line for SSC60□-F, SSC50□, SSC57□, SSC10□, SNB10D and SNT10D**

Attach a noise filter in each power line of SPW48□, FAN and external power supply unit. Alternatively, other devices such as noise-cut transformer and insulating transformer can be used if its characteristic of noise-reducing effects is same as the following equipment.

Noise filter and external power supply unit shall be installed in the same cabinet of the connecting terminal board for them.

If digital Input/output modules such as SDV144, SDV521, SDV531, SDV53A and SDV541 are used, power line for an external power shall be separated from the power line of SPW48□ and FAN.

This means that two AC power cables are out from the cabinet.

It is possible to use power tap outside of the cabinet. Please refer to the following figure.

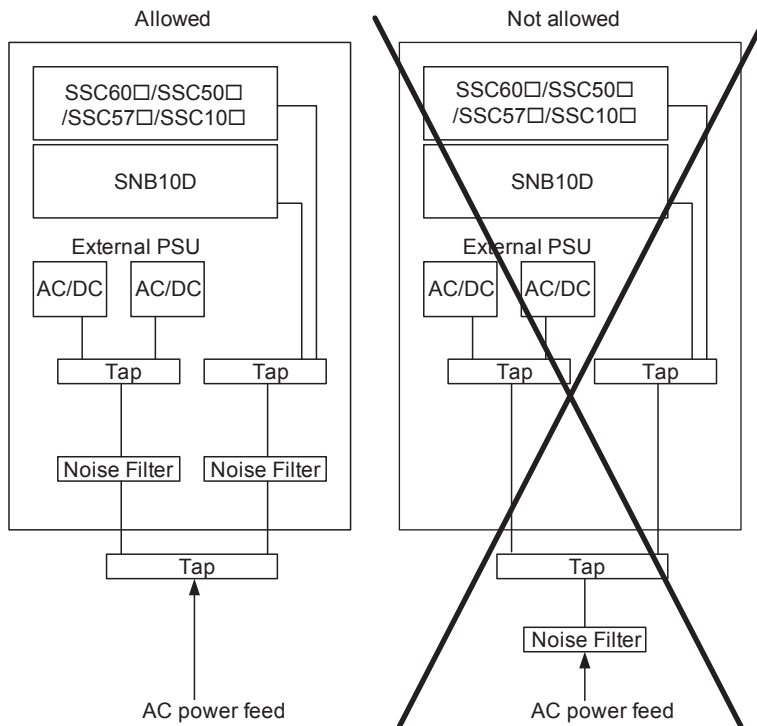


Figure Wiring for AC power cables

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The following table shows example of a noise filter.

Category	Manufacturer	Model no.	Power Source
Noise filter	OKAYA Electric Industries Co., LTD	SUPH-EX10-ER-6	100 - 120 V AC
			220 - 240 V AC
	COSEL Co., LTD	NBH-20-432	24 V DC (*1)

*1: For expansion or modification of unit, the existing TDK Lambda PSHN-2020 can also be used.



IMPORTANT

Lay the incoming wires to a noise filter separately from its outgoing wires.

Minimize the wiring to the ground terminals of the noise filters to minimize the impedance.

● Power-line for SENG

Noise-cut transformer shall be installed in the cabinet and attached in the power-line cable of SENG in case of using VI702, VF702.

The following table shows applicable noise-cut transformer.

Table Applicable noise-cut transformer

Description	Manufacturer	Model
Noise-cut Transformer	DENKENSEIKI Research Institute CO., Ltd	NCT-I1 (*1)
	TAMURA Corporation	NRPT-TB0.5 (*2)

*1: Purchase it through distributor.

*2: Sales was terminated. Use NCT-I1 when purchase noise-cut transformer newly.



IMPORTANT

Lay the incoming wires to a noise-cut transformer separately from its outgoing wires.

Minimize the wiring to the ground terminal of the noise-cut transformer to minimize the impedance.

■ Installation of Ferrite Cores for Vnet/IP

Attach ferrite cores on the power cables, the communication cables and the signal cables.

The following table shows the cables to which ferrite cores are to be attached, the models and quantities of the ferrite cores to be attached, and the locations at which they are to be attached. Ferrite core is not required if the component is not listed below. See also the figure following the table for the locations of installation.

Table Cables that Need Ferrite Cores to be Attached to, and Ferrite Core Models and Quantities for Vnet/IP (1/2)

Component	Description	Ferrite Core Model (*1)	Quantity	Location (See the Figures)	
Power supply	SSC60□-F Power module	AC/DC power cable	ZCAT3035-1330	3	(1)
	SSC50□ Power module	AC/DC power cable	ZCAT3035-1330	2	–
	SSC57□ Power module	AC/DC power cable	ZCAT3035-1330	2	–
	SNB10D Power module	AC/DC power cable	ZCAT3035-1330	4	(2)
	SNT10D Power module	AC/DC power cable	ZCAT3035-1330	2	(3)
	AVR10D Power module	AC/DC power cable	ZCAT3035-1330	4	(4)
Fan	SSC60□-F Fan unit	AC/DC power cable	ZCAT3035-1330	3	(5)
	SSC50□-F Fan unit	AC/DC power cable	ZCAT3035-1330	2	–
	SSC57□-F Fan unit	AC/DC power cable	ZCAT3035-1330	2	–
External power supply (Input side)	Power Supply (SDV531, SDV541)	AC power cable (Input side)	ZCAT3035-1330	1	(6)
			ZCAT2032-0930	1	

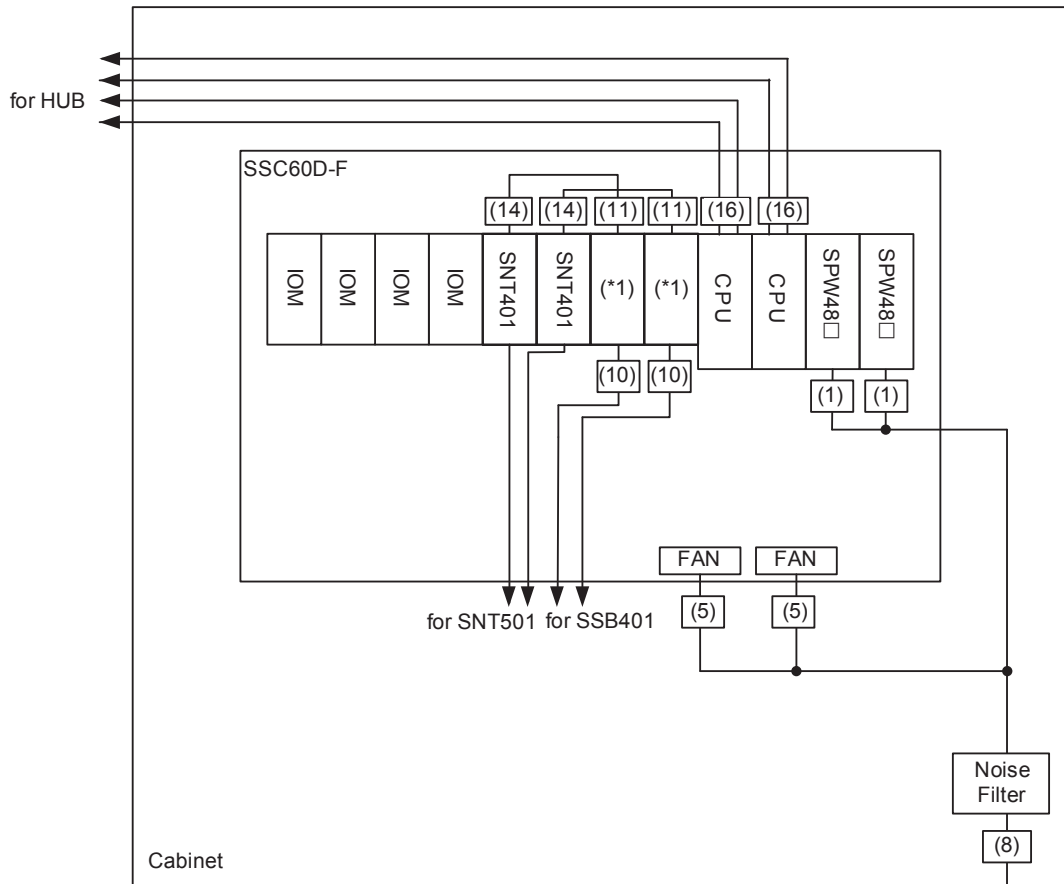
*1: The part number of ZCAT3035-1330 is A1179MN, and ZCAT2032-0930 is A1193MN. Models ZCAT3035-1330 and ZCAT2032-0930 are from TDK Corporation.

Table Cables that Need Ferrite Cores to be Attached to, and Ferrite Core Models and Quantities for Vnet/IP (2/2)

Component		Description	Ferrite Core Model (*1)	Quantity	Location (See the Figures)
External power supply (output side)	Power Supply (SDV531, SDV541)	DC power cable (Output side)	ZCAT3035-1330	3	(7)
			ZCAT2032-0930	1	
	Power Supply (SDV521, SDV53A)	DC power cable (Output side)	ZCAT3035-1330	1	
Noise filter (Input side)	AC power-line filter	AC power cable	ZCAT3035-1330	1	(8)
			ZCAT2032-0930	3	(9)
			ZCAT3035-1330	1	
ESB bus coupler module	SEC402	ESB bus cable	ZCAT3035-1330	5	(10)
	SEC401	ESB bus cable	ZCAT3035-1330	5	(10)
			ZCAT3035-1330	1	(11)
ESB bus interface module	SSB401	ESB bus cable	ZCAT3035-1330	4	(12)
			ZCAT3035-1330	1	(13)
Optical ESB bus repeater module	SNT401	ESB bus cable	ZCAT3035-1330	1	(14)
	SNT501	ESB bus cable	ZCAT3035-1330	1	(15)
CPU	SCP461	Vnet/IP cable	ZCAT3035-1330	1	(16)
	SCP451	Vnet/IP cable	ZCAT3035-1330	3	-
Fan unit	SSC60□-F Fan unit	Flat cable	ZCAT3035-1330	1	-(*2)
	SSC50□-F Fan unit	Flat cable	ZCAT3035-1330	1	-(*2)
	SSC57□-F Fan unit	Flat cable	ZCAT3035-1330	1	-(*2)
Analog module	SAI143	KS1 cable	ZCAT3035-1330	4	(17)
	SAV144				
	SAI533				
Digital module	SDV144	AKB331 cable	ZCAT3035-1330	3	(18)
	SDV521	AKB651 cable	ZCAT3035-1330	4	
	SDV531	AKB331 cable	ZCAT3035-1330	3	
	SDV53A	AKB331 cable	ZCAT3035-1330	3	
	SDV541	AKB331 cable	ZCAT3035-1330	3	
Terminal board	SEA4D	KS1 cable	ZCAT3035-1330	1	(19)
	SED4D	AKB331 cable	ZCAT3035-1330	1	(20)
Relay board	SRM53D	AKB331 cable	ZCAT3035-1330	3	-
	SRM54D				
Bus converter	VC401	V net cable	ZCAT3035-1330	4	(21)
	VI451	Vnet/IP cable	ZCAT3035-1330	4	(22)

*1: The part number of ZCAT3035-1330 is A1179MN, and ZCAT2032-0930 is A1193MN. Models ZCAT3035-1330 and ZCAT2032-0930 are from TDK Corporation.

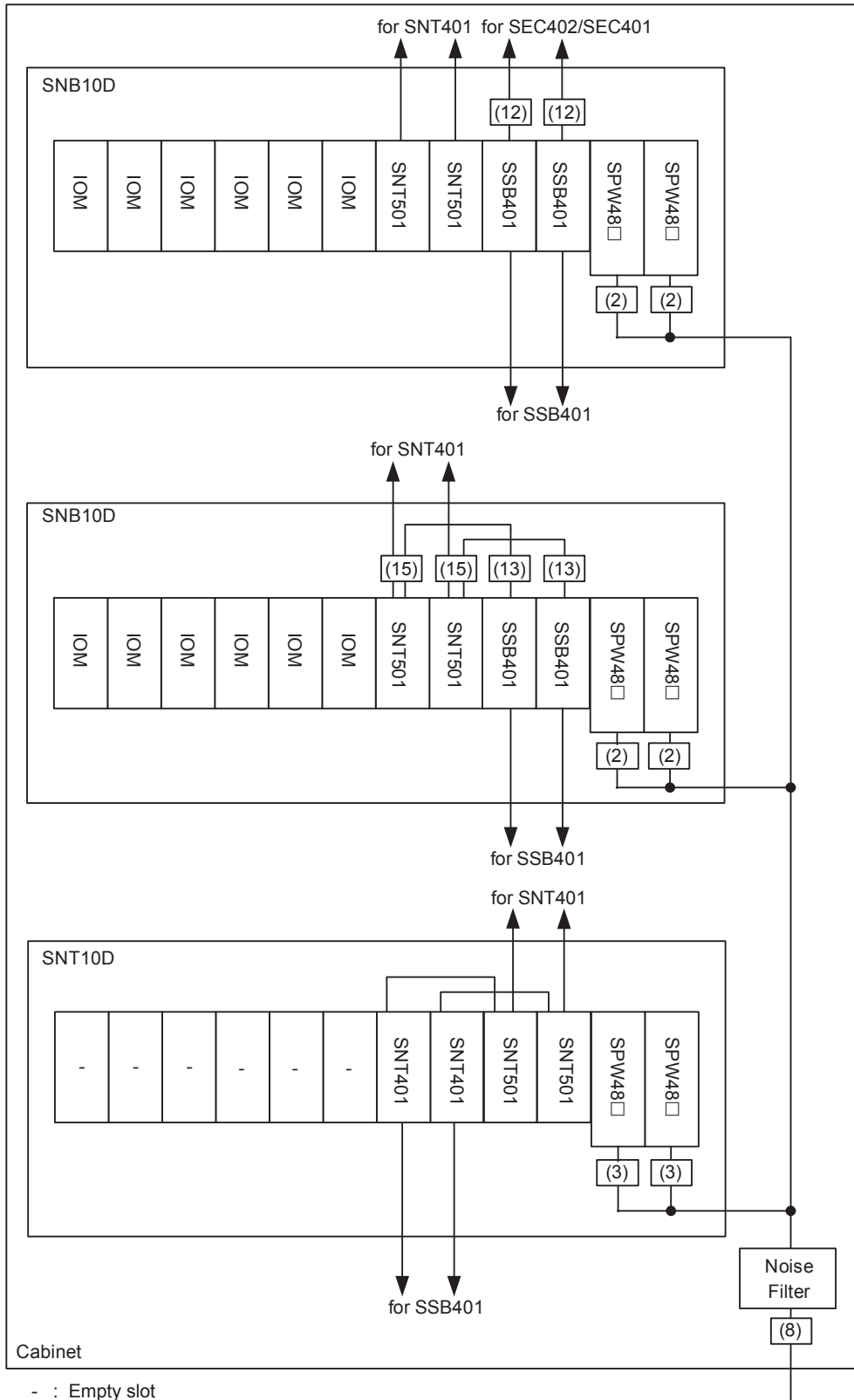
*2: The component is mounted on the standard model.



*1: SEC401/SEC402 ESB Bus Coupler Module
 Note: IOM is abbreviation of Input/Output Modules.
 Note: Figures in () show the locations listed in "Table Cables that Need Ferrite Cores to be Attached to, and Ferrite Core Models and Quantities". It is NOT a number of ferrite core.

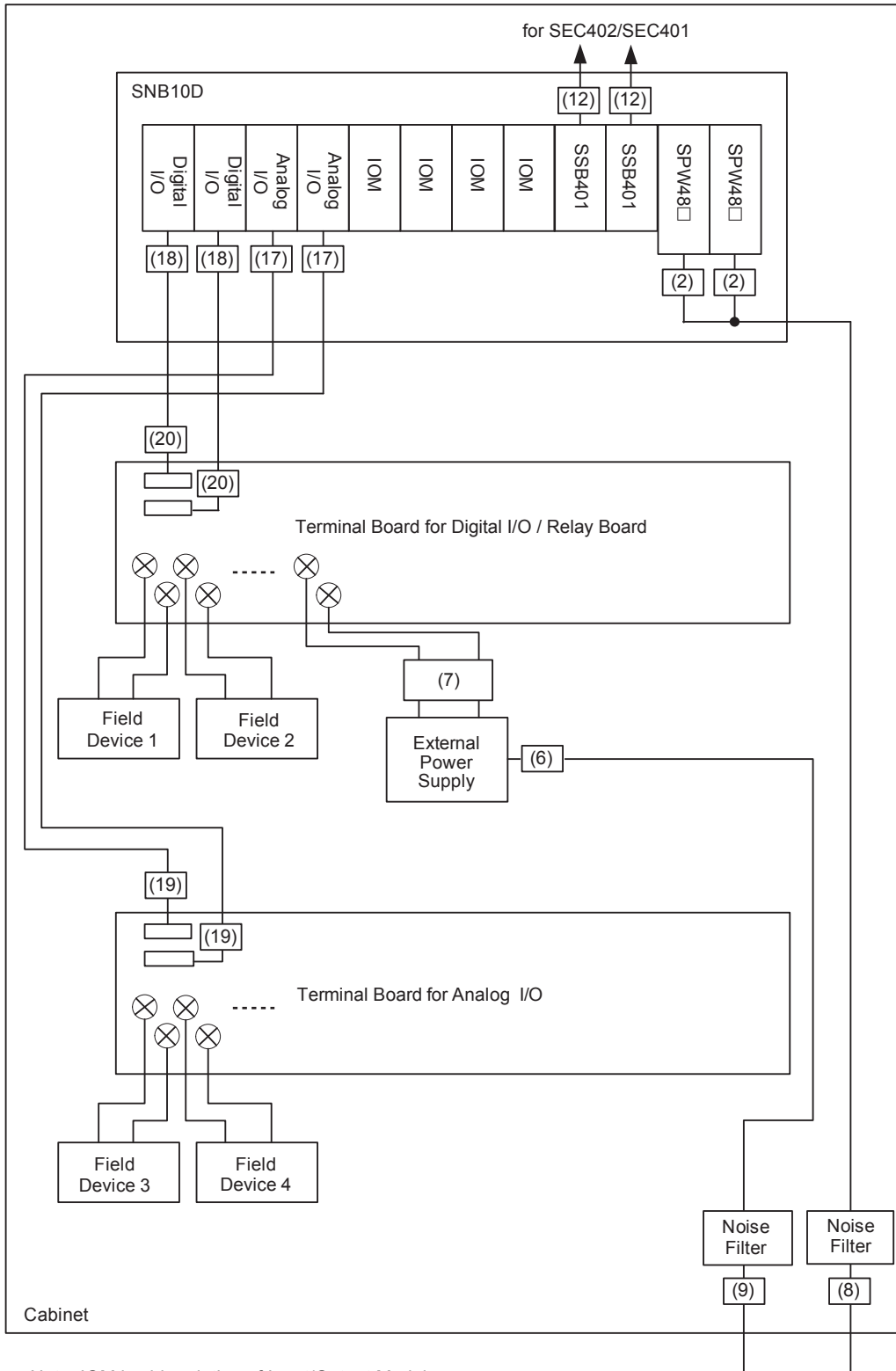
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Figure Locations of Ferrite Core Installation for SSC60D-F



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Figure Locations of Ferrite Core Installation for SNB10D and SNT10D

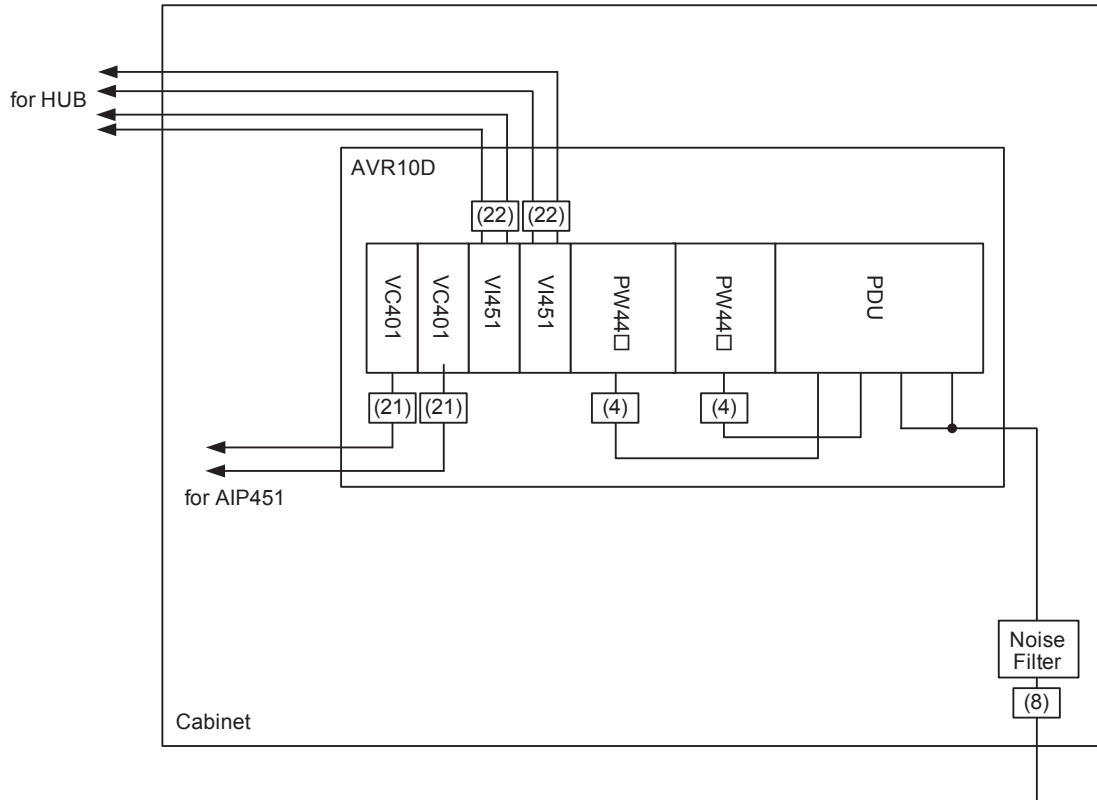


Note: IOM is abbreviation of Input/Output Modules.

Note: Figures in () show the locations listed in "Table Cables that Need Ferrite Cores to be Attached to, and Ferrite Core Models and Quantities". It is NOT a number of ferrite core.

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Figure Locations of Ferrite Core Installation for Input/Output Modules, Terminal Boards and Relay Boards



Note: Figures in () show the locations listed in "Table Cables that Need Ferrite Cores to be Attached to, and Ferrite Core Models and Quantities". It is NOT a number of ferrite core.

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Figure Locations of Ferrite Core Installation for AVR10D

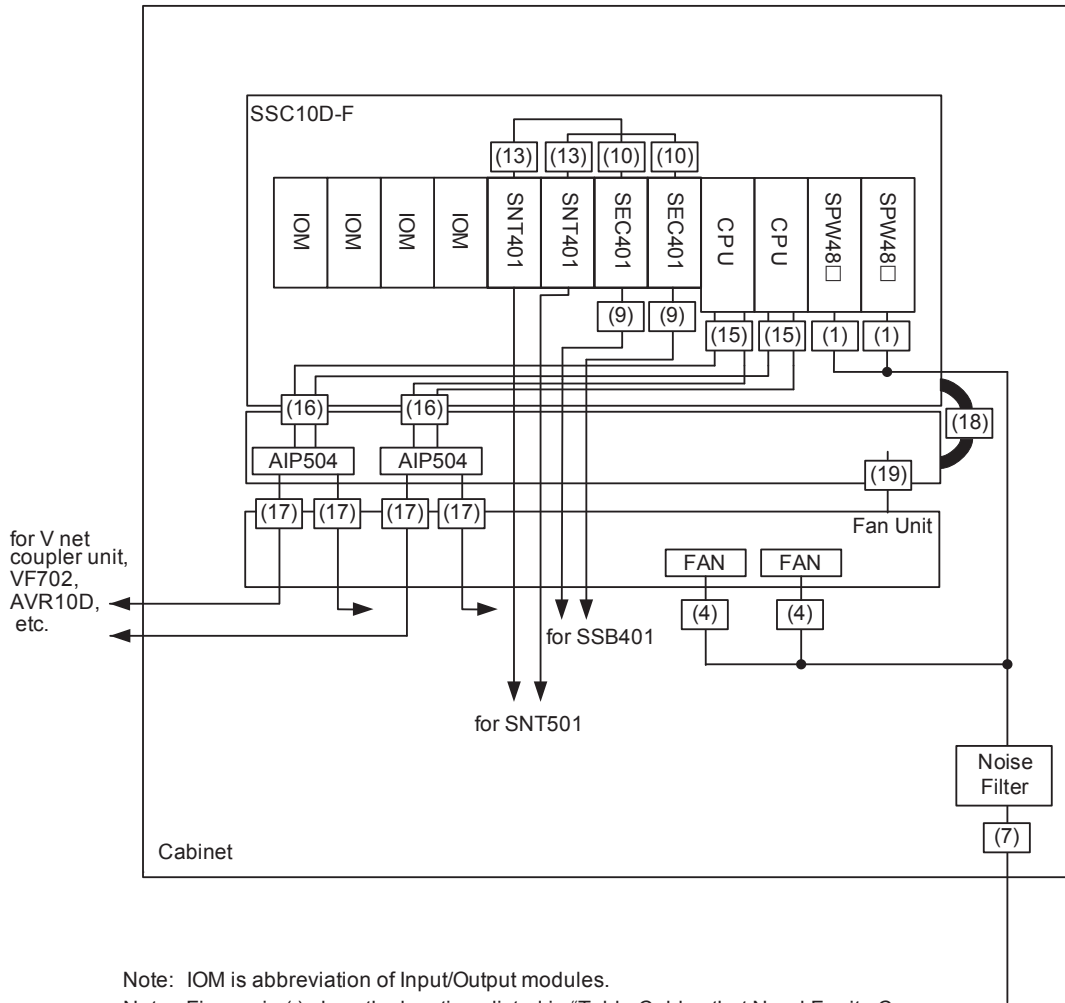
■ Installation of Ferrite Cores for V net

Attach ferrite cores on the power cables, the communication cables and the signal cables. The following table shows the cables to which ferrite cores are to be attached, the models and quantities of the ferrite cores to be attached, and the locations at which they are to be attached. Ferrite core is not required if the component is not listed below. See also the figure following the table for the locations of installation.

Table Cables that Need Ferrite Cores to be Attached to, and Ferrite Core Models and Quantities for V net

Component		Description	Ferrite Core Model (*1)	Quantity	Location (See Figure)
Power Supply	SSC10□ Power Module	AC/DC power cable	ZCAT3035-1330	2	(1)
	SNB10D Power Module	AC/DC power cable	ZCAT3035-1330	4	(2)
	SNT10D Power Module	AC/DC power cable	ZCAT3035-1330	2	(3)
Fan	SSC10□ Fan unit	AC/DC power cable	ZCAT3035-1330	2	(4)
External power supply (Input side)	Power Supply (SDV531, SDV541)	AC power cable (Input side)	ZCAT3035-1330	1	(5)
			ZCAT2032-0930	1	
External power supply (Output side)	Power Supply (SDV531, SDV541)	DC power cable (Output side)	ZCAT3035-1330	3	(6)
			ZCAT2032-0930	1	
Noise filter (Input side)	AC power-line filter	AC power cable	ZCAT3035-1330	1	(7)
			ZCAT2032-0930	3	
ESB bus coupler module	SEC401	ESB bus cable	ZCAT3035-1330	5	(9)
			ZCAT3035-1330	1	(10)
ESB bus interface module	SSB401	ESB bus cable	ZCAT3035-1330	4	(11)
			ZCAT3035-1330	1	(12)
ESB bus interface module	SNT401	ESB bus cable	ZCAT3035-1330	1	(13)
	SNT501	ESB bus cable	ZCAT3035-1330	1	(14)
CPU	SCP401	V net coupler cable	ZCAT3035-1330	5	(15)
V net coupler unit	AIP504	V net coupler cable	ZCAT2032-0930	4	(16)
		V net cable	ZCAT3035-1330	4	(17)
Fan unit	SSC10□-F Fan unit	Flat cable	ZCAT3035-1330	1	(18)
	Back of SSC10□-F	Flat cable	E04SF360270127	1	(19)
Analog module	SAI143	KS1 cable	ZCAT3035-1330	4	(20)
	SAV144				
	SAI533				
Digital module	SDV144	AKB331 cable	ZCAT3035-1330	3	(21)
	SDV521	AKB651 cable		4	
	SDV531	AKB331 cable		3	
	SDV53A	AKB331 cable		3	
	SDV541	AKB331 cable		3	
Terminal board	SEA4D	KS1 cable	ZCAT3035-1330	1	(22)
	SED4D	AKB331 cable	ZCAT3035-1330	1	(23)
Relay board	SRM53D	AKB331 cable	ZCAT3035-1330	3	(23)
	SRM54D				

*1: The part number of ZCAT3035-1330 is A1179MN, and ZCAT2032-0930 is A1193MN. Models ZCAT3035-1330 and ZCAT2032-0930 are from TDK Corporation, and the E04SF360270127 is from SEIWA Electric Mfg. Co., Ltd.

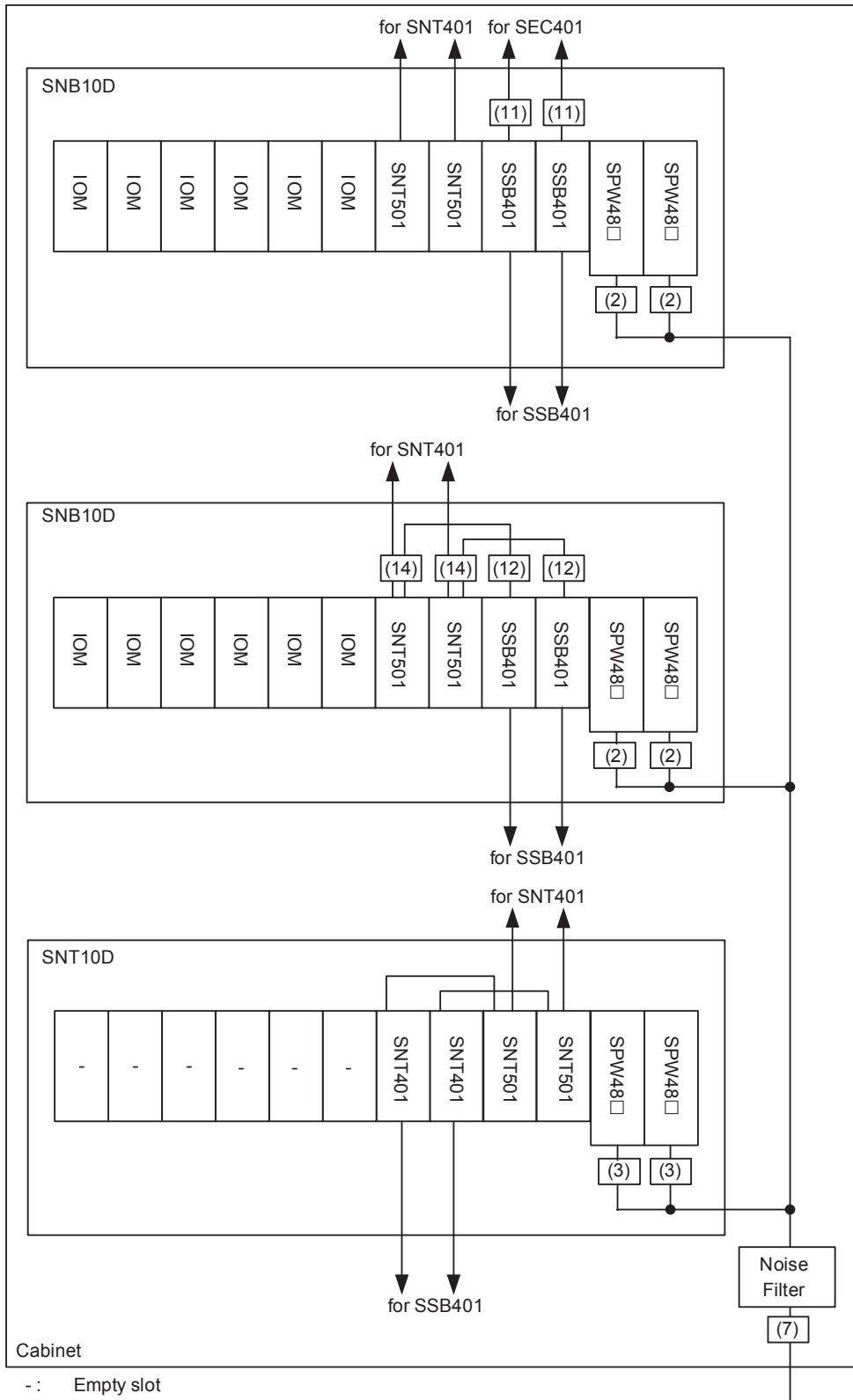


Note: IOM is abbreviation of Input/Output modules.

Note: Figures in () show the locations listed in "Table Cables that Need Ferrite Cores to be Attached to, and Ferrite Core Models and Quantities". It is NOT a number of ferrite core.

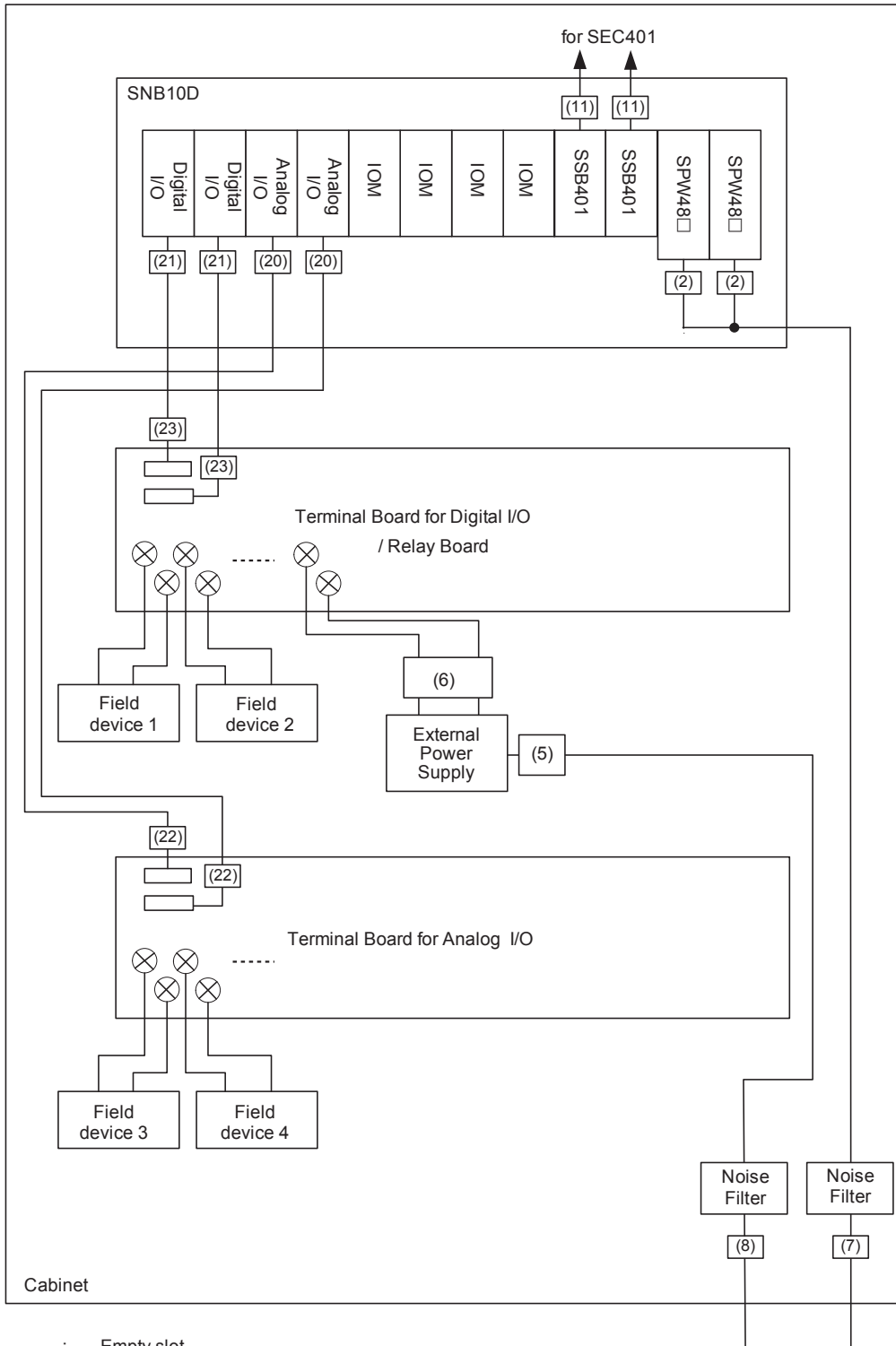
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Figure Locations of Ferrite Core Installation for SSC10D-F



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Figure Locations of Ferrite Core Installation for SNB10D and SNT10D



-: Empty slot
 Note: IOM is abbreviation of Input/Output modules.
 Note: Figures in () show the locations listed in "Table Cables that Need Ferrite Cores to be Attached to, and Ferrite Core Models and Quantities". It is NOT a number of ferrite core.

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Figure Locations of Ferrite Core Installation for Input/Output Modules, Terminal Boards and Relay Boards

■ Location of Ferrite Cores for Cables

For the following cables, be careful about the locations at which you install ferrite cores:

Power-line cables:

Install ferrite cores on each cable at the nearest possible place to each connector.
In order to prevent the load at the connectors, secure the power-line cables to the cabinet frame or dummy plate using cable ties at the nearest possible place to each ferrite core.

ESB bus cables:

Install ferrite cores on each cable at the nearest possible place to each connector.
In order to prevent the load at the connectors, secure the ESB bus cables to the cabinet frame or dummy plate using cable ties at the nearest possible place to each ferrite core.

Vnet/IP and V net cables:

Install ferrite cores on each cable at the nearest possible place to each connector.
In order to prevent the load at the connectors, secure the Vnet/IP or V net cables to the cabinet frame or dummy plate using cable ties at the nearest possible place to each ferrite core.

V net coupler cables:

Install ferrite cores on each cable at the nearest possible place to each connector.
In order to prevent the load at the connectors, secure the V net coupler cables to the cabinet frame or dummy plate using cable ties at the nearest possible place to each ferrite core.

Flat cable connecting SSC10□-F to its fan unit:

Install ferrite cores on the flat cable connecting each SSC10□-F to its fan unit. The flat cable needs not be secured.

Cables connected to analog input/output modules and digital input/output modules:

- Cables Connecting to terminal boards or relay boards
Install ferrite cores on each cable at the nearest possible place to each connector.
In order to prevent the load at the connectors, secure the cables to the cabinet frame or dummy plate using cable ties at the nearest possible place to each ferrite core.
- Vinyl insulated cables used with pressure clamp terminals
Install ferrite cores for all cables. Refer to “Table Cables that Need Ferrite Cores to be Attached to, and Ferrite Core Models and Quantities” for the number of cores.
It is possible to consolidate multiple cables as per the cable diameter if same ferrite cores are used for both plus (+) and minus (-) lines.

Signal cables connected to terminal boards or relay boards:

Install ferrite cores on each cable at the nearest possible place to each connector.
In order to prevent the load at the connectors, secure the cables to the cabinet frame or dummy plate using cable ties at the nearest possible place to each ferrite core.

■ Installing Unit Components in Cabinet

Unit components here indicate the SSC60□-F, SSC50□, SSC57□, SSC10□ and SNB10D node units and SNT10D unit for optical bus repeater modules. When installing these unit components in a cabinet, dummy plates may have to be installed and a gasket may have to be attached to the dummy plates in the following cases:

- There is a large space between unit components.
- There is no space between unit components.
- Unit components are installed unevenly inside the cabinet.

● When Leaving a Large Space between Unit Components

When leaving a large space between unit components, install the following dummy plates to board up the spaces. A UNIT equals 44.45 mm high. Depending on the location of the dummy plate, attach an EMI shielding gasket to the dummy plate.

Table Space Sizes and Part Numbers of Dummy Plates

Space Size (UNITS in Height)	Dummy Plate
1	T9082EX
2	T9933VF
3	T9082EY
6	T9082EZ

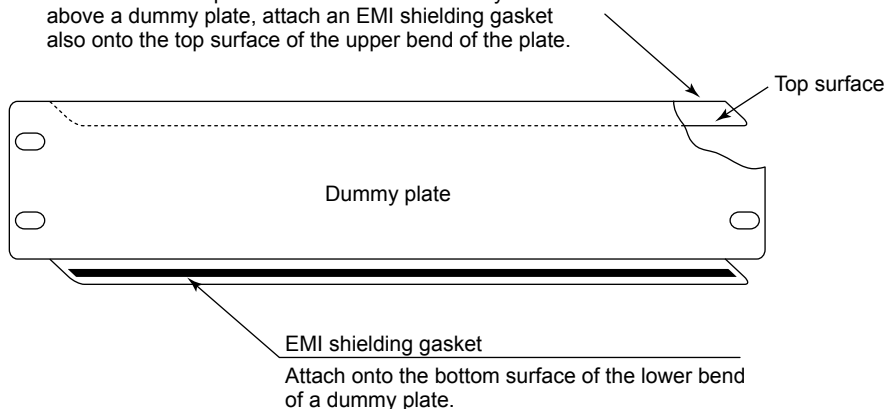
1 UNIT = 44.45 mm

Part number of EMI shielding gasket: G9312AD (1 meter long)

Location to attach EMI shielding gasket:

Attach an EMI shielding gasket onto the bottom surface of the lower bend of a dummy plate as shown below. Where a unit component is installed immediately above a dummy plate, attach an EMI shielding gasket also onto the top surface of the upper bend of the plate. However, for the dummy plate installed at the bottom of the component mounting area, no EMI shielding gasket needs to be attached onto its lower bend.

Where a unit component is installed immediately above a dummy plate, attach an EMI shielding gasket also onto the top surface of the upper bend of the plate.



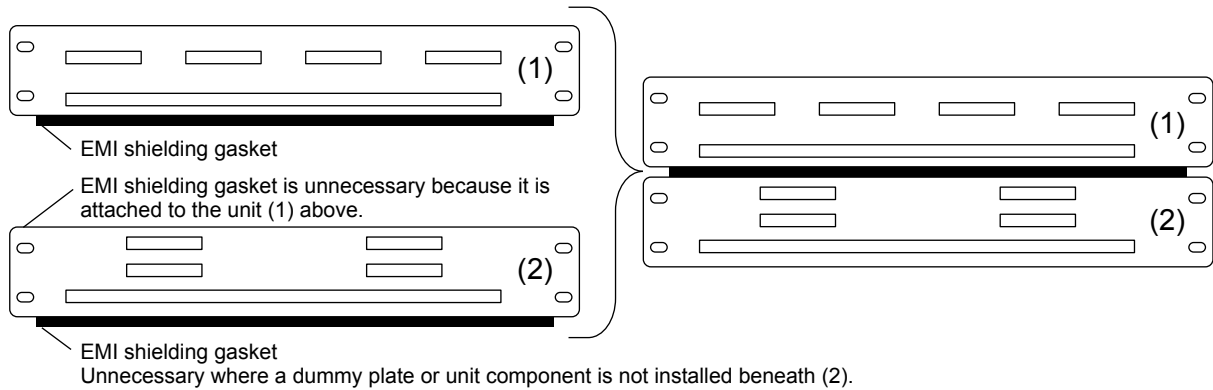
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Figure Examples of Installing EMI Shielding Gasket to Dummy Plate

● **When Installing Unit Components with No Space between Them**

When installing two unit components with no space between them, attach an EMI shielding gasket onto the bottom surface of the lower bend of the upper unit. However, for the unit installed at the bottom of the component mounting area, no EMI shielding gasket needs to be attached onto its lower bend.

For the EMI shielding gaskets, use the model introduced in the paragraph under “When Leaving a Large Space between Unit Components.”



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Figure Examples of Installing EMI Shielding Gasket to Unit Component

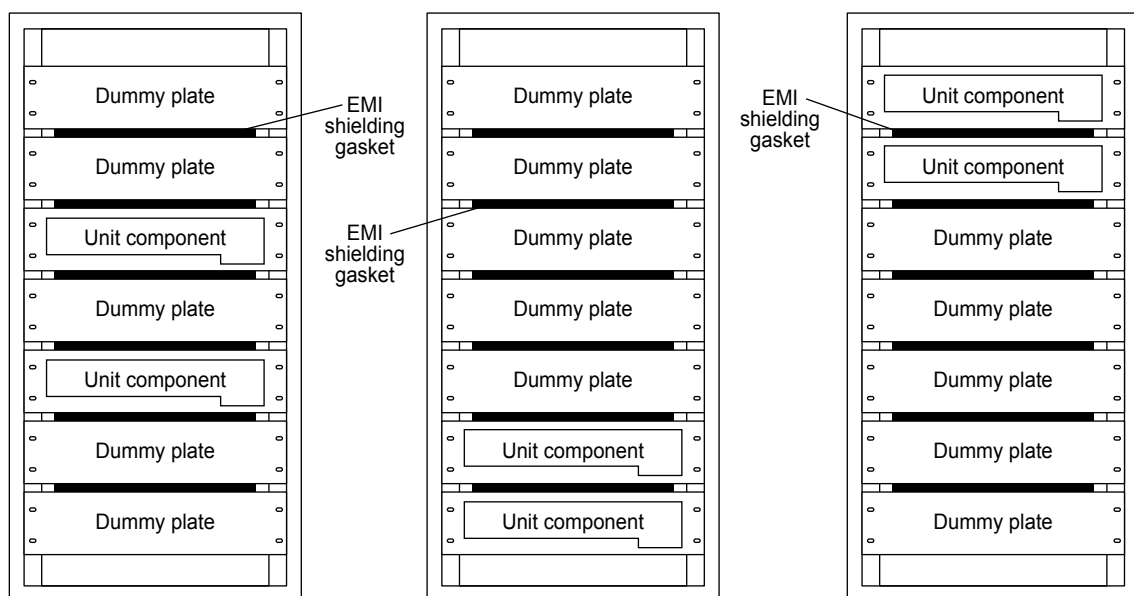
● **When Installing Unit Components Unevenly Inside Cabinet**

When installing unit components unevenly and gathering them to the upper or lower part of a cabinet, leaving a large space in the cabinet, install dummy plates. Attach an EMI shielding gasket to the dummy plates.

For the EMI shielding gaskets, use the model introduced in the paragraph under “When Leaving a Large Space between Unit Components.”

SEE ALSO

For how to attach EMI shielding gaskets, refer to “When Leaving a Large Space between Unit Components.”



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Figure Example of Installing Dummy Plates and EMI Shielding Gaskets in Cabinet

2. Transportation, Storage and Installation

This chapter describes the precautions in transporting, storing, and installing the ProSafe-RS system.

SEE ALSO See Section 1.2, "Control Room Environment" for the environmental requirement for each piece of equipment.

2.1 Precautions for Transportation

This section describes the precautions required to prevent accidents and damage when transporting ProSafe-RS system equipment. These precautions apply when the equipment is contained in our original packing.

■ Transportation

**SEE
ALSO**

For ambient temperature, humidity, vibration and impact, see Section 1.2, "Control Room Environment."

● Loading

- Do not load crates on top of others or turn them on their sides.
- Keep all crates upright.
- Secure loaded crates using ropes, and cover them completely with waterproof coverings.
- Do not load crates outdoors when it is raining.

● Don't Stack Outdoors

Be sure to store cargoes inside a warehouse if they must be stored for some time.

● Transportation

Cargoes contain precision instruments. Select a company specializing in the transportation of computers and precision instruments.

Keep all products upright during air transport, freightage, or truck transport. When transporting by track, drive at low speed to avoid vibration and impact. Also, slow down to the limit on a bad road.

● Others

Do not transport equipment through areas where there may be corrosive gas, intense electric or magnetic fields.

2.2 Unpacking

In unpacking the received cargoes and equipment, inspect them according to inspection list below. It is recommended to unpack by Yokogawa engineers or in their presence.

Table Inspection List

	Inspection Items	Result		Measures Required
Exterior	• Environment of unpacking location (temperature, humidity, dust)	Suitable	Unsuitable	If unsuitable, select proper location according to specified environmental requirements.
	• Rapid temperature fluctuation (should be within ± 10 °C/h)	No	Yes	If yes, do not unpack and wait until the fluctuation remains within ± 10 °C/h.
	• Damage to equipment exterior • Condensation or its trace on equipment exterior. (*1)	No No	Yes Yes	If damaged badly, inform Yokogawa. If yes, inform Yokogawa.
Interior	• Loose parts inside equipment.	No	Yes	If yes, remove them and check the surrounding.
	• Damage to equipment interior. • Condensation or its trace on equipment interior. (*1)	No No	Yes Yes	If damaged badly, inform Yokogawa. If yes, inform Yokogawa.

- *1: Condensation symptoms are as follows:
- Dew patterns on PCBs.
 - Printed circuit copper trace is floating off the board.
 - Label characters on PCBs are smudged.
 - Connectors on PCBs are smudged.
 - Dew patterns or traces of droplets are found on cabinet panels.



IMPORTANT

Condensation may cause a fatal system failure in the ProSafe-RS system. Be sure to unpack the equipment indoor under the specified environmental conditions. Strictly observe the allowable temperature fluctuation range of ± 10 °C/h. Do not bring the equipment into a heated room straight from the outside in winter. Our warranty does not cover any damage caused by condensation. Proper treatment may be able to minimize the damage caused by condensation. Contact Yokogawa in case of condensation.

2.3 Storage

The delivery date should be determined in accordance with your installation schedule. Avoid storing products more than three months. If long-term storage more than three months cannot be avoided, consult Yokogawa in advance because it is necessary to provide waterproofing, condensation prevention, and dustproofing measures as well as periodical inspections.

■ Storage Condition

Store products without unpacking. Be sure to confirm that the crate is not damaged. To store them after unpacking, be sure to take the precautions described below.

■ Location of Storage

Store products in a warehouse or indoor facilities - never in an open-air location.

■ Storage Environment

- Ambient Temperature for storage: 5 to 40 °C.
- Avoid direct sunlight.
- Prevent condensation.
- Do not store products where corrosive gas or salty air may be present.

**SEE
ALSO**

See "Section 1.2 Control Room Environment" for permissible temperature, humidity and temperature fluctuation of storage area.

■ Storage of Packed Equipment

- Place squared pieces of lumber with a height of 100 mm or higher on the floor. The lumber should be long enough so that more than 100 mm remains outside of the crate on every side.
- Securely place unopened crates on the lumber platform.
- Do not stack crates in piles.
- Make sure to provide good air circulation in the storage area and periodically inspect the crates to keep them under proper conditions.

■ Storage of Unpacked Equipment

To store unpacked products without power connection, follow the specified environmental requirements. If stored in a non-air-conditioned room, cover them with polyethylene or other sheets for protection against dust and moisture. For moisture-proofing, place a sufficient amount of Silica gel or other desiccating agent inside the covering and inspect its effectiveness from time to time.

2.4 Servicing Area

Take enough space around equipment for its operation and maintenance service. This servicing area is indicated for each equipment.

The servicing area should be considered in determining the size of installation location. When installing a number of equipment side by side, take the largest service - area between them if different dimensions are indicated for different side of equipment, as indicated below.

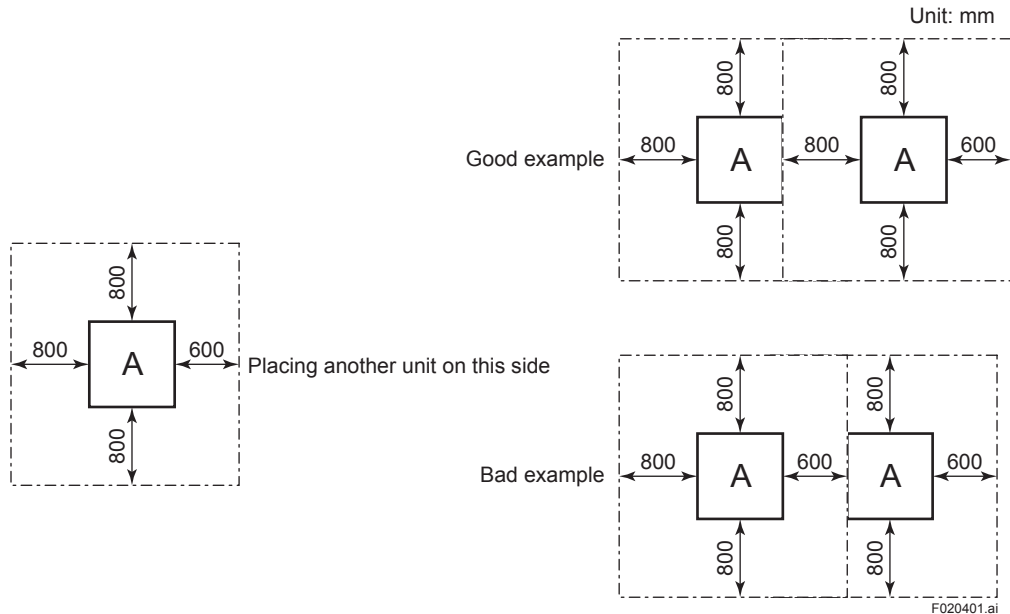


Figure Servicing Area when Installing Units Side-by-side

**SEE
ALSO**

For equipment servicing areas, refer to "External Dimensions" (SD).

2.5 Installation

Before installation, be sure that anchor bolts, pedestals, and cable holes are provided according to the customer's system configuration plans. Check that the positions of holes on the floor fit the anchor bolt holes in the channel base of each piece of equipment.

2.5.1 Installation on Floor

The installation method varies with the type of the floor and building.

- After unpacked, be careful not to put any impact until the equipment is fixed to the floor to prevent it from falling to the floor.
- Install devices as specified in the plans. Check the position of front and back panels of the cabinet.
Avoid physical shock. Never use hammers.
- Fix each equipment to the floor.

The explanation below shows how to fix devices on different types of floors.

■ Concrete Floor

Clamp the equipment to the floor using anchor bolts. It is recommended to use M12 bolts and 3200 N•cm (320 kgf•cm) tightening torque.

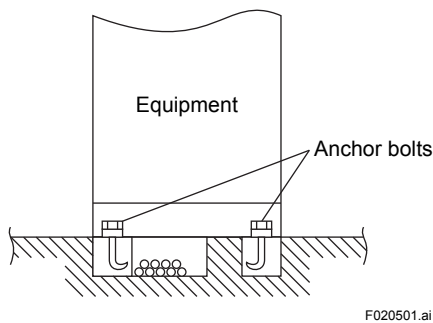


Figure Using Anchor Bolts

■ Steel Floor

Clamp the equipment to the floor using clamp bolts.

After cabling through the riser duct, fill the duct with rubber sponges and seal the top with putty.

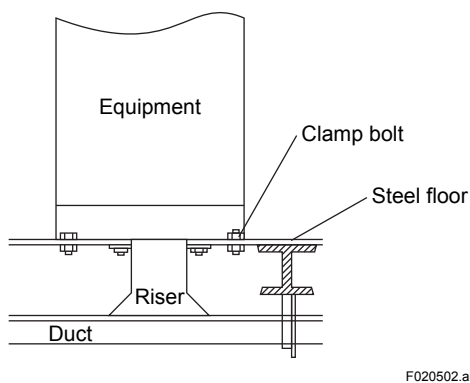
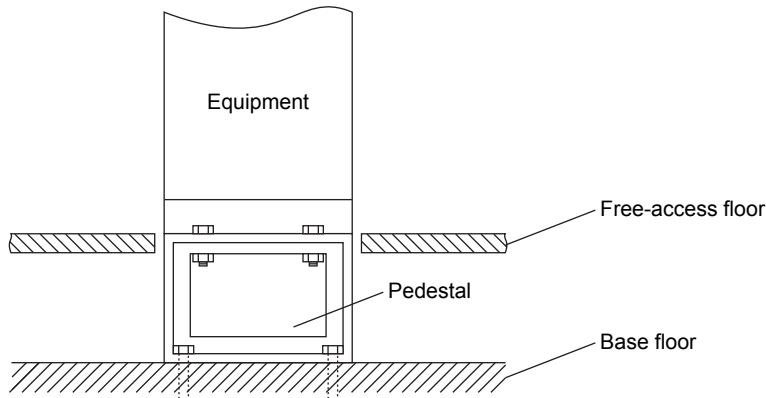


Figure Using Clamp Bolts

■ “Free-access” Floor

Clamp the equipment to pedestals that are anchored to the base floor.

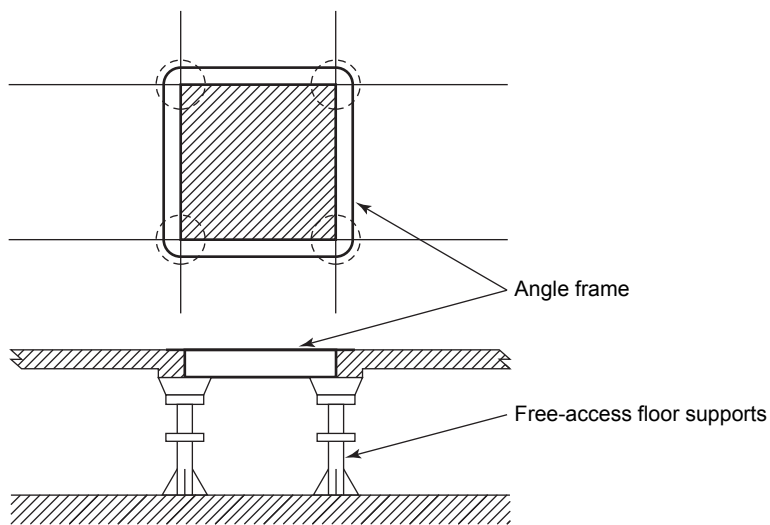


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Figure Using Pedestal

In the “free-access” floor, make holes for riser cables to connect to each piece of equipment as follows:

- If one floor tile is removed, be sure to reinforce the opening with an angle frame for floor stability.



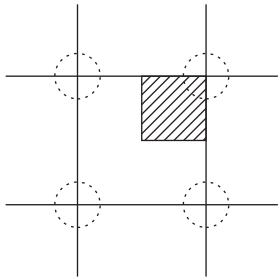
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Figure Removing One Floor Tile

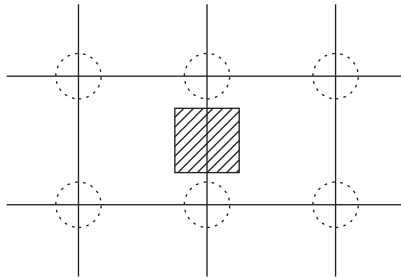
- Do not make a holes near the floor supports.
- Do not cut away more than 1/3 of a floor tile.

**IMPORTANT**

If a number of neighboring floor tiles are removed, be sure to provide angle frames or pedestals for reinforcement.



Bad example



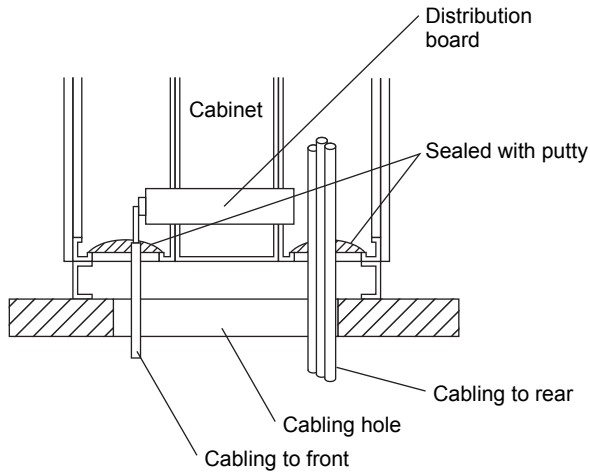
Good example

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Figure Partially Cutting Floor Tile

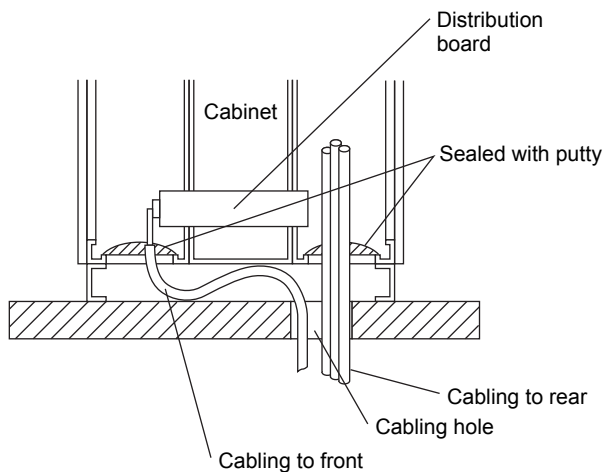
■ Size of Cabling Holes in Floor

For ease of cabling, and for separating power cables from signal cables, it is recommended that you make holes in the floor for cabling that are the maximum size indicated in the floor plans. If the specified maximum size hole cannot be provided due to the floor construction or pit dimensions, the size may be smaller within the range indicated in the plans. If you use the specified minimum size of hole, use flexible cables that can bend inside the channel base.



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Figure Cabling through Maximum Size Hole



F020507.ai

Figure Cabling through Minimum Size Hole

2.5.2 Rack Mounting

Rack-mount devices include:

SSC60S, SSC60D, SSC50S and SSC50D Safety Control Units (for Vnet/IP);
 SSC57S and SSC57D Safety Control Unit (for Vnet/IP-Upstream)
 SSC10S and SSC10D Safety Control Units (for V net);
 SNB10D Safety Node Unit;
 SNT10D Unit for Optical Bus Repeater Module;
 YNT511D, and YNT522D Optical Bus Repeaters;
 YNT512D Bus Repeaters;
 SEA4D, SED2D, SED3D, SED4D and SWD2D Terminal Board;
 SBA4D, SBD2D, SBD3D, and SBD4D Terminal Board (*1);
 SRM53D and SRM54D Relay Board;
 SBM54D Relay Board (*1);
 AEPV7D Power Supply Bus Unit Vertical Type (*2)
 AEP7D Primary Power Supply Bus Unit; and
 AVR10D Duplexed V net router.

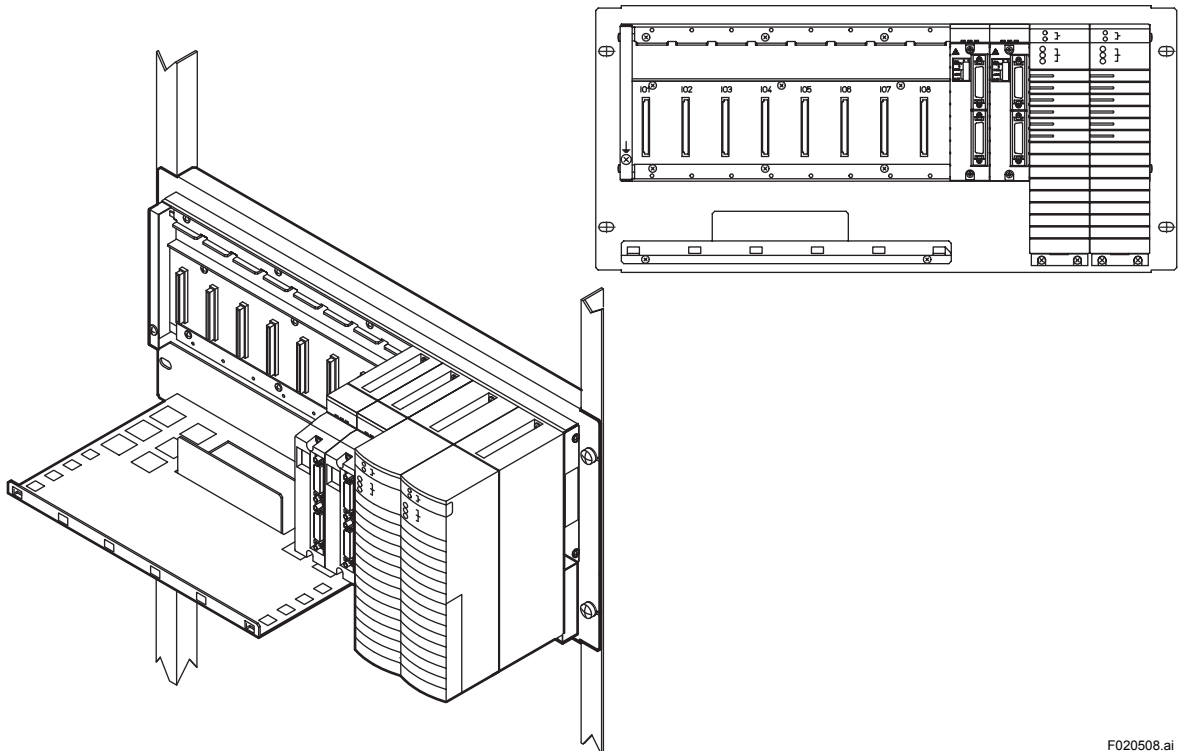
*1: DIN Rail Mount Type

*2: AEPV7D can not be installed to 19-inch Rack.



IMPORTANT

- To meet the Safety Standards and EMC Standards, the devices must be installed in a lockable metal cabinet. The cabinet must conform to IEC/EN/CSA 61010-2-201 or provide degrees of protection IP3X or above and IK09 or above.
- When installing rack mount devices on the same rack, keep 3-unit spacing (1 unit: 44.45 mm) under a safety control unit. Other units can be installed next to each other with specified condition.
For more details, see “Providing Space for Heat Radiation”.



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Figure Mounting SNB10D Safety Node Unit

Notes on Installation



IMPORTANT

For safety during installation, secure an ample working space and work in a team. Be sure to observe the following when installing on a rack or on an instrumentation panel:

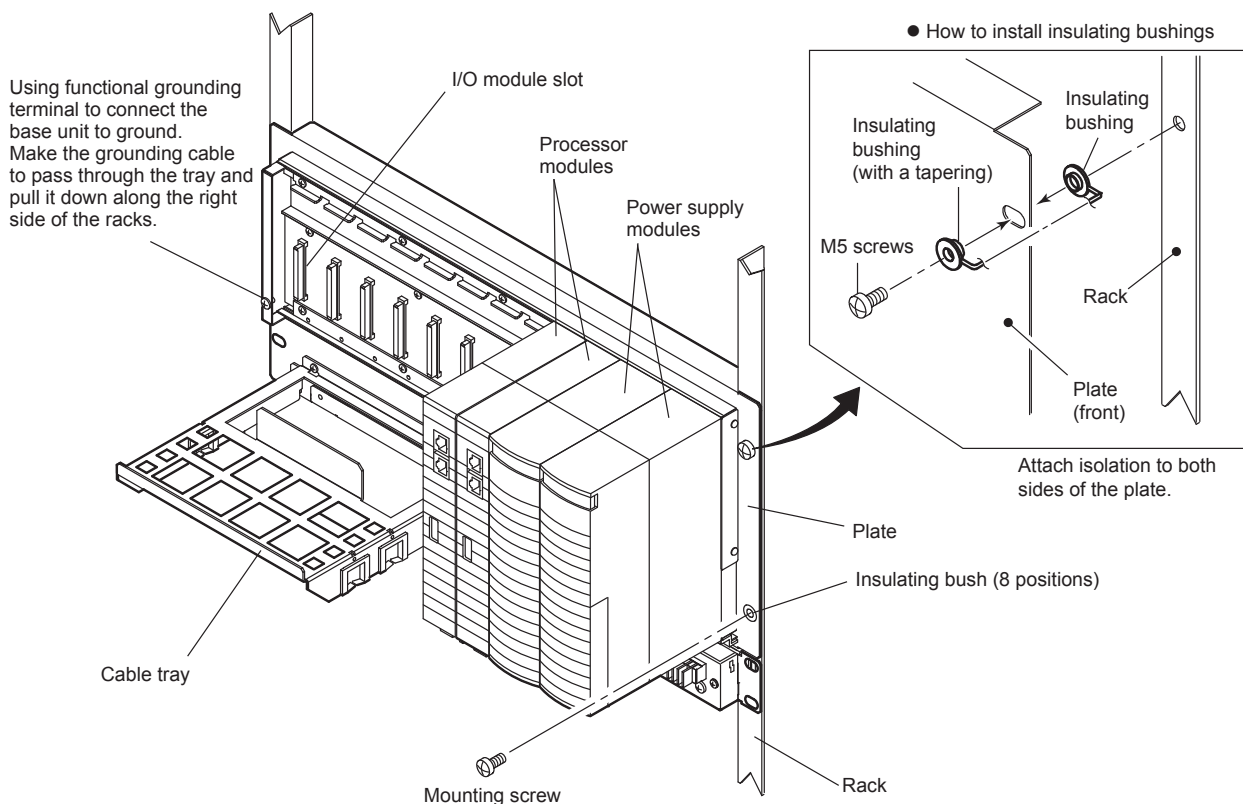
● Insulation from Rack

The safety control unit or safety node unit or Unit for Optical Bus Repeater Module must be insulated from the rack using insulating bushing to prevent direct contact. Place the bushing on both sides of the plate, as shown in the figure below. Make sure that the rack-mounted equipment is electrically insulated from the rack. Insulating bushing is supplied as an accessory.

When you mount a device with insulating bushing to a rack, please do not leave it in an unstable condition where it is only hooked with loose screws. It may add unnecessary force to an insulating bushing to cause breakage.

● Installation Procedure

1. Fasten a pair of insulating bushings together to each of the screw holes on the plate or the bracket on the device. The tapering end of the insulating 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.



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Figure Mounting SSC10D on Rack

**IMPORTANT**

- The safety control unit or safety node unit or Unit for Optical Bus Repeater Module has no power supply switch. It is recommended that an external switch or breaker be provided to turn the power on and off.
 - If multiple node units are present, connect individual ground wires to terminals on the base units.
-

● Installation Direction

Install the device in the rack with the screws in the vertically correct direction.

Check the installation direction by referring to SD (External Dimensions).

TIP

When the device is supplied with power even if it is temporary, the device must be installed on the rack.

Placing the device on a desk etc. and laying it on its side should be avoided.

The device may become malfunction if the heat radiated from the device cannot be cooled smoothly.

● Providing Space for Heat Radiation

Leave space at the top and bottom of rack-mount equipment to permit heat radiation.

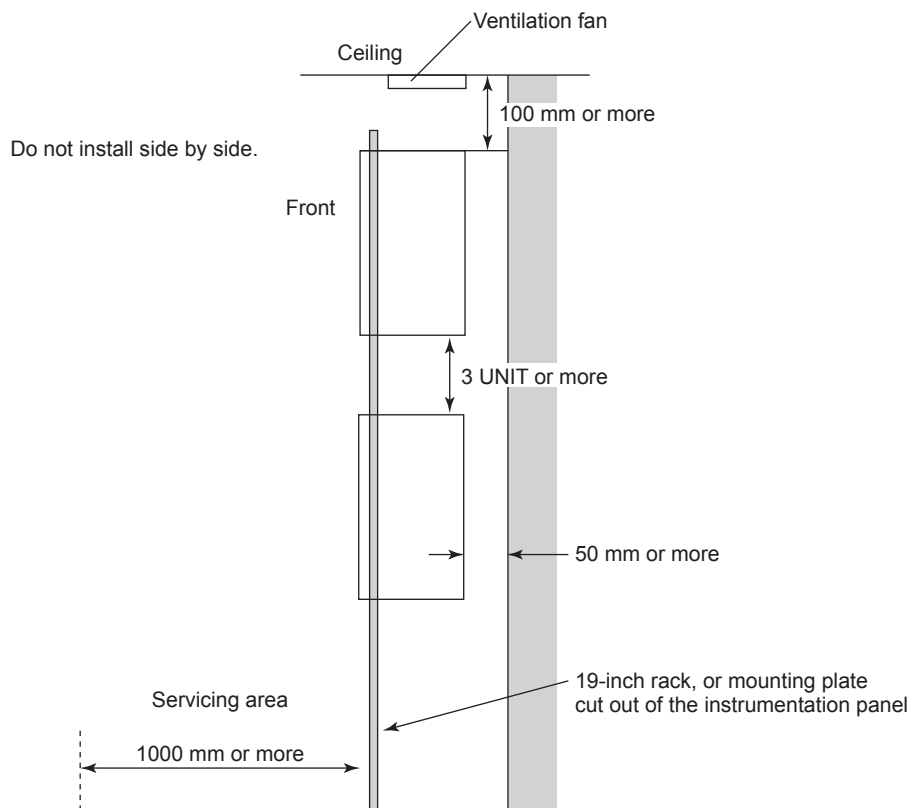
- Separate the top of the instrumentation board at least 100 mm away from the ceiling, and cut a ventilation hole of 200 cm² or larger in the ceiling or install a ventilation fan.
- Keep at least 50 mm between the back of the equipment and the instrumentation panel or wall.
- When installing an 19-inch rack mount devices on the same rack, maintain a 3-unit spacing (1 unit: 44.45 mm) between devices. Above the installed devices, there are a number of openings for ventilation purposes on the trays.
- When putting cables on the trays, make sure that the openings are not blocked so as to ensure the airflow through the ventilation openings.

● Providing Area for Servicing

When mounting devices in the 19-inch rack, the mounting plate cut out of instrumentation panel, and so on, leave an area for servicing.

Leave an area for servicing.

- All the work to connect cables to 19-inch rack mountable devices and I/O modules will be performed from the front.
- The work to confirm indicator lamps, configure card settings, and remove/insert cards will be performed from the front.
- The front is the area for wiring and servicing. Leave at least 1000 mm of space at the front.



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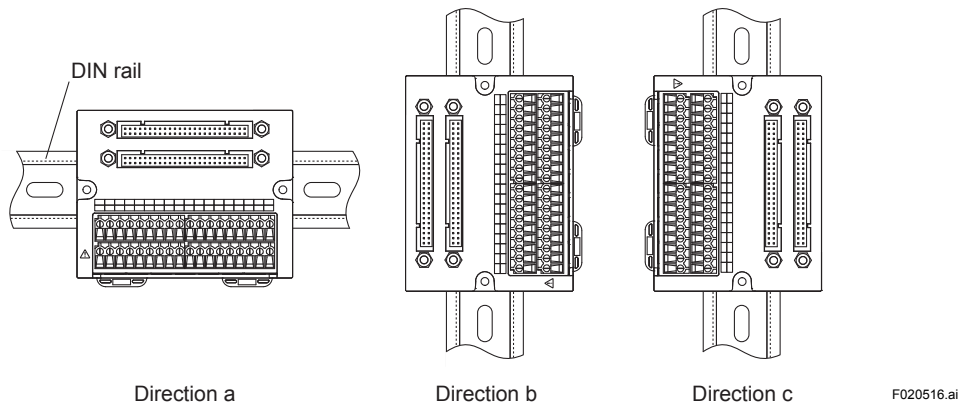
Figure Space Required for Rack-mount Equipment

● **Terminal Board and Relay Board Mounting Directions**

Mount a terminal board and a relay board in the directions as shown in the below figure.

When mounting SBD2D in the direction of b or c, the following conditions must be met.

- When the ambient temperature is 60 °C or lower, the total load current of the SBD2D must be kept within the specified value of 8 A or lower.
- When the ambient temperature is at 70 °C, the total load current must be 6 A or lower.
- In case the ambient temperature is in between 60 and 70 °C, reduce the total load current from 8 A maximum by the rate of 0.2 A/°C.



● **Remarks for 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.

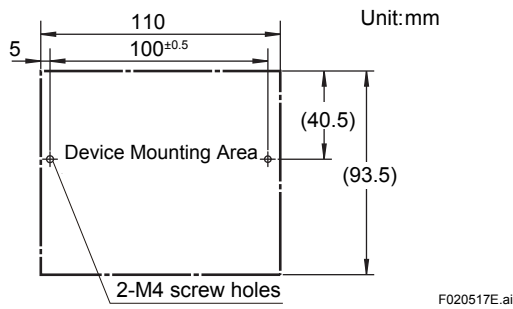


Figure Screw Installation Dimensions for the SBA4D

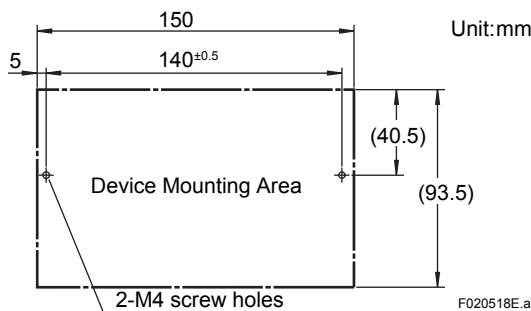


Figure Screw Installation Dimensions for the SBD2D, SBD3D, and SBD4D

● Remarks for Installing to a DIN Rail

On the back of DIN rail mountable terminal board, there are two bumps (projections) for fixing screws on the wall. Be sure not to let mechanical interference happen between these bumps and screw tops from the DIN rail. The height of the shaded areas in the below figures must be kept as 2.5 mm or shorter than the DIN rail surface.

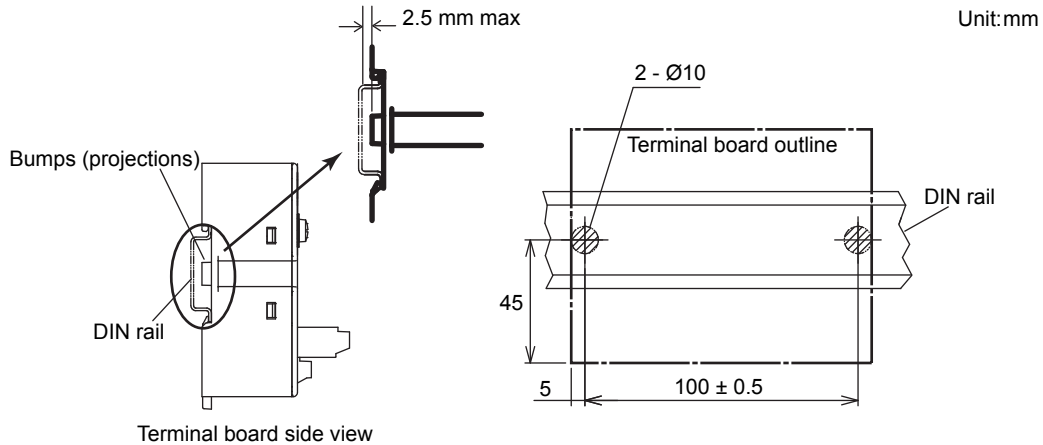


Figure Mounting SBA4D to DIN rail for terminal board

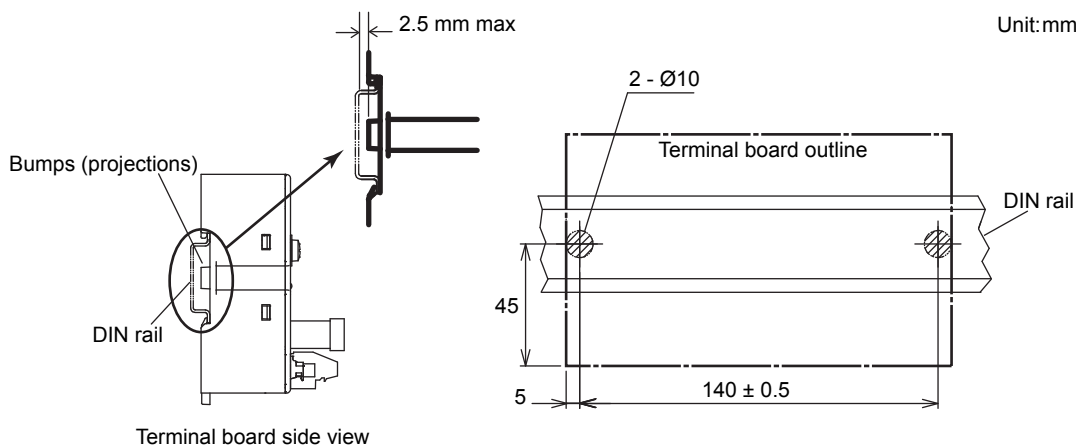


Figure Mounting SBD2D, SBD3D, and SBD4D to DIN rail for terminal board

● Cautions of the Power Source for the Loads of SBM54D

In the case of using multiple power sources for the loads of SBM54D, there are cautions of the load voltage.

When the load voltage is different between loads.

All of the load voltages must be in either the range below.

- Load voltages ≤ 100 V
- 50 V < Load voltages ≤ 150 V

● Cautions of the Digital Output Module when SBM54D is Used

The functions of disconnection diagnosis, ON pulse diagnosis and OFF pulse diagnosis for SDV541 must be disabled when SBM54D is used.

2.5.3 Installation Guideline for Cabinet

■ Installation Guideline for Rittal Cabinet (Up to 11 Nodes)

The following shows examples and notes for installing a safety control unit and up to 10 safety node units in the Rittal TS8 cabinet.

● Applicable Cabinet

Rittal TS8 cabinet (W: 800 mm D: 800 mm H: 2000 mm)

● Temperature Conditions

- If a safety control unit is equipped with a fan unit, the ambient temperature of the cabinet must be 50°C or lower. If it is not equipped with a fan unit, the ambient temperature of the cabinet must be 30°C or lower.
- Ambient temperature of the safety control unit and safety node units in the cabinet must satisfy the temperature values specified in GS (General Specifications).

● Installation Conditions

- Applicable units
 - Safety Control Unit SSC60□/SSC50□/SSC57□: 1 unit
 - Safety Node Unit SNB10D and Unit for Optical ESB Bus Repeater Module SNT10D: Up to 10 units
 - Primary Power Supply Bus Unit AEP7D and AEPV7D: Up to 2 units
 - Other heat-generating devices must not be installed in the cabinet.
- Fan configuration
 - Configuration of door fans, node fans, and roof vent

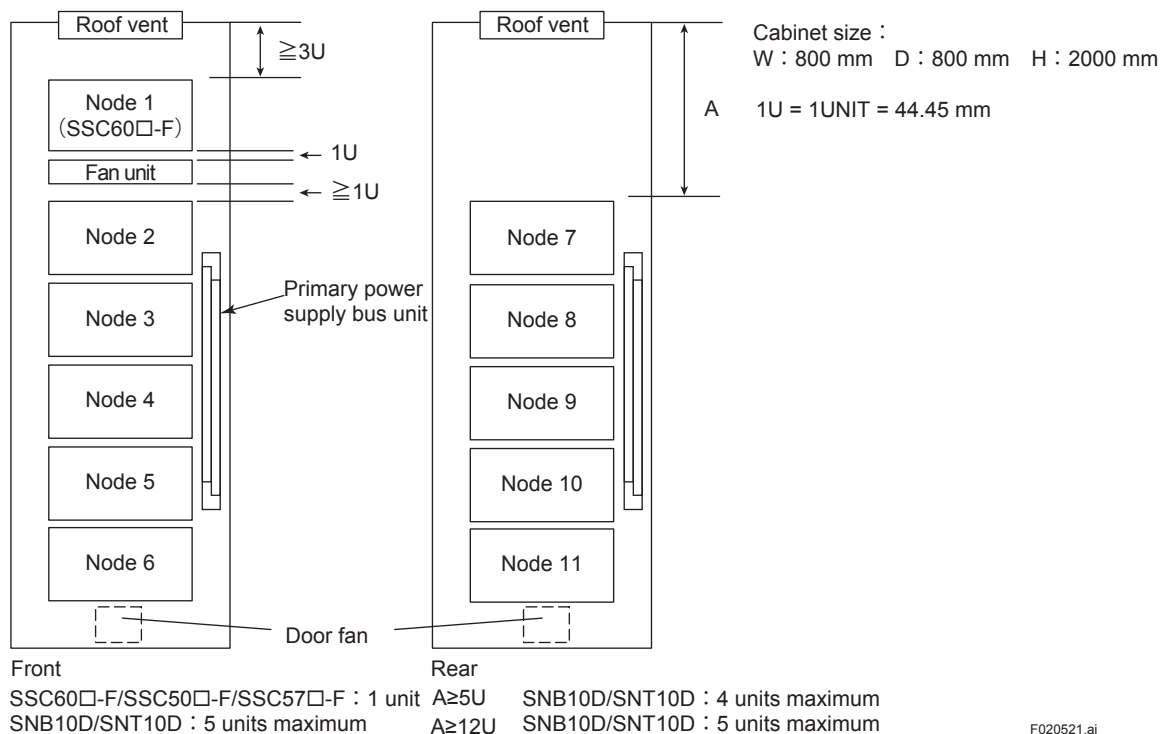
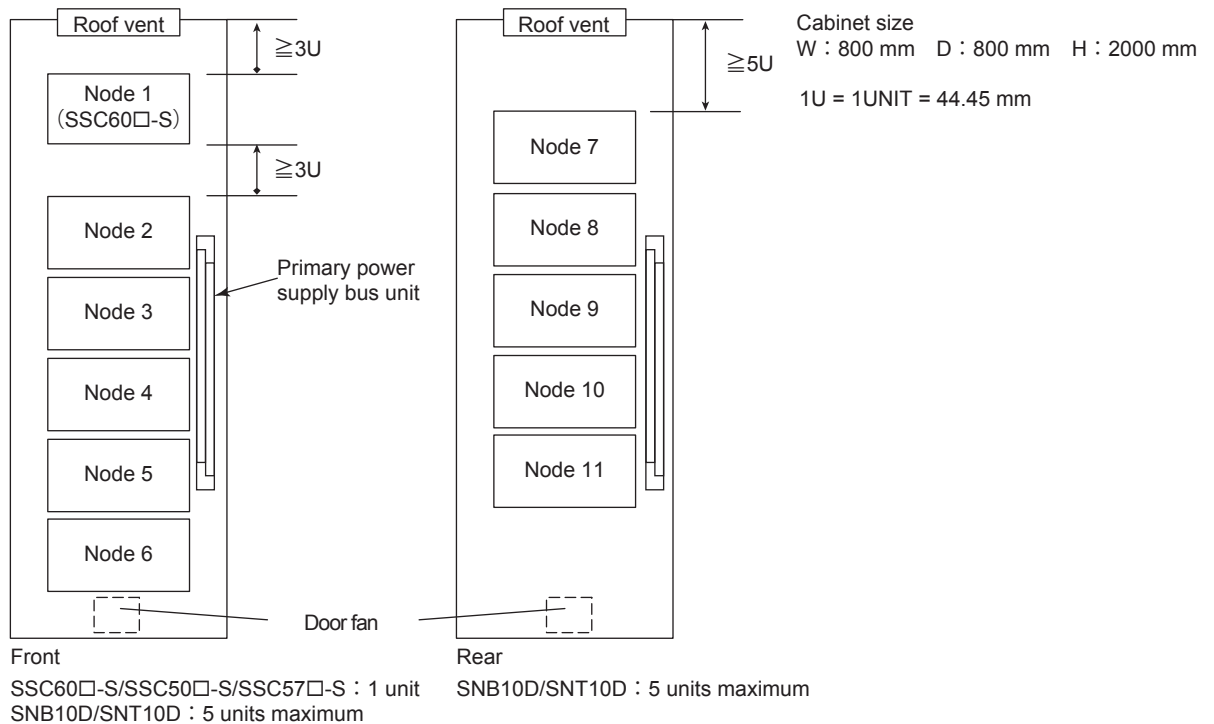


Figure Installation of SSC60□/SSC50□/SSC57□ for Rittal cabinet (with Fan Unit)

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Figure Installation of SSC60□/SSC50□/SSC57□ for Rittal cabinet (without Fan Unit)

- Fan specifications
 - Door fan (on one side): Maximum air flow rate 230 m³/h or more
 - The roof vent must be larger than the opening area of the door fan.
- I/O module installation restrictions
 - Refer to and follow the installation restrictions specified in “■ NODE UNIT MOUNTING RESTRICTIONS” in the “ProSafe-RS Outline of I/O Modules” (GS 32Q06K20-31E).

■ Installation Guideline for Rittal Cabinet (Up to 14 Nodes)

The following shows examples and notes for installing a safety control unit and up to 13 safety node units in the Rittal TS8 cabinet. If the units are installed under the following conditions, the temperature rise in the cabinet compared to the ambient temperature of the cabinet is 10°C or lower.

● Applicable Cabinet

Rittal TS8 cabinet (W: 800 mm D: 800 mm H: 2000 mm)

● Temperature Conditions

- Ambient temperature of the cabinet must be 50°C or lower.
- Ambient temperature of the safety control unit and safety node units in the cabinet must satisfy the temperature values specified in GS (General Specifications).

● **Installation Conditions**

- Applicable units
 - Safety Control Unit SSC60□-F: 1 unit
 - Safety Node Unit SNB10D and Unit for Optical ESB Bus Repeater Module SNT10D: Up to 13 units
 - Primary Power Supply Bus Unit AEP7D and AEPV7D: Up to 2 units
 - Other heat-generating devices must not be installed in the cabinet.
- Fan configuration
 - There are the following two types of fan configurations.
 - Type 1: Configuration of door fans, node fans, and door vents
 - Type 2: Configuration of door fans, node fans, and roof vent

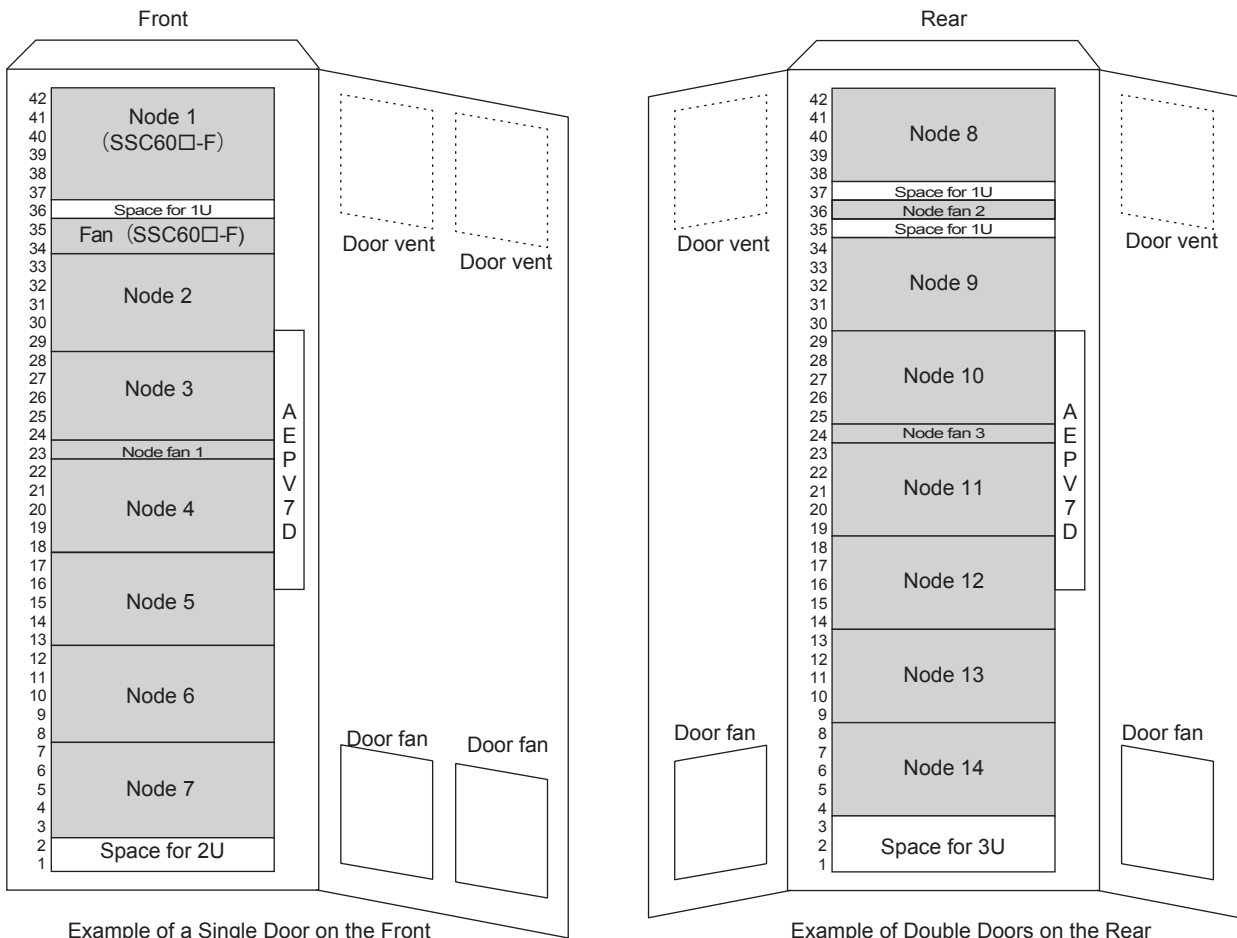
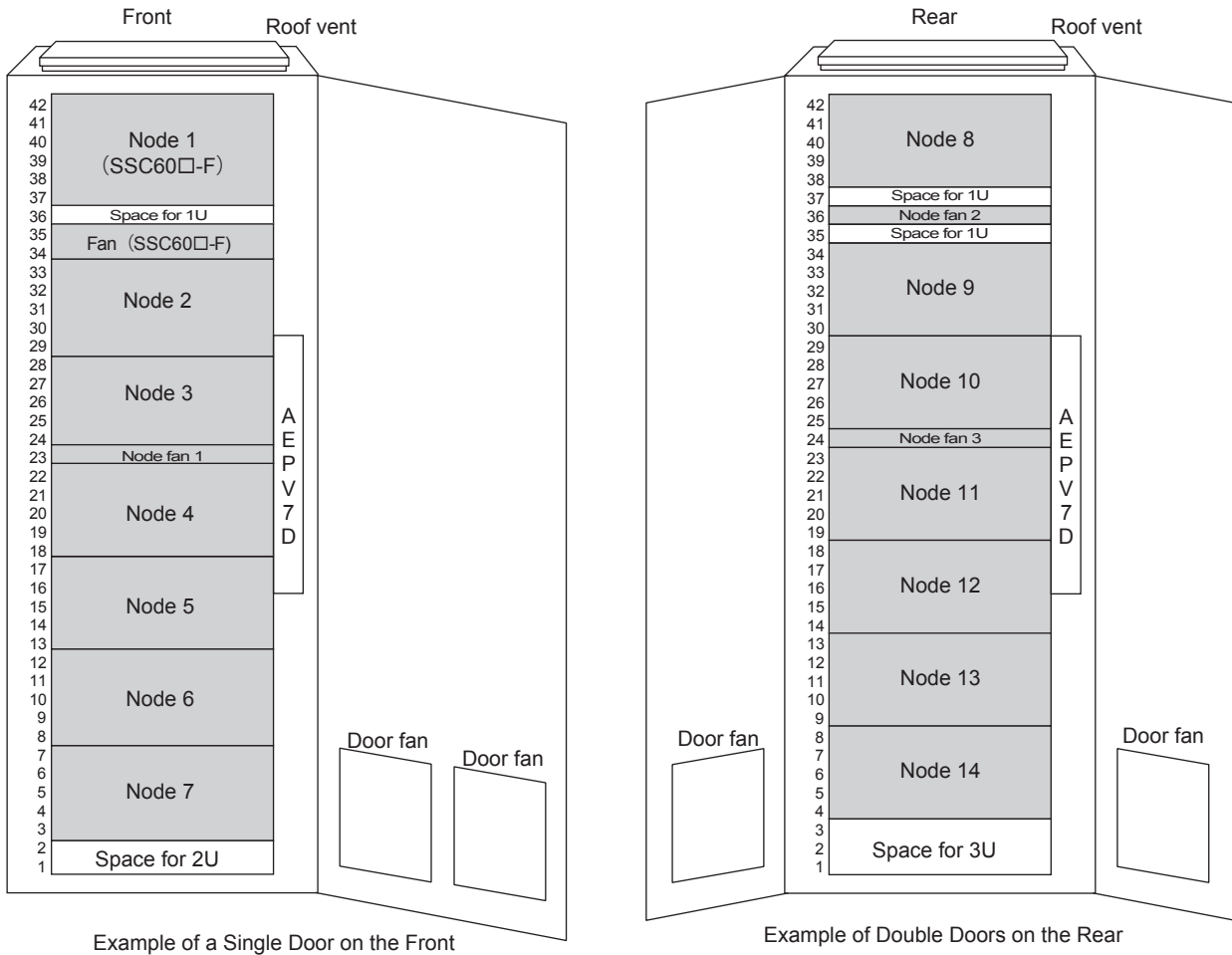


Figure Fan Configuration of Type 1 and Installation Positions in the Cabinet

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Example of a Single Door on the Front

Example of Double Doors on the Rear

F020524.ai

Figure Fan Configuration of Type 2 and Installation Positions in the Cabinet

The required number of node fans varies depending on the number of nodes to be installed.

Table Number of Nodes to Be Installed and Need to Install Fans

	Location No. (*1)	7 units on one side	6 units on one side	5 units on one side	4 units on one side
Front	37-42	Node 1 (SSC60□-F)	Node 1 (SSC60□-F)	Node 1 (SSC60□-F)	Node 1 (SSC60□-F)
	34-35	Fan (SSC60□-F)	Fan (SSC60□-F)	Fan (SSC60□-F)	Fan (SSC60□-F)
	29-33	Node 2	Node 2	Node 2	Node 2
	24-28	Node 3	Node 3	Node 3	Node 3
	23	Node Fan 1	Node Fan 1	—	—
	18-22	Node 4	Node 4	Node 4	Node 4
	13-17	Node 5	Node 5	Node 5	—
	8-12	Node 6	Node 6	—	—
	3-7	Node 7	—	—	—
Rear	38-42	Node 8	Node 8	Node 8	Node 8
	36	Node Fan 3	Node Fan 2	Node Fan 2	—
	30-34	Node 9	Node 9	Node 9	Node 9
	25-29	Node 10	Node 10	Node 10	Node 10
	24	Node Fan 3	Node Fan 3	—	—
	19-23	Node 11	Node 11	Node 11	Node 11
	14-18	Node 12	Node 12	Node 12	—
	9-13	Node 13	Node 13	—	—
	4-8	Node 14	—	—	—

—: Not installed

*1: Location numbers correspond to the installation positions in the figure above.

- Fan specifications
 - Door fan (on one side): Maximum air flow rate 210 m³/h or more
 - Node fan: Maximum air flow rate 480 m³/h or more
 - The door vent and roof vent must be larger than the opening area of the door fan.
- I/O module installation restrictions
 - Refer to and follow the installation restrictions specified in “■ NODE UNIT MOUNTING RESTRICTIONS” in the “ProSafe-RS Outline of I/O Modules” (GS 32Q06K20-31E).
- Detecting a fan failure
 - It is recommended to monitor the rotation of the fans or the temperature in the cabinet to detect a fan failure.

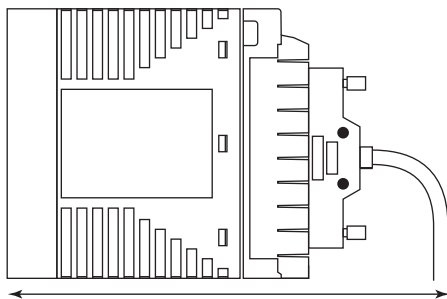
■ Notes on Installation

● Depth of Cabinet

The following table shows the depth from the blunt curb of the signal cable to the edge of the rack, when the signal cable is connected with the I/O module in a cabinet.

Table Depth of cabinet

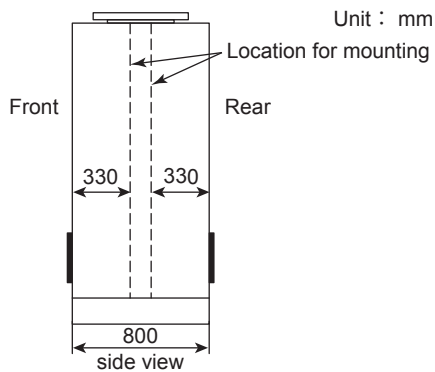
I/O Module	Depth from the cable blunt curb to the edge of the rack (mm)
SDV144	230
SDV521	290
SDV526	250
SDV531	230
SDV53A	260
SDV541	230



Depth from the blunt curb of the signal cable to the edge of the rack

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● Location



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2.5.4 Desktop Equipment

There are SENG (PCs), general-purpose printers, etc. as the devices used on the desks.

When installing any devices on the desks, take care about the following:

- It should provide a level horizontal surface for the PC or printer.
- A work space should be preserved to connect the cables.
- Support rising cables to prevent their weight from being applied to connectors directly. Keep a space of 100 mm radius or more around the connectors.
- Do not place the desk such as to expose the PC to direct sunlight or high humidity.

2.5.5 Installing Control Network Interface Card

This section describes how to install VI702 or VF702 Control Network interface card. The card is installed in a PCI Express slot of an SENG PC to connect it to the Control Network.

**SEE
ALSO**

- The steps described below are based on general-purpose PC/AT compatible machines. For details, refer to the manual for the specific PC.
 - For the station address setting, refer to the Safety Control Stations (Hardware), IM 32Q06C10-31E, IM 32S06C10-21E or IM 32S06C10-01E.
-

● Card Installation Procedure

1. Set the station address for the control bus interface card.
2. Turn off the computer and unplug the power cord for safety.
3. Remove the PC cover.
4. Remove the slot cover.
5. Insert the control bus interface card in the slot. Make certain that the card is properly set in the slot.
6. Attach the computer cover.
7. Write the station address on a seal (sticker) and attach it to the front of the PC or in another similarly easy-to-view place.

**SEE
ALSO**

- For the electrostatic protection, refer to 1.5.2, "Countermeasures against Static Electricity."
 - For the control bus connections, refer to 3.7, "Connecting Bus Cable."
-

3. Cabling

This section describes how to cable the installed system equipment.

Connecting terminals for power, grounding, and signal cables are shown in figures.

The figures also show how to connect the SENG to field control units, and optical fiber cables to the optical bus repeaters.

3.1 Cables and Terminals

It is recommended that you use flexible, thin, easy-to-bend, twisted-pair cables to connect the terminals of the system equipment. Use solderless (crimp-on) terminals with insulating cover, which have low contact resistance little aging.

Rigid cables make cabling work difficult and exert unnecessary force on the terminals, which may result in system failures.

Cables with the temperature rating of an ambient temperature plus 10 °C or more must be used.

As for the following models, cables with the temperature rating as shown in the below Table must be used.

Table Rating temperature of Cables

Models	Cables	Temperature rating of Cables
SBD2D,SBD3D,SBD4D	Signal Cables (including READY terminal)	An ambient temperature plus 20 °C or more
	Input Power Cables	An ambient temperature plus 30 °C or more
SBM54D	Signal Cables (excluding READY terminal)	An ambient temperature plus 40 °C or more
	Input Power Cables Signal Cables (READY terminal)	An ambient temperature plus 20 °C or more
SYEPD4D	Input Power Cables	An ambient temperature plus 30 °C or more
SYEPD5D	Input Power Cables	90 °C or more
AEP7D (100-120 / 220-240 V AC)	Input Power Cables	An ambient temperature plus 30 °C or more
AEP7D (24 VDC)	Input Power Cables	An ambient temperature plus 50 °C or more
AEPV7D (100-120 / 220-240 V AC)	Input Power Cables	An ambient temperature plus 30 °C or more
AEPV7D (24 VDC)	Input Power Cables	An ambient temperature plus 40 °C or more

■ Signal Cables

Nominal conductor cross-sectional area: 0.75 to 2.00 mm²
For SED2D 0.75 to 5.5 mm²

Example of suitable cables:

600 V polyvinyl chloride insulated wires (IV); IEC 60227-3/JIS C 3307
Polyvinyl chloride insulated wires for electrical apparatus (KIV); IEC 60227-3/JIS C 3316
600 V Grade heat-resistant polyvinyl chloride insulated wires (HIV); IEC 60227-3/JIS C 3317
Heat-resistant PVC wire (UL1015/UL1007)
PVC insulated and PVC sheathed control cables (CVV); JIS C 3401

Solderless (crimp-on) terminal lugs: Circular solderless terminal lugs for M4 screw terminal

■ Alarm and Control Circuit Cables

Nominal conductor cross-sectional area: 0.5 to 1.25 mm²

Example of suitable cables:

600 V polyvinyl chloride insulated wires (IV); EC 60227-3/JIS C 3307

Polyvinyl chloride insulated wires for electrical apparatus (KIV); IEC 60227-3/JIS C 3316

Heat-resistant PVC wire (UL1007)

Solderless (crimp-on) terminal lugs: Circular solderless terminal lugs for M4 screw terminal

■ Power Cables

Nominal conductor cross-sectional area

For rack-mounted 100-120 V AC /220-240 V AC-driven equipment: 1.25 to 2.0 mm²

For rack-mounted 24 V DC-driven equipment: Minimum 2.0 mm²

For cabinets: Minimum 8.0 mm²

Example of suitable cables:

600 V polyvinyl chloride insulated wires (IV); IEC 60227-3/JIS C 3307

Polyvinyl chloride insulated wires for electrical apparatus (KIV); IEC 60227-3/JIS C 3316

Solderless (crimp-on) terminal lugs: Circular solderless terminal lugs for M4 or M6 screw terminal

Note: Use cables capable of supplying current required by respective pieces of equipment with low voltage drop.

■ Grounding Cables

**SEE
ALSO**

See Section 1.4, "Grounding," for wiring of grounding cables connecting grounding bars of different cabinets and/or panels to each other.

Nominal conductor cross-sectional area: Minimum 2.0 mm²

Example of suitable cables:

600 V polyvinyl chloride insulated wires (IV); EC 60227-3/JIS C 3307

Polyvinyl chloride insulated wires for electrical apparatus (KIV); IEC 60227-3/JIS C 3316

Solderless (crimp-on) terminal lugs: Circular solderless terminal lugs for M4 screw terminal

■ Cable Terminals

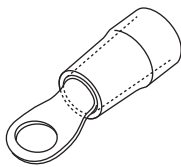
Use the specified solderless terminals and sleeves for pressure clamp terminal on the end of terminal-connected cables, providing low contact resistance, high durability, and low aging.

● Solderless Lug



IMPORTANT

- Be sure to use solderless terminals with insulating sheath.
- Use solderless terminals and crimp tools from the same manufacturer.
- Use appropriate crimp tools meeting the cable size.

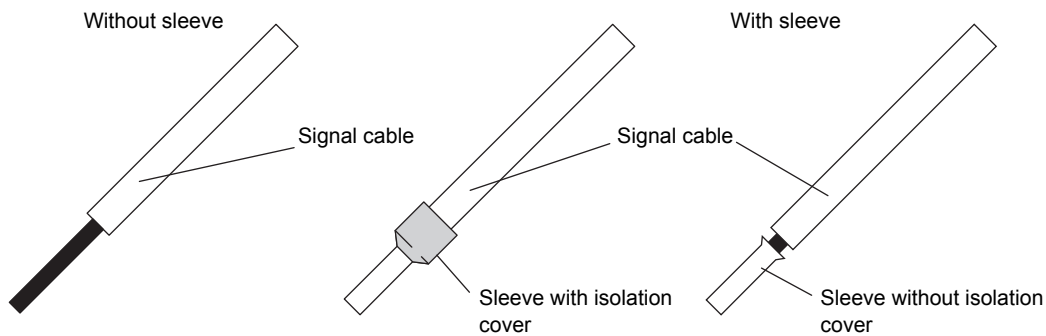


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Figure Solderless Terminal with Insulating Sheath

● Sleeve for pressure clamp terminal

When connecting the process I/O signal to the pressure clamp terminal of the I/O module, strip the cable coating (without a sleeve) or attach a sleeve to the cable.



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Figure Sleeve for Pressure Clamp Terminal



IMPORTANT

- Use a sleeve for pressure clamp terminal and a clamp tool from the same manufacturer.
- Use a sleeve for pressure clamp terminal and a clamp tool which suit the cable size.

■ Bending radius of the cable

When connecting a cable to a system instrument, ensure to secure the minimum bending radius of the cable.

The minimum bending radius is either the value shown in the cable manufacturer's specifications or six-fold of the cable conductor diameter, whichever is bigger should be applied.

3.2 Connecting Power

Power is connected either by using a grounding bipolar three-prong plug or by wiring to terminals.

The safety control unit and safety node unit in the ProSafe-RS have no power switch. So, it is recommended that a breaker be installed for each piece of equipment in the same room, for maintenance and safety requirements.



CAUTION

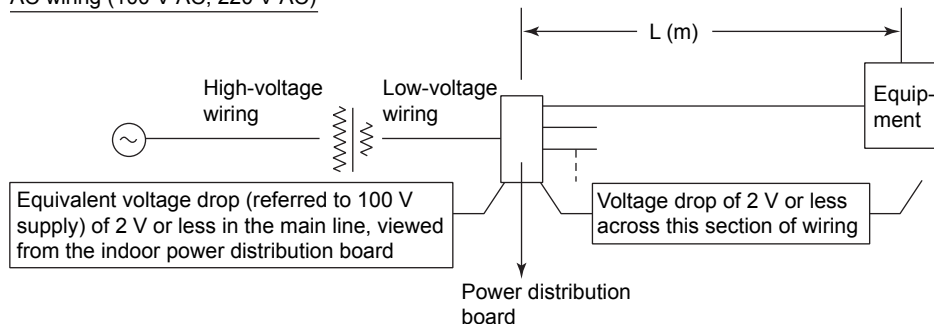
- Lay power cables 1 cm or more away from signal cables.
- Use power and ground cables conforming to the safety standards of each country.

■ Type and Maximum Length of Power Cables

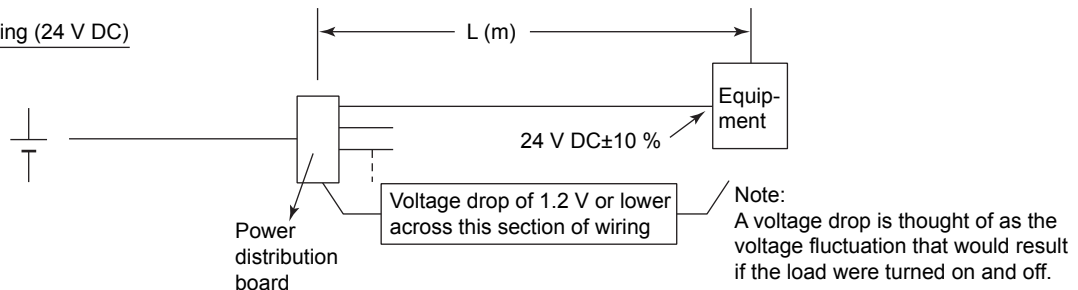
Formulas are given below for determining the type and the maximum length (m) of branch cables from an indoor low-voltage main line.

- The standard type of cable used (nominal cross sectional area) is equivalent to JIS C 3312.
- Calculate the maximum power cable length from the following conditions as shown in the figure.
However, the power cable must meet the conditions described as “AC Power Specification” in Section 1.3. The conditions in Section 1.3 always take top priority.

AC wiring (100 V AC, 220 V AC)



DC wiring (24 V DC)



F030201.ai

Figure Maximum Cable Length Calculation Conditions

[Maximum power cable length calculation]

Use the following formula to calculate the maximum power cable length:

(a) 100 V AC and 220 V AC models

$$L \text{ (m)} = \frac{\text{Voltage drop across wiring}}{\text{Conductor resistance (ohm/km)} \times (\text{Number of cores}) \times \text{Equipment current consumption}} \times 1000$$

F030202.ai

(b) 24 V DC model

$$L \text{ (m)} = \frac{\text{Voltage drop across wiring}}{\text{Conductor resistance (ohm/km)} \times (\text{Number of cores}) \times \text{Equipment current consumption}} \times 1000$$

F030203.ai

Note: In the formulas above, the voltage drop across wiring is assumed to be 2 V for AC power supplies and 1.2 V for DC power supplies; the number of cores is two; and the conductor resistance is as specified in the table below.

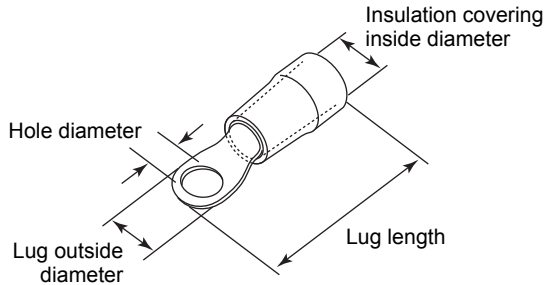
Table Wire Nominal Cross Sectional Areas and Resistances

Wire nominal cross sectional area	5.5 mm ²	8 mm ²	14 mm ²	22 mm ²
Wire conductor resistance	3.37 ohm/km	2.39 ohm/km	1.36 ohm/km	0.82 ohm/km

■ Power Cable Termination

● Cable Termination

Use solderless lugs for power cables (see Figure).



F030204.ai

Figure Solderless (crimp-on) Lug

● Solderless (crimp-on) Lug Specifications

The solderless lug to use must have the dimensions given in table according to the nominal cross sectional area of the power cable for which the lug is to be used.

Table Solderless Lug Dimensions

Nominal cross sectional area (mm ²)	Screw used (mm)	Hole diameter (mm)	Lug outside diameter (mm)	Lug length (mm)	Insulation covering inside diameter (mm)
1.25	4	4.3 or more	8.2 or less	approx.21	3.6 or more
2.0	4	4.3 or more	8.7 or less	approx.21	4.3 or more
8.0	6	6.3 or more	12.2 or less	approx.41	7.0 or more
5.5	5	5.3 or more	9.7 or less	approx.29	5.9 or more
22.0	8 (hexagon head bolt)	8.3 or more	16.8 or less	approx.50	11.0 or more



IMPORTANT

- Always use solderless lugs with insulating covering.
- Always use solderless lugs and crimp-on tool manufactured by the same manufacturer.
- The crimp-on tool must be matched to the wire thickness.

■ Power Distribution Boards

Power distribution boards are normally provided by the customer. Figures show examples of AC and DC power distribution boards.

● AC Power Distribution Board

The power cables is branched to each unit by way of a circuit breaker. Each power system uses three terminals (AC and ground: ISO M4 to M6 screws).

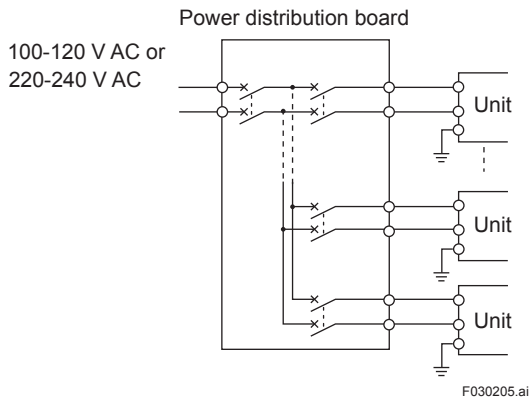


Figure AC Power Distribution Board

● 24 V DC Power Distribution Board

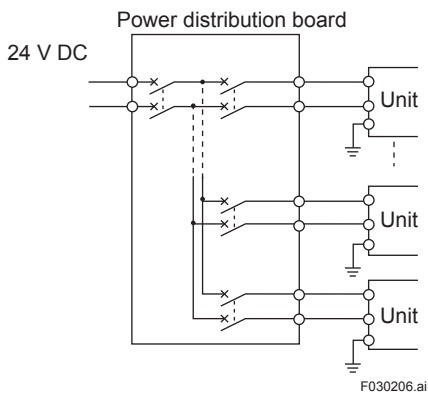


Figure 24 V DC Power Distribution Board

SEE ALSO For equipment grounding, see Section 3.4, "Power and Ground Cabling."

■ Terminal Connection

The power supply and grounding of the following devices are connected to the three terminals with M4 screws.

Functional ground

- SSC60S, SSC60D, SSC50S, SSC50D, SSC57S, SSC57D, SSC10S and SSC10D Safety Control Units
- SNB10D Safety node Unit
- SNT10D Unit for Optical Bus Repeater Module
- AVR10D Duplexed V net router

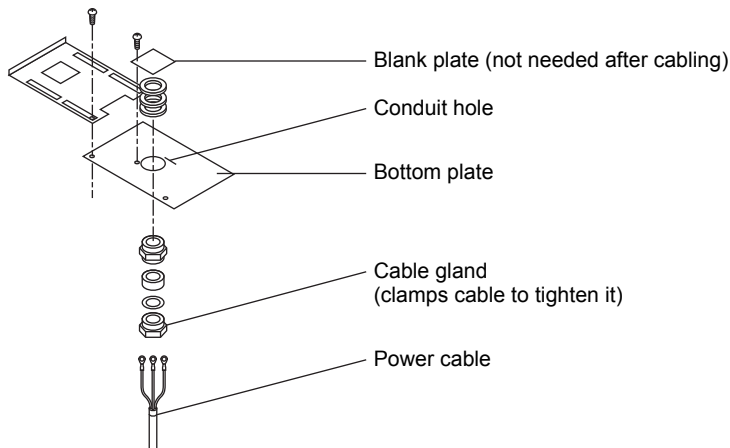
Protective ground

- YNT511D, and YNT522D Optical Bus Repeaters
- YNT512D Bus Repeaters
- AEPV7D Power Supply Bus Unit, Vertical Type
- AEP7D Primary Power Supply Bus Unit

■ Conduit Power-cabling

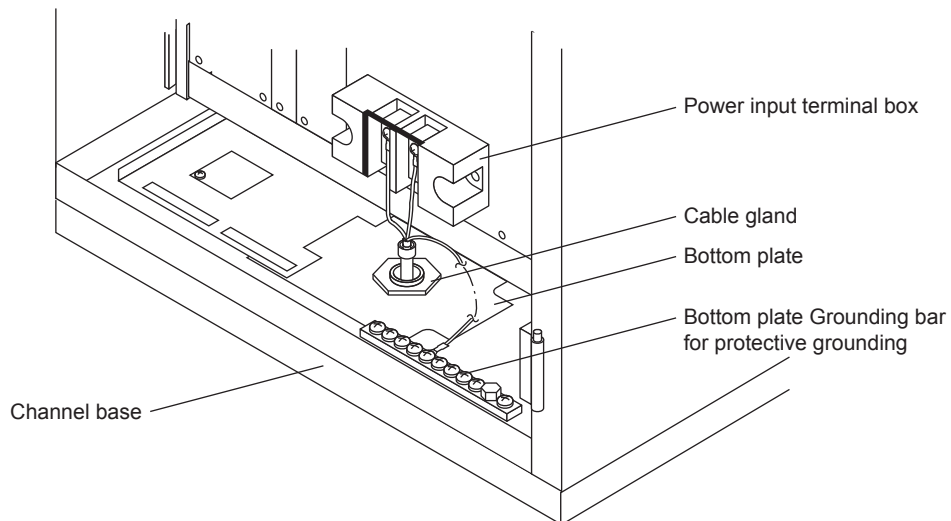
Conduit cabling using cable glands is recommended to lay a power cable at the entrance of the cabinet for the following reasons:

To prevent the power cable from making contact with metallic plates or putting its weight on the power connection terminal.



F030207.ai

Figure Conduit Hole & Cable Gland



F030208.ai

Figure Conduit Cabling

3.3 Connecting Ground Cable

Connect ground cables for the ProSafe-RS as follows:



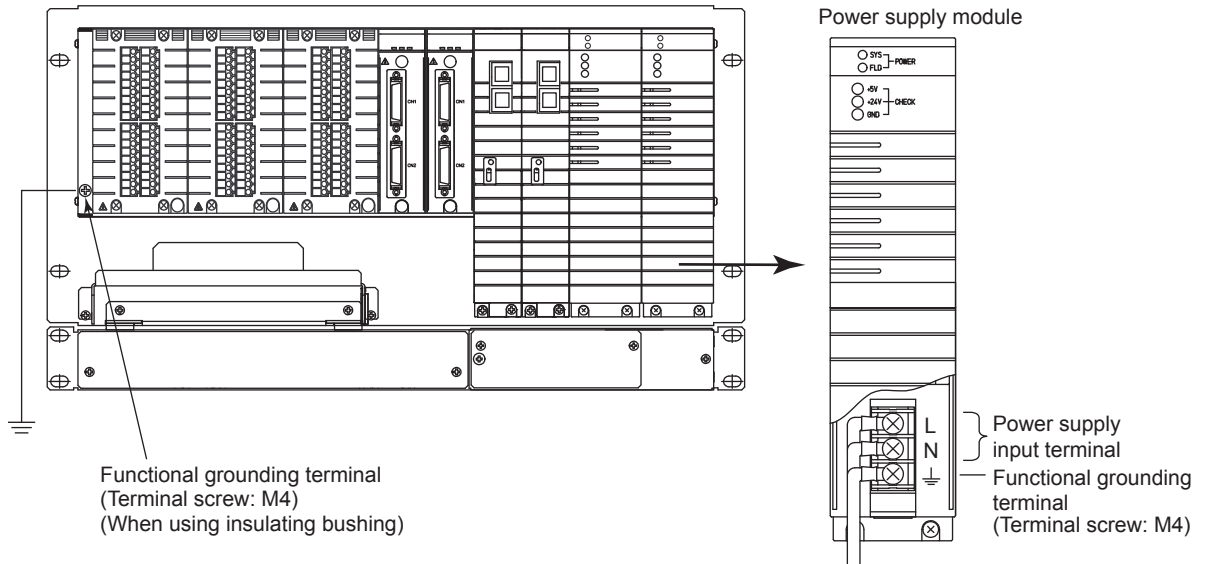
CAUTION

- Connect the terminal connection type device to the protective conductor terminal.
 - Connect a power cable of the plug-in device to a grounded socket. The equipment case is grounded when the power cable is plugged in.
-

3.4 Power and Ground Cabling

The following figures illustrate how to connect power and grounding cables for ProSafe-RS hardware equipment.

■ SSC60S/SSC60D Safety Control Unit

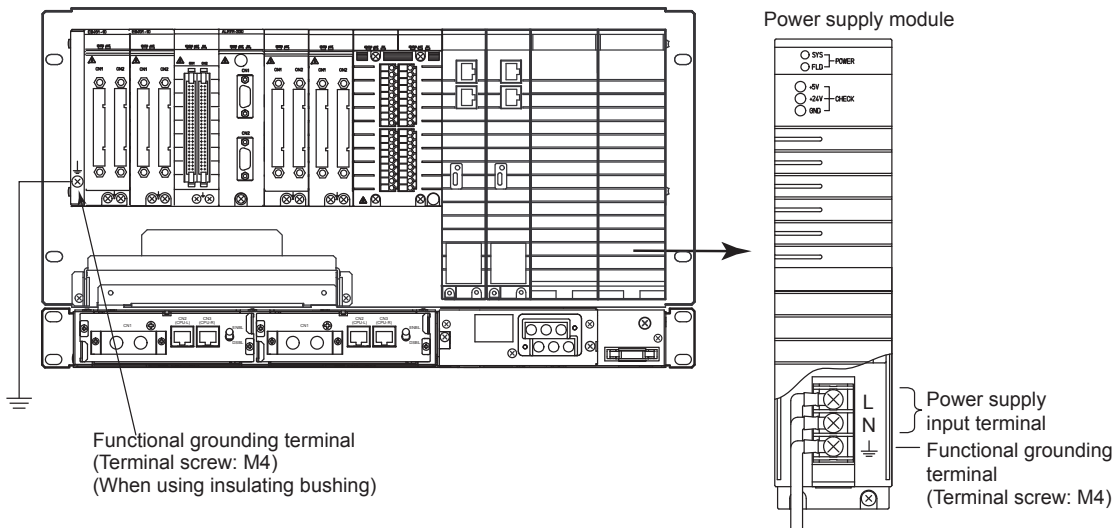


Note: The same cable connections can be applied to SSC50S/SSC50D/SSC57S/SSC57D.

F030407.ai

Figure SSC60S/SSC60D Cable Connections

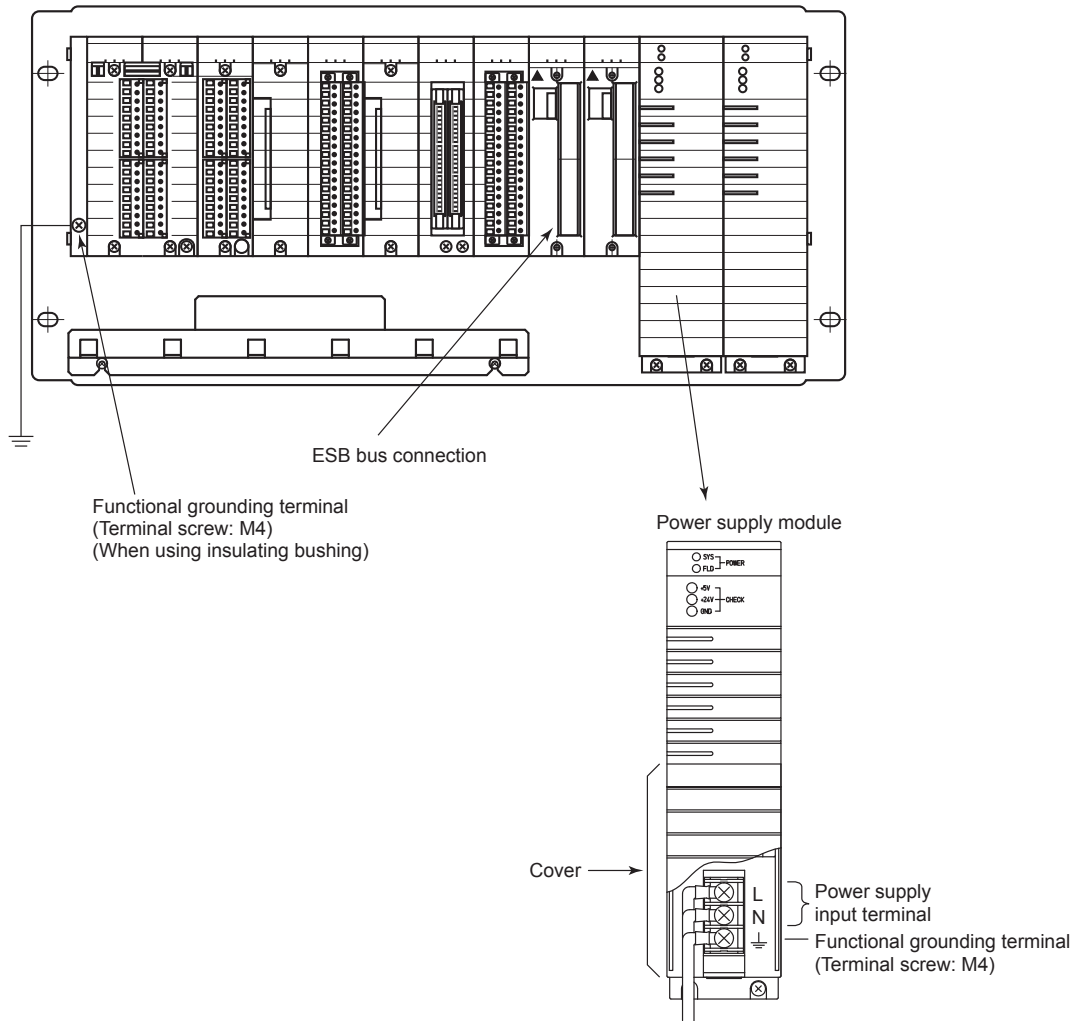
■ SSC10S/SSC10D Safety Control Unit



F030401.ai

Figure SSC10S/SSC10D Cable Connections

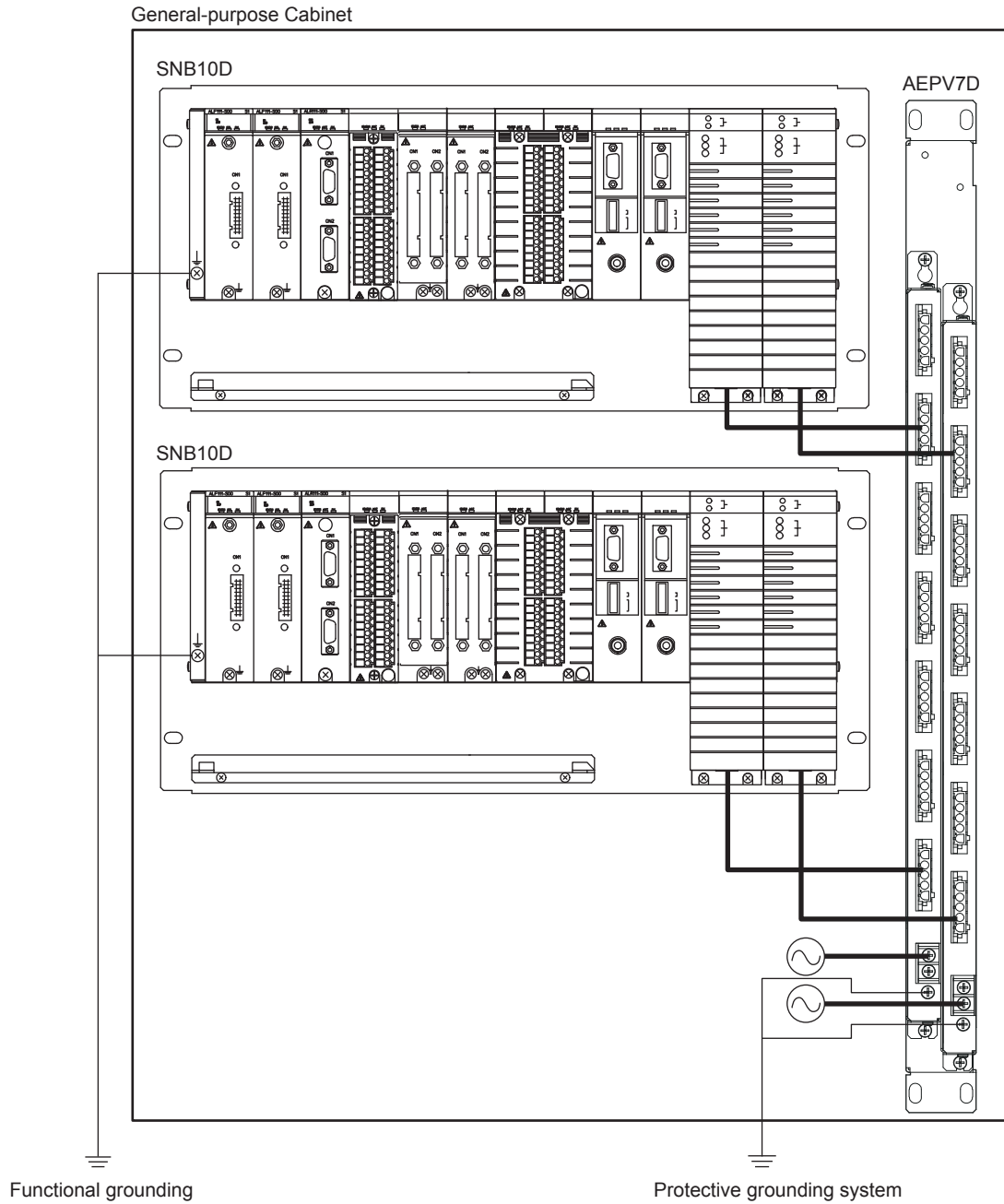
■ SNB10D Safety Node Unit



F030402.ai

Figure SNB10D Power Cable Connection

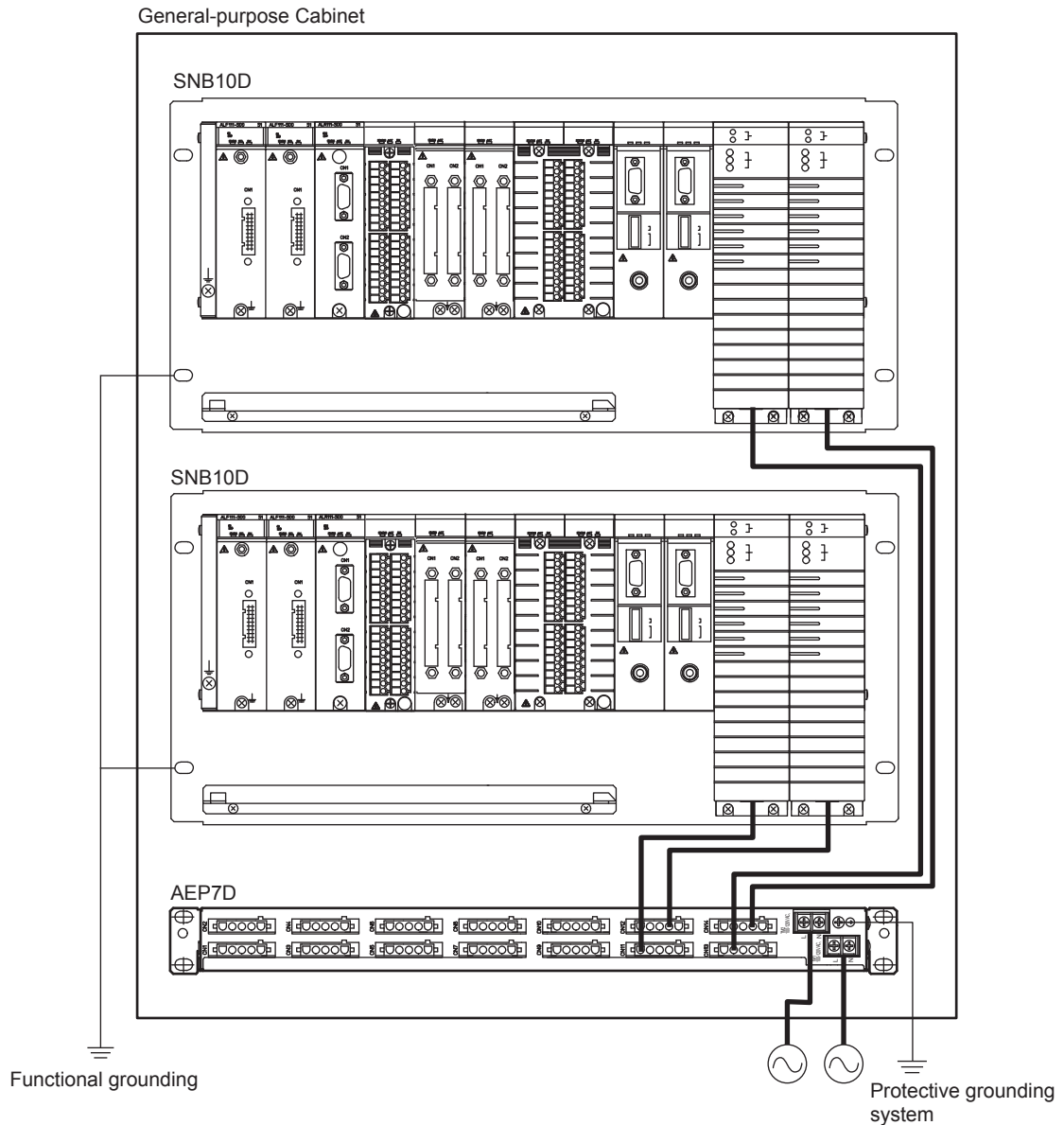
An example of installing a node unit in a general-purpose cabinet along with an AEPV7D Power Supply Bus Unit is shown.



F030403.ai

Figure Example of Installing AEPV7D in a General-purpose Cabinet (Dual AC Power Supply Line)

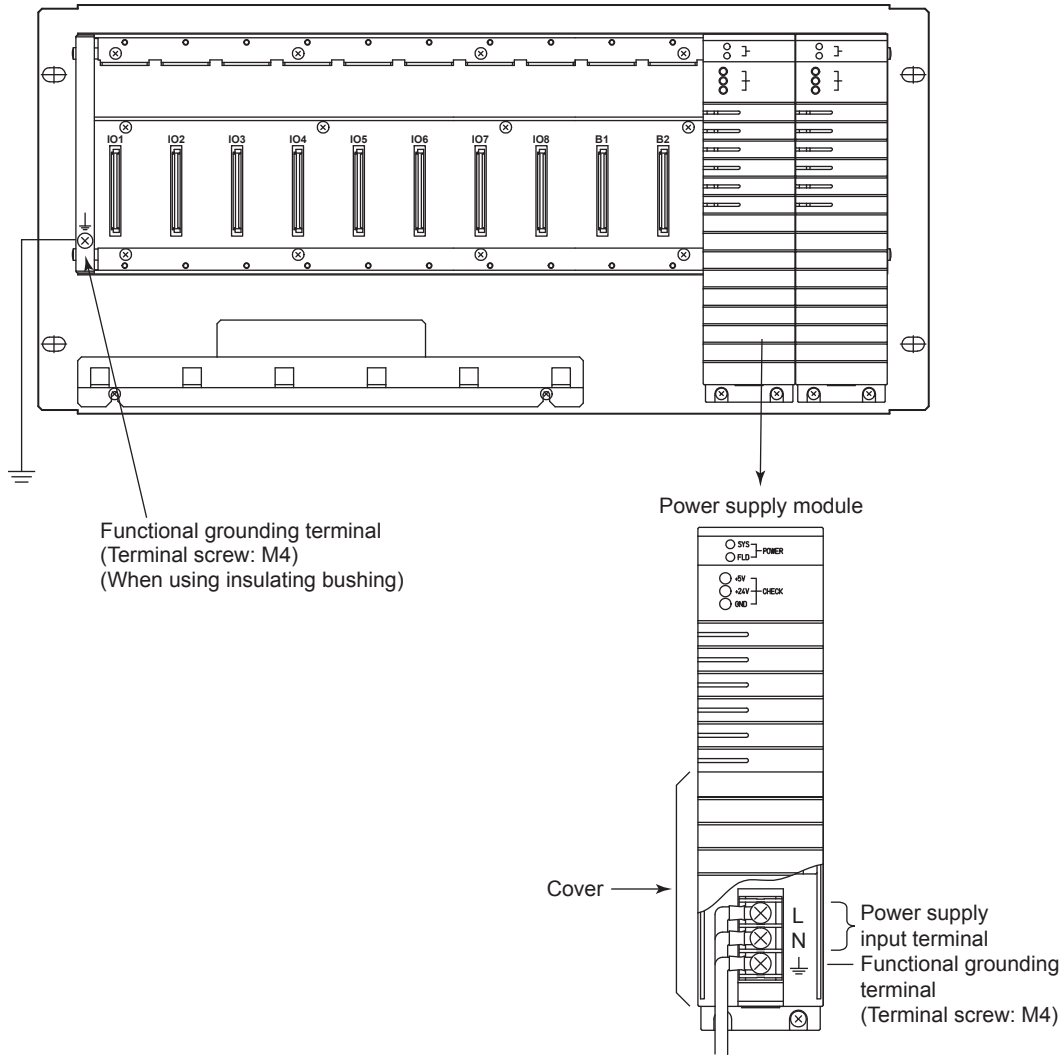
An example of installing a node unit in a general-purpose cabinet along with an AEP7D Primary Power Supply Bus Unit is shown.



F030410.ai

Figure Example of Installing AEP7D in a General-purpose Cabinet (Dual AC Power Supply Line)

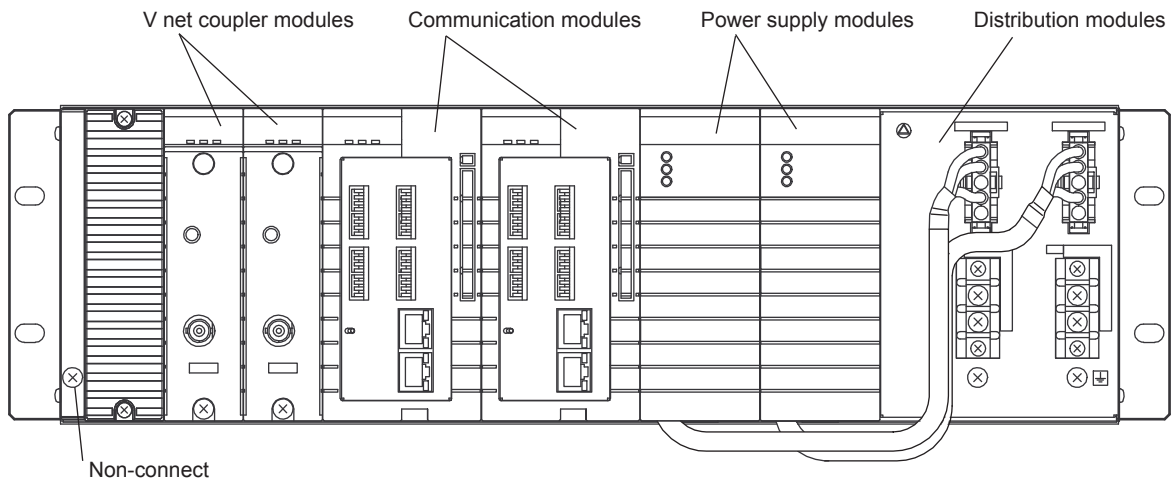
■ SNT10D Unit for Optical Bus Repeater Module



F030406.ai

Figure SNT10D Power Cable Connection

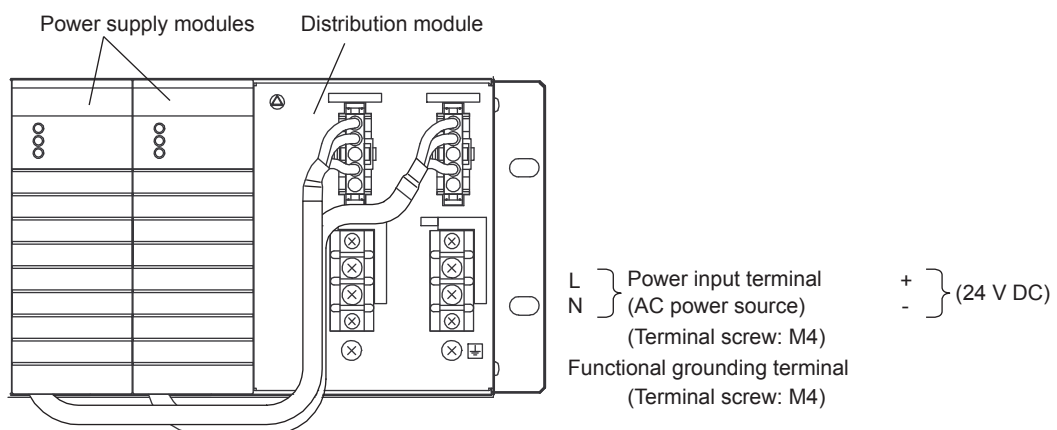
■ AVR10D Duplexed V net Router



F030407.ai

● Cabling for Power Supply

The figure below shows the connection terminals for power supply cables.



F030408.ai

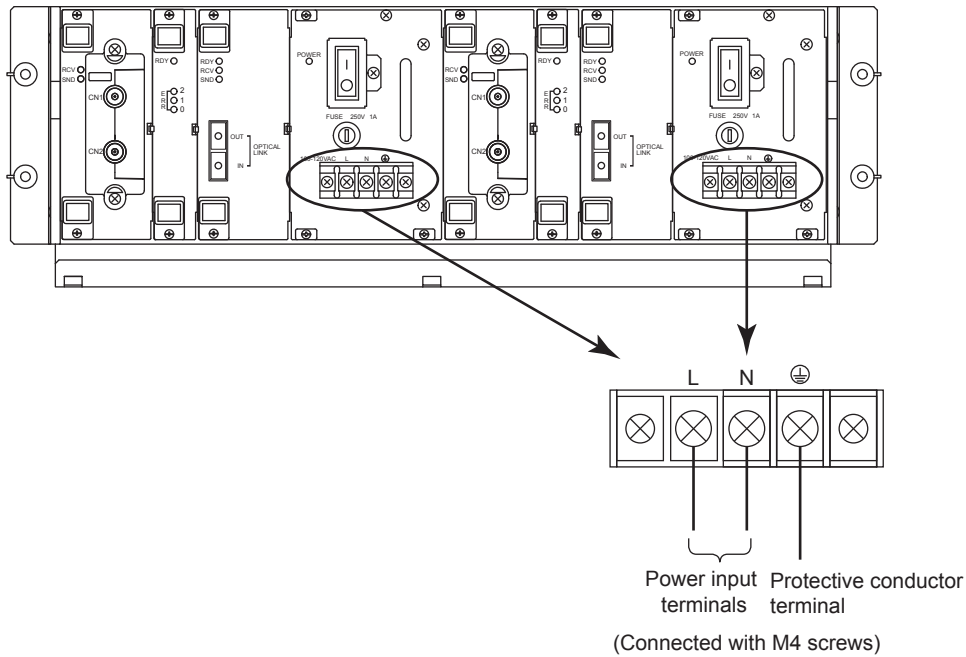
● Power Cable Connection



IMPORTANT

When power to the V net router is turned off, communications with the areas within the coverage of the V net service are disabled. The service coverage area needs to be taken into consideration when designing a system to supply power to the V net router (e.g. providing an independent power source for the V net router).

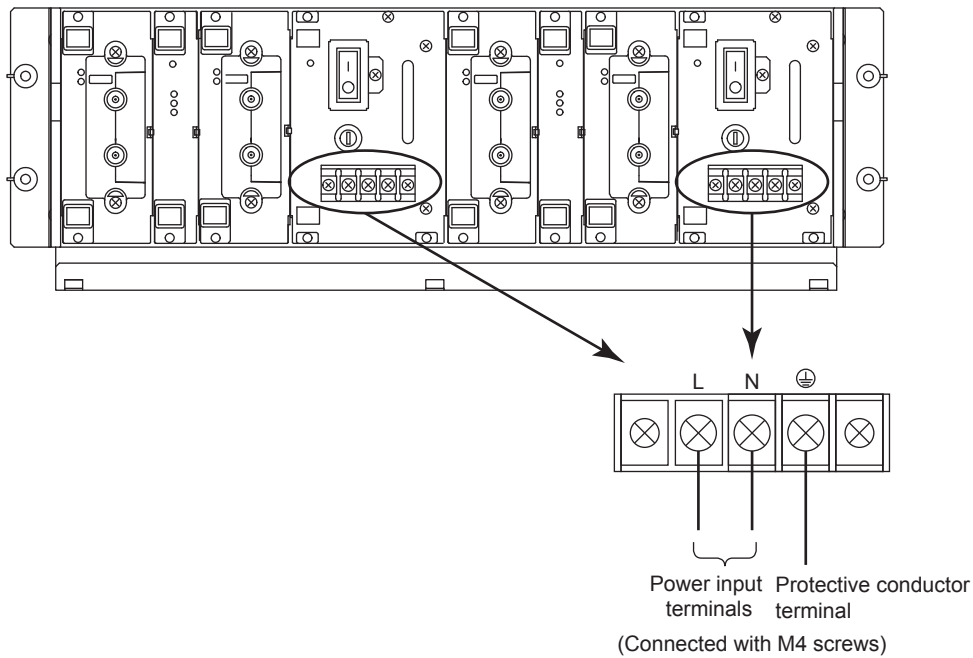
■ YNT511D/YNT522D Optical Bus Repeater



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Figure Optical Bus Repeater Power Cable Connection

■ YNT512D Bus Repeater



F030405.ai

Figure Bus Repeater Power Cable Connection

■ SEA4D Analog Terminal Board

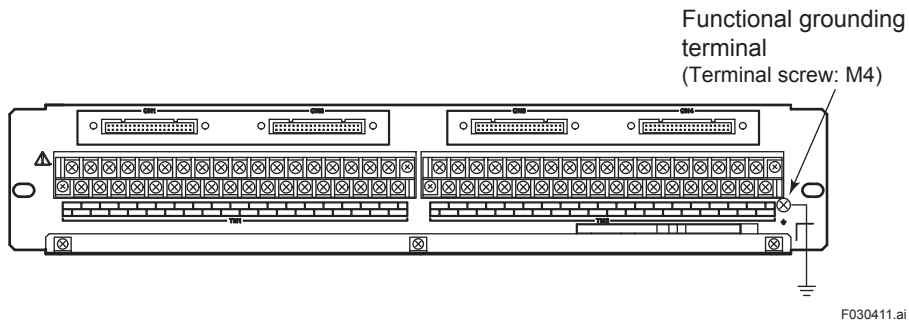


Figure SEA4D Ground Cable Connection

■ SED2D Digital Terminal Board

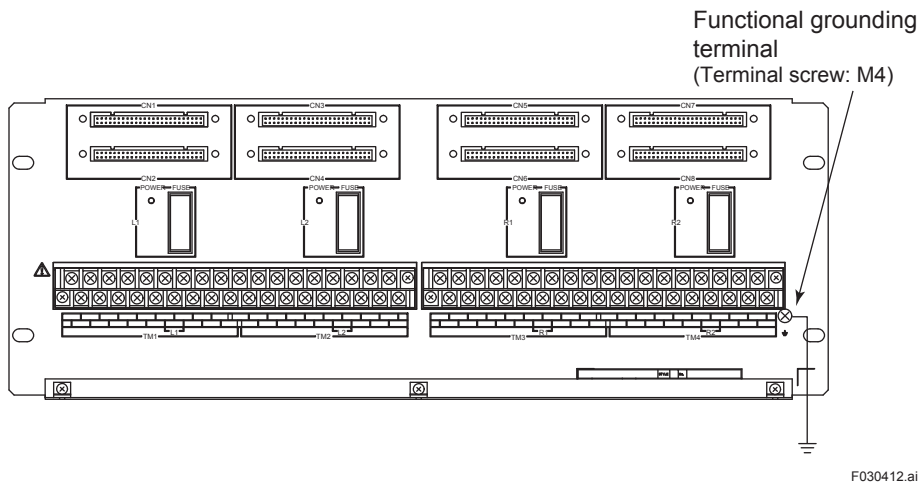


Figure SED2D Ground Cable Connection

■ SED3D Digital Terminal Board

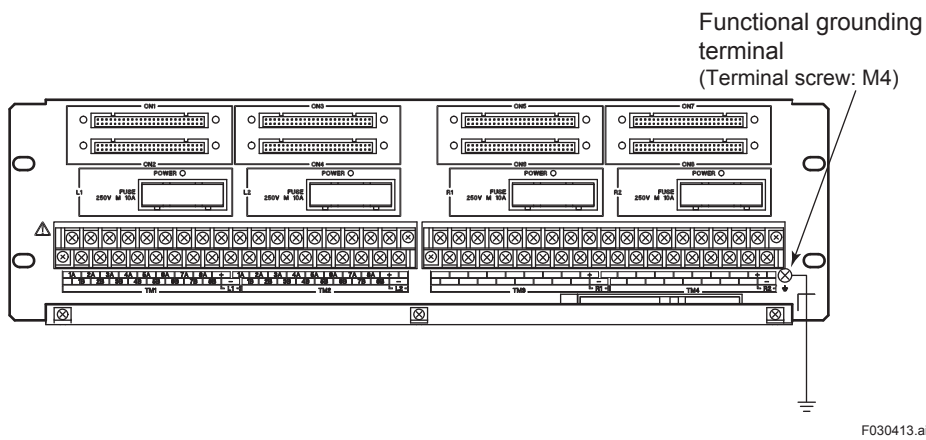


Figure SED3D Ground Cable Connection

■ SED4D Digital Terminal Board

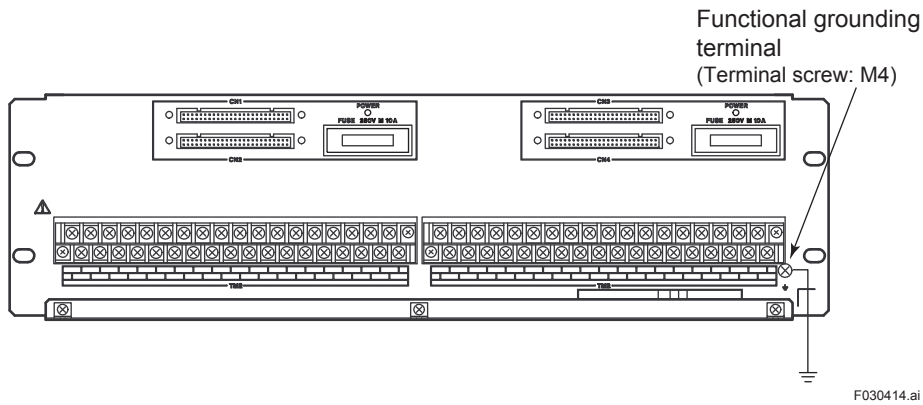


Figure SED4D Ground Cable Connection

■ SWD2D Digital Terminal Board

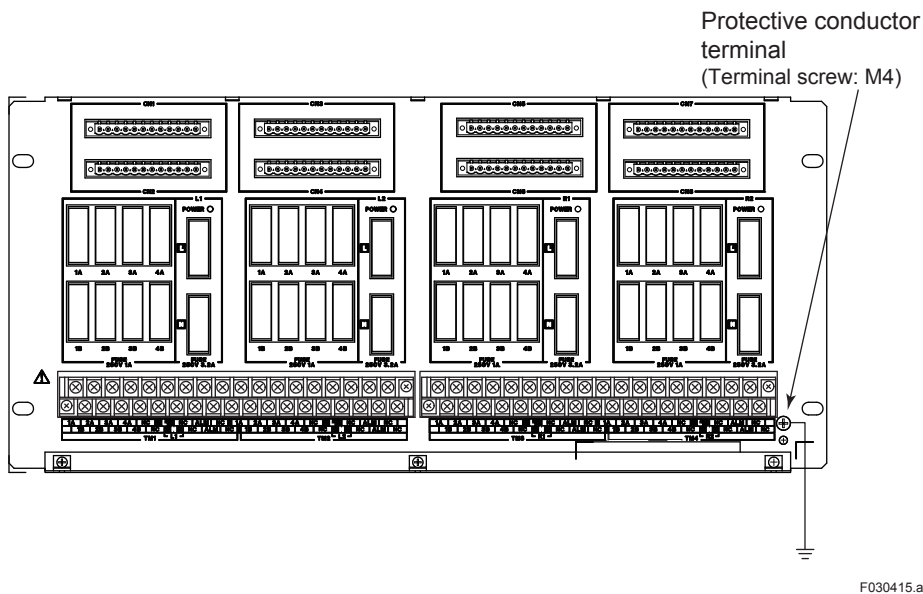
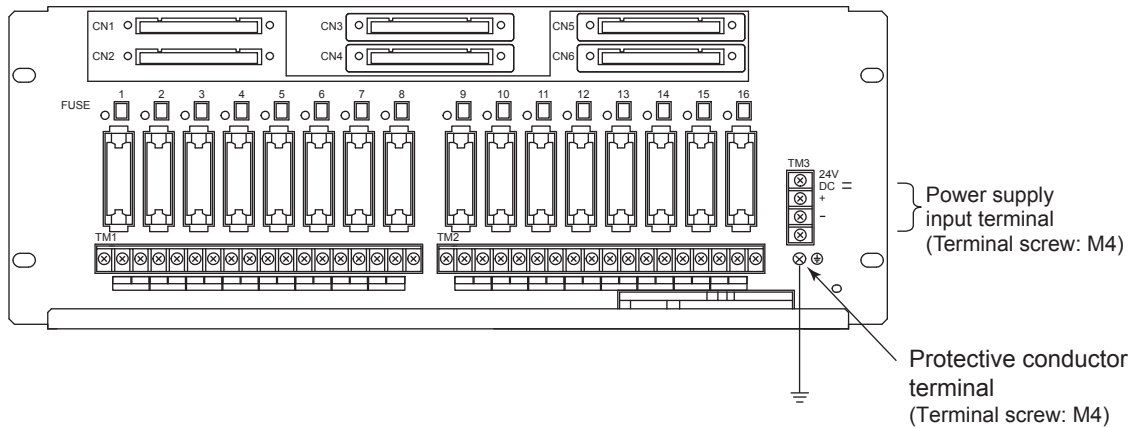


Figure SWD2D Ground Cable Connection

TIP

Terminal Boards of DIN rail mount type such as SBA4D, SBT4D, SBR4D, SBD2D, SBD3D and SBD4D don't have a grounding terminal.

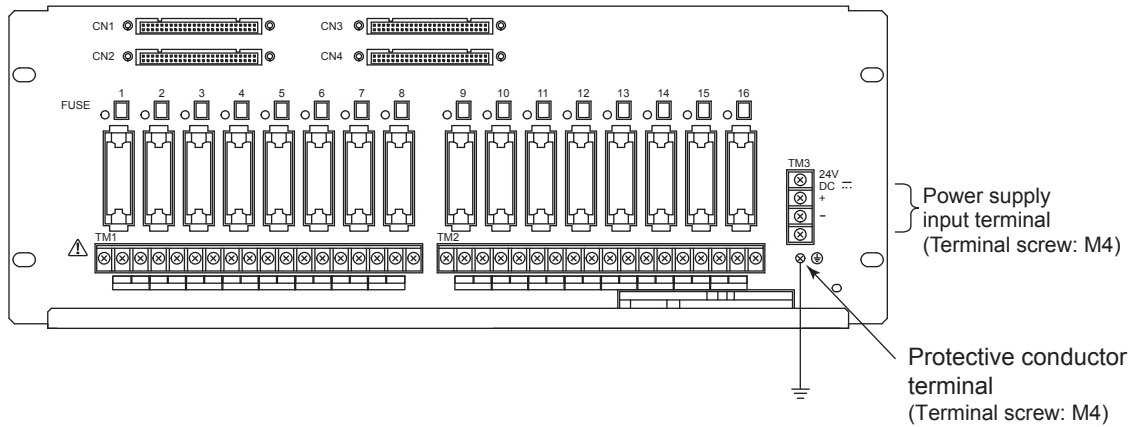
■ SRM53D Relay Board for Digital Output



F030416.ai

Figure SRM53D Ground Cable Connection

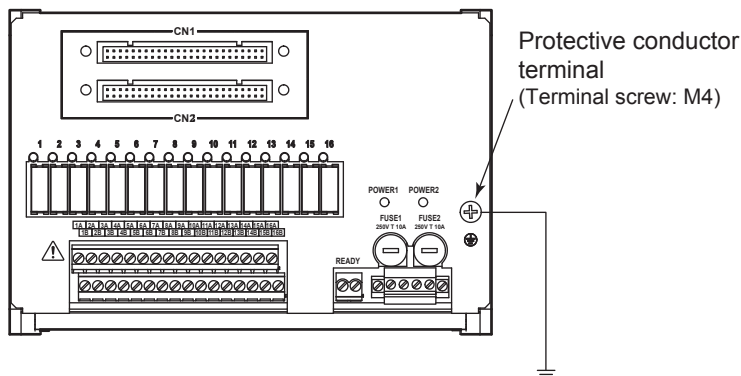
■ SRM54D Relay Board for Digital Output



F030417.ai

Figure SRM54D Ground Cable Connection

■ SBM54D Relay Board for Digital Output: DIN rail mount type



F30418E.ai

Figure SBM54D Ground Cable Connection

3.5 Connecting Signal Cable

The terminals or connectors of I/O modules interface I/O signals from/to the field.



IMPORTANT

Do not ground the secondary side of the field power supply connected to the digital modules.

■ Process I/O Signal Connection

- Power, control bus, and signal cables must be separately laid. Avoid laying them in parallel.
- In case of using multicore cables for field wiring, do not share one multicore cable with I/O modules of different voltage types (i.e. 48 V DC and 24 V DC).
 - 48 V DC: SDV53A
 - 24 V DC: SDV144, SDV521, SDV531, SDV541
- The use of group-shielded twisted-pair cables is recommended for analog signal input specifically in order to prevent induction noise. A twisted-pair cable pitch of 50 mm or less should be used and the shielded cables must be grounded.
- The use of twisted-pair cables is also recommended for digital signals.
- The twisted-pair cable has the following advantages over a solid wire:
 - More flexible for easy curving and cabling in limited spaces.
 - With good contact and durable in using a solderless contact.
- Signal cables must be clamped so that their weight does not affect terminals.
- Use solderless lug or pressure clamp terminal contact when process I/O signals are connected with terminals.
- Be careful when laying cables so as not to place excessive force on the cables.

● Solderless Lug



IMPORTANT

- Use the solderless contact with an insulation covering.
- Use the solderless contact and crimp tools of the same manufacturer.
- Use correct-size crimp tools according to cable sizes.

● Pressure Clamp Terminal



IMPORTANT

- The ProSafe-RS uses pressure clamp terminals for signal connections to the I/O modules.
 - For the cable connection with a sleeve attached, use a sleeve and a clamp tool from the same manufacturer.
 - Use a clamp tool suitable for the cable size.
-

● Channel Fuse



IMPORTANT

Due to the short circuit between the input channel of a digital input module and the ground, the protection fuse mounted in front of the module may be blown up. To avoid the blow of the protection fuse, it is recommended to use a fuse (50 mA, fast-blow type) to each input channel. This important notice is applied for digital input module SDV144 style code S1 to S3.

■ Signal Cable Termination

● Solderless Lug

- Solderless lug specifications
The specifications for solderless lugs are determined by the nominal cross sectional area of the power cable for which lugs are used, lug screws, terminal dimensions, and the like.

Table Solderless Lug Dimensions

Nominal cross sectional area (mm ²)	Screw used (mm)	Hole diameter (mm)	Lug outside diameter (mm)	Lug length (mm)	Insulation covering inside diameter (mm)	Dimension "C" (mm)	Remarks
1.25	3.5 (*1)	3.7 or more	6.8 or less	Approx. 21	3.6 or more	4.0 or more	
2.0	3.5 (*1)	3.7 or more	6.8 or less	Approx. 21	3.6 or more	4.0 or more	
1.25	4 (*2)	4.3 or more	8.2 or less	Approx. 21	3.6 or more	7.0 or more	
2.0	4 (*2)	4.3 or more	8.7 or less	Approx. 21	4.3 or more	7.1 or more	
5.5	4 (*2)	4.3 or more	8.7 or less	Approx. 25	5.8 or more	5.9 or more	Only SED2D

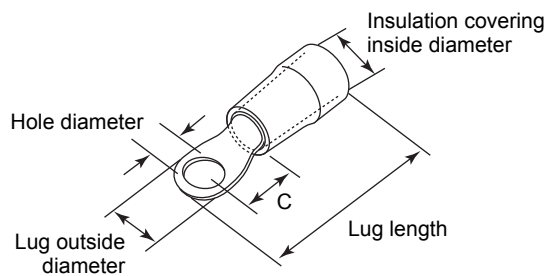
*1: Recommended tightening torque is 0.8 N•m.

*2: Recommended tightening torque is 1.2 N•m.



IMPORTANT

- Always use solderless lugs with insulated covering.
- Always use solderless lugs and crimp-on tool manufactured by the same manufacturer.
- The crimp-on tool must be matched to the wire thickness.



F030501.ai

Figure Solderless Lug

● Pressure Clamp Terminal (for Pressure Clamp Terminal Block)

- Terminal processing
When connecting the process I/O signal to the pressure clamp terminal of an I/O module, strip the cable coating (without a sleeve) or attach a sleeve to the cable. The following shows the length of the coating stripped for cases when a sleeve is not used and when it is used.

SBT4D, STA4S, STA4D, STB4S, STB4D

Table Without a Sleeve

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

Table With a Sleeve

Cable thickness	When using a sleeve with an insulating cover				When using a sleeve without insulating cover		
	Peel-off Length	Sleeve dimensions		Weidmuller Model No.	Peel-off Length	Sleeve dimensions	Weidmuller Model No.
		Total length	Contact section length			Total length	
0.5 mm ²	11 mm	16 mm	10 mm	H0.5/16	11 mm	10 mm	H0.5/10
0.75 mm ²	11 mm	16 mm	10 mm	H0.75/16	11 mm	10 mm	H0.75/10
1 mm ²	11 mm	16 mm	10 mm	H1/16	11 mm	10 mm	H1/10
1.25 to 1.5 mm ²	11 mm	16 mm	10 mm	H1.5/16	11 mm	10 mm	H1.5/10

SBR4D, SBA4D, SBD2D, SBD3D, SBD4D, SBM54D

Table Without a Sleeve

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

Table With a Sleeve

Cable thickness	When using a sleeve with an insulating cover				When using a sleeve without insulating cover		
	Peel-off Length	Sleeve dimensions		Weidmuller Model No.	Peel-off Length	Sleeve dimensions	Weidmuller Model No.
		Total length	Contact section length			Total length	
0.5 mm ²	8 mm	14 mm	8 mm	H0.5/14	8 mm	6 mm	H0.5/6
0.75 mm ²	8 mm	14 mm	8 mm	H0.75/14	8 mm	6 mm	H0.75/6
1 mm ²	8 mm	14 mm	8 mm	H1/14	8 mm	6 mm	H1/6
1.5 mm ²	8 mm	14 mm	8 mm	H1.5/14	8 mm	7 mm	H1.5/7
2.5 mm ²	8 mm	14 mm	8 mm	H2.5/14D	8 mm	7 mm	H2.5/7

■ MIL Connector Cover SCCC0□

● SCCC01 (for flat ribbon cables)

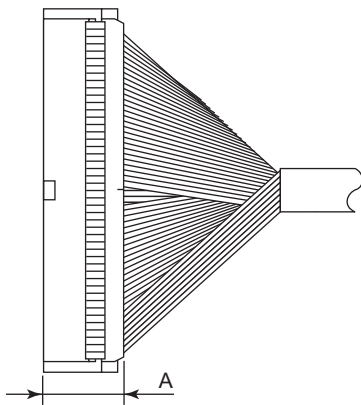
When using the SCCC01, use connectors conforming to the following requirements:

- MIL-C-83503-compliant Connector
- Connector with one pin that prevents improper insertion (both 40- and 50-pin connectors)
- The following dimensions must be satisfied:

$$16.5 \text{ mm} - B \leq A \leq 15.8 \text{ mm}$$

where, A = connector height

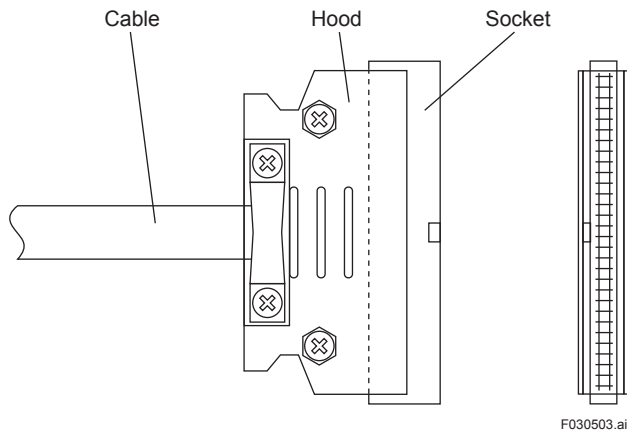
B = engagement length



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Note: For the engagement length, contact the connector manufacturer.

● SCCC02 (for separate cables)



F030503.ai

Cables and connectors that can be used for the SCCC02 are listed in the table below.

Manufacturer	Manufacturer's Model	Product Name	Remarks
Japan Aviation Electronics Industry, Limited	PS-D4C50N	Socket	
	PS-HD50	Hood	
	PS-SF-C1-1	Contact	AWG24 to AWG22
Hitachi Cable, Ltd.	UL 2464SB 25P x 22AWG	Cable	

■ Connecting Signal Cables to Terminals

● Connecting to Pressure-clamp Terminal

1. Loosen the cable connecting terminal screw.
2. Strip the cable coating (without a sleeve) or attach a sleeve to the cable, then insert the tip of the cable into the connecting section of the pressure clamp terminal.
3. Fasten the screw using the special tool (a screwdriver conforming to the DIC 5264B standard with a tip width of 0.6 mm and a shaft diameter of 3.5 mm) with a fastening torque of 0.5 Nm.

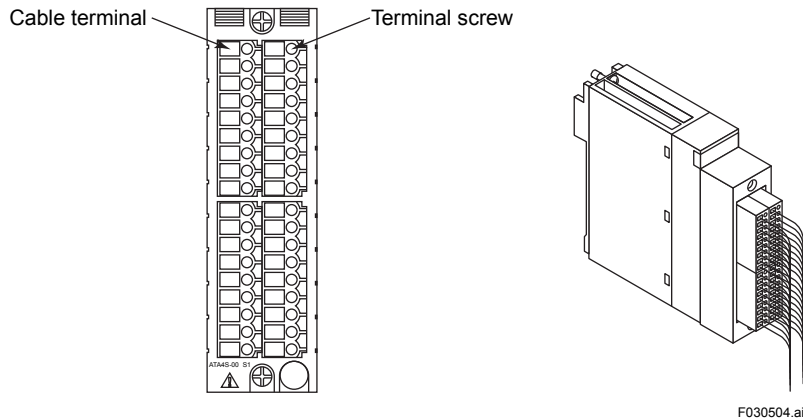


Figure Connecting Signal Cable to Terminal



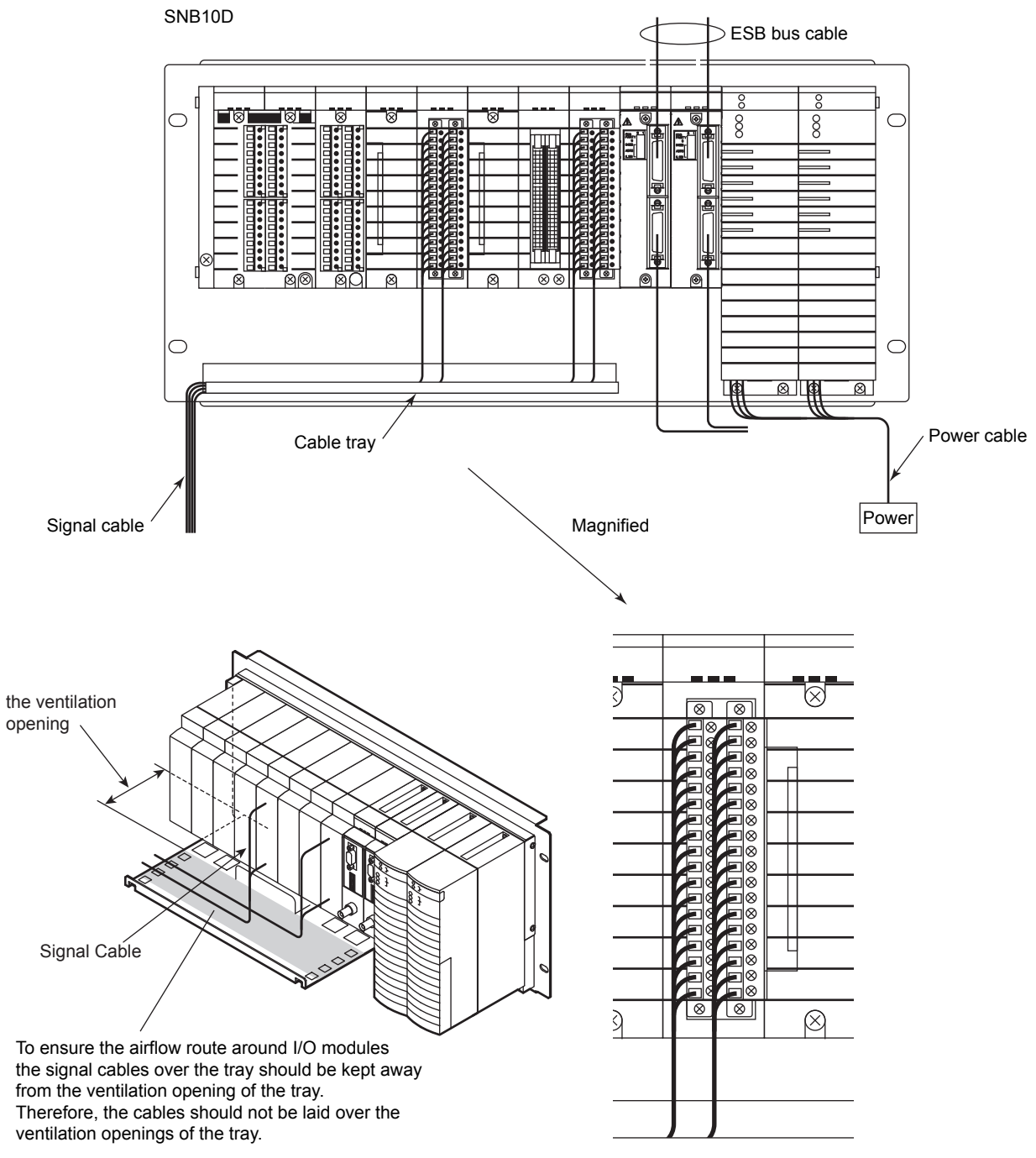
IMPORTANT

Do not use non-standard signal cables or sleeves. Otherwise improper connection may result.

Be sure to remove the cable sheath just as much as specified, fit the sleeve, and clamp the cable firmly to the terminal.

● **SSC60S/SSC60D/SSC50S/SSC50D/SSC57S/SSC57D/SSC10S/SSC10D and SNB10D Cable Connections**

The following shows SNB10D unit cable connections.



F030505.ai

Figure SNB10D Unit Cable Connections

● Signal Cabling



IMPORTANT

The signal cable for the top node unit (NU) must be wired at the innermost part in the field control area as the figure shows.

When fixing cables to a clamp, allow enough space so that the cards can be maintained.

Bind the bottom cables to the clamp bar on the channel base.

- Push in the signal cables for the top NU as far as they will go.

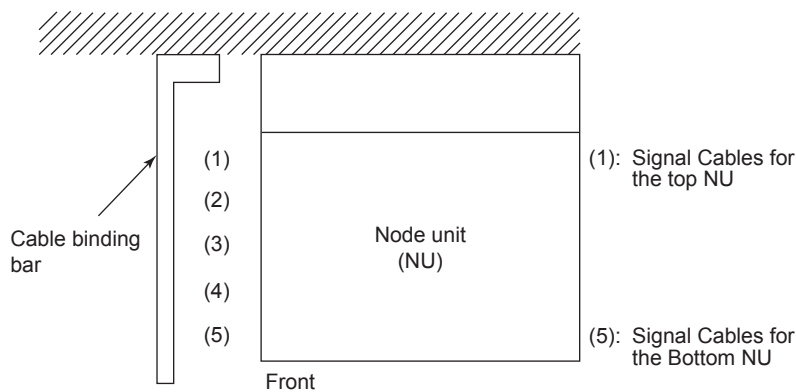


Figure Signal Cabling

● I/O Module with Signal Cable Interface Adapter Cabling

When connecting a dedicated cable to an I/O module, ensure to keep the minimum bending radius of the cable.

Place the cable in front of the separator on the cable tray for ventilation.

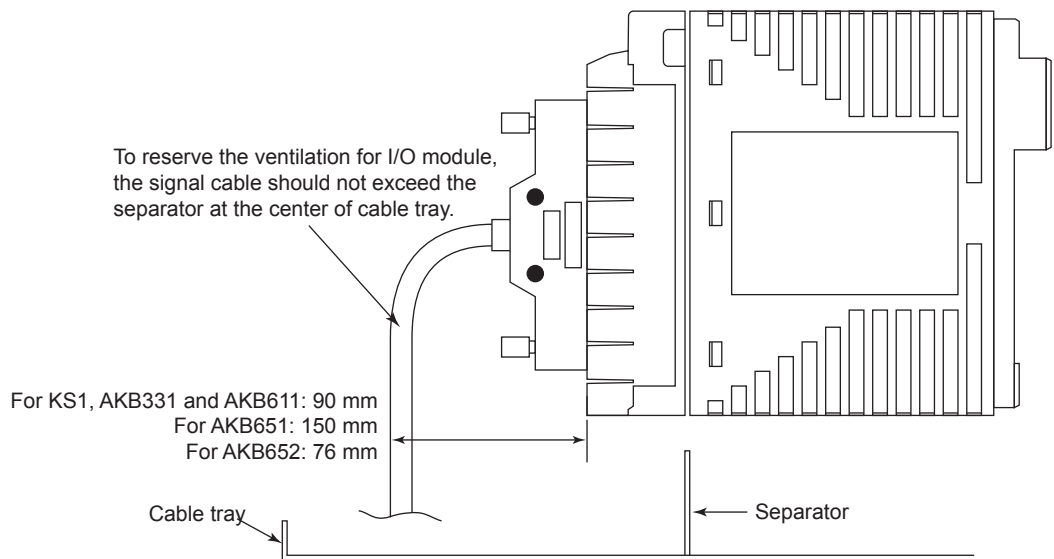


Figure I/O Module with Signal Cable Interface Adapter Cabling

3.6 Connecting Signal Cables to I/O Modules

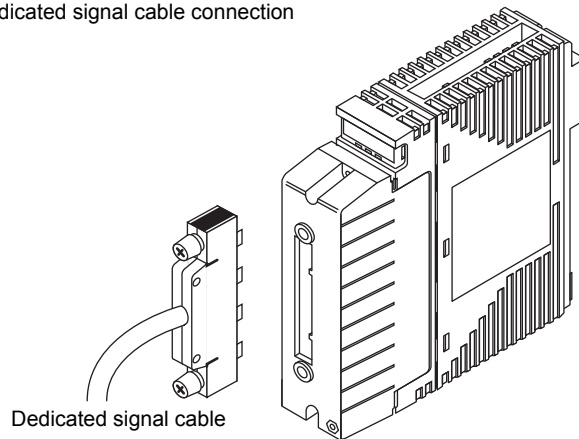
3.6.1 Combination of I/O Modules and Terminal Blocks

A pressure clamp terminal block or signal cable interface adapter is available for field wiring, or MIL cables provided by the user may be used.

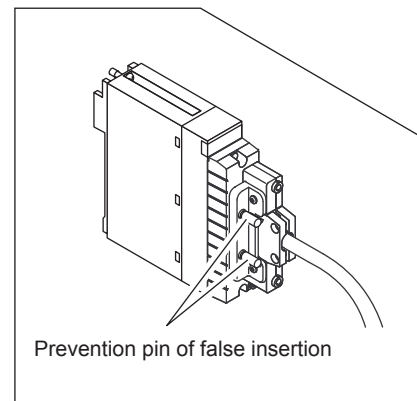
**SEE
ALSO**

For the terminal arrangement of the pressure clamp terminals and terminal board, and the pin arrangement of the MIL connector, refer to GS 32Q06J10-31E, GS 32S06J10-21E or GS 32S06J10-01E "Field Device Connection (for ProSafe-RS)."

Dedicated signal cable connection

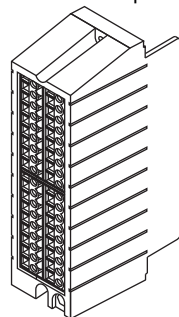


Dedicated signal cable with prevention pin of false insertion (option)

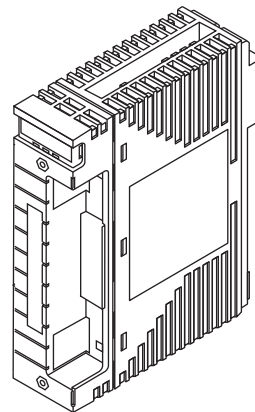


Pressure clamp terminal connection

Pressure clamp terminal block



I/O module



MIL cable connection

Connector cover for MILcable

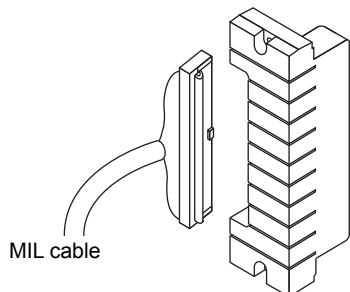


Figure Terminals for Field Wiring

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3.6.2 Signal Cable Connections

The following table shows the signal cable connections.

Table Signal Cable Connections for I/O Modules (1/2)

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

X: Can be connected. -: Cannot be connected.

*1: General-purpose cables are pressure clamp terminals and MIL cables.

*2: Yokogawa-specific cables are special cables for connecting input/output modules to terminal boards.

*3: If no option code is selected, a wrong connection to I/O modules with different signals cannot be avoided.

*4: If option codes associated with I/O modules are selected, a wrong connection to I/O modules with different signals can be avoided.

Table Signal Cable Connections for I/O Modules (2/2)

Model	Name	I/O Channels per Module	Signal Connection			
			Pressure Clamp Terminal	MIL Cable	Yokogawa-specific Cable (*2)	
					No option code (*3)	Option code (*4)
Digital Input/Output Module						
SDV531-S63 SDV531-SF3	Digital output module (24 V DC, Module isolation, Yokogawa-specific cables (*2))	8	–	–	X (AKB331-M□□□)	–
SDV531-L6□ SDV531-LF□	Digital output module (24 V DC, Module isolation, Yokogawa-specific cables (*2))	8	–	–	X (AKB331-M□□□) (AKB651-M□□□) (*7)	X (AKB331-M□□□/SDV53L) (AKB651-M□□□/DV53L)
SDV53A-S□3	Digital output module (48 V DC, Module isolation, Yokogawa-specific cables(*2))	8	–	–	X (AKB331-M□□□) (AKB651-M□□□) (*7)	X AKB331-M□□□/ SDV53A) (AKB651-M□□□/DV53A)
SDV541-S5□ SDV541-SE□	Digital output module (24 V DC, Module isolation, General-purpose cables (*1))	16	X	X	–	
SDV541-S6□ SDV541-SF□	Digital output module (24 V DC, Module isolation, Yokogawa-specific cables (*2))	16	–	–	X (AKB331-M□□□) (AKB651-M□□□) (*7)	X (AKB331-M□□□/SDV541) (AKB651-M□□□/DV541)
Communications Module						
ALR111	Serial communication module (RS-232C, 2-port) (*6)	Two ports	–	–	X (D-Sub 9-pin connector) (*5)	
ALR121	Serial communication module (RS-422/RS-485, 2-port) (*6)	Two ports	–	–	X (M4-terminal block, 10 poles) (*5)	
ALE111	Ethernet communication module	One port	–	–	X (RJ-45) (*8)	

- X: Can be connected. –: Cannot be connected.
- *1: General-purpose cables are pressure clamp terminals and MIL cables.
- *2: Yokogawa-specific cables are special cables for connecting input/output modules to terminal boards.
- *3: If no option code is selected, a wrong connection to I/O modules with different signals cannot be avoided.
- *4: If option codes associated with I/O modules are selected, a wrong connection to I/O modules with different signals can be avoided.
- *5: A Yokogawa-specific cable can be connected without using a terminal block.
- *6: If optical ESB extended distance is longer than 5 km, ALR1□1 module for Modbus Slave cannot be mounted to I/O node.
- *7: In case of connecting AKB651 to SDV531-L6□, SDV531-LF□, SDV53A-S□3, SDV541-S6□ and SDV541-SF□, Marine Standards are not certified.
- *8: ALE111 supported in R3.02.00 or later can be mounted on SSC60□, SSC50□ or SSC57□.



IMPORTANT

When connecting a Yokogawa-specific cable to an module, ensure to keep the minimum bending radius of the cable.

The minimum bending radius of the Yokogawa-specific cable is six-fold of the diameter of the cable.

3.6.3 Connecting Signal Cables to I/O Modules

■ Pressure Clamp Terminal

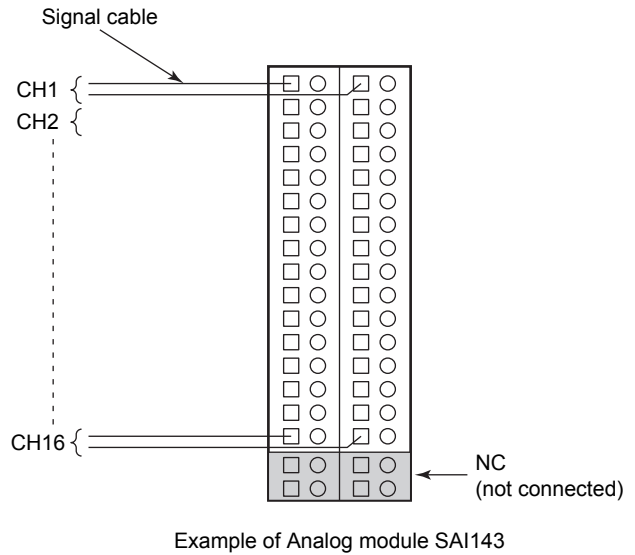
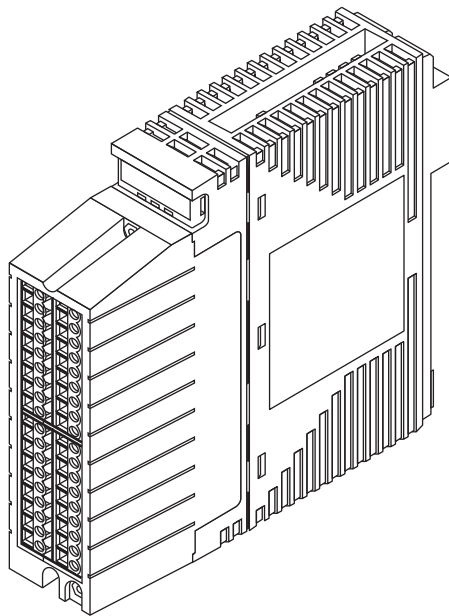


Figure I/O Module with Pressure Clamp Terminal

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■ Dual-redundant Pressure Clamp Terminal

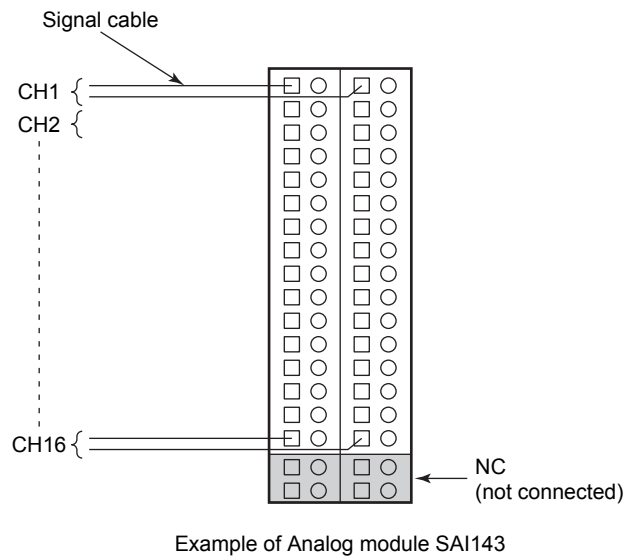
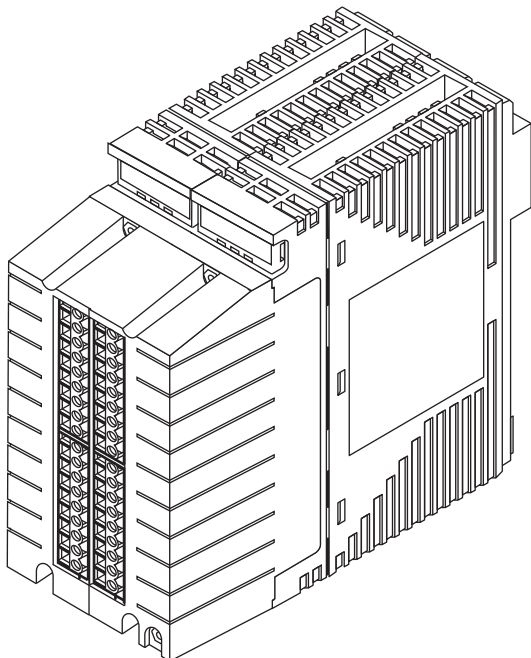
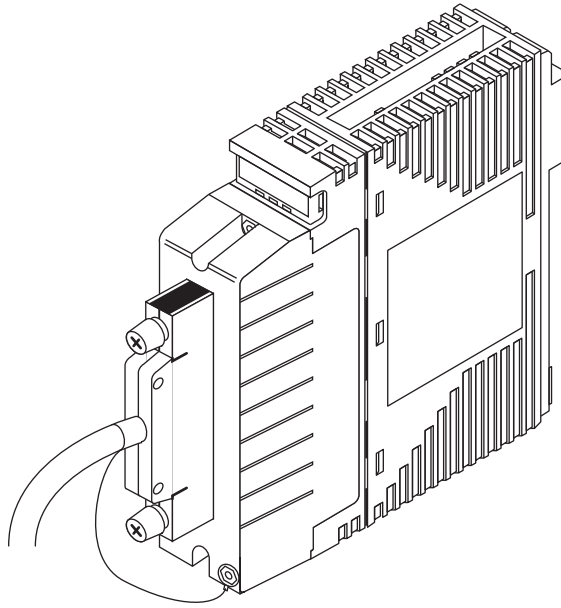


Figure I/O Module with Dual-redundant Pressure Clamp Terminal

F030603.ai

■ Signal Cable Interface Adapter



F030604.ai

Figure I/O Module with Signal Cable Interface Adapter

The I/O modules are arranged in a dual-redundant configuration on the terminal board.

■ Connecting Signal Cables to Analog Input Modules

Signal cables are connected to different terminals according to the devices to be connected as shown below.

Table Analog Input Module Signal Names and Types of Input

Module	Signal Name	Type of Input	
		SAI143 (*1)	IN □ A
	IN □ B	Two-wire transmitter input - (Setting pin: two-wire input)	Current input + (Setting pin: four-wire input)

□ : Channel number

*1: If the SAI143 module power are off or abnormal, the current input loop remains open. Do not use current signals with other receiving devices.

■ Connecting I/O Module to Terminal Board

The I/O module with signal cable interface adapter can be connected to the terminal board using a Yokogawa-specific cable. Field signals are connected through the terminal board.

● Example of Connection to SEA4D

SEA4D terminal board allows SAI143, SAV144 or SAI533 modules in both single and dual-redundant configurations.

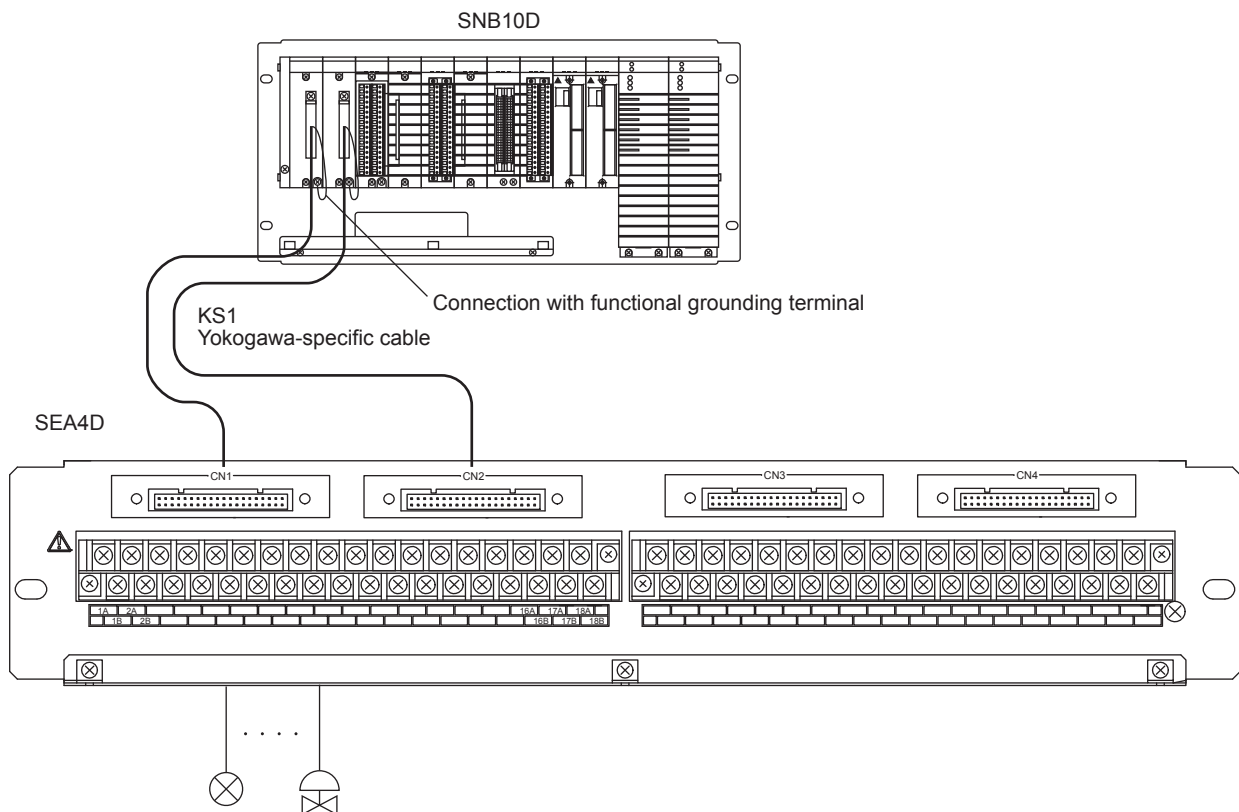


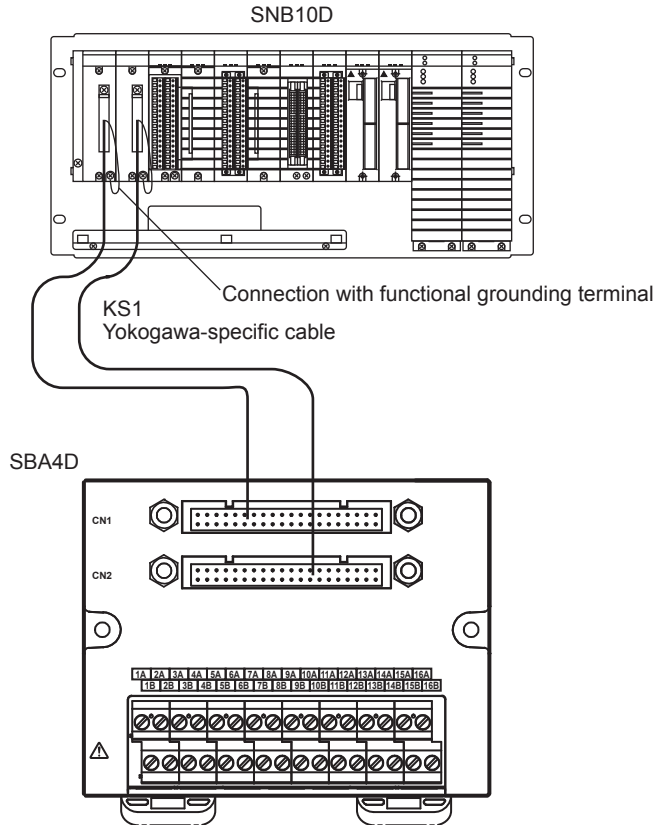
Figure Example of Terminal Board Connection with Dual-redundant I/O Module

**SEE
ALSO**

For the signal cable interface adapter model and the cable model for I/O modules, refer to GS 32Q06J10-31E, GS 32S06J10-21E or GS 32S06J10-01E "Field Device Connection (for ProSafe-RS)."

- **Example of Connection to SBA4D**

SBA4D terminal board allows SAI143, SAV144 or SAI533 modules in both single and dual-redundant configurations.

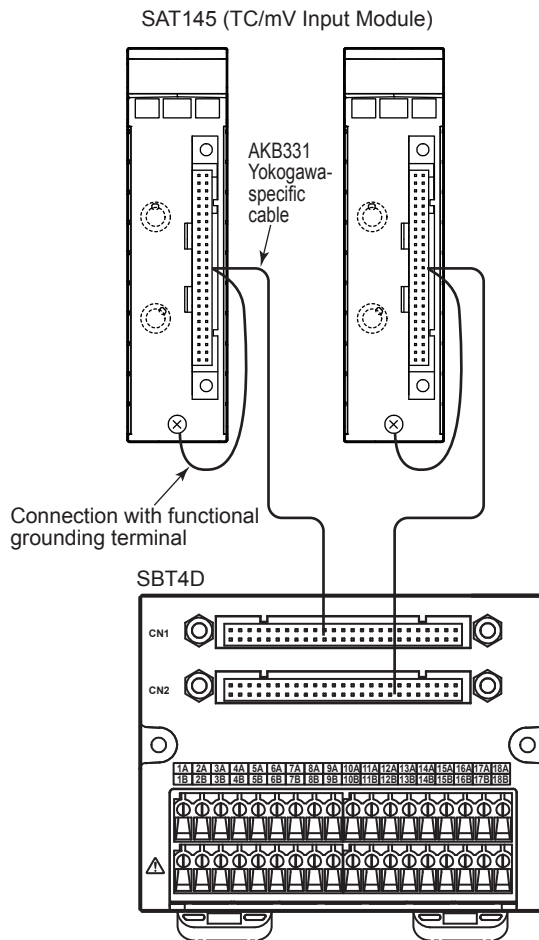


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Figure Connecting Analog I/O Modules to SBA4D Terminal Board (for Dual-redundant Use)

- **Example of Connection to SBT4D**

SBT4D terminal board allows SAT145 modules in both single and dual-redundant configurations.

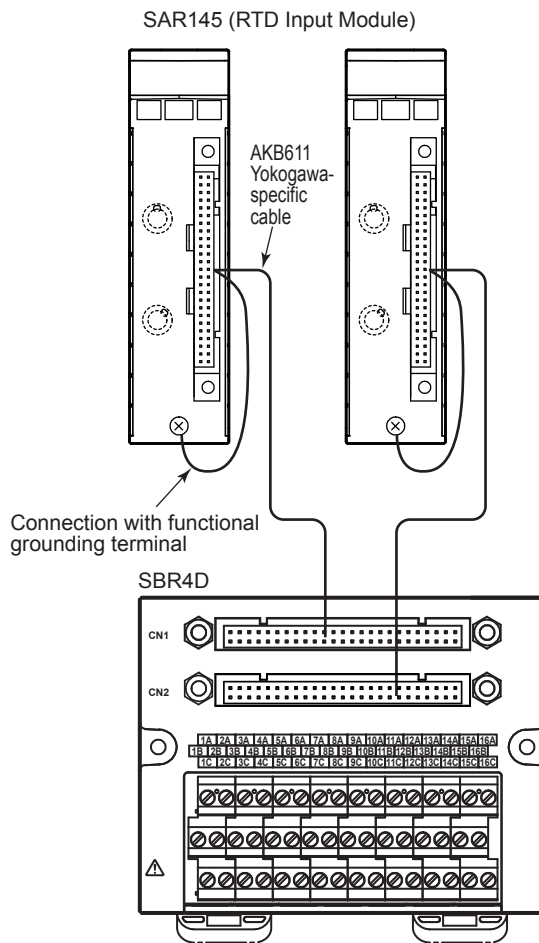


F030622.ai

Figure Connecting TC/mV Input Modules to SBT4D Terminal Board (for Dual-redundant Use)

- **Example of Connection to SBR4D**

SBR4D terminal board allows SAR145 modules in both single and dual-redundant configurations.



F030623.ai

Figure Connecting RTD Input Modules to SBR4D Terminal Board (for Dual-redundant Use)

- **Example of Connection to SED2D**

SED2D terminal board allows SDV521 modules in both single and dual-redundant configurations.

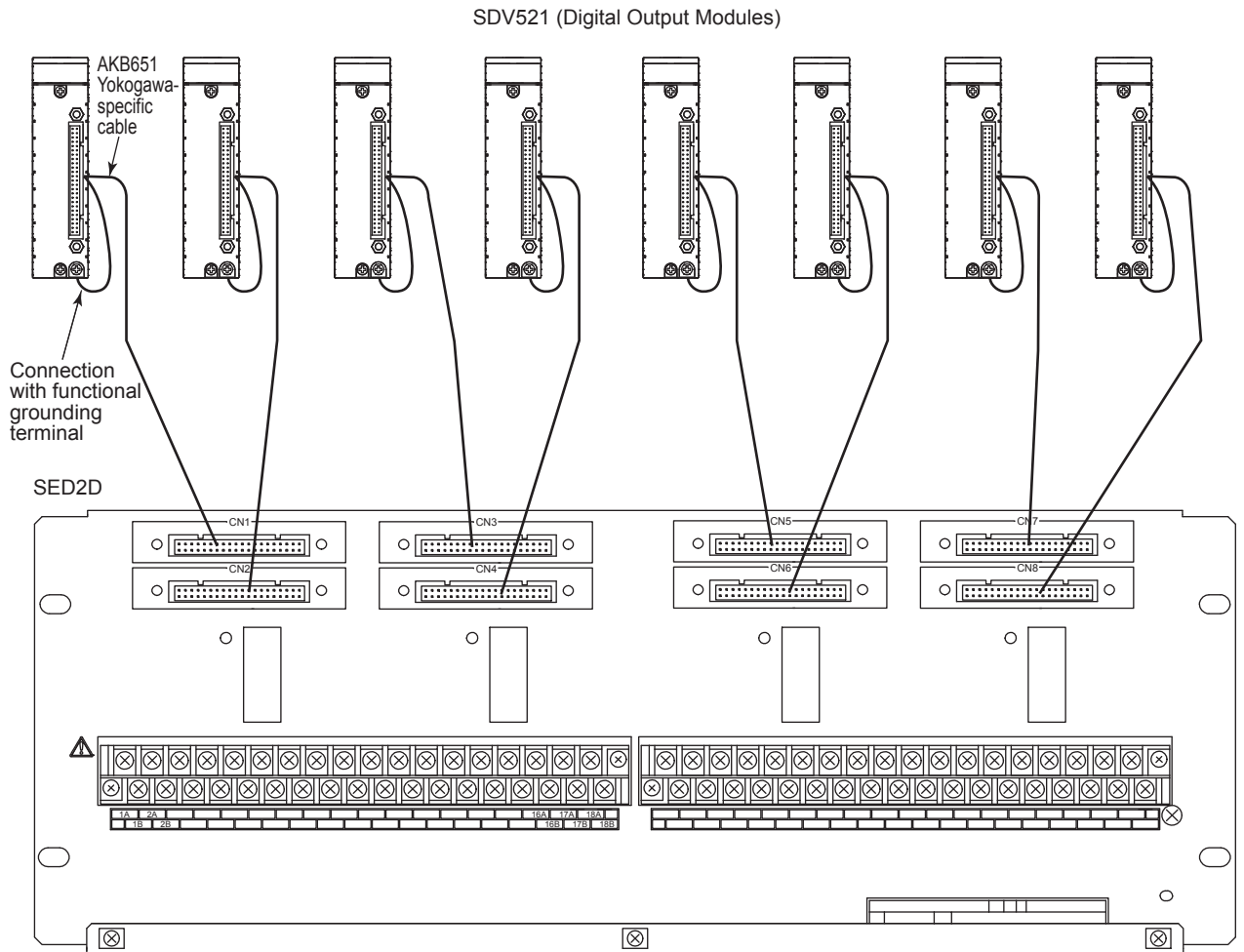


Figure Connecting Digital Output Modules to SED2D Terminal Board (for Dual-redundant Use)

- **Example of Connection to SBD2D**

SBD2D terminal board allows SDV521 modules in both single and dual-redundant configurations.

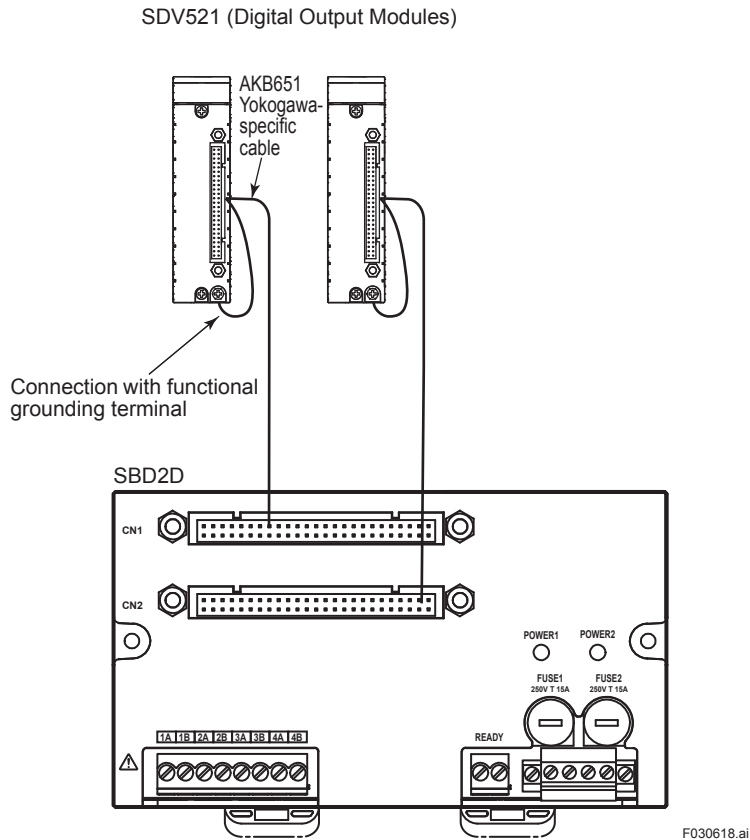
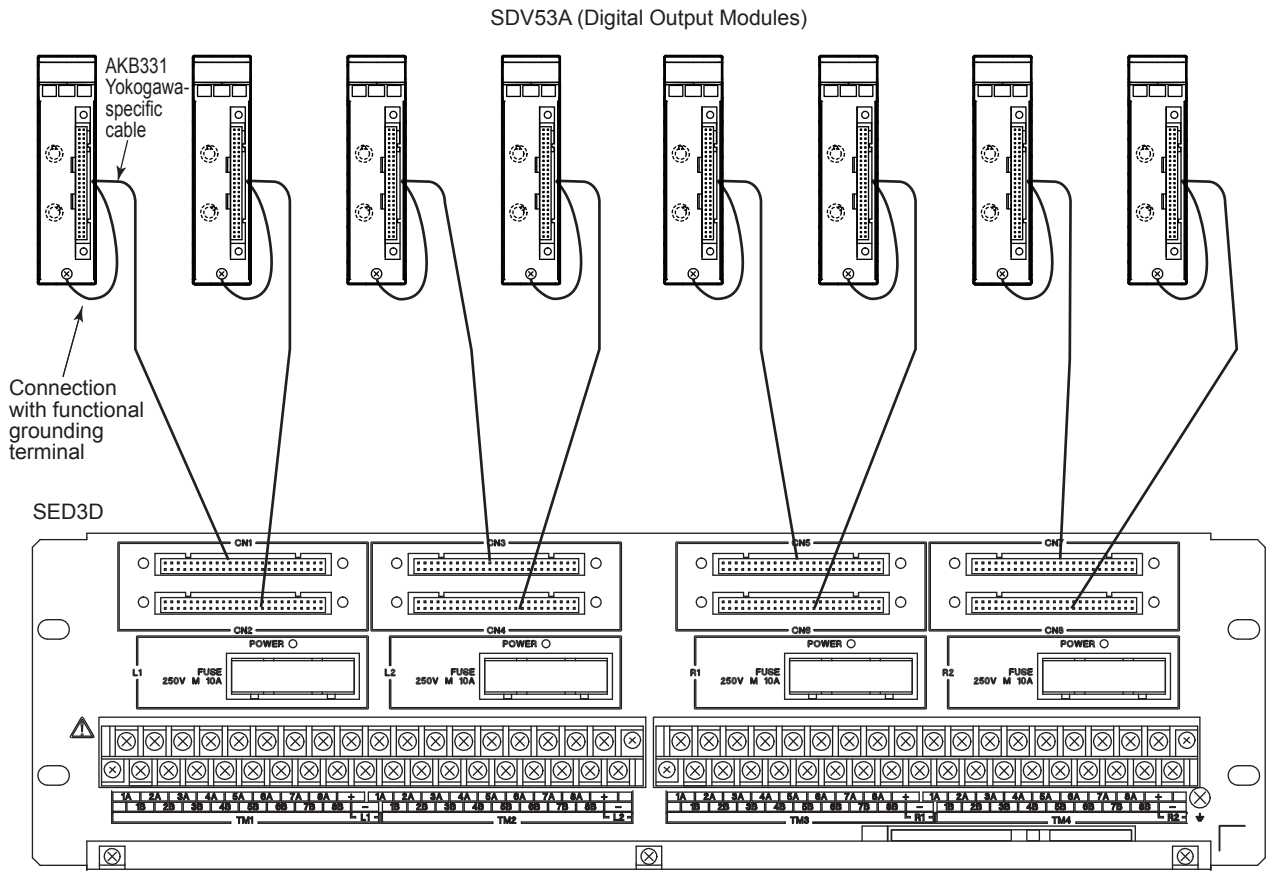


Figure Connecting Digital Output Modules to SBD2D Terminal Board (for Dual-redundant Use)

● Example of Connection to SED3D

SED3D terminal board allows SDV53A modules in both single and dual-redundant configurations.



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Figure Connecting Digital Output Modules to SED3D Terminal Board (for Dual-redundant Use)

● **Example of Connection to SBD3D**

SBD3D terminal board allows SDV53A or SDV531 modules in both single and dual-redundant configurations.

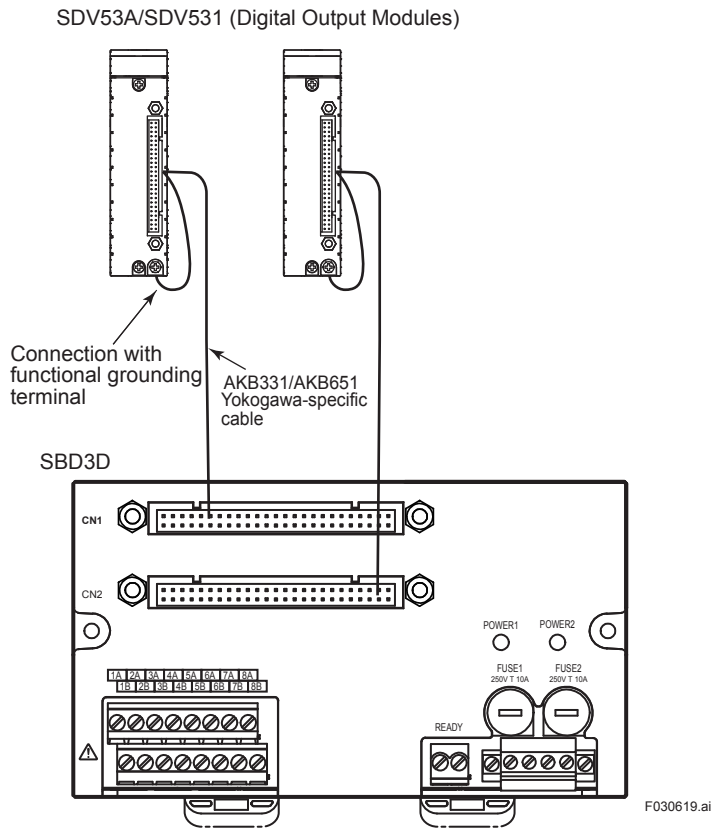
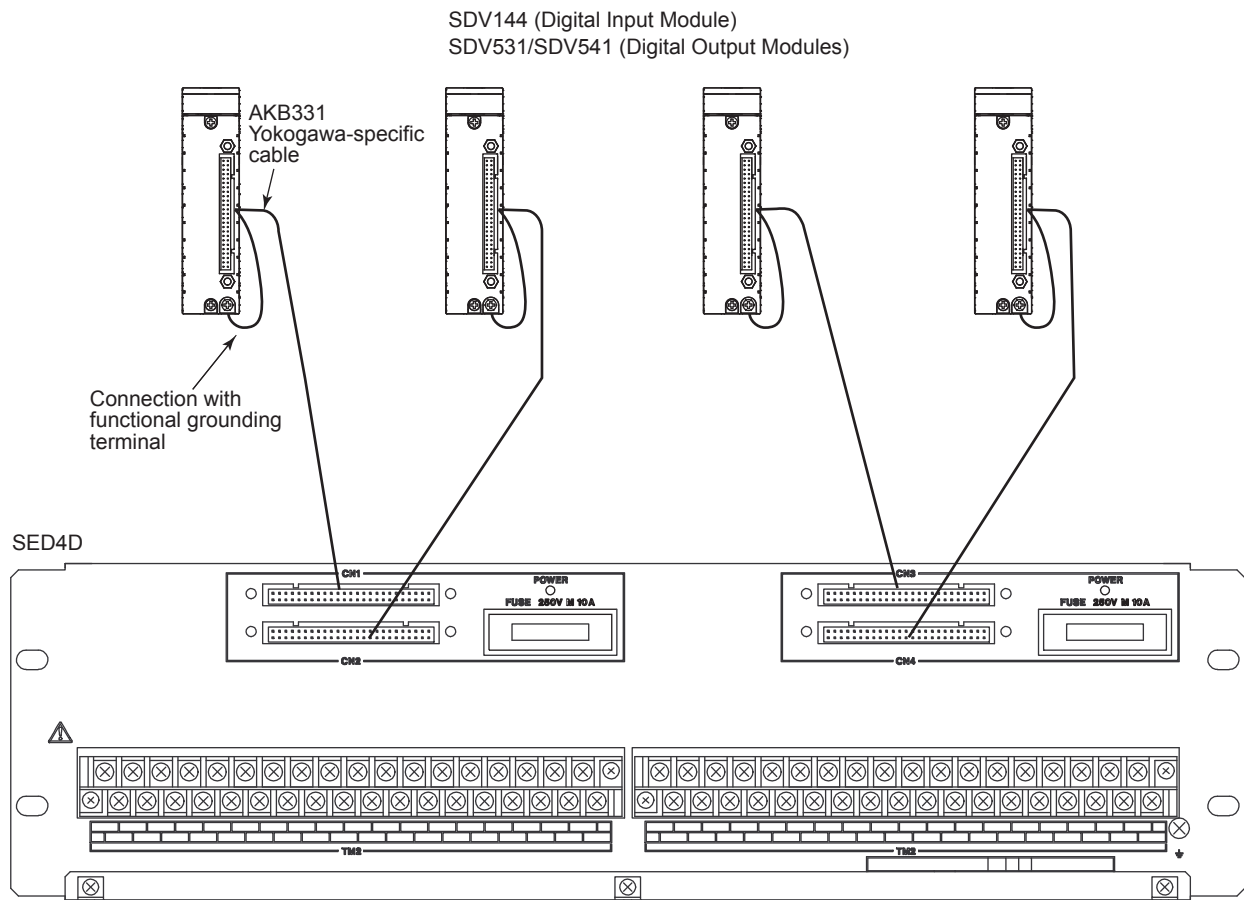


Figure Connecting Digital Output Modules to SBD3D Terminal Board (for Dual-redundant Use)

● Example of Connection to SED4D

SED4D terminal board allows SDV144, SDV531 or SDV541 modules in both single and dual-redundant configurations.



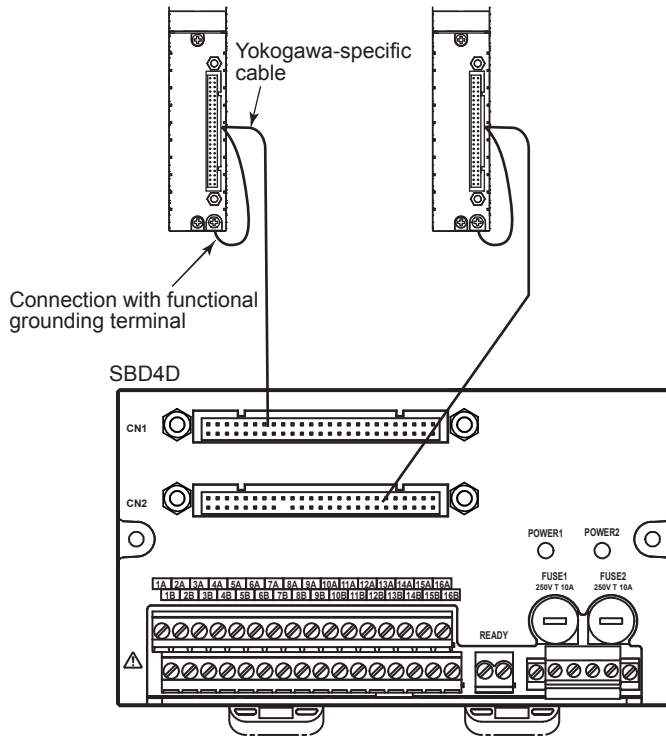
F030615.ai

Figure Connecting Digital Input/Output Modules to SED4D Terminal Board (for Dual-redundant Use)

● **Example of Connection to SBD4D**

SBD4D terminal board allows SDV144 or SDV541 modules in both single and dual-redundant configurations.

SDV144 (Digital Input Module) AKB331 Yokogawa-specific cable
 SDV541 (Digital Output Module) AKB331/AKB651 Yokogawa-specific cable



F030620.ai

Figure Connecting Digital I/O Modules to SBD4D Terminal Board (for Dual-redundant Use)

● Example of Connection to SWD2D

SWD2D terminal board allows SDV526 modules in both single and dual-redundant configurations.

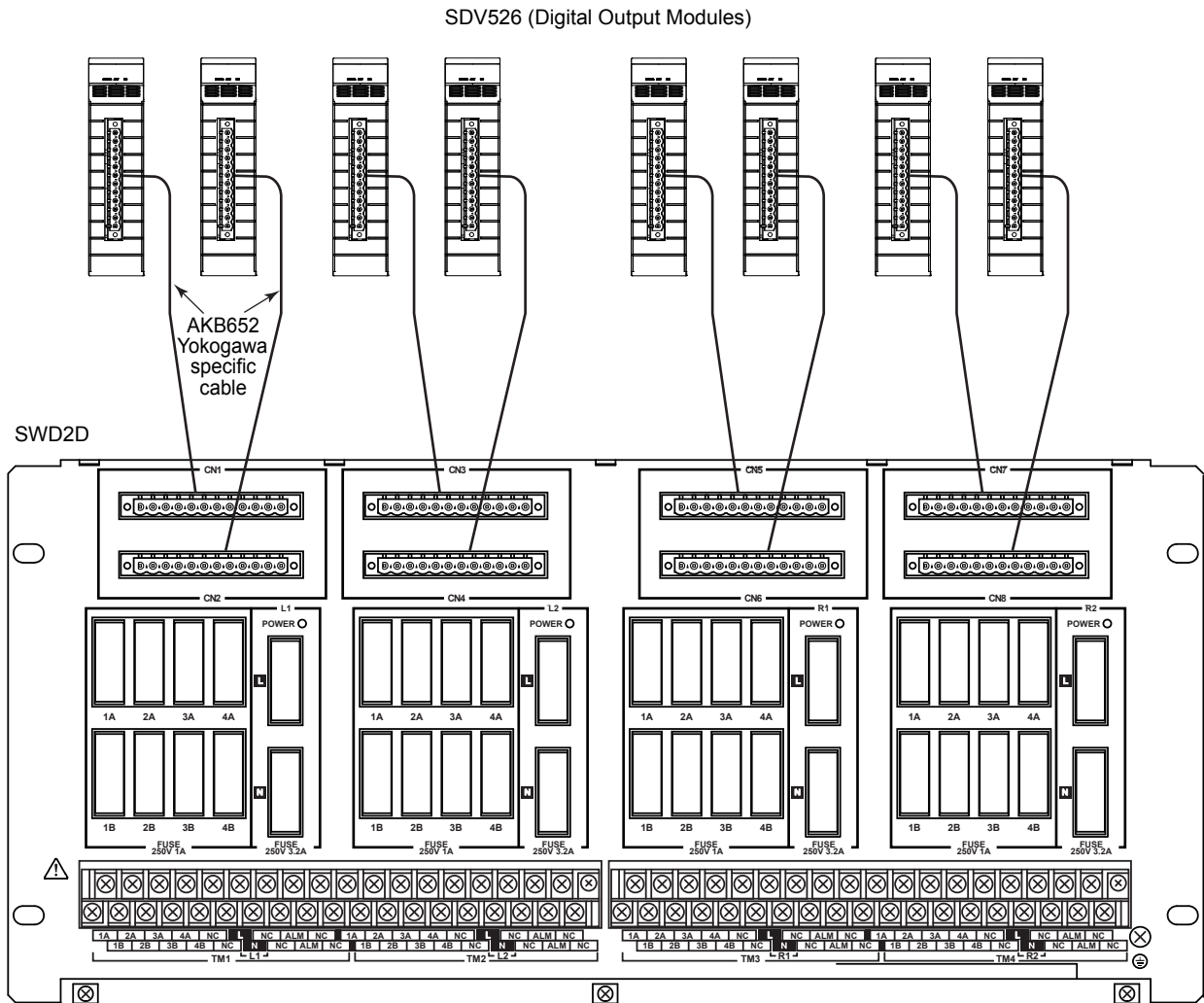


Figure Connecting Digital Output Modules to SWD2D Terminal Board (for Dual-redundant Use)

■ Connecting Digital Output Modules to Relay Boards

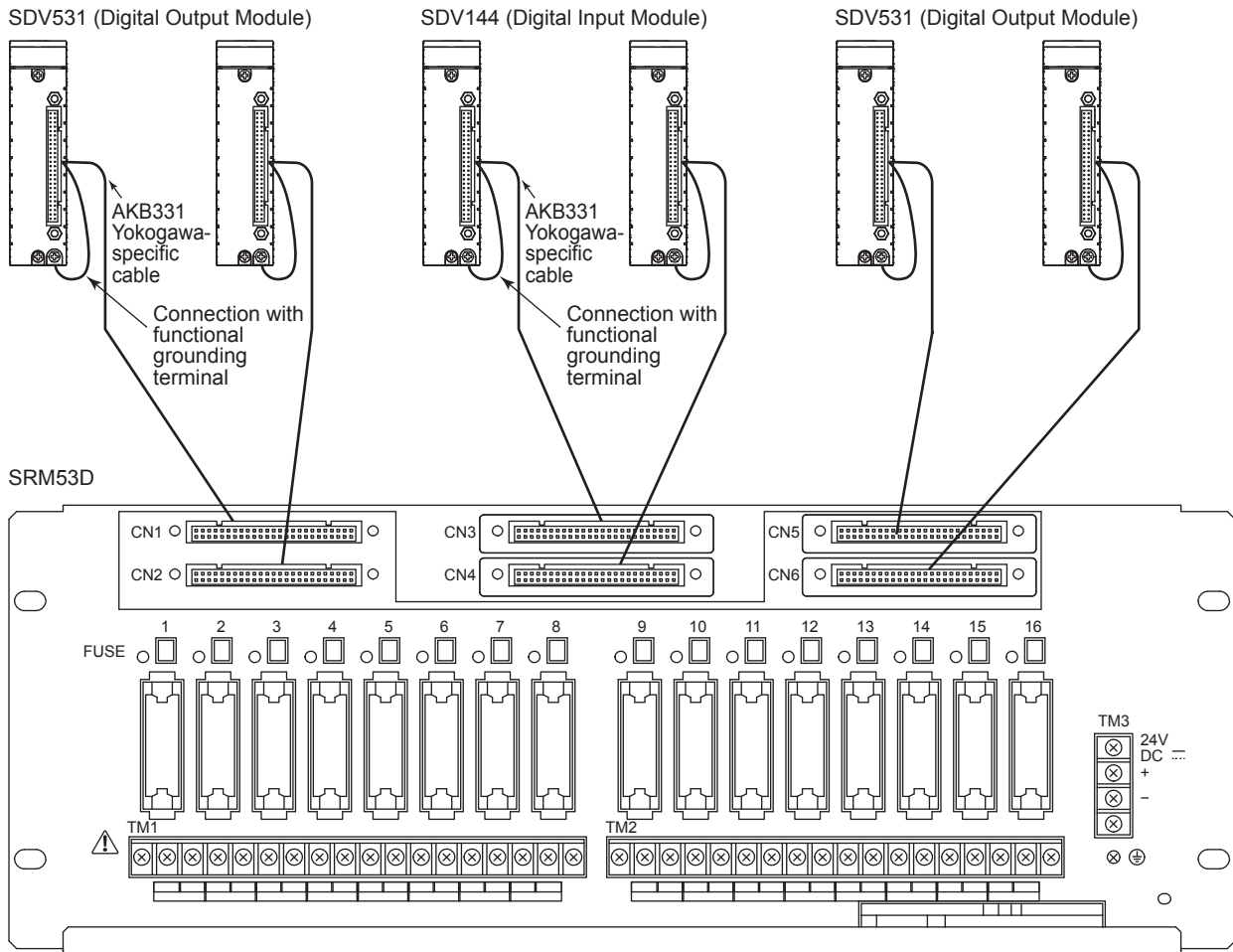
● Example of Connection to SRM53D Relay Board

The SRM53D relay board allows SDV531 modules to be dual-redundant.

The SDV144 digital input modules can read back relay output statuses (up to 16 points) (*1).

The SDV144 digital input modules can also be dual-redundant.

*1: 16-point relay output statuses, including 1 to 8 points of CN1 (CN2 for dual-redundant use) and 9 to 16 points of CN5 (CN6 for dual-redundant use), can be read over simultaneously.

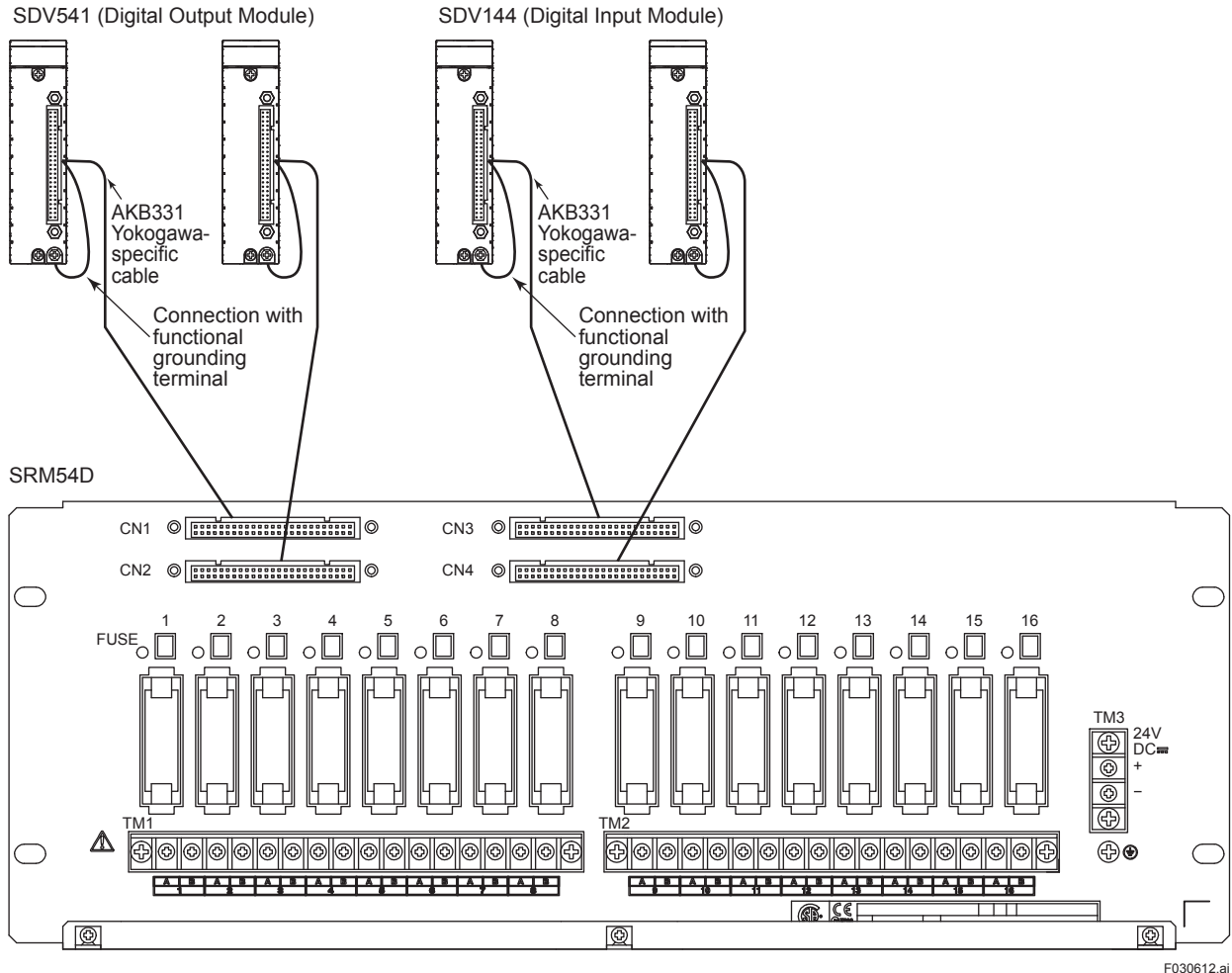


F030611.ai

Figure Connecting Digital I/O Modules to SRM53D (for Dual-redundant Use)

● Example of Connection to SRM54D Relay Board

The SRM54D relay board allows SDV541 modules to be dual-redundant. The SDV144 digital input module can read back relay output statuses. The SDV144 digital input modules can also be dual-redundant.

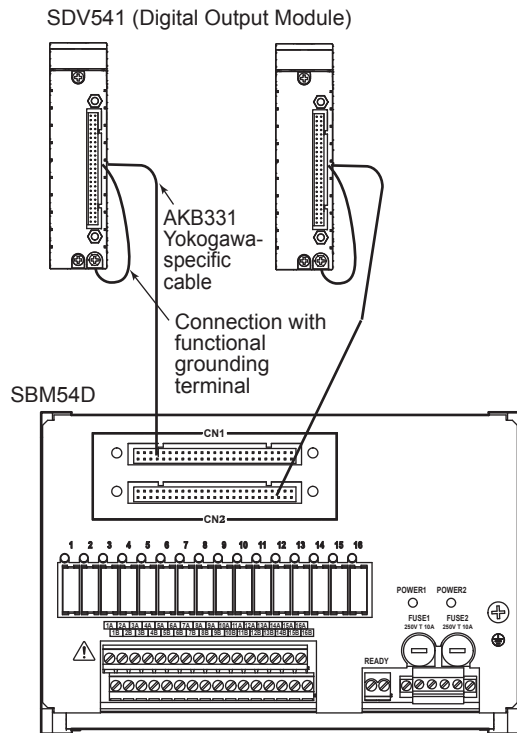


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Figure Connecting Digital I/O Modules to SRM54D Relay Board (for Dual-redundant Use)

- **Example of Connection to SBM54D Relay Board**

The SBM54D relay board allows SDV541 modules to be dual-redundant.



F030621.ai

Figure Connecting Digital Output Modules to SBM54D Relay Board (for Dual-redundant Use)

■ Connecting Wiring Check Adapters

Connect the wiring check adapters to detect disconnected or short-circuited field wiring between the digital input module and field equipment. These adapters should be connected at the field equipment side. The two types of these adapters are:

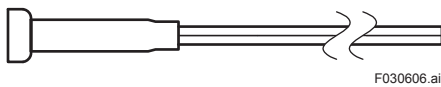
- **SCB100:** Disconnection detection while accepting an OFF signal
If this type of adapter is connected in parallel with a sensor switch, a disconnection occurring while accepting an OFF signal can be detected.
- **SCB110:** Short-circuit detection
If this type of adapter is connected in series with a sensor switch, a short-circuit in the power line, occurring while accepting an ON signal, or a short-circuit with other channels can be detected. In addition to the above wiring check adapters, input module's diagnostic functions should be able to detect disconnections or short-circuits.

SEE ALSO

For more information about diagnostic features of the input modules, see the following:
 “■ Items Set for Each Channel (Discrete Input)” in A4.6, “Items Set for Discrete Inputs” of the Safety Control Station Reference (IM 32Q03B10-31E, IM 32S03B10-21E or IM 32S03B10-01E).

● Shape of Wiring Check Adapters

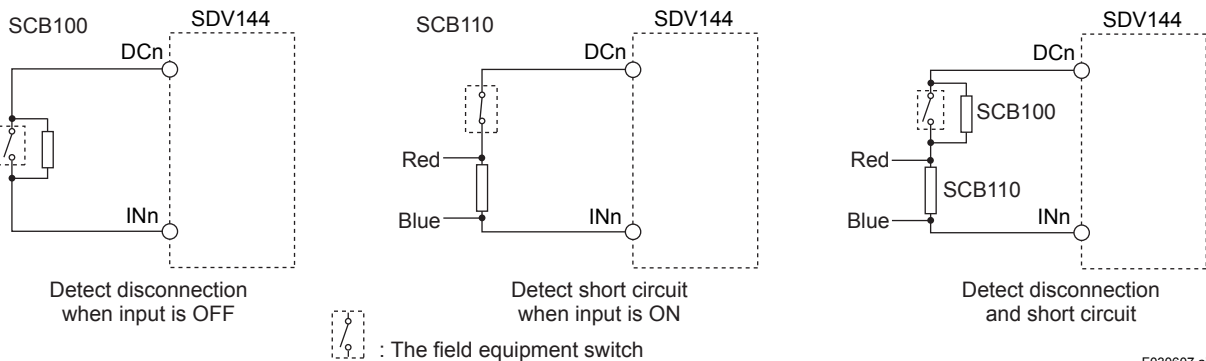
The following figure shows the shape of the SCB100 and SCB110.



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Figure External View of SCB100 and SCB110

● Connecting Wiring Check Devices



F030607.ai

Figure Connecting Wiring Check Adapters



IMPORTANT

- Connect the SCB110 with correct polarity. If it is connected incorrectly, no detection can be made.
- To detect short-circuits or disconnections in the field wiring effectively, locate the adapters in the vicinity of the field equipment. Also install these adapters in a location out of direct sunlight and sheltered from rain.
- Be careful not to bend a covered part.

3.7 Connecting Bus Cable

There are three types of control network bus named as Vnet/IP, Vnet/IP-Upstream and V net for the ProSafe-RS system.

Vnet/IP or Vnet/IP-Upstream is used for SSC60S/SSC60D, SSC50S/SSC50D and SSC57S/SSC57D. V net is used for SSC10S/ SSC10D. Vnet/IP-Upstream is the same connection as Vnet/IP.

This section describes each control network bus cabling and ESB bus cabling related to the control network bus.

3.7.1 Vnet/IP network

Information on Vnet/IP interface connection and an example of SENG and SCS connection are shown below:

● Vnet/IP Interface

- Topology : tree connection
- Configuration : dual redundancy only
- Connector : RJ45 connector
- Intra-domain connection : L2SW used
- Inter-domain connection : L3SW used
- Recommended cable : UTP cable of CAT5e or above (optical cable for outdoor use)

● SENG and SCS Connection

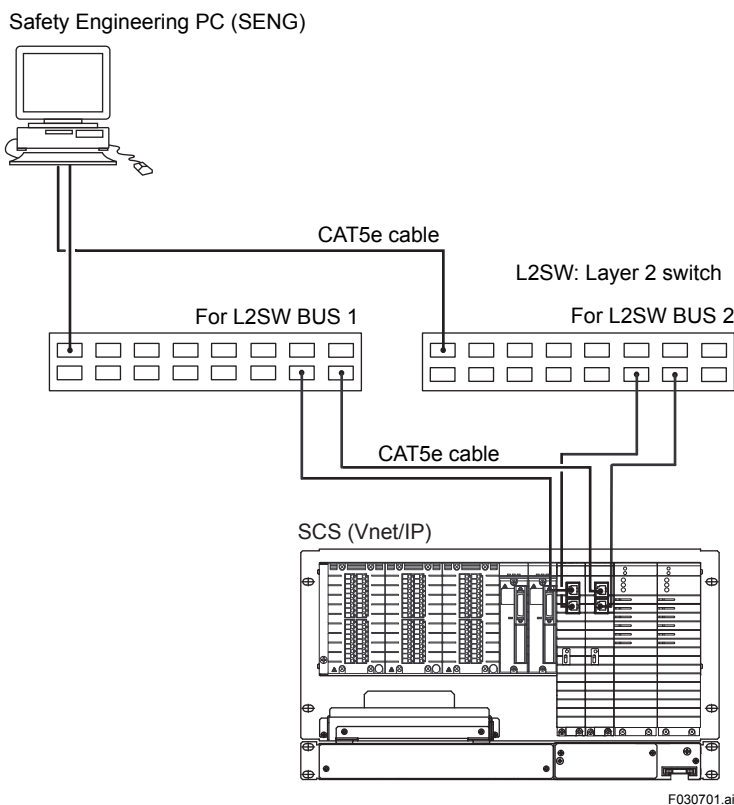


Figure Example of SENG and SCS Connection

- **Example of Connection between V net Router and SCS**

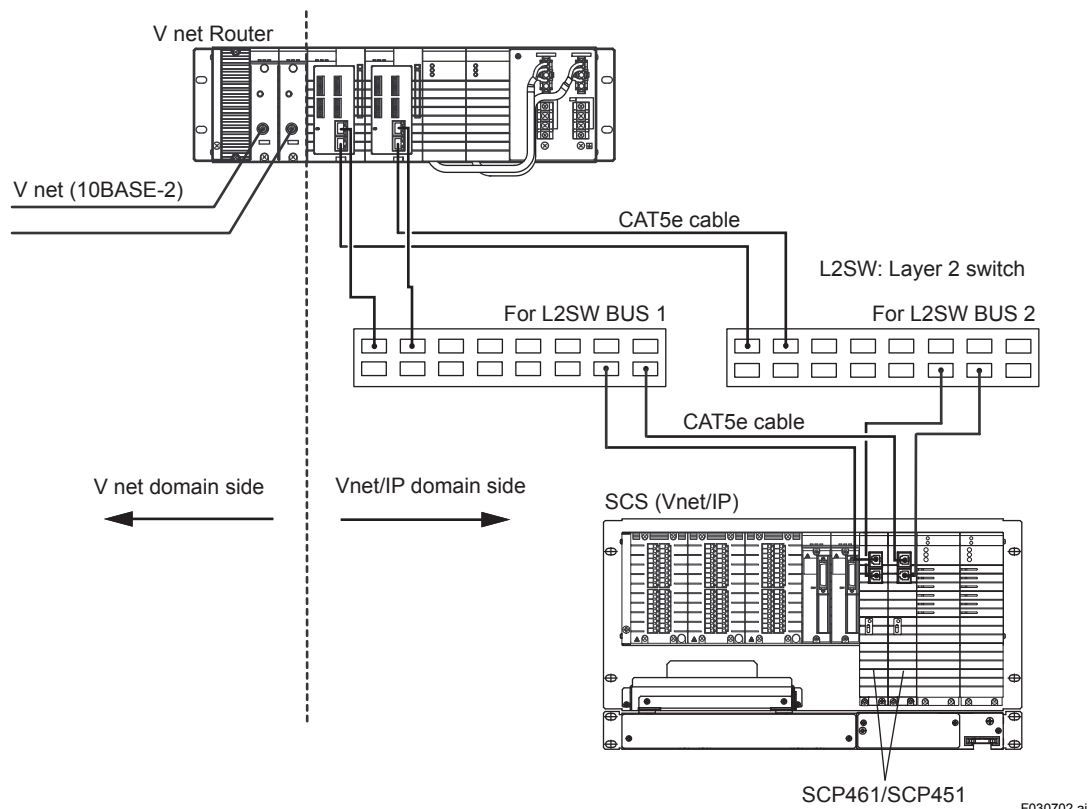


Figure Example of Connection between V net Router and SCS

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- **Differentiation between BUS 1 and BUS 2**

Use different colors, etc., to differentiate between BUS 1 and BUS 2.

- **Destination Display**

Attach a display tag at the tip of cables to indicate the station number, switch number, and port number of the destination.

- **Cable Fixing**

Fix cables securely so that their connectors are not exposed to undue stress.

- **Handling of Vnet/IP Cables Connected to the Processor Module (SCP461/SCP451)**

- Turn the power on after connecting the cables to the SCP461/SCP451.
- When removing the SCP461/SCP451 on-line, remove it with the cable connected to it.
- Before installing the SCP461/SCP451 on-line, connect a cable to it.

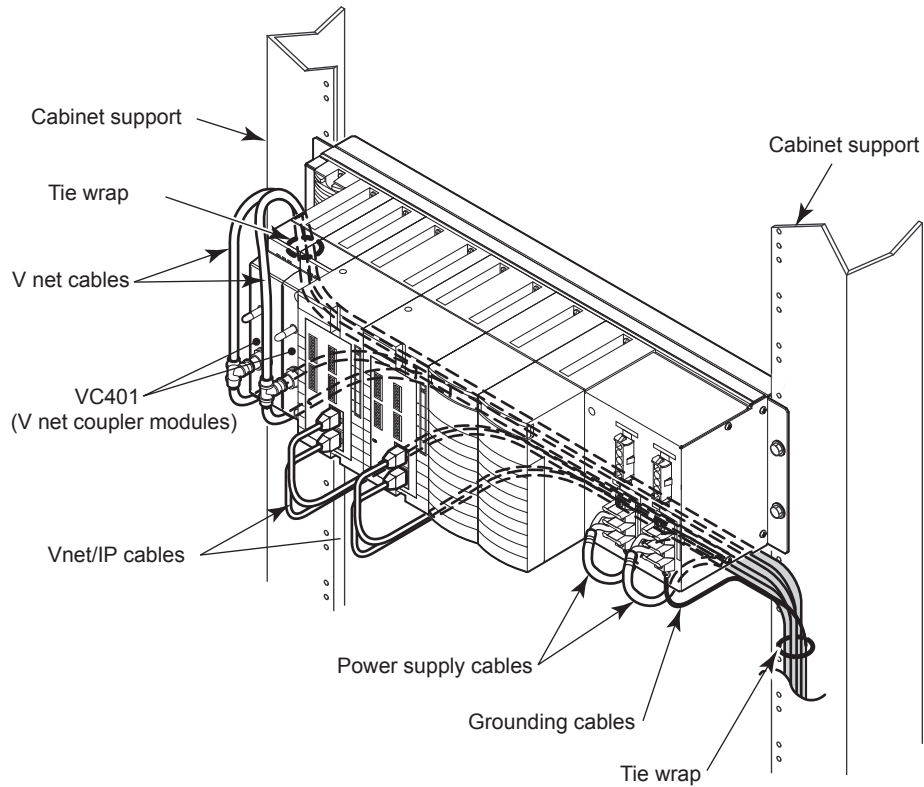
- **Handling communication module for V net router (VI451) of Duplexed V net router (AVR10D) and connecting cable**

- Switch on after connecting a cable to VI451.
- Remove VI451 on line with a cable connected to VI451.
- Attach VI451 on line after connecting cable to VI451.

- **Handling VI702/VI701 and connecting cable**

- Do not power on PC until a cable is attached.
- Power off PC first to remove a cable.

- **Cabling for AVR10D System**



Use a tie wrap to fix the V net cable onto the support on the side of the VC401.

F030703.ai

Figure Cabling Diagram for the AVR10D System

3.7.2 V net



IMPORTANT

If the sheath of the control-bus cable is connected, there is a possibility that (ground loop) currents will flow in the sheath. Take note of the following points.

Before connecting a V net splitter (N-type or BNC-type) to coaxial cable, use the following method to drain static electricity: wear a wrist strap. If the cable is already connected to other stations, this is not necessary.

- Momentarily short the cable inner conductor to the outer sheath.
 - Next connect the cable to the coupler.
-

The following is an example of connecting a control bus (V net).

- Attach a T-shaped plug to the BUS1 and BUS2 BNC connectors of the control bus interface card. Order the T-shaped plug separately.
- Connect V net cables (10BASE-2 cable: YCB141) to the BUS1 and BUS2 through previous station.
- Connect V net cables (10BASE-2) from the other side of the T-shaped plug to next station.
- When connecting V net cable (10BASE-5 cable: YCB111) to next station, place a connection unit (YCB147) between V net cable (YCB141) and V net cable (YCB111). Order a connection unit separately.
- When no next station is connected, attach YCB148 V net Terminator for 10BASE-2 cable and YCB118 for 10BASE-5 cable.



IMPORTANT

In this document, 10BASE-5 and 10BASE-2, terminology of Ethernet, are used to describe the V net cables for easier understanding. Actually, V net is different from Ethernet. Yokogawa's YCB111 and YCB141 cables should be used instead of 10BASE-5 and 10BASE-2 cables.

● Connecting V net Cables (10BASE-2)

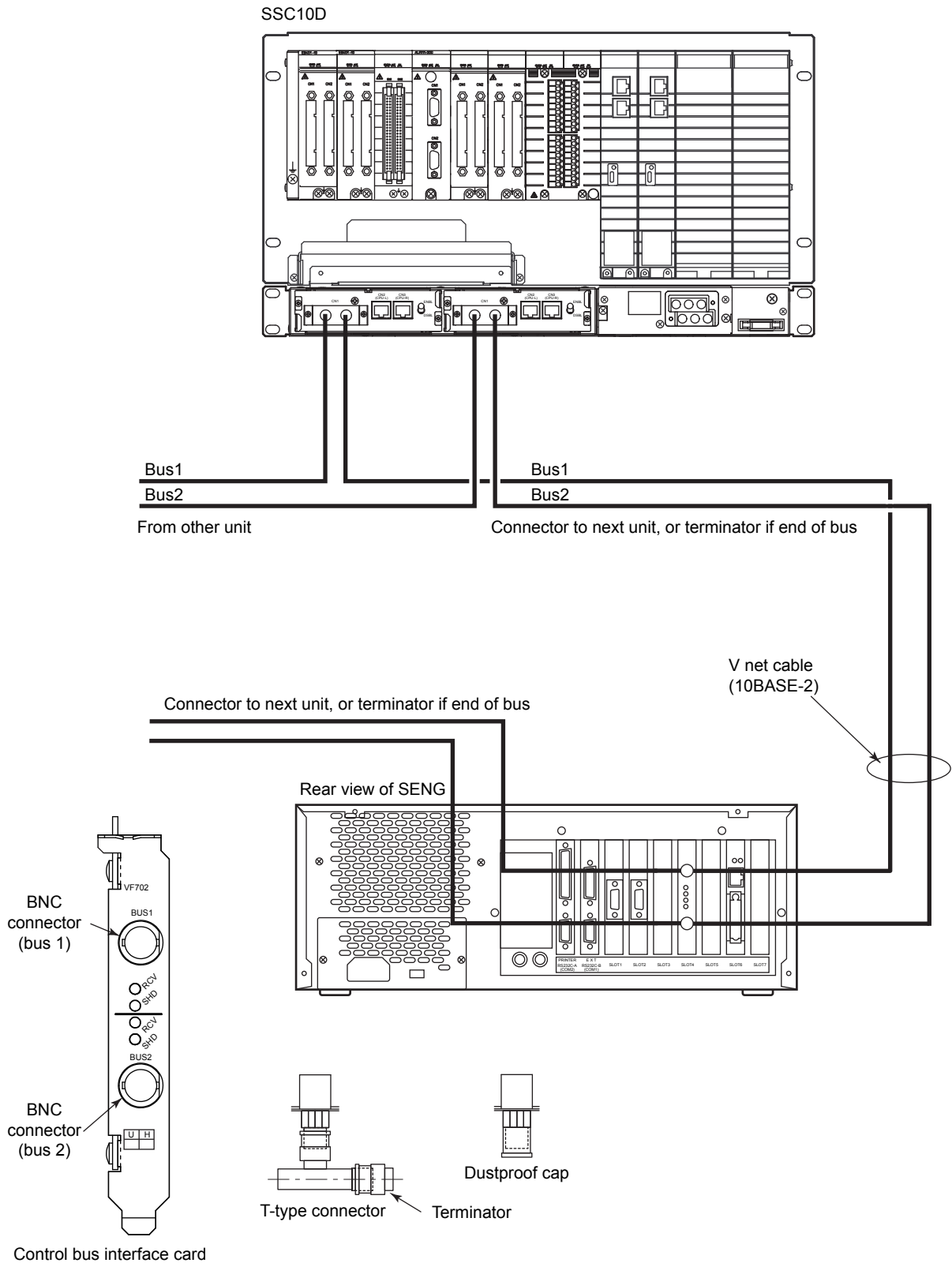
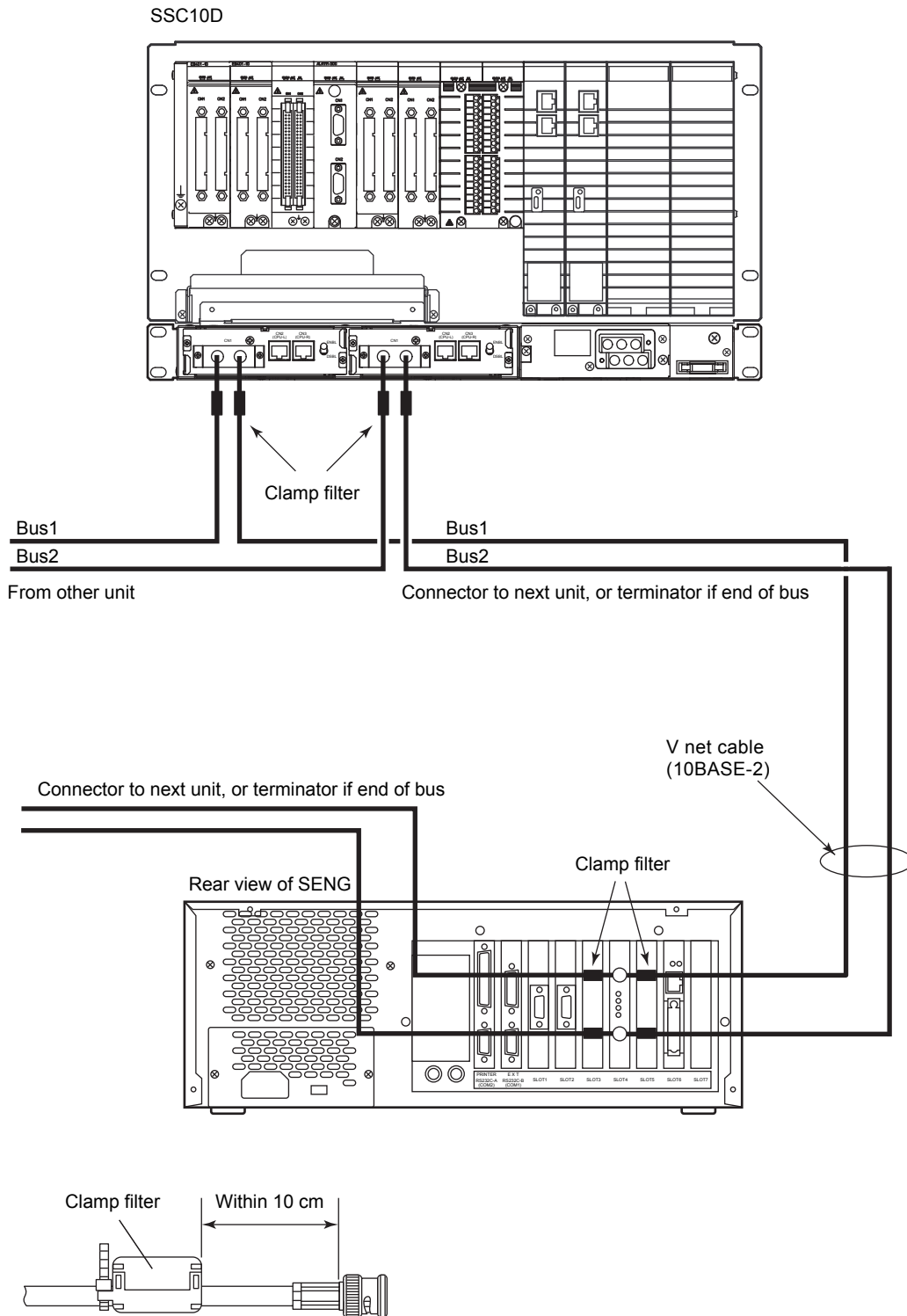


Figure V net Cable (10BASE-2) Connection

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● **Connecting Clamp Filters on V net Cables (10BASE-2)**

Clamp filters are required to comply with the EN54-2 standard.



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Figure Example of Connecting Clamp Filters on V net Cables (10BASE-2)

● Connecting V net Cables (10BASE-5) and (10BASE-2) Interconnection Example

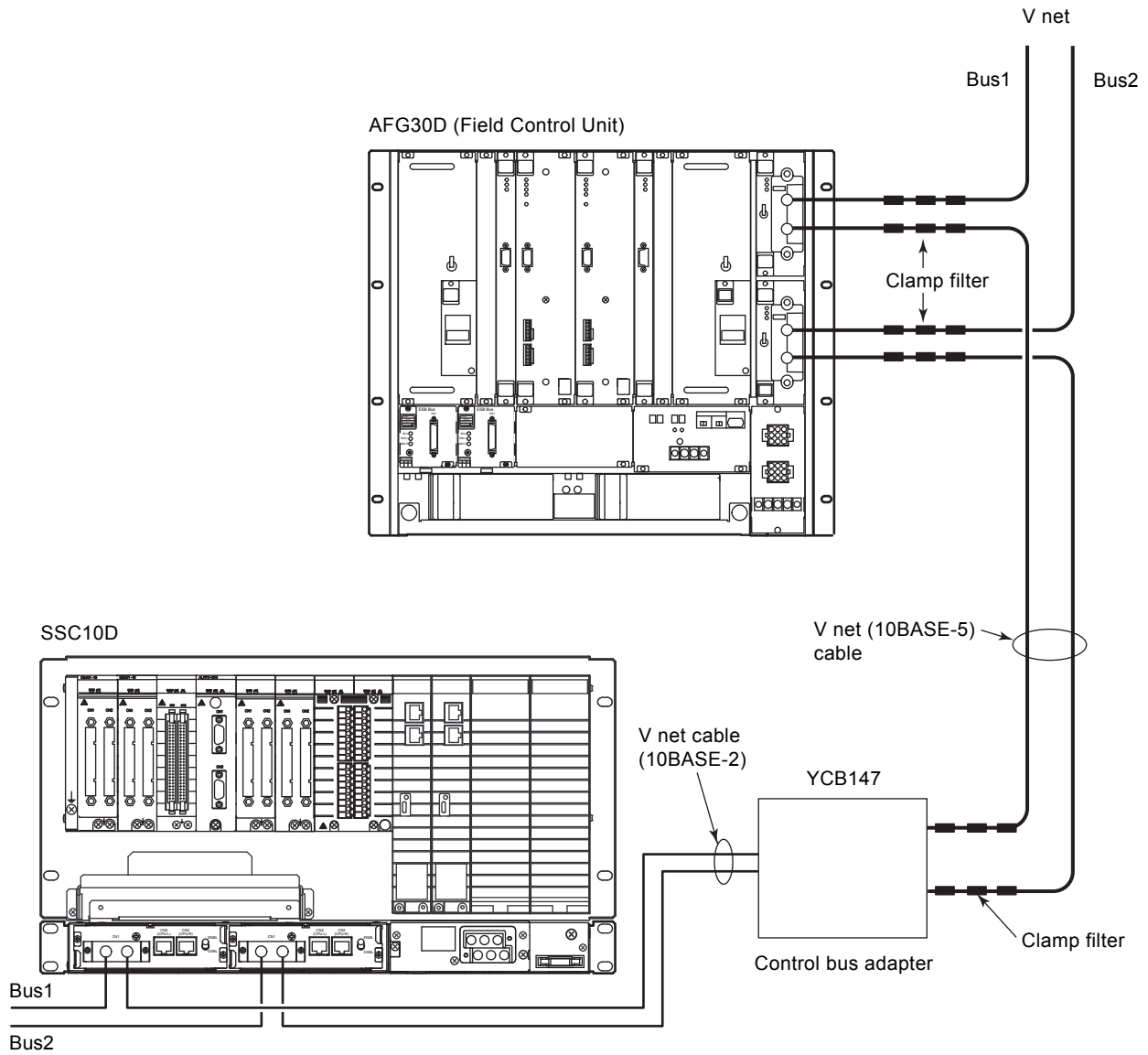


Figure V net Cable (10BASE-5 and 10BASE-2) Connection

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● Control Bus Adapter

The ProSafe-RS system uses a V net cable (10BASE-2) in control buses for a safety engineering PC (SENG) and a safety control unit. For interconnections with CENTUM VP or CENTUM CS 3000 equipment using a 10BASE-5 cable, a control bus adapter is required.

The figure below shows how a 10BASE-5 cable and a 10BASE-2 cable are connected.

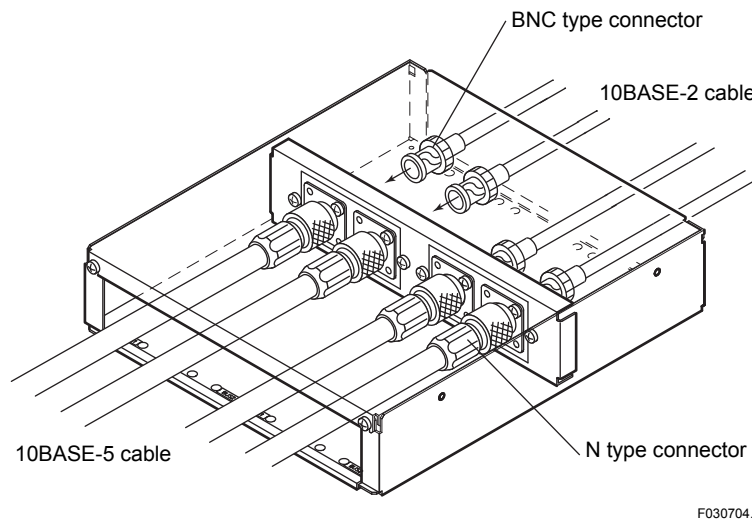


Figure Control Bus Adapter (YCB147)

The thickness and weight of the two types of cable are different; the control bus adapter is used to connect them.

- The V net cable should be tightened as close to the control bus adapter as possible to minimize the length of the 10BASE-2.
- For ease of maintenance, mount the adapter above floor and near the SENG.
- Do not mount the adapter in a passageway or aisle between equipment.
- The rack mountable adapter illustrated above can be mounted in a rack or cabinet.

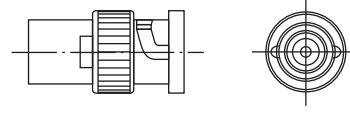
● **V net Cable (10BASE-2)**

- V net cable (10BASE-2)



Connection: Type BNC plug
Finished cable dimensions: $\varnothing 5$

- V net terminator (for 10BASE-2 cable)



Connection: Type BNC plug
Impedance: 50 ohm

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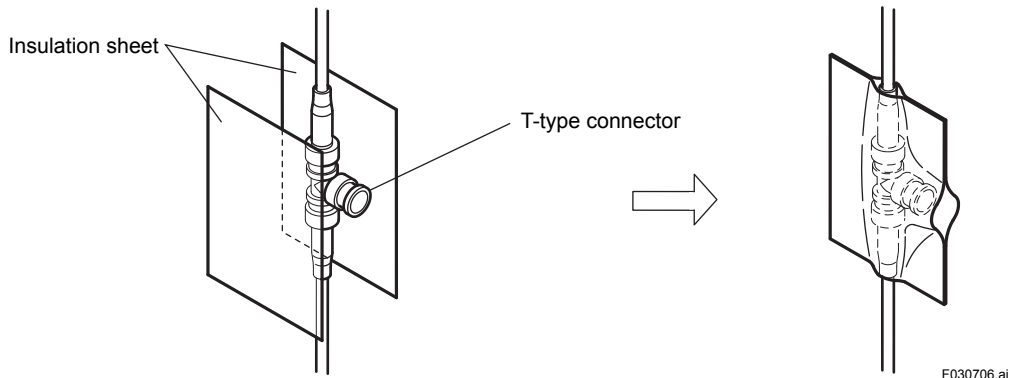
Figure V net Cable and V net terminator (for 10BASE-2 cable)

T-type connector

When the V net cable is connected, put the T-type connector between two pieces of Insulation sheets to prevent it from touching other metals. The surfaces of the insulation sheets that come with the T-type connector (2 sheets) are adhesive. The figure below shows how to attach them.

Place two pieces of insulation sheets so that the adhesive surfaces face the T-type connector and sandwich the T-type connector between them.

Press the two pieces of insulation sheets together tightly with your fingers, making sure that the sheets cover the metal part of the T-type connector.

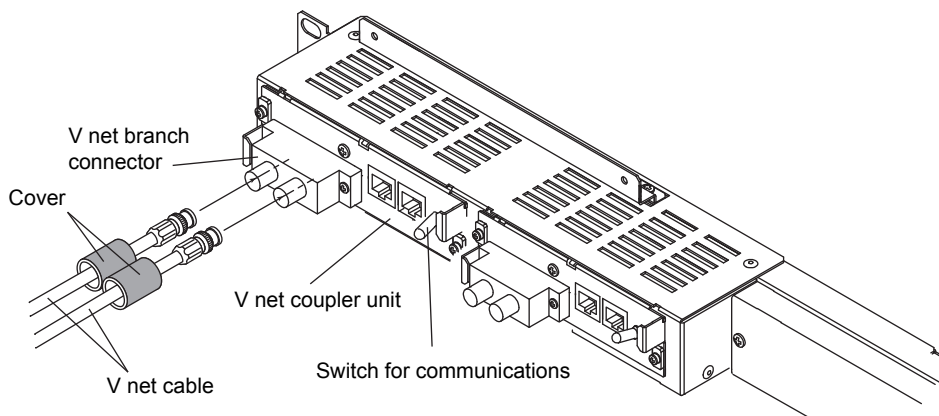


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Figure Insulation Sheet

BNC Connector Cover

If V net (10BASE-2) cables are connected to the SSC10S or SSC10D, install BNC connector covers to prevent the BNC connectors from coming into contact with other pieces of metal. Four BNC connector covers are supplied with the SSC10S or SSC10D.

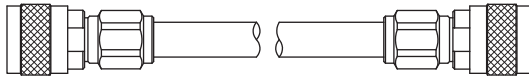


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Figure BNC Connector Cover

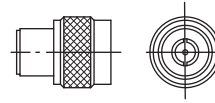
● V net Cable (10BASE-5)

- V net cable (10BASE-5)



Connection: Type N plug
Finished cable dimensions: \varnothing 10.3

- V net terminator (for 10BASE-5 cable)



Connection: Type N plug
Impedance: 50 ohm

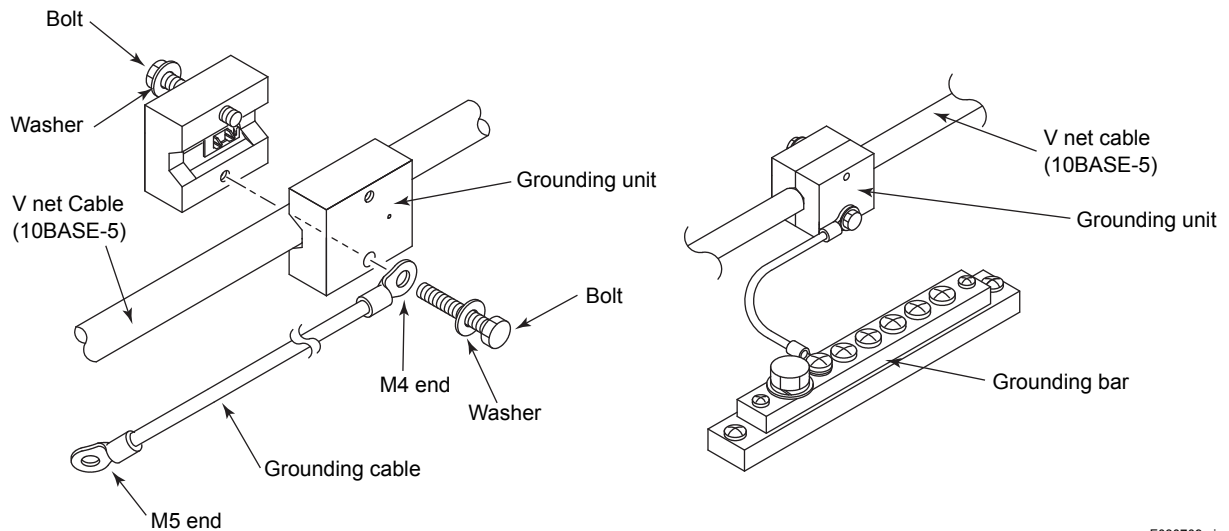
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Figure V net Cable and V net terminator (for 10BASE-5 cable)

V net grounding unit (YCB117)

When you use a V net cable for extension, use the YCB117 V net Grounding Unit. The unit is used to ground V net-connected devices at one point for safety. Ground each bus in a segment at one point (In a segment, devices can communicate on the same bus without repeater).

Place the unit on the bottom of the cabinet. You do not need to secure it. Connect a grounding cable to a grounding bar of the cabinet, as shown below.



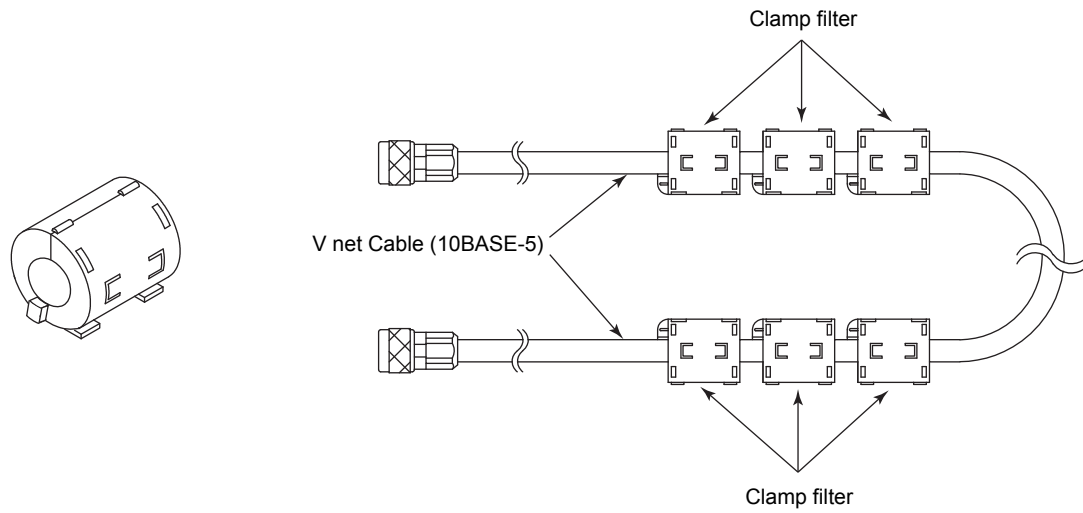
F030709.ai

Figure Assembly of V net Grounding Unit and Its Use

Clamp filter

In order to enhance noise immunity, attach three clamp filters in succession at both ends of the V net cable (10BASE-5) near to the V net couplers.

Refer to the figure below for a typical mounting example.



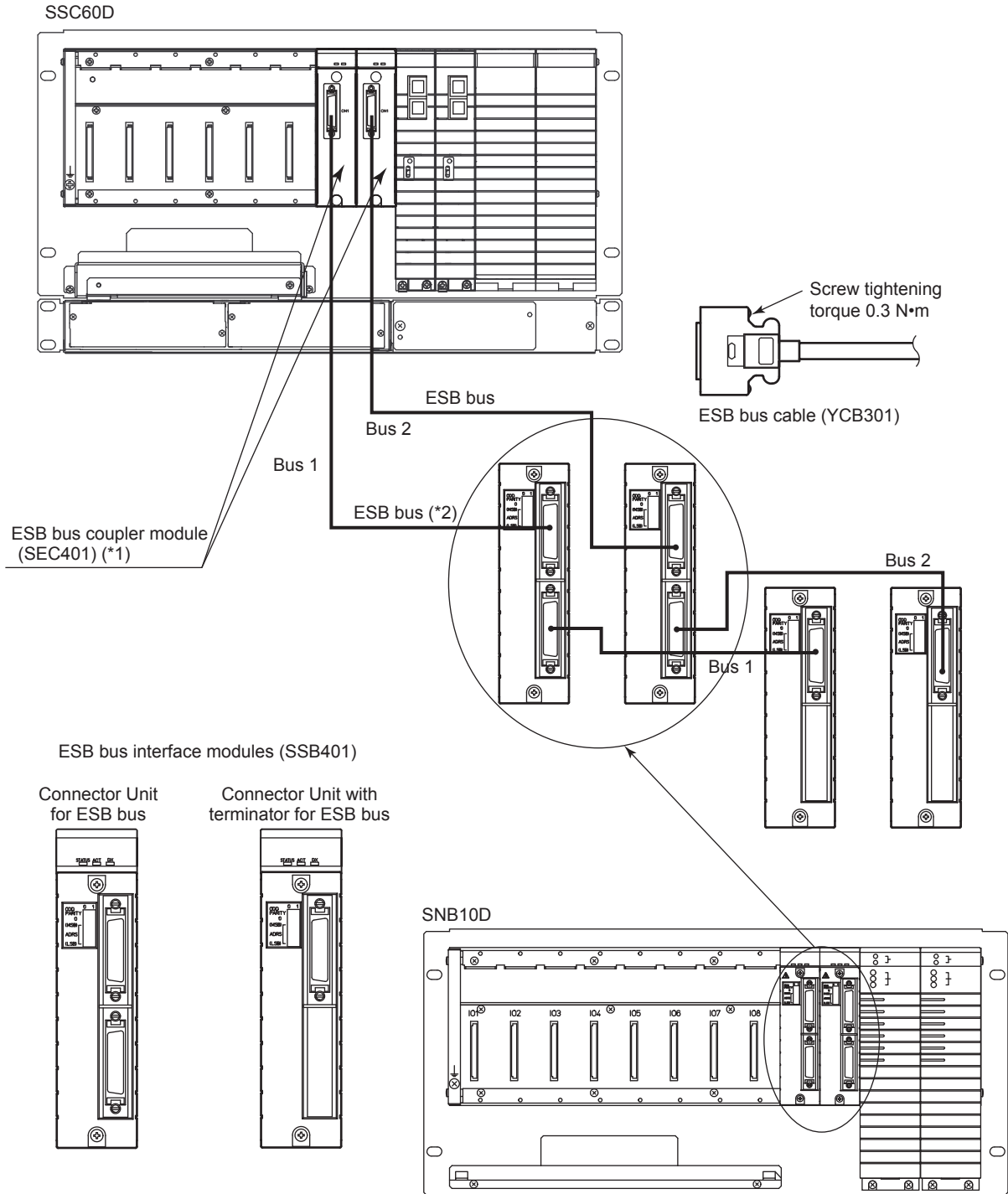
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Figure Clamp filter

3.7.3 ESB Bus

Either the ESB bus branching connector or the branching connector that has a built-in ESB bus terminator must be mounted to SSB401 installed in the SNB10D safety node unit. If a node unit is connected next, select the ESB bus branching connector. If the node unit is the last one, select the branching connector that has a built-in ESB bus terminator.

The following is an example of connecting an ESB bus using SEC401 ESB bus coupler module. SEC401 can be installed in SSC60□, SSC50□, SSC57□ and SSC10□.



*1: Total number of SNB10D safety node units must be 9 or less when SEC401 is used.

*2: Length of ESB buses must be 10 m or shorter from SEC401.

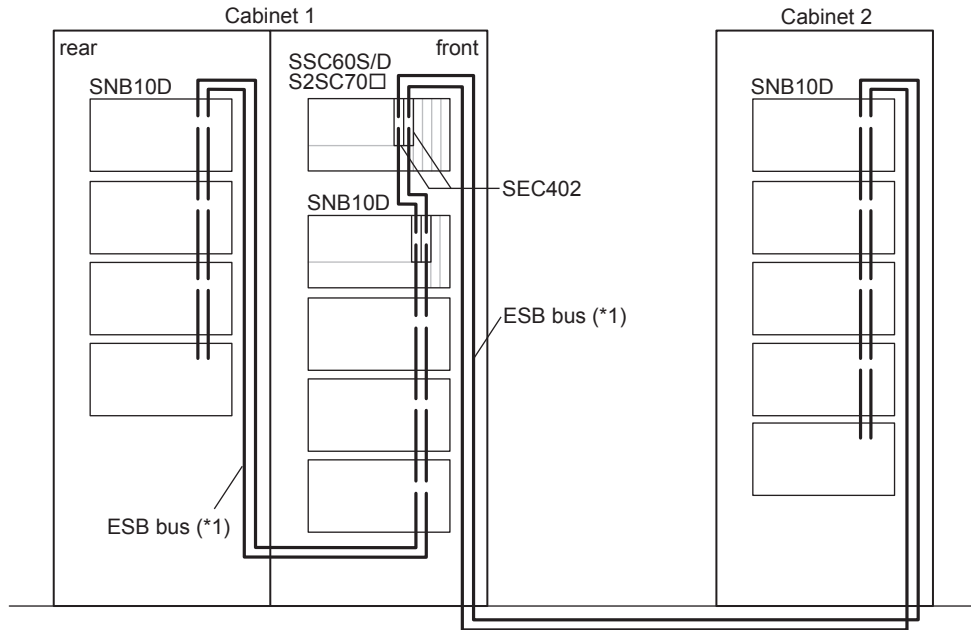
Figure ESB bus Connection (SSC60D)

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Using SEC402 ESB bus coupler module, up to 13 SNB10D safety node units (*1) can be connected to SSC60□ safety control unit. SEC402 has two ports to connect ESB bus cables. Up to 9 SNB10D units can be connected to each of the upper and lower port, and up to 13 SNB10D units can be connected to SEC402 as a total of the upper and lower ports. SEC402 can work normally even when node units are only connected to either of the two ports, leaving the other port vacant and not terminated. ESB Bus communication is available at this condition.

*1: To connect 10 or more SNB10Ds, CFS1350 Node Expansion Package is required.

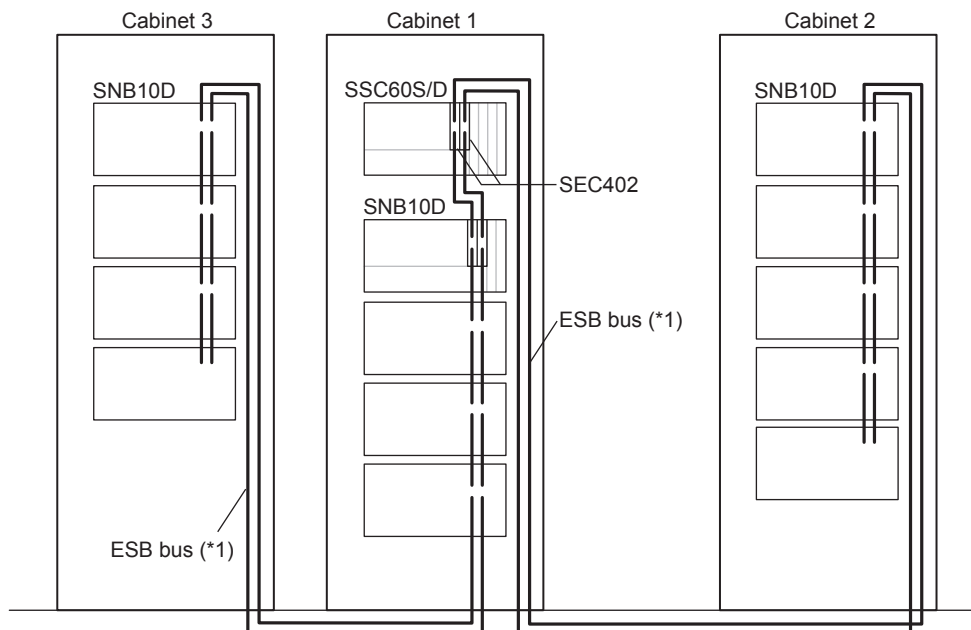
The following are examples of ESB bus connection using SEC402.



*1: Length of ESB buses must be 10 m or shorter each from the upper and lower port of SEC402.

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Figure ESB bus Connection when Two Cabinets are Used



*1: Length of ESB buses must be 10 m or shorter each from the upper and lower port of SEC402.

F030710.ai

Figure ESB bus Connection when Three Cabinets are Used

3.7.4 Optical ESB Bus Repeater

Optical ESB Bus Repeaters use fiber-optic cables to connect an SNT401/SNT411 Optical ESB Bus Repeater Master Module and an SNT501/SNT511 Optical ESB Bus Repeater Slave Module to each other.

When SSC60□, SSC50□ or SSC57□ is used for the safety control unit, SNT401, SNT411, SNT501 and SNT511 are available. However, when SSC10□ is used for the safety control unit, SNT411 and SNT511 can not be used though SNT401 and SNT501 can be used.

You can connect these devices in the structures of star and chain type connections.

In one method, optical ESB bus repeater module unit (SNT10D) is used and in the other, it is not.

Examples of connecting optical ESB bus repeater modules are shown below using SNT401 and SNT501. The same connection can be applied to SNT411 and SNT511.

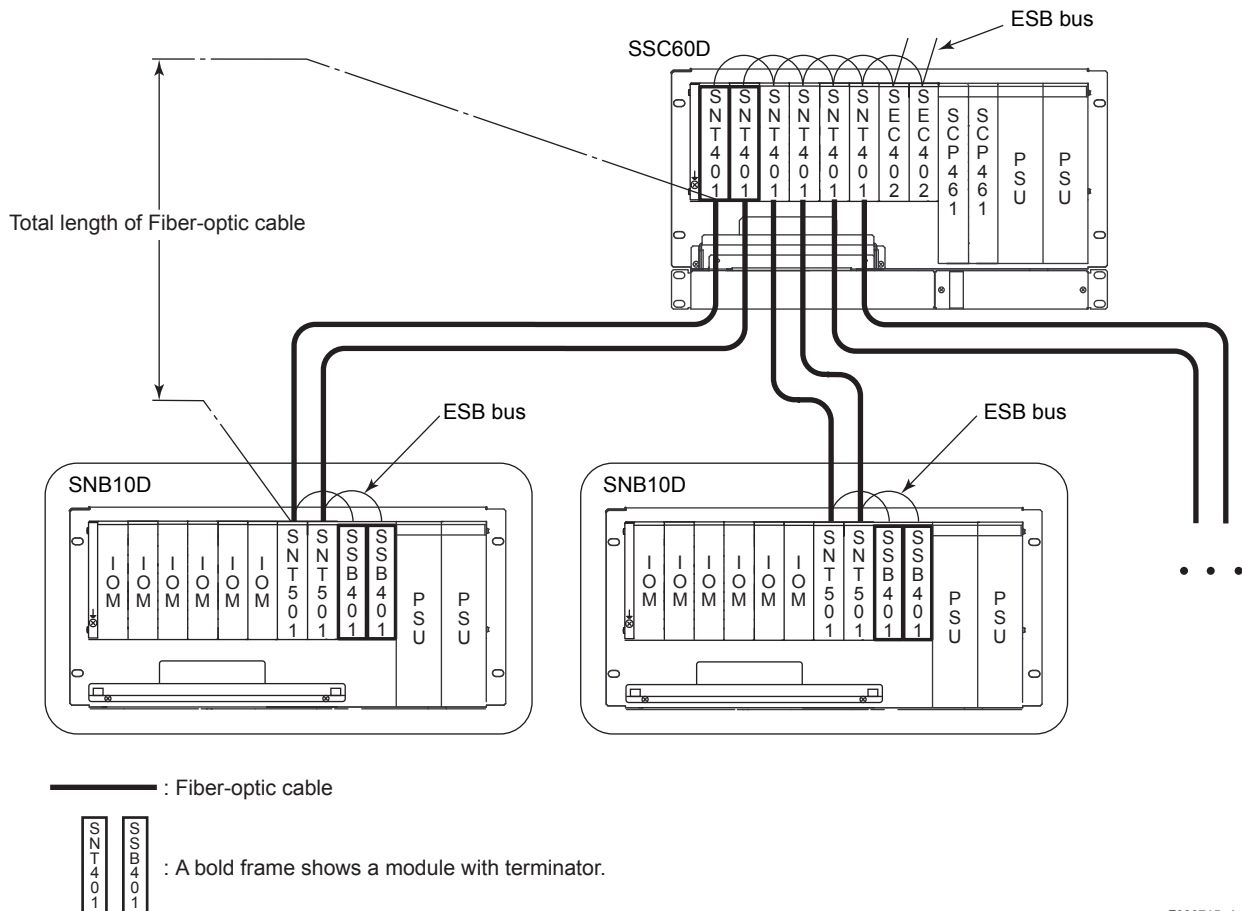
■ Star Type Connection

Star type connection is possible when connecting SNT401/SNT411 installed on SSC60□/SSC50□/SSC57□/SSC10□ (safety control unit) or SNT10D (unit for Optical ESB bus repeater module) to SNT501/SNT511 installed on SNB10D (safety node unit).

Note: When SSC10□ is used for the safety control unit, SNT411 and SNT511 cannot be used.

Fiber-optic cable for ESB bus can be star-connected to SNT501/SNT511.

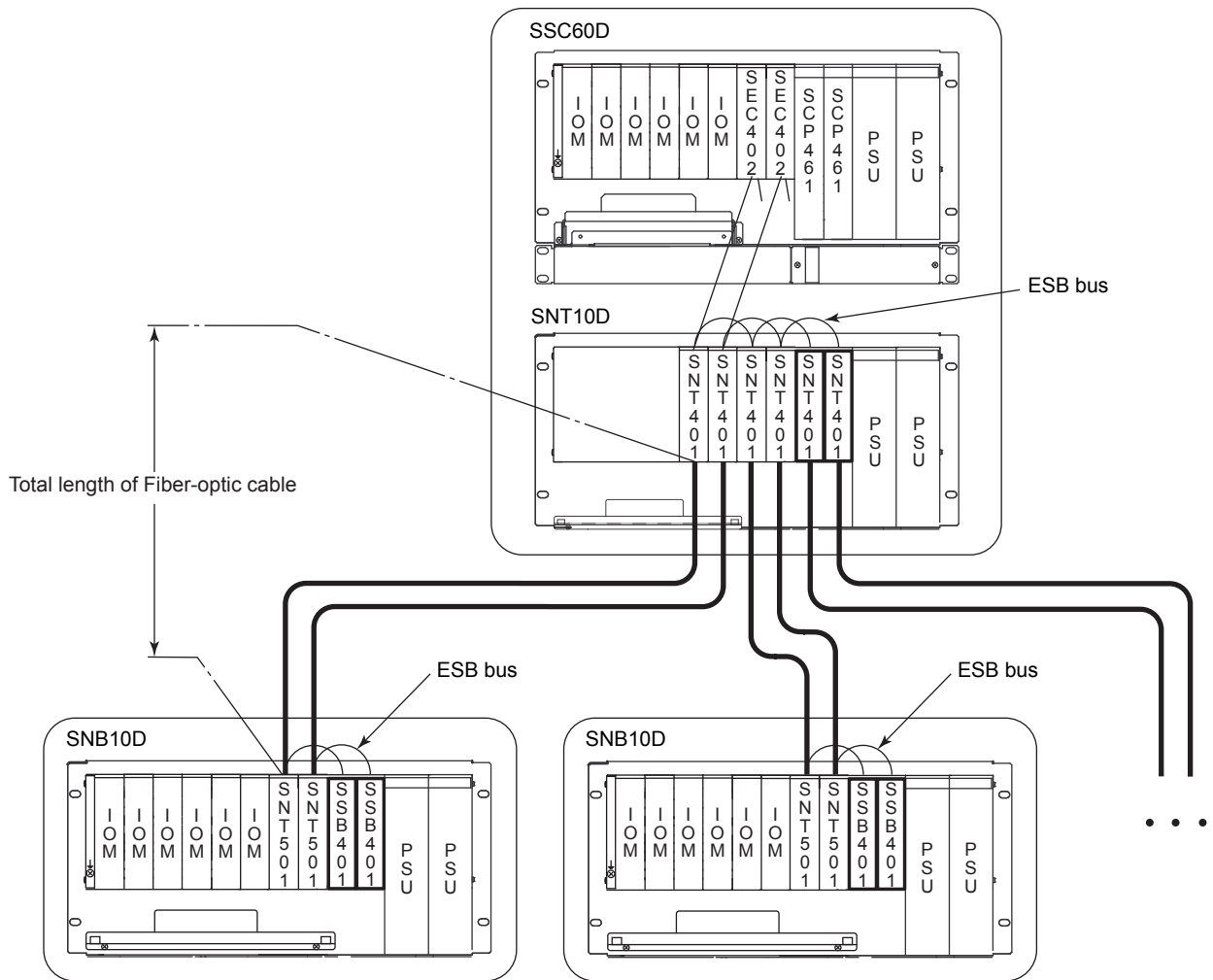
Example of not using SNT10D



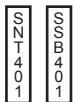
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Figure Star Type Connection: Not Using SNT10D

Example of using SNT10D



— : Fiber-optic cable



: A bold frame shows a module with terminator.

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

Figure Star Type Connection: Using SNT10D

Chain Type Connection

There are two structures of chain type connections: one uses the SNT10D Unit for Optical Bus Repeater Modules and the other does not use any SNT10D Unit for Optical Bus Repeater Modules.

Where No SNT10D Unit Is Used

The SNT401/SNT411 modules installed on the SSC60□/SSC50□/SSC57□/SSC10□ Safety Control Unit as well as on the SNB10D Safety Node Unit can be chain-connected respectively to SNT501/SNT511 modules installed on the SNB10D Unit. In such a case, the number of I/O modules that can be installed on SSC60□/SSC50□/SSC57□/SSC10□ and SNB10D is up to four and six respectively. If you have a plan to connect an SNB10D and your SNB10D with fiber-optic cables in the future, it is recommended that you reserve sufficient slots in your SNB10D for optical ESB bus repeater modules.

Note: When SSC10□ is used for the safety control unit, SNT411 and SNT511 cannot be used.

Example of not using SNT10D

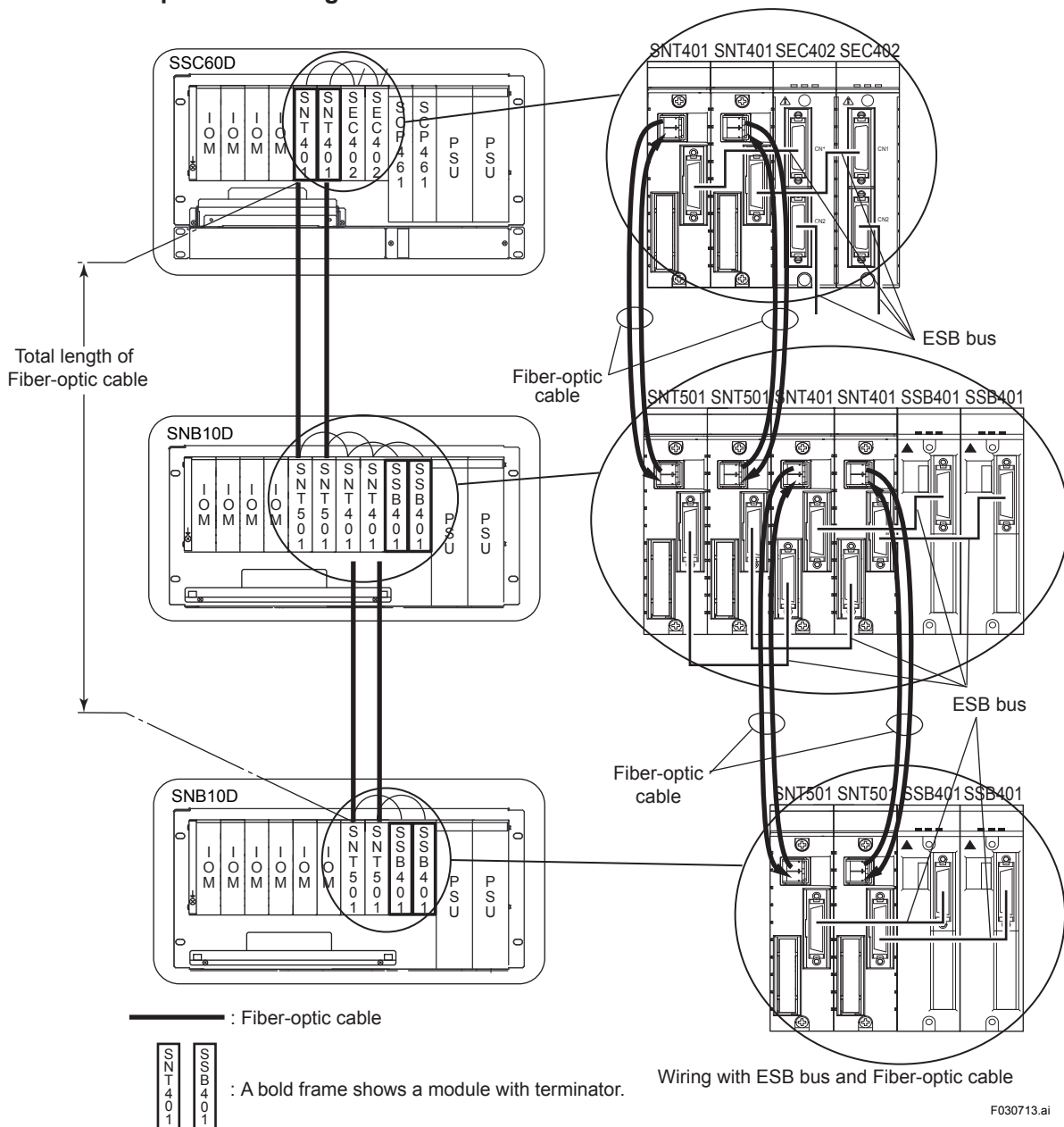


Figure Chain Type Connections: Not Using SNT10D

● Where an SNT10D Unit Is Used

The SNT10D is used for SSC60□, SSC50□, SSC57□, SSC10□ and SNB10D to allow the SNT401/SNT411 and SNT501/SNT511 modules to be chain-connected to each other. In such a case, the number of I/O modules that can be installed on each unit is six to eight. This can result in the same installation as in ESB-bus cable connections on the ESB bus.

Note: When SSC10□ is used for the safety control unit, SNT411 and SNT511 cannot be used.

Example of using SNT10D

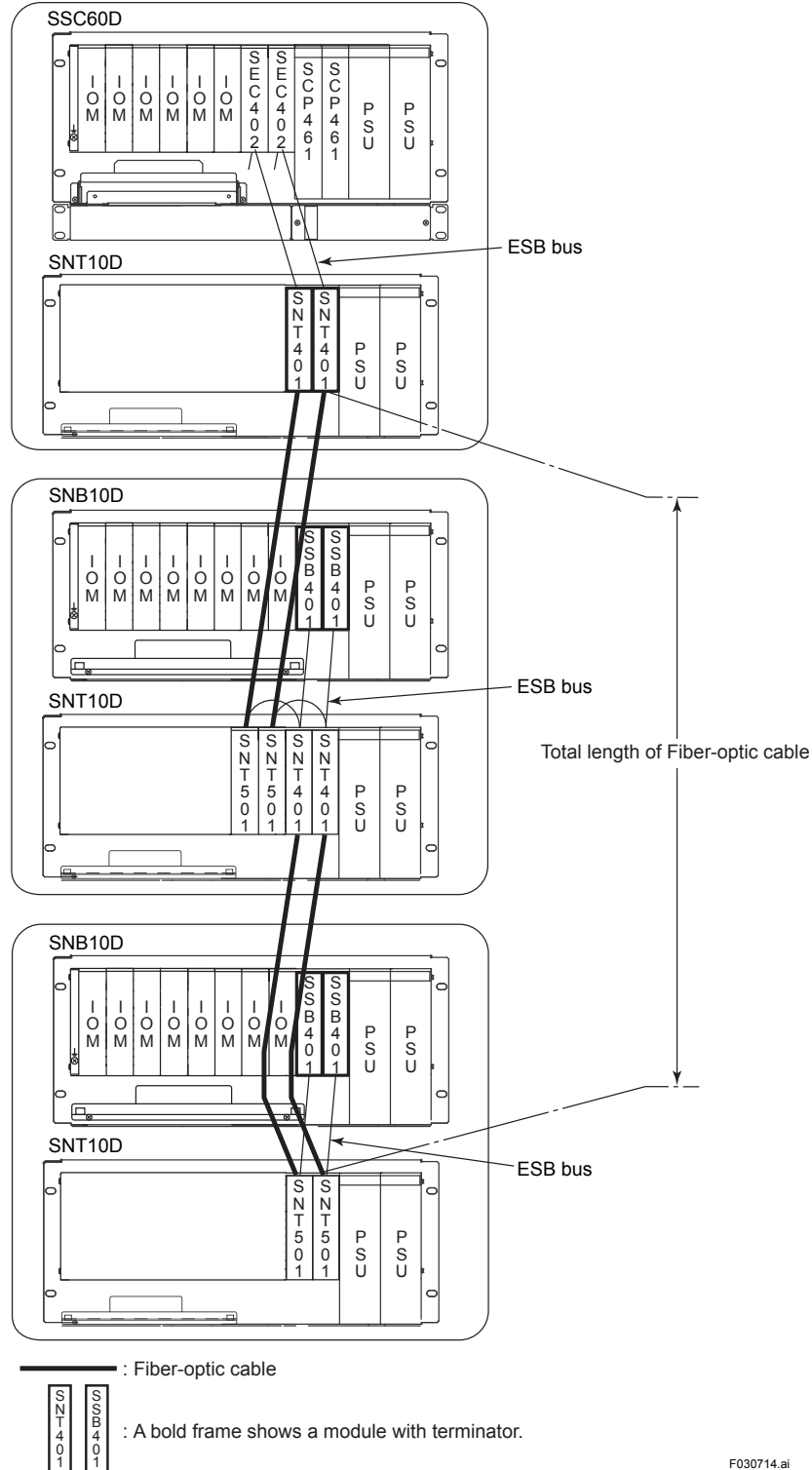


Figure Chain Type Connections: Using SNT10D

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● Total Length of Fiber-optic Cable

The total length of the fiber-optic cables is the sum total of the length of each fiber-optic cable from terminal end to terminal end, connected between the SSC60□/SSC50□/SSC57□/SSC10□ and the SNB10D or the SNT10D for optical ESB bus repeater modules at the extreme end.

Combination of optical ESB bus repeater modules determines the length.

Table total length of fiber-optic cables

Combinations	Each Stage	2 Stage Total (*1)
SNT401 and SNT501	Maximum 5 km	Maximum 5 km (*2)
SNT411 and SNT511	Minimum 5 km	5 km to 50 km
Mix of combination of SNT401 and SNT501 and that of SNT411 and SNT511	Stage with combination of SNT401 and SNT501: Maximum 5 km	5 km to 50 km (*3)

*1: Both star and chain type connections are available.

*2: When SSC60□, SSC50□ or SSC57□ is used for the safety control unit, the maximum extension length is 10 km.

*3: When SSC60□, SSC50□ or SSC57□ is used for the safety control unit, the maximum extension length of the combinations "SNT401 + SNT501" and "SNT411 + SNT511" must be less than 50 km.

● Precautions for Mounting the Optical ESB Bus Repeater Module

Regardless of star or chain type connections, optical bus repeater modules can be used up to two pairs of SNT401 and SNT501, or SNT411 and SNT511 modules.

If using the SNT10D in a high-temperature environment (60 to 70°C), do NOT install optical bus repeater modules in the two slots on the left side of the power supply unit (PSU).

The dummy cover (SDVC01) should be put on the slot which has no optical repeater module.

● Specifications of Fiber-optic Cables Used in Optical ESB Bus Repeater Modules

The table below shows the specifications of the fiber-optic cables used in optical ESB bus repeater modules.

Table Specifications of Fiber-optic Cables Used in Optical ESB Bus Repeater Modules

Item	Specification
Connector	Type LC connector (IEC 61754-20-compliant product)
Cable	Silica-based single-mode fibers (JIS C6835 SSMA-9.3/125, IEC 60793-2-50B1.1)
Number of cores used	Two

Note: When both SNT411 and SNT511 style codes are S1, use an attenuator or something similar of 1-2 dB. When SNT411 or SNT511 style code is S1 or later, use an attenuator or something similar of 3-4 dB.

Fiber-optic cables with the temperature rating of an ambient temperature plus 20 °C or more must be used.

Lay fiber-optic cables according to the manufacturer's cable handling precautions such as allowable bending radius.

Secure and wire the fiber-optic cables so as not to put extra stress on the cable trays in the units listed below:

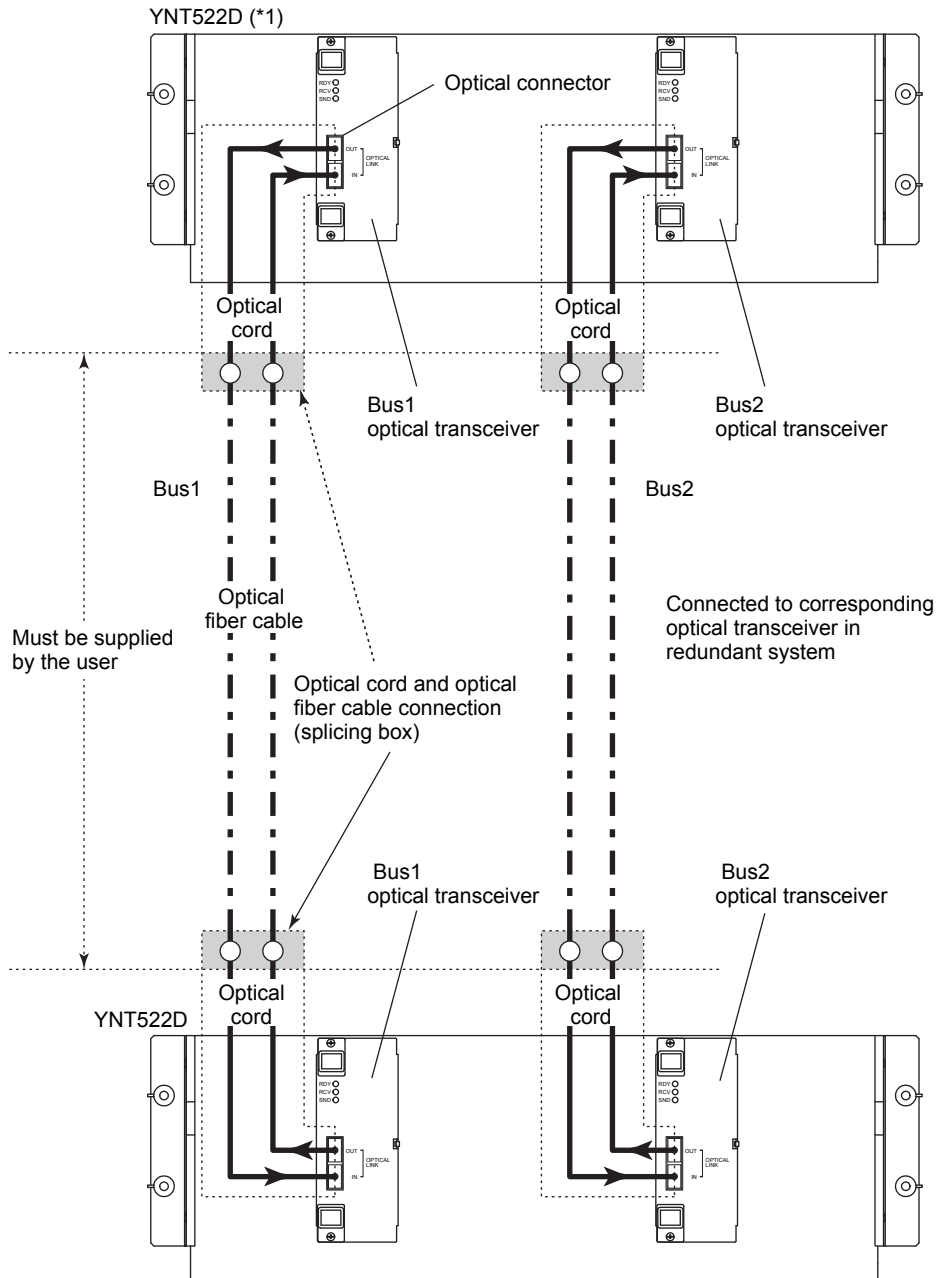
- Safety control unit
- Safety node unit
- Unit for optical bus repeater module

3.8 Connecting Optical Fiber Cable

The optical bus repeater is used in the ProSafe-RS system to convert part of the control bus to optical fiber cables.

The optical fiber cables should be provided by the user.

Connect the optical transceivers of a pair of optical bus repeaters as shown below. (Only the optical transceivers are used in the figure.)



*1: Optical Bus Repeater for Dual-Redundant Bus of CENTUM VP or CS 3000

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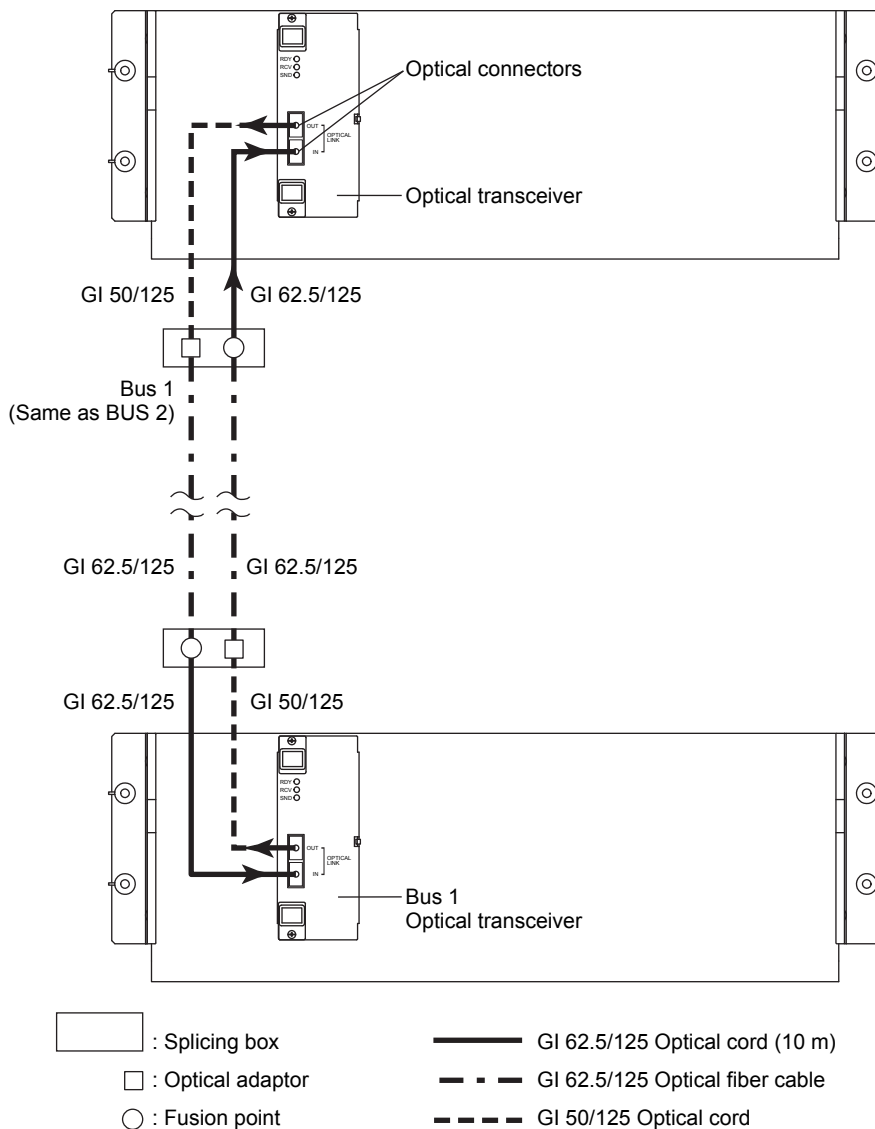
Figure Connecting Optical Cord and Optical Fiber Cable

■ To Use GI 62.5/125 Optical Fiber Cable

It is recommended to use a GI 50/125 optical fiber cable (core diameter 50 μm, clad diameter 125 μm) for an optical bus repeater. However, a general-use GI 62.5/125 optical fiber cable can also be used. Compared to a GI 50/125 optical fiber cable, a large volume of light is emitted by connecting a GI 62.5/125 optical fiber cable to the output connector of an optical bus repeater. If the input connector of an optical bus repeater receives a larger volume of light than the maximum volume of light to be received, data transmission fails.

Therefore, connect a GI 62.5/125 optical fiber cable according to the instructions given below.

1. To restrict a volume of light, you must insert a GI 50/125 optical fiber cable of 10 m in length between the output connector of an optical bus repeater and a GI 62.5/125 optical fiber cable in the field.
2. To connect the two types of cables, use an optical adaptor inside the splicing box located under the floor near a cabinet to install an optical bus repeater.



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Figure Connection of GI 62.5/125 Optical Fiber Cable

4. Installation Specifications

This section summarizes power consumption, in-rush current, fuse (breaker) ratings, durability of parts, and other data for the installation of the ProSafe-RS system.

■ Electrical Specifications

Power consumption (current) and other electrical data are shown below.

Table Electrical Specifications (1/2)

Equipment	Input voltage range		Maximum power consumption/current dissipation (*1), VA, A	Heating value, J/h (*2)
	Voltage, V AC	Frequency, Hz		
SSC60S-S Safety Control Unit (for Vnet/IP)	100-120	50 or 60 ± 3	200 VA	432 x 10 ³ (120 W)
	220-240		230 VA	
	24 V DC		5.5 A	
SSC60S-F Safety Control Unit (for Vnet/IP)	100-120	50 or 60 ± 3	240 VA	540 x 10 ³ (150 W)
	220-240		290 VA	
	24 V DC		7.0 A	
SSC60D-S Duplex Safety Control Unit (for Vnet/IP)	100-120	50 or 60 ± 3	200 VA	432 x 10 ³ (120 W)
	220-240		230 VA	
	24 V DC		5.5 A	
SSC60D-F Duplex Safety Control Unit (for Vnet/IP)	100-120	50 or 60 ± 3	240 VA	540 x 10 ³ (150 W)
	220-240		290 VA	
	24 V DC		7.0 A	
SSC50S-S Safety Control Unit (for Vnet/IP)	100-120	50 or 60 ± 3	200 VA	432 x 10 ³ (120 W)
	220-240		230 VA	
	24 V DC		5.5 A	
SSC50S-F Safety Control Unit (for Vnet/IP)	100-120	50 or 60 ± 3	240 VA	540 x 10 ³ (150 W)
	220-240		290 VA	
	24 V DC		7.0 A	
SSC50D-S Duplex Safety Control Unit (for Vnet/IP)	100-120	50 or 60 ± 3	200 VA	432 x 10 ³ (120 W)
	220-240		230 VA	
	24 V DC		5.5 A	
SSC50D-F Duplex Safety Control Unit (for Vnet/IP)	100-120	50 or 60 ± 3	240 VA	540 x 10 ³ (150 W)
	220-240		290 VA	
	24 V DC		7.0 A	
SSC57S-S Safety Control Unit (for Vnet/IP-Upstream)	100-120	50 or 60 ± 3	200 VA	432 x 10 ³ (120 W)
	220-240		230 VA	
	24 V DC		5.5 A	
SSC57S-F Safety Control Unit (for Vnet/IP-Upstream)	100-120	50 or 60 ± 3	240 VA	540 x 10 ³ (150 W)
	220-240		290 VA	
	24 V DC		7.0 A	

*1: The power consumption in steady operation is indicated in VA (AC) or A (DC). When the power consumption varies according to the installed number of equipment, the power consumption by the maximum number of units installed is listed.

*2: The heating value in steady operation is indicated in Joule/hour. When the heating value varies according to the installed number of equipment, the heating value by the maximum number of units installed is listed.

Table Electrical Specifications (2/2)

Equipment	Input voltage range		Maximum power consumption/current dissipation (*1), VA, A	Heating value, J/h (*2)
	Voltage, V AC	Frequency, Hz		
SSC57D-S Duplex Safety Control Unit (for Vnet/IP-Upstream)	100-120	50 or 60 ± 3	200 VA	432 x 10 ³ (120 W)
	220-240		230 VA	
	24 V DC		5.5 A	
SSC57D-F Duplex Safety Control Unit (for Vnet/IP-Upstream)	100-120	50 or 60 ± 3	240 VA	540 x 10 ³ (150 W)
	220-240		290 VA	
	24 V DC		7.0 A	
SSC10S-S Safety Control Unit	100-120	50 or 60 ± 3	200 VA	432 x 10 ³ (120 W)
	220-240		230 VA	
	24 V DC		5.5 A	
SSC10S-F Safety Control Unit	100-120	50 or 60 ± 3	240 VA	540 x 10 ³ (150 W)
	220-240		290 VA	
	24 V DC		7.0 A	
SSC10D-S Duplex Safety Control Unit	100-120	50 or 60 ± 3	200 VA	432 x 10 ³ (120 W)
	220-240		230 VA	
	24 V DC		5.5 A	
SSC10D-F Duplex Safety Control Unit	100-120	50 or 60 ± 3	240 VA	540 x 10 ³ (150 W)
	220-240		290 VA	
	24 V DC		7.0 A	
SNB10D Safety Node Unit (with maximum number of I/O Modules Installed)	100-120	50 or 60 ± 3	200 VA	432 x 10 ³ (120 W)
	220-240		230 VA	
	24 V DC		5.5 A	
SNT10D Unit for Optical Bus Repeater Module	100-120	50 or 60 ± 3	200 VA	432 x 10 ³ (120 W)
	220-240		230 VA	
	24 V DC		5.5 A	
AVR10D Duplexed V net router	100-120	50 or 60 ± 3	80 VA	158 x 10 ³ (44 W)
	220-240		110 VA	
	24 V DC		1.7 A	
YNT511D or YNT522D Optical Bus Repeater for Redundant Bus	100-120	50 or 60 ± 3	80 VA	160 x 10 ³ (23 W)
	220-240		110 VA	
	24 V DC		2 A	
YNT512D Bus Repeater for Redundant Bus	100-120	50 or 60 ± 3	80 VA	160 x 10 ³ (23 W)
	220-240		110 VA	
	24 V DC		2 A	

*1: The power consumption in steady operation is indicated in VA (AC) or A (DC). When the power consumption varies according to the installed number of equipment, the power consumption by the maximum number of units installed is listed.

*2: The heating value in steady operation is indicated in Joule/hour. When the heating value varies according to the installed number of equipment, the heating value by the maximum number of units installed is listed.

■ In-Rush Current for Each Component

Actual in-rush current data measured for each ProSafe-RS component is listed below.

Table System Equipment Power-On In-Rush Current

Equipment	In-rush current (A) 100 V AC		In-rush current (A) 220 V AC		In-rush current (A) 24 V DC	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
SSC60S-S Safety Control Unit	62	5	124	5	30	23
SSC60S-F Safety Control Unit (Wide range temperature type)	82	9	168	8	40	23
SSC60D-S Duplexed Safety Control Unit	62	5	124	5	30	23
SSC60D-F Duplexed Safety Control Unit (Wide range temperature type)	82	9	168	8	30	23
SSC50S-S Safety Control Unit	62	5	124	5	30	23
SSC50S-F Safety Control Unit (Wide range temperature type)	82	9	168	8	40	23
SSC50D-S Duplexed Safety Control Unit	62	5	124	5	30	23
SSC50D-F Duplexed Safety Control Unit (Wide range temperature type)	82	9	168	8	30	23
SSC57S-S Safety Control Unit	62	5	124	5	30	23
SSC57S-F Safety Control Unit (Wide range temperature type)	82	9	168	8	40	23
SSC57D-S Duplexed Safety Control Unit	62	5	124	5	30	23
SSC57D-F Duplexed Safety Control Unit (Wide range temperature type)	82	9	168	8	30	23
SSC10S-S Safety Control Unit	62	5	124	5	30	23
SSC10S-F Safety Control Unit (Wide range temperature type)	82	9	168	8	40	23
SSC10D-S Duplexed Safety Control Unit	62	5	124	5	30	23
SSC10D-F Safety Control Unit (Wide range temperature type)	82	9	168	8	30	23
SNB10D Safety Node Unit	62	5	124	5	30	23
SNT10D Unit for Optical Bus Repeater Module	62	5	124	5	30	23
AVR10D Duplexed V net router	47	1	48	0.5	10	2
YNT511D and YNT522D Optical Bus Repeaters for Redundant Bus	48	5	112	12	40	4
YNT512D Bus Repeater for Redundant Bus	48	5	112	12	40	4

Input current peak values and waveforms, influenced by input impedance, vary with system configurations, line sharing with other systems, and other factors. The rush current data shown above have been measured under the predetermined conditions (see below). Please note that the values are subject to change.

The power input circuit, with an in-rush current limiting circuit, restrains primary in-rush current, turning any current exceeding the limits to secondary and successive rush current.

- **Measurement Conditions**

Input voltage: 132/264 V AC, 50 Hz, and 24 V DC

Line impedance: Approx. 0.4 ohms (external line impedance and internal impedance)

Turn-on timing: At 50 Hz, 90° or 5 ms after the AC zero-crossing point (60 Hz data are almost the same as the 50 Hz data shown above.)

- **Note**

- The timing of the maximum primary/secondary in-rush current varies with devices.
- The restart in-rush current after a momentary power failure exceeds the above data and its timing is also different.
- For a system composed of multiple pieces of equipment, the in-rush current is normally smaller than the total of the in-rush currents by individual pieces of equipment.

■ Maximum Power Consumption of I/O Modules

Table Maximum Power Consumption of I/O Modules

Model	Name	Maximum current consumption (mA) 5 V DC	Maximum current consumption (mA) 24 V DC
Analog Input/Output Module			
SAI143-S	Analog input module (4 to 20 mA, 16-channel, Module isolation)	320	550
SAI143-H	Analog input module (4 to 20 mA, 16-channel, Module isolation, HART communication)	320	550
SAV144	Analog input module (1 to 5 V/1 to 10 V, 16-channel, Module isolation)	300	140
SAI533	Analog output module (4 to 20 mA, 8-channel, Module isolation, HART communication)	320	300
SAT145	TC/mV input module (16-channel, Isolated Channels)	400	200
SAR145	RTD input module (16-channel, Isolated Channels)	500	200
Digital Input/Output Module			
SDV144	Digital input module (non-voltage contact, 16-channel, Module isolation)	290	140
SDV521	Digital output module (24 V DC/2 A, 4-channel, Module isolation)	280	140
SDV526	Digital output module (100-120 V AC, 4-channel, Module isolation)	500	50
SDV531	Digital output module (24 V DC, 8-channel, Module isolation)	280	140
SDV53A	Digital output module (48 V DC, 8-channel, Module isolation)	290	150
SDV541	Digital output module (24 V DC, 16-channel, Module isolation)	300	150
ESB Bus Interface Module			
SNT401	Optical ESB Bus Repeater Master Module	500	0
SNT501	Optical ESB Bus Repeater Slave Module	500	0
SNT411	Optical ESB Bus Repeater Master Module 5 km - 50 km (for SSC60□, SSC50□, SSC57□)	500	-
SNT511	Optical ESB Bus Repeater Slave Module 5 km - 50 km (for SSC60□, SSC50□, SSC57□)	500	-
Communication Module			
ALR111	Serial communication module (RS-232C, 2-port)	500	-
ALR121	Serial communication module (RS-422/RS-485, 2-port)	500	-
ALE111	Ethernet communication module (1-port) (*1)	500	-
Bus Interface Module			
SEC402	ESB Bus Coupler Module (for SSC60□, 2-Port)	500	-
SEC401	ESB Bus Coupler Module	500	-

*1: ALE111 supported in R3.02.00 or later can be mounted on SSC60□, SSC50□ or SSC57□.

■ Fuse (Breaker) Specifications

Fuse (breaker) ratings are listed below.

Table Fuse (Breaker) Ratings

Equipment	Built-in fuse rating (A/V)	External breaker rating (A/V) (*1)
SNT10D Unit for Optical Bus Repeater Module (for 100 V or 220 V AC power supply)	6.3/250	15/250
SNT10D Unit for Optical Bus Repeater Module (for 24 V DC power supply)	10/250	20/250
SSC60S/SSC60D Safety Control Unit (for 100 V AC power supply)	6.3/250	15/250
SSC60S/SSC60D Safety Control Unit (for 220 V AC power supply)	6.3/250	15/250
SSC60S/SSC60D Safety Control Unit (for 24 V DC power supply)	10/250	20/250
SSC50S/SSC50D Safety Control Unit (for 100 V AC power supply)	6.3/250	15/250
SSC50S/SSC50D Safety Control Unit (for 220 V AC power supply)	6.3/250	15/250
SSC50S/SSC50D Safety Control Unit (for 24 V DC power supply)	10/250	20/250
SSC57S/SSC57D Safety Control Unit (for 100 V AC power supply)	6.3/250	15/250
SSC57S/SSC57D Safety Control Unit (for 220 V AC power supply)	6.3/250	15/250
SSC57S/SSC57D Safety Control Unit (for 24 V DC power supply)	10/250	20/250
SSC10S/SSC10D Safety Control Unit (for 100 V AC power supply)	6.3/250	15/250
SSC10S/SSC10D Safety Control Unit (for 220 V AC power supply)	6.3/250	15/250
SSC10S/SSC10D Safety Control Unit (for 24 V DC power supply)	10/250	20/250
SNB10D Safety Node Unit (for 100 V or 220 V AC power supply)	6.3/250	15/250
SNB10D Safety Node Unit (for 24 V DC power supply)	10/250	20/250
AVR10D Duplexed V net router (for 100 V or 220 V AC power supply)	3.15/250	10/250
AVR10D Duplexed V net router (for 24 V DC power supply)	6.3/250	15/250
YNT511D/YNT522D Optical Bus Repeater for Redundant Bus (100 V AC)	1/250	5/250
YNT511D/YNT522D Optical Bus Repeater for Redundant Bus (220 V AC)	2/250	10/250
YNT511D/YNT522D Optical Bus Repeater for Redundant Bus (24 V DC)	2/250	10/250
YNT512D Bus Repeater for Redundant Bus (for 100 V AC power supply)	1/250	5/250
YNT512D Bus Repeater for Redundant Bus (for 220 V AC power supply)	2/250	10/250
YNT512D Bus Repeater for Redundant Bus (for 24 V DC power supply)	2/250	10/250

*1: Recommended.

■ Durability of Parts

Some hardware components require periodical replacement. As a guideline to the intervals between preventive maintenance checks, the following table lists components with life span of less than 10 years. Users should replace the components indicated by a cross mark X during the preventive maintenance check. For other components, users should not attempt to replace them; contact Yokogawa for replacement.

Note: Random failures within the recommended replacement intervals may occur in some parts.



IMPORTANT

Parts reliability and durability depends much on environment in which they are used. Even within a range of environmental requirements, it is still important to be used in “desirable environment” to enhance reliable operation and durability.

For example, when a device whose temperature range is 5-40 degrees centigrade is used always in 35 degrees centigrade, its estimated failure rate is generally almost doubled and durability decreases by almost half, compared to the same device used in 25 degrees centigrade.

If there are corrosive gases; moreover, they promote corrosion of contact parts and printed circuit boards and their durability is shortened, compared to those in cleaner atmosphere. If there is more dust; in addition, we have to shorten the cleaning and replacement cycle for filters.

● Control Devices (SSC60□, SSC50□, SSC57□, SSC10□ and SNB10D)

Component	Part number	Recommended replacement period	Replacement by user	Remarks
Power Supply Module (100-120 V AC power supply)	SPW481	8 years	X	Average ambient temperature of 40°C or lower
Power Supply Module (220-240 V AC power supply)	SPW482	8 years	X	Average ambient temperature of 40°C or lower
Power Supply Module (24 V DC power supply)	SPW484	8 years	X	Average ambient temperature of 40°C or lower
Battery Pack	S9185FA	3 years	X	Average ambient temperature of 30°C or lower (*1)
		1.5 years	X	Average ambient temperature of 40°C or lower (*1)
		9 months	X	Average ambient temperature of 50°C or lower (*1)
Aluminum Electrolytic Capacitor	—	8 year	—	For SPW481, SPW482, and SPW484 power supply modules and power supply units for fan units (S9159FA and S9160FA) Average ambient temperature of 40°C or lower
Built-in Fuse	S9109VK	8 years	—	For SPW481 power supply module
	S9109VK	8 years	—	For SPW482 power supply module
	A1546EF	8 years	—	For SPW484 power supply module
Fan Unit	AIP602	4 years	X	Average ambient temperature of 60°C or lower
	A1159EM	4 years	X	Fan only Average ambient temperature of 60°C or lower

X: Can be replaced.
—: Cannot be replaced.

*1: Including temperature during storage.

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

Component	Part number	Recommended replacement period	Replacement by user	Remarks
Power Supply Module (100 - 120 V AC power supply)	SPW481	8 years	X	Average ambient temperature of 40°C or lower
Power Supply Module (220 - 240 V AC power supply)	SPW482	8 years	X	Average ambient temperature of 40°C or lower
Power Supply Module (24 V DC power supply)	SPW484	8 years	X	Average ambient temperature of 40°C or lower
Aluminum Electrolytic Capacitor	–	8 years	–	For SPW481, SPW482, and SPW484 power supply module Average ambient temperature of 40°C or lower
Built-in Fuse	S9109VK	8 years	–	For SPW481 power supply module
	S9109VK	8 years	–	For SPW482 power supply module
	A15456EF	8 years	–	For SPW484 power supply module
SFP optical module (*1)	–	–	–	Recommended replacement period – every four years if in a G3 environment

X: Can be replaced.

–: Cannot be replaced.

*1: Applies to SNT401, SNT411, SNT501, and SNT511.

● Control Devices (AVR10D)

Part names	Part numbers	Recommended replacement cycle	Replacement by user	Remarks
Aluminum Electrolytic Capacitor	–	8 years	–	For PW441, PW442, PW444 Average ambient temperature of 40°C or lower
Built-in power fuse	S9109VK	8 years	–	For PW441, PW442, PW444

–: Cannot be replaced.

● Communications Devices (YNT511D/YNT522D Optical Bus Repeater for Redundant Bus, YNT512D Bus Repeater for Redundant Bus)

Component name	Part number	Recommended replacement period	Replacement by user	Remarks
Power Supply Module (100-120 V AC power supply)	PW501	8 years	X	Average ambient temperature of 40°C or lower
Power Supply Module (220-240 V AC power supply)	PW502	8 years	X	Average ambient temperature of 40°C or lower
Power Supply Module (24 V DC power supply)	PW504	8 years	X	Average ambient temperature of 40°C or lower
Fuse	A1361EF	3 years	X	1 A for PW501
	A1349EF	3 years	X	2 A for PW502
	A1363EF	3 years	X	2 A for PW504

X: Can be replaced.

5. Post-installation Inspection and Environmental Preservation

■ Post-installation Inspection

Upon the completion of installation of the instrumentation, before turning on the power inspect the items listed below to avoid contaminating the system with dust or condensation.

Table Inspection before Power On

	Inspection items (daily inspection/maintenance items)
Environment	<input type="checkbox"/> No water intrusion from cable ducts. <input type="checkbox"/> No wind/rain blowing in <input type="checkbox"/> Air-conditioned <input type="checkbox"/> Cable ducts and cabinet bottoms covered to prevent entry of wind, dust, moisture <input type="checkbox"/> Cabinets and surroundings cleaned <input type="checkbox"/> No dust entering from air vents <input type="checkbox"/> Free of salty, ferrous, corrosive gas <input type="checkbox"/> No direct sunlight on equipment
Equipment	<input type="checkbox"/> No condensation or traces on cabinet interior/exterior <input type="checkbox"/> No discoloration or rust on cabinet interior/exterior <input type="checkbox"/> No condensation or traces on modules (disconnect cards on the upper, middle, and lower stands, and left and right sides of the cabinet to check that there is no condensation on the modules or defects anywhere in the cabinet.) <input type="checkbox"/> No dust remaining inside cabinet

It is recommended that you turn on the power in the presence of Yokogawa when turning it on first.

■ Post-installation Environment Preservation

The following precautions should be taken to preserve the proper operating environment after the system has been installed:

- Seal the pits if they are shared by equipment in other rooms, preventing entry of dust and moisture from the other rooms.
- Seal all cable ducts of equipment and building with putty upon completion of cabling.
- Always turn on air conditioner. Turning it on/off may cause condensation inside equipment. If you turn on the power of an air conditioner after a long stop, turn on the air conditioner first and the system. Otherwise condensation may occur.
- Monitor and record the room ambient temperature and humidity. To maintain the reliability of the equipment, be sure to remove the cause if they fluctuate violently.
- Note that leaving exits and entrances open during installation, or leaving open cable ducts while pulling cables, may result in condensation.

Revision Information

- Title : ProSafe-RS Installation Guidance
- Manual No. : TI 32S01J10-01E

Mar 2005/1st Edition

Newly published

Nov 2005/2nd Edition

- 1.6 "Measures against EMI" added
- 2.5.2 YNT511S, YNT512S, YNT521S deleted
Model YNT521 changed to YNT522
Instruction for Providing Space for Heat Radiation added
"Installation Direction" added
- 3.2 YNT511S, YNT512S and YNT521S deleted
Model YNT521 changed to YNT522
- 3.4 Model YNT521D changed to YNT522D
- 3.6.4 KS1 corrected to AKB331
- 3.6.5 Section added
- 3.6.6 Section added
- 3.8 Model YNT521D changed to YNT522D
- 4. YNT511 corrected to YNT511D
Model YNT521D changed to YNT522D
SND10D corrected to SNB10D

Aug 2006/3rd Edition/R1.02 or later

General Suffix code added to section of I/O module models in each table

- 1.2 Operating temperature added to temperature/humidity
Details of applied standards related to safety revised
Standard for Hazardous Locations added to applied standards
Value of crest factor revised
Comment on excluding SRM53D/SRM54D from products for corrosive gas added to remarks
- 1.3 Figure of System Operating Voltage Range corresponded to revised crest value
- 1.7 SAI143-H03, SAI533-H□3, SDV541-S□3, SNT10D, SNT401 and SNT501 added to GS
Environment-compatible Products
SDV531-S13 revised to SDV531-S23
- 2.5.2 SNT10D added to Rack Mounting
SNT10D added to functional ground in terminal connection system
- 3.4 SNT10D newly added
- 3.6 Figure of optional prevention pin of false insertion added to figure of terminal connection
- 3.6.2 SAI143-H03, SAI533-H□3, SDV541-S□3 added to I/O Modules and Signal Cable Connection
SDV531-S13 revised to SDV531-S23
Item of Option code/No option code added to Yokogawa-specific Cable
- 3.6.3 SAI143-H03 added to Signal Name and Type of Input in Analog Input Modules
Connecting I/O Module to Relay Boards newly added and SDV531, SRM53D, SDV541 and SRM54D added
- 3.6.4 Calculation formula revised (SDV541 added)
For terminal boards connection,
Section for SDV531-S13/SDV531-S23 separated from that for SDV531-S33/SDV541-S33
Section for SDV541 used with single pressure clamp terminal block newly added
- 3.7 Title of safety control unit added below V net Cables (between 10BASE-5 and 10BASE-2)
Interconnection Example. Section for Optical ESB Bus Repeater newly added
- 4. SNT10D added in Table Electrical Specifications, wide range temperature type added to equipment SSC10□-F
SNT10D added in Table System Equipment Power-On In-Rush Current, Duplexed Safety Control Unit added to equipment title of SSC10D-F
SAI143-H03, SAI533-H03 and SDV541-S13 added in Table Maximum Power Consumption of I/O Modules
SNT10D added in Table Fuse (Breaker) Ratings. Equipment title YNT522 revised to YNT511D/YNT522D, YNT512 to YNT512D. Optical Bus Repeater revised to Dual-redundant Optical Repeater

Communications Devices YNT511/YNT522 and YNT512 revised to YNT511D/YNT522D and YNT512D. Optical Bus Repeater revised to Dual-redundant Optical Repeater
Table of Unit Devices (SNT10D) added to Table of Durability Parts

Dec. 2007/4th Edition/R1.03 or later

General Description of isolated I/O module added

- 1.2 Scribal error in the applicable standard corrected
- 1.7 SDV521-S33, SDV531-L added to G3 Environment-compatible Products
- 2.5.2 Note related to space for heat radiation in rack-mount devices added
- 3.1 Note on cable connections added
- 3.6.2 SDV521-S33, SDV531-L33 added to Signal Cable Connection for I/O Modules
- 3.6.3 Figure of wiring check devices revised
The following three sections are moved to ProSafe-RS Outline of I/O Modules (GS 32S06K20-01E) because they are included in the general specifications.
- 3.6.4 Limitations on Digital Output Module Connections
- 3.6.5 Limitations on Digital Input Module Connections
- 3.6.6 Limitations on Length of Field Wiring Cable When Field Wiring Diagnosis Is Enabled
- 3.7 Limitations on ESB bus cable length added
Section "Optical ESB Bus Repeater" revised to "Optical ESB Bus Repeater (Using SNT401, SNT501)"
Example of not using SNT10D added to Example of Star Connection of Optical ESB Bus Repeater
otal length of Fiber-optic cable revised
"Recommended cable" in the table revised to "Cable"
- 4 SDV521-S33, SDV531-L added to Table of Maximum Power Consumption of I/O Modules

Jun. 2008/5th Edition

- 1. "1.8 Compliance with Marine Standards" added
- 1.2 Electric Field Strength (Electric Wave Condition) revised
Applied Standards revised

Dec. 2008/6th Edition/R2.02 or later

- 1.2 Safety standards and EMC conformity standards in the applied standards revised
- 1.7 SDV526 added
- 3.5 Description of the cabling for AKB652 added
- 3.6.2 SDV526 added
- 3.6.3 Example of connection to SWD2D added
- 4. SDV526 added

Jan. 2010/7th Edition/R2.03 or later

- 1.7 SDV53A added
- 1.8 Part Numbers of Dummy plates revised
- 2.5.2 Description of Depth of Cabinet added
- 2.5.4 VF702 changed from VF701
- 3.6.2 SDV53A added
- 3.6.3 Examples of connection to SED3D and SED4D added
- 3.7 VF702 changed from VF701
- 4. SDV53A added

Aug. 2010/8th Edition

- 1.8 Descriptions of "Compliance with Marine Standards" are added.
Locations of ferrite cores are changed.
- 3.5 Caution for field wirings using multicore cables is added.

Jun. 2011/9th Edition

Cautions for Safely Applying the Device

- Changed from CSA 60950-1 to CSA C22.2 No.60950-1.
- Changed from CSA 61010-1 to CSA C22.2 No.61010-1.
- UL60950-1 and IEC60950-1 added.
- 1.2 SBM54D added in Table Installation Environment Specifications.
- 1.3 The description of "For stable operation, a high quality power supply is required." deleted.
The description of "digital power analyzer WT series" in TIP added.
The description "or shut down" in In-Rush Current section deleted.

- 2.5.2 “Terminal board and relay board mounting directions”,
“Remarks for mounting on a wall surface” and “Remarks for installing to a DIN rail” added.
“Caution of the Power Source for the Load of SBM54D” and “Caution of the Digital Output module when SBM54D is used” added.
- 3.5 The description of “This important notice is applied for digital input module SDV144 style code S1 to S3” added in Channel Fuse section.
The information on Pressure Clamp Terminal (for Pressure Clamp Terminal Block) for SBA4D, SBD2D, SBD3D, SBD4D and SBM54D added.
- 3.6.3 The “Example of Connection” for SBA4D, SBD2D, SBD3D, SBD4D and SBM54D added.
- 4. Changed the “Replacement by user” from “Cannot be replaced” to “Can be replaced.” on SPW481, SPW482 and SPW484.

Aug. 2011/10th Edition

- 1.7 Vnet/IP related products (SSC60□, SSC50□, SEC402, SNT411, SNT511, and AVR10D), SAT145, SAR145, SBT4D, SBR4D and AEPV7D added in G3 Environment Compatible Products.
- 1.8 Vnet/IP related products (SSC60□, SSC50□, SEC402, SNT411, SNT511, VI701, VI702 and AVR10D) added in Marine Standard-compliant ProSafe-RS Components and Installation of Ferrite Core.
- 2.5.2 Vnet/IP related products (SSC60□, SSC50□ and AVR10D) and AEPV7D added in rack-mount devices.
- 2.5.4 Vnet/IP related product (VI702) added.
- 3.2 Vnet/IP related products(SSC60□, SSC50□ and AVR10D) and AEPV7D added.
- 3.4 Vnet/IP related product (SSC60□) added.
An example of installing AEPV7D in a general-purpose cabinet added.
AVR10D Duplexed V net Router added.
- 3.5 Terminal processing of pressure clamp terminal for SBT4D and SBR4D added.
Vnet/IP related products (SSC60□ and SSC50□) added.
I/O cable with signal cable interface adapter cabling for AKB611 added.
- 3.6.2 Signal cable connections for SAT145 and SAR145 added.
- 3.6.3 Example connection for SBT4D and SBR4D added.
- 3.7.1 Vnet/IP network cabling added.
- 3.7.2 V net network cabling remarked.
- 3.7.3 ESB Bus rearranged.
- 3.7.4 Optical ESB Bus Repeater merged with Vnet/IP related products.
- 4 Electrical specification and In-rush current for Vnet/IP related products added.
Maximum power consumption for SAT145, SAR145, SNT411, SNT511 and SEC402 added.
Fuse specification for Vnet/IP related products added.
Durability of parts for AVR10D added.

Dec. 2011/11th Edition

Trademark changed from ProSafe-RS to ProSafe.

- 1.2 Vibration condition changed on control room environment.
Description about breakers added in accordance with safety requirement.
Korea KC marking added in EMC conformity standards.
- 1.4 PL-PEM added in insulating sheet material.
- 2.5.2 Description of (for V net) added for SSC10S and SSC10D
Changed the description from isolation bushing to insulating bushing.
- 3.1 IEC 60227-3 added as signal cable standards.
- 3.6.3 Clerical error correction for example of connection to SBR4D.

Mar. 2012/12th Edition

- 2.5.2 Total number of I/O nodes in Rittal cabinet corrected.
- 3.7.3 Total number of SNB10D corrected.

June 2012/13th Edition

Cautions for Safely Applying the Device

- Caution of Wiring I/O Cables corrected.
- Caution of Connected Devices added.
- 1.8 Marine Standard-compliant ProSafe-RS Components added.
Applicable noise filter added.

Aug. 2012/14th Edition

- 1.2 Correct Temperature of Normal operation in Table Installation Environment Specifications.
- 3.6.2 Add AKB651-M□□□ into SDV531-L33, SDV53A-S33 and SDV541-S33 for Signal Cable Connections.
Add AKB651-M□□□/DV53L, AKB651-M□□□/DV53A and AKB651-M□□□/DV541 as Yokogawa-specific Cable Option code.

Nov. 2012/15th Edition

- 1.2 Revise EMC Conformity Standards
- Revise notes of Temperature in Table Installation Environment Specifications
- 1.7 Add ALR121-□□B, ALE111-□□1 and the high-density installation type for G3 Environment-compatible Products
- 1.8 Add comment on excluding the high-density installation type and ALR121-S0B from Marine Standard-compliant ProSafe-RS Components
- 3.4 Add Ground Cable Connection for Terminal Board and Relay Board
- 3.6.2 Delete AKB331-M□□□/SDV531 for SDV531-S33
Add ALE111
- 4 Add ALE111 and the high-density installation type

Apr. 2013/16th Edition

- General Clerical error correction
- 1.2 Revise description of Applied Standard
- 1.7 Revise models of G3 Environment-compatible Products
- 3.6.2 Revise models of Signal Cable Connection
- 4 Revise models of Maximum Power Consumption of I/O Modules

Aug. 2013/17th Edition

- 1.2 Revise Measurement Categories
Revise safety Standards
Revise Withstanding voltage of Installation Environment Specifications
- 1.8 Revise SAI143 of Marine Standards
- 3.1 Add caution for temperature rating of cables
- 3.4 Add terminal screw size
- 3.7.4 Add caution for temperature rating of fiber-optic cables

Sep. 2013/18th Edition

- Cautions for Safely Applying the Device
Add Tightening Torque of Screws
- General Add SSC57S/SSC57D
- 3.7 Revise Connecting Bus Cable

Oct. 2014/19th Edition

- General "Protective grounding terminal" was changed to "Protective conductor terminal"
(Based on IEC 61010-1).
"Grounding bus" was changed to "Protective grounding system".
"FG" was changed to "Functional grounding terminal".
"100 ohm or less" and "10 ohm or less" were changed to "Protective grounding system".
Clerical error correction
- Safety Precautions
Revise description of Protective conductor terminal and Functional grounding terminal
Add caution of Earth Wiring
- 1.2 Add EAC Marking in Applied Standards
Change from C-Tick Marking to RCM
Add notice of Protective grounding system in Safety Standards
Revise Grounding in Table Installation Environment Specifications
- 1.4 Revise Grounding Circuit
Delete Grounding Grouped Cabinets
Revise Grounding with Other System
Delete Grounding Side-by-side Cabinets
- 1.5.1 Revise Grounding with Lightning Arresters

-
- 1.8 Add SSC57 and ALE111 in Marine Standard-compliant ProSafe-RS Components
 - Revise models of noise filter
 - 2.4 Add reference of External Dimensions (SD)
 - 3.2 Delete Three-prong Plug Connection

Dec. 2014/20th Edition

Safety Precautions

- Precautions were added.
- 1.7 ALR121-□□3 and ALE111-□□3 were added.
- 1.8 Description for ALR121 was revised.

Apr. 2015/21st Edition

General

- The Vnet/IP parts of SSC60 in the figure is changed to a simple square.
- 2.5.2 "Installation Guideline for ACB41 cabinet" was deleted.
- "Article 2.5.3 Installation Guideline for Cabinet" was separated from Article 2.5.2.
- "Installation Guideline for Rittal Cabinet (Up to 14 Nodes)" was added.

Aug. 2015/22nd Edition

Safety Precautions

Trade Mark

- Symbol was added
- Description was revised.
- 1.2 Description of Installation Specification was revised.
- EN61010-2-201, EN60825-1, and IEC 61326-3-1 were added.
- Specification requirement of cabinet was revised.
- 1.3 Cabling requirement was added.
- 1.9 Marine Standards. Model of Noise cut transformer was added.
- 2.3 Ambient Temperature for storage was added.
- 2.5.2 The requiremnt items for Cabinet was added.
- Description of Providing Area Servicing was added.
- 3.1 Bending radius of the cable was added.
- 3.2 Schematic symbol was revised.
- 3.4 The description of AVR10DR Terminal was added.
- 3.5 Bending radius radiation was added.
- 3.6.2 Bending radius radiation was added.

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