Technical Information

ProSafe-RS
Installation Guidance

TI 32P01J10-01EN

YOKOGAWA

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TI 32P01J10-01EN

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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 caution is required when handling the equipment. This symbol is labeled on the Product to indicate the possibility of dangers such as electric shock on personnel and equipment, and also indicate that the user must refer to the User's Manuals for necessary actions. In the User's Manuals, this symbol is used together with a signal word "WARNING" or "CAUTION" at the locations where precautions for avoiding dangers are described.

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.

WARNING

Indicates precautions to avoid a danger that may lead to death or severe injury.

CAUTION

Indicates precautions to avoid a danger that may lead to minor or moderate injury or property damage.

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

WARNING

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

WARNING

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

IMPORTANT

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

IMPORTANT

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

Fuse Replacement

WARNING

- 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

- ProSafe, CENTUM, PRM, STARDOM, FAST/TOOLS, Exaopc, FieldMate, and Vnet/IP are either registered trademarks or trademarks of Yokogawa Electric Corporation.
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CONTENTS

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.

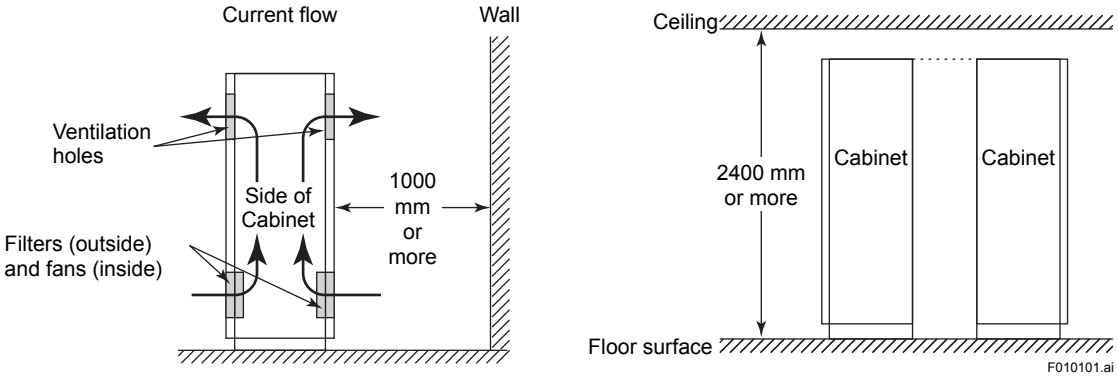

Figure Wall Clearance and Ceiling Height

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 ±10°C/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/s^2 or less.

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

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

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/m^3. Minimize corrosive gas such as hydrogen sulfide (H_2S), sulfur dioxide (SO_2), chlorine, and conductive dust such as iron powder and carbon.

The allowable content of H_2S, SO_2, 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 Altitude
N-IO node (*1) (*2) : 3000 m or less
Other than N-IO node : 2000 m or less

Installation category based on IEC 61010-1 (*3)

Category I

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

Category II

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

Pollution degree based on IEC 61010-1: 2 (*4)

*1: For more information about the device, refer to General Specification (GS).
*2: For S2BN4D and S2BN5D, the installation altitude is 2000 m or less.
*3: 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.
*4: 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	IEC/EN/CSA 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.

Conformity 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 GS 32P01B60-01EN “ProSafe-RS Standards Compliant Models”.

Functional Safety Standards

IEC 61508, IEC 61511-1 and IEC 62061

Programmable Controllers Standards (*1), (*2), (*3)

IEC 61131-2

Application Standards (*1)

EN 54-2, EN 298 (*3), (*4), EN 50156-1, NFPA 72, NFPA 85, and NFPA86

Safety Standards (*5), (*6), (*7), (*8)

[CSA]
CAN/CSA-C22.2 No.61010-1, CAN/CSA-IEC 61010-2-201, CAN/CSA-C22.2 No.61010-2-030

[CE Marking] Low Voltage Directive
EN 61010-1, EN 61010-2-201, EN 61010-2-030, EN 60825-1

[EAC Marking]
CU TR 004

*1: A lightening arrester or the like is required to meet this surge immunity standard.
*2: 24 V DC and 48 V DC field power to DI and DO shall not be provided directly from a DC distribution network. The field power supply cable length must be 30 m or less.
*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 to DI and DO shall not be provided directly from a DC distribution network. The field power supply cable length must be 10 m or less.
*5: 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.
*6: Measurement inputs of this equipment are applied to Measurement category I for IEC/EN/CSA 61010-1:2001 and O (Other) for IEC/EN/CSA 61010-2-030.
*7: 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
*8: The ground suitable for the power distribution system in the country or region has to be used for protective grounding system.

EMC Conformity Standards (*1), (*2), (*3)

[CE Marking] EMC Directive
EN 55011 Class A Group1 (*4)
EN 61000-6-2
EN 61000-3-2 (*5)
EN 61000-3-3
EN 61326-1 (*6)

[RCM]
EN 55011 Class A Group1 (*4)

[KC Marking]
Korea Electromagnetic Conformity Standard

[EAC Marking]
CU TR 020

[Functional Safety]
IEC 61326-3-1 (*6) (*7)

*1: A lightening arrester or the like is required to meet this surge immunity standard.
*2: 24 V DC and 48 V DC field power to DI and DO shall not be provided directly from a DC distribution network. The field power supply cable length must be 30 m or less.
*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: A Class A hardware device is designed for use in the industrial environment. Please use this device in the industrial environment only.
*5: An external device such as a power unit with harmonic current neutralizer and an active harmonics conditioner must be connected to meet this harmonic current emission standard. See Section 1.3 “Power Supply System”.
*6: The base plate for barrier S2BN4D and S2BN5D conforms to the EMC standards with conditions. For details, refer to GS 32P06P10-01EN “Base Plates for Barrier (for N-IO)”.
*7: Where the system power uses 24 V DC (S2PW504), use an external uninterruptible power supply (UPS).

Standard for Hazardous (Classified) Locations

[ATEX Type “n”]
[IECEx Type “n”]
[Canada (FM) Non-Incendive]
[US (FM) Non-Incendive]

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)
LR (Lloyd’s Register)
DNV GL

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 (1/2)

Item		Specifications			Remarks
		Safety Control Unit (SCU)	Safety Node Unit, Unit for Optical Bus Repeater Module	N-IO Node (*1)	
Temperature	Normal operation	-20 to 40ºC (*2) (standard type SCU for Vnet/IP)	-20 to 70ºC (*3) (*4)	-40 to 70ºC (*5) (*6)	
		-20 to 70ºC (*3) (wide range temperature type SCU for Vnet/IP)			
	Transportation/storage	–40 to 85°C			
Humidity	Normal operation	5 to 95% RH (non-condensing)			5 to 85% RH when the SRM53D/ SRM54D/SBM54D is mounted.
	Transportation/storage	5 to 95% RH (non-condensing)			
Temperature change	During operation	Within ± 10ºC/h			
	Transportation/storage	Within ± 20ºC/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%		24 V DC: –15% 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 & grounding terminals
Insulation resistance		20 M ohms at 500 V DC			Between power & grounding 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			

*1: An N-IO node consists of S2NN30D, S2BN1D, S2BN4D, S2BN5D, S2MMM843, S2MDV843, S2KPB10, and S2KLF10.
*2: 0 to 40°C when ALR111-S□1, ALR121-S□1, or ALE111-S□1 is mounted.
*3: 0 to 60°C when ALR111-S□1, ALR121-S□1, or ALE111-S□1 is mounted.
*4: -20 to 50°C when S2LP131-S□1 is mounted.
0 to 50°C when S2LP131-S□1 and ALR111-S□1, ALR121-S□1, or ALE111-S□1 are mounted.
*5: For S2BN4D and S2BN5D, the ambient temperature must be from -20 to 60°C.
*6: When the S2NN30D Node Interface Unit is used with an optical ESB bus with the following specifications at an altitude of 2000 m or higher, the ambient temperature range is -40 to 60°C.
S2NN30D-□□□□□01□□ S2NN30D-□□□□□02□□ S2NN30D-□□□□□10□□
S2NN30D-□□□□□11□□ S2NN30D-□□□□□12□□ S2NN30D-□□□□□20□□
S2NN30D-□□□□□21□□ S2NN30D-□□□□□22□□

Table Installation Environment Specifications (2/2)

Item		Specifications			Remarks
		Safety Control Unit (SCU)	Safety Node Unit, Unit for Optical Bus Repeater Module	N-IO Node (*1)	
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)		Amplitude: 17.5 mm 5 Hz ≤ f < 8.4 Hz	
		Acceleration: 4.9 m/s^2 (9 Hz to 150 Hz)		Acceleration: 4.9 m/s^2 (8.4 Hz ≤ f < 150 Hz)	
	Non-continuous vibration	Amplitude: 3.5 mm (5 Hz to 9 Hz)		Amplitude: 3.5 mm 5 Hz ≤ f < 8.4 Hz	
		Acceleration: 9.8 m/s^2 (9 Hz to 150 Hz)		Acceleration: 9.8 m/s^2 (8.4 Hz ≤ f < 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 (above sea level)		2000 m or less		3000 m or less (*6)	

*1: An N-IO node consists of S2NN30D, S2BN1D, S2BN4D, S2BN5D, S2MMM843, S2MDV843, S2KPB10, and S2KLF10.

*6: When the S2NN30D Node Interface Unit is used with an optical ESB bus with the following specifications at an altitude of 2000 m or higher, the ambient temperature range is -40 to 60°C.

S2NN30D-□□□□□01□□ S2NN30D-□□□□□02□□ S2NN30D-□□□□□10□□
S2NN30D-□□□□□11□□ S2NN30D-□□□□□12□□ S2NN30D-□□□□□20□□
S2NN30D-□□□□□21□□ S2NN30D-□□□□□22□□

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.

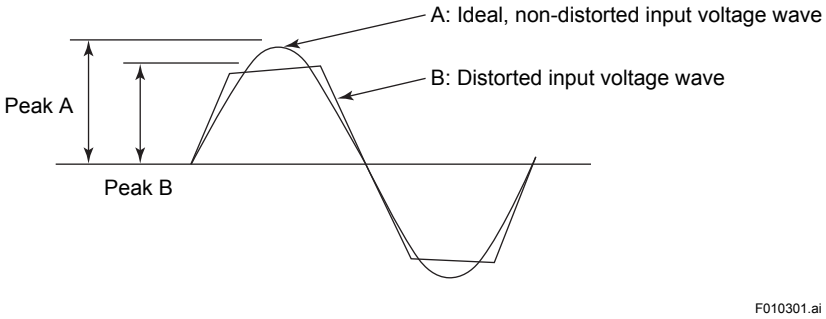


Figure Distorted Input Voltage Waveform

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.

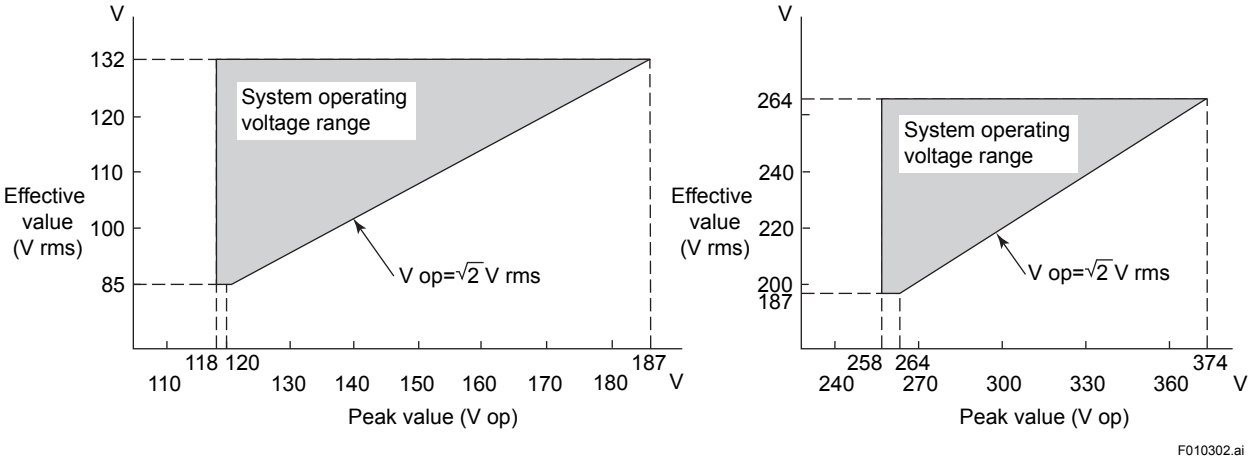


Figure System Operating Voltage Range

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.

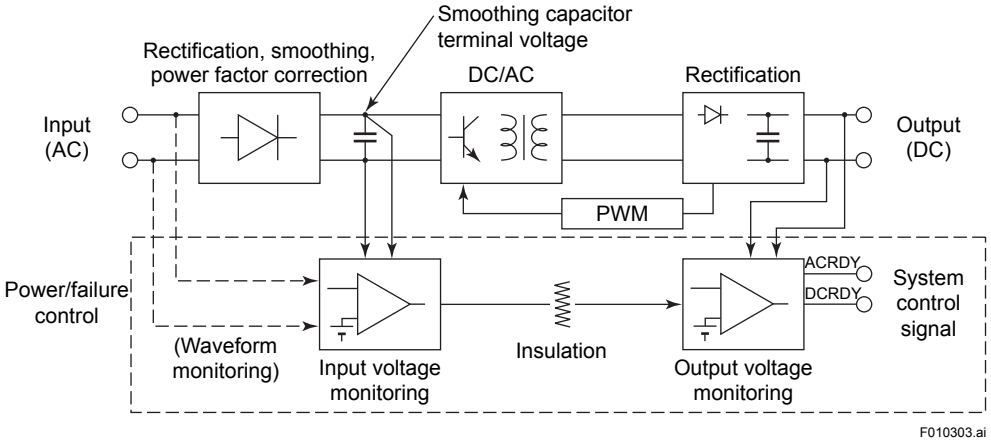


Figure Power Circuit Diagram of Safety Control Unit

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.

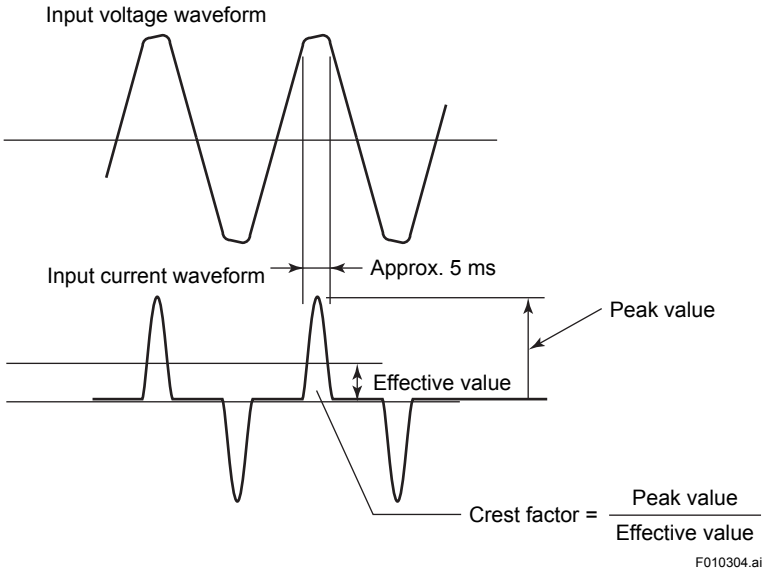


Figure Input Voltage and Input Current Waveforms

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.

Notes for the field power supply unit of N-IO

As described in GS 32P06K20-01EN "Base Plate (for N-IO)", field power supply (24 V DC) is required when Digital output function of the base plate with disconnecting terminal (Model S2BN1D) is utilized.

When using the node interface unit S2NN30D-□4□□□□□□□ (24 V DC power input type) in combination with S2BN1D and the power supply unit as shown on the left side of the figure below, it is recommended to separate the power supply as shown in right.

This is because the rapid change of the field output load of S2BN1D may causes an influence on 24 V power line, it is worried that the input voltage rating of S2NN30D will not be satisfied.

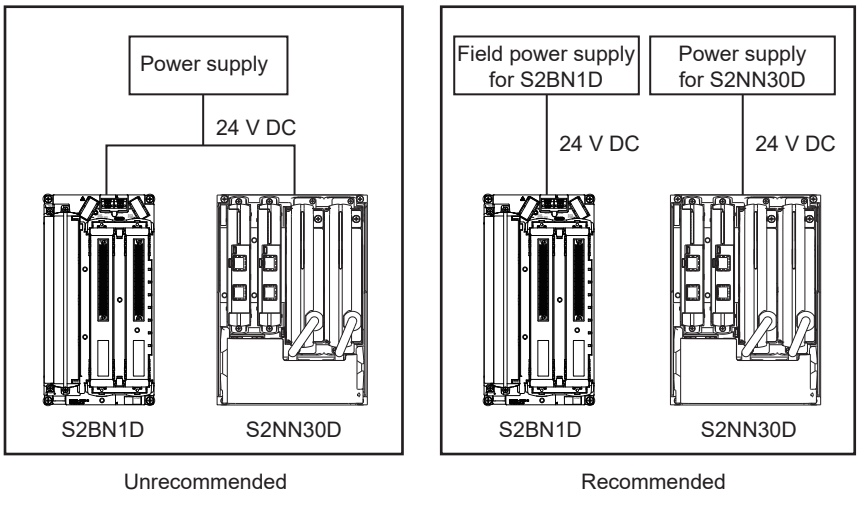


Figure Connection of the field power supply of S2BN1D

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.”

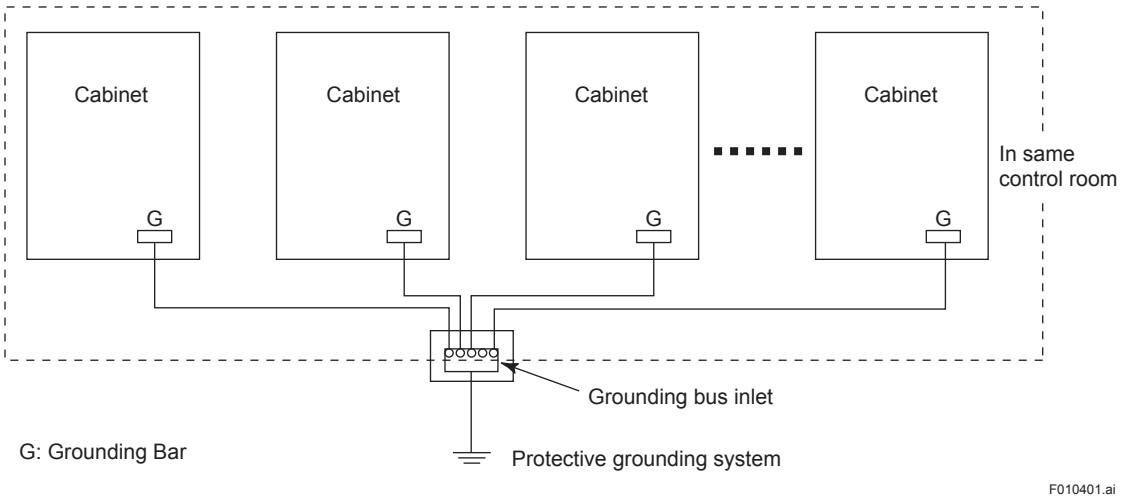


Figure Grounding connected to a single grounding bus inlet

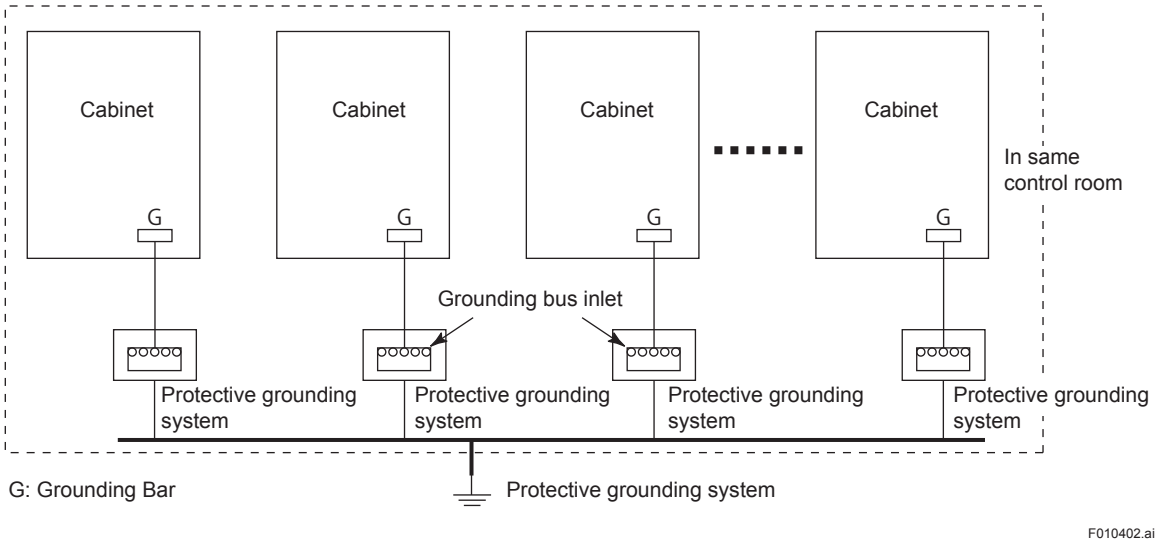


Figure Grounding connected to each grounding bus inlet

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.

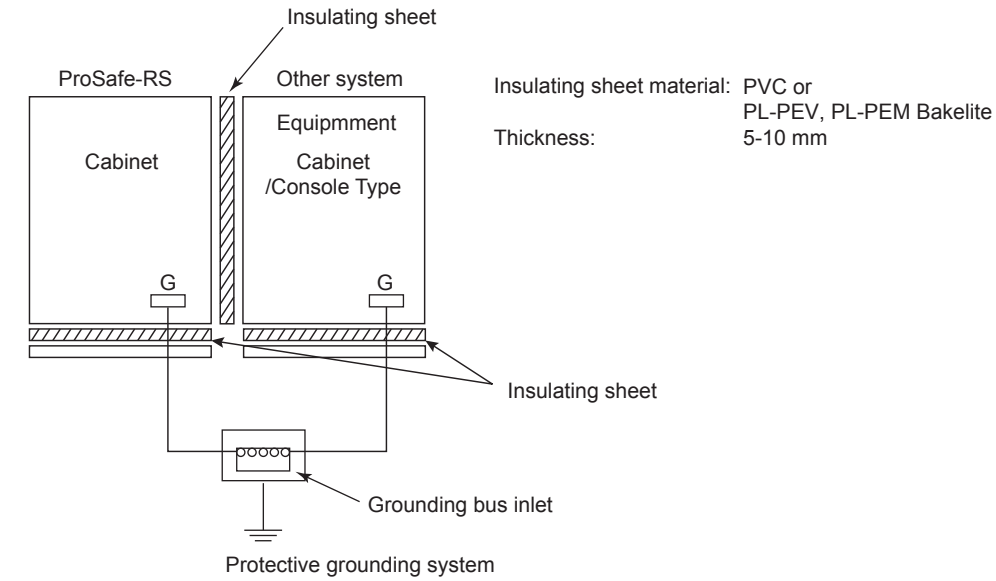


Figure Grounding Using Insulating Sheets

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)	• CRT display instability, distortion, color shift, color fringing. • Destroys magnetic/flexible disk data.	• 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	• Equipment maloperation. • Interference with signals.	• 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	• Interference with signals. • Equipment maloperation. • Component damage.	• 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	• Equipment maloperation. • Electronic component deterioration, damage. • Paper jam.	• Discharge static electricity from operators. • Provide proper humidity. • Ground equipment properly. • Use antistatic floor material and clothing.
Inductive load open/close	• Spike noise interference to power andsignal lines.	• Add spark-killer to noise source. • Separate laying of cables.
Radio (electric field)	• CRT display disruption. • Equipment maloperation. • Interference with signals.	• 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	• Equipment Maloperation (noise imposed on signal lines)	• 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.

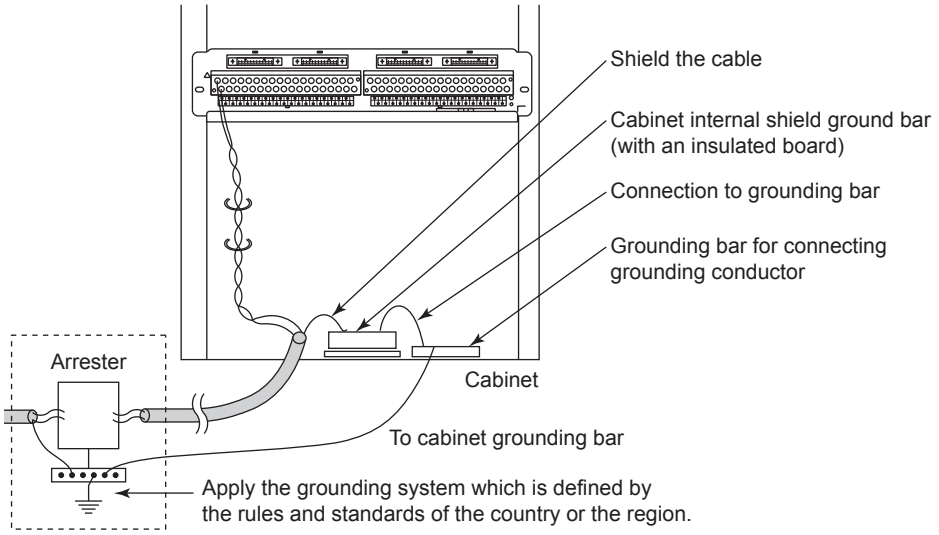
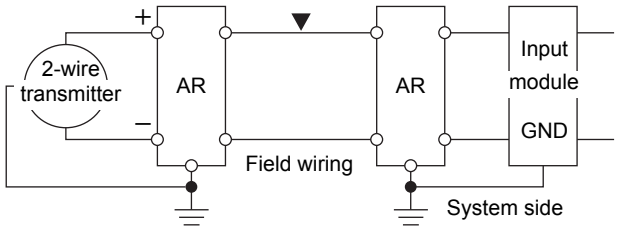


Figure Grounding with Lightning Arresters

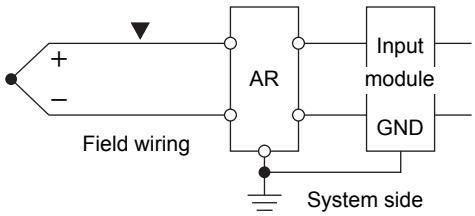
Examples of Arrester

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

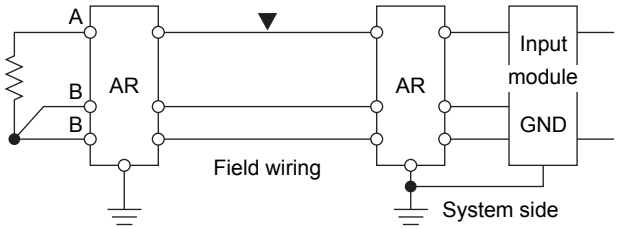
● 2-wire transmitter



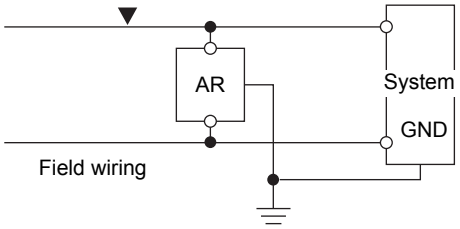
● Thermocouple



● Resistance temperature detector



● Power supply



▼: Induced lightning strike point

AR: Arrester

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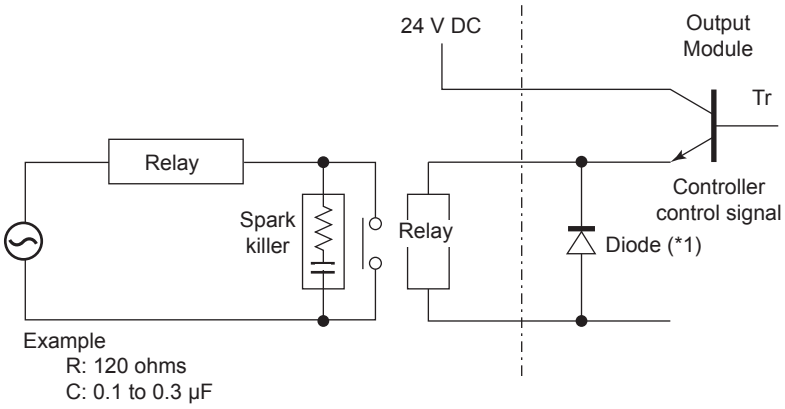
Figure Examples of Arrester Installation

Examples of Spark-killer and Diode Installation

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

● Relay contact for FIO

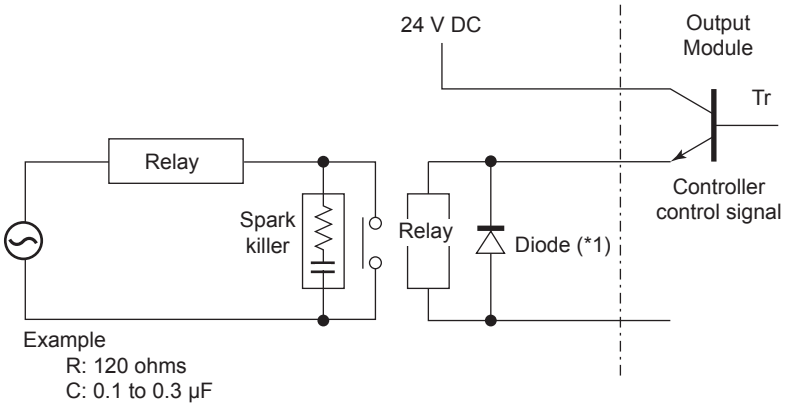
The spark killer protects relay contacts from noise occurring when inductive loads working under AC operation are turned off.



*1: The 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.

● Relay contact for N-IO

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



*1: The diode protects the output transistor from noise occurring during on-to-off transition of the relay.

● Power supply

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

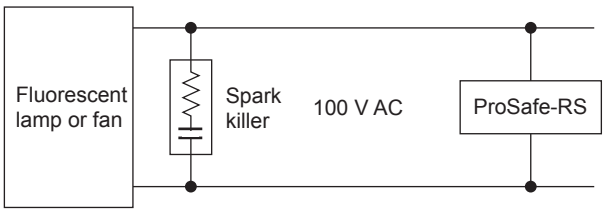


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Figure Examples of Spark-killer Installation

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.

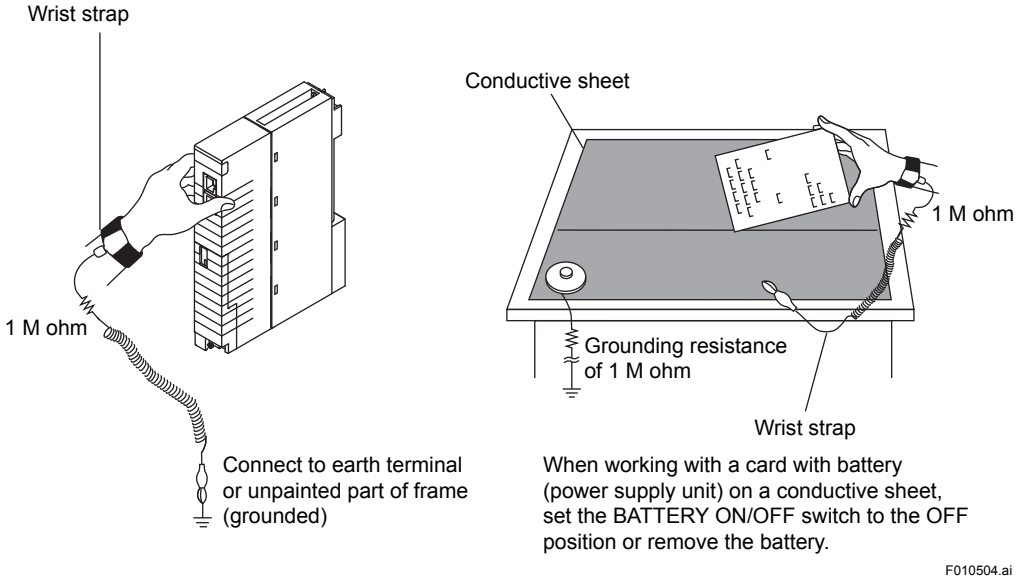


Figure Example of Use of A Wrist Strap and Conductive Sheet

- 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:

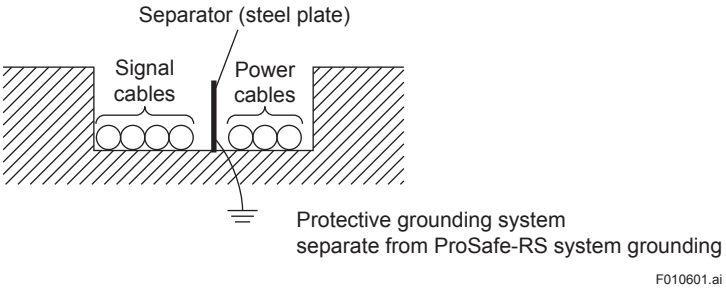


Figure Separator Used in Duct/Pit

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

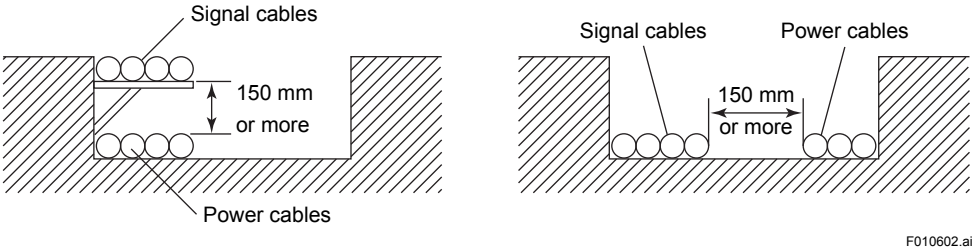


Figure Distance between Cables under Pit/Free-access Floor

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.

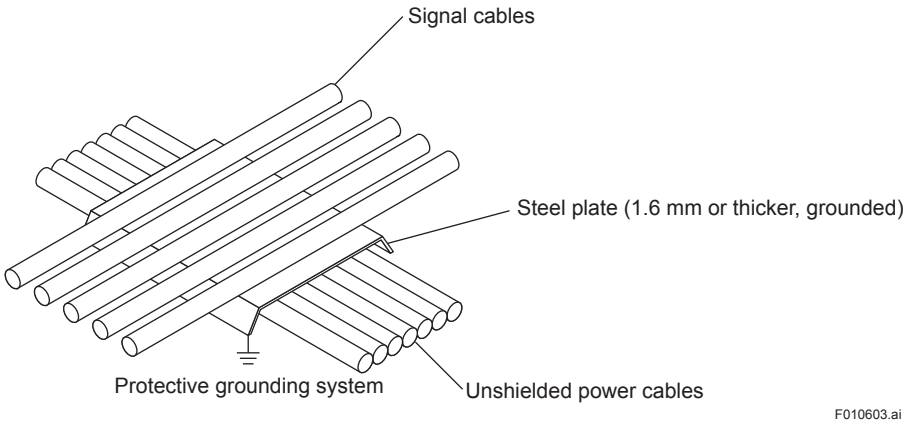


Figure Intersecting Cables under Pit/Free-access Floor

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)
		S2SC70☐	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 channels, Module isolation)
		SAI143-H	Analog input module (4 to 20 mA, 16 channels, Module isolation, HART Communication)
		SAV144	Analog input module (1 to 5 V/1 to 10 V, 16 channels, Module isolation)
		SAI533	Analog output module (4 to 20 mA, 8 channels, Module isolation, HART Communication)
		SAT145	TC/mV Input Module (16 channels, Isolated Channels)
		SAR145	RTD Input Module (16 channels, Isolated Channels)
		SDV144	Digital input module (no-voltage contact, 16 channels, Module isolation)
		SDV521	Digital output module (24 V DC/2 A, 4 channels, Module isolation)
		SDV526	Digital output module (100-120 V AC, 4 channels, Module isolation)
		SDV531	Digital output module (24 V DC, 8 channels, Module isolation)
		SDV53A	Digital output module (48 V DC, 8 channels, Module isolation)
		SDV541	Digital output module (24 V DC, 16 channels, Module isolation)
3	ESB Bus Interface Module	SEC402	ESB Bus Coupler Module (2-port)
		SEC401	ESB Bus Coupler Module
	N-ESB Coupler Module	S2EN402	N-ESB Bus Coupler Module (2-port)
		S2EN404	N-ESB Bus Coupler Module (4-port)
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
		SNT511	Optical ESB Bus Repeater Slave Module 5 km - 50 km

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
		S2LP131	Fire and gas communication module
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 channels x 2)
		SBA4D	Terminal board for Analog: DIN rail mount type (Single and Dual-redundant, 16 channels x 1)
		SBT4D	Terminal board for TC/mV: DIN rail mount type (Single and Dual-redundant, 16 channels x 1)
		SBR4D	Terminal board for RTD input: DIN rail mount type (Single and Dual-redundant, 16 channels x 1)
		SED2D	Digital terminal board (Single and Dual-redundant, 4 channels x 4)
		SED3D	Digital terminal board (Single and Dual-redundant, 8 channels x 4)
		SED4D	Digital terminal board (Single and Dual-redundant, 16 channels x 2)
		SWD2D	Digital terminal board (Single and Dual-redundant, 100 to 120 V AC, 4 channels x 4)
		SBD2D	Terminal board for Digital output: DIN rail mount type (Single and Dual-redundant, 4 channels x 1, for SDV521)
		SBD3D	Terminal board for Digital output: DIN rail mount type (Single and Dual-redundant, 8 channels x 1, for SDV53□)
		SBD4D	Terminal board for Digital: DIN rail mount type (Single and Dual-redundant, 16 channels x 1, for SDV144/SDV541)
		S1BB4D	Terminal Board for Analog Input, 3-wire: DIN rail mount type
10	Router	AVR10D- □□□□□1	Duplexed V net router
		AW810D- □□□□□6	Wide Area Communication Router
11	Node Interface Unit	S2NN30D	Node Interface Unit (for N-IO)
12	Base Plate	S2BN1D	Base Plate with disconnecting terminal (for N-IO, 16 channels)
		S2BN4D	Base Plate for Barrier (for N-IO, MTL Barrier)
		S2BN5D	Base Plate for Barrier (for N-IO, P+F Barrier)
13	I/O Module	S2MMM843	Analog Digital I/O Module (16 channels, module isolation)
		S2MDV843	Digital I/O Module (16 channels, module isolation)

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 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 cm^2 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	H_2S	< 3	< 10	< 50	≥ 50	[mm^3/m^3]
	SO_2, SO_3	< 10	< 100	< 300	≥ 300	
	Cl_2	< 1	< 2	< 10	≥ 10	
	NOx	< 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:

- **ABS (American Bureau of Shipping)**
- **BV (Bureau Veritas)**
- **LR (Lloyd's Register)**
- **DNV GL**

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	S2SC70S-F	Safety control Unit (19-inch rack mountable)	Including SCP461, SPW481, SPW482, and SPW484. S2SC70S-S and S2SC70D-S do not comply.
	S2SC70D-F		
	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. Suffix code "-F" is certified for category ENV3, and "-S" is certified for category ENV2.
	SSC50D		
	SSC57S		
	SSC57D		
	SNB10D	Node unit for dual-redundant ESB bus (19-inch rack mountable)	Including SSB401, SPW481, SPW482 and SPW484.
Node Interface Unit	S2NN30D	Node Interface Unit (for N-IO)	Exclude DIN rail type. Including S2EN501, S2PW503 and S2PW504. S2PW503 and S2PW504 are applicable only when attached to S2NN30D.
Base Plate	S2BN1D	Base plate with disconnecting terminal (for N-IO)	Exclude DIN rail type.
	S2BN4D	Base plate for Barrier (for MTL Barrier)	
	S2BN5D	Base plate for Barrier (for P+F Barrier)	
I/O Module	S2MMM843	Analog digital I/O module	
	S2MDV843	Digital I/O module	
Input/Output Module	SAI143	Analog input module (4 to 20 mA, 16 channels, and module isolation)	(*1) SAI143-H□C 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 channels, Isolated Channels)	
	SAR145	RTD input module (16 channels, Isolated Channels)	
	SAI533	Analog output module (4 to 20 mA, 8 channels and module isolation)	(*1)

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

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

Product	Model	Module Type	Description
Input/Output Module	SDV144	Digital input module (16 channels, contact input and module isolation)	(*2) SDV144-S□C does not comply.
	SDV521	Digital output module (4 channels, 24 V DC/2A, and module isolation)	SDV521-S3C does not comply.
	SDV531	Digital output module (8 channels, 24 V DC, and module isolation)	(*2) SDV531-L complies with Marine Standards from style code S3. SDV531-L□C does not comply.
	SDV53A	Digital output module (8 channels, 48 V DC, and module isolation)	
	SDV541	Digital output module (16 channels, 24 V DC, and module isolation)	(*2) SDV541-S□C 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.
Optical ESB bus repeater module	SNT401	Optical ESB bus repeater master module	
	SNT411	Optical ESB bus repeater master module 5 km to 50 km	
	SNT501	Optical ESB bus repeater slave module	
	SNT511	Optical ESB bus repeater slave module 5 km to 50 km	
ESB Bus Interface Module	SEC402	ESB bus coupler module	
	SEC401		
N-ESB Bus Coupler Module	S2EN402	N-ESB Bus coupler Module (for 2-port)	
	S2EN404	N-ESB Bus coupler Module (for 4-port)	
Cover	S2DCV02	Dummy cover (for N-IO I/O module)	
Communication Module	ALR111	Serial communications module (RS-232C, 2-port)	
	ALR121	Serial communications module (RS-422/RS-485, 2-port)	
	ALE111	Ethernet communication module	
	S2LP131	Fire and Gas Communication Module	
Terminal Board	SEA4D	Analog terminal board (single and dual-redundant, 16 channels x 2)	
	SED2D	Digital terminal board (single and dual-redundant, 4 channels x 4)	
	SED3D	Digital terminal board (single and dual-redundant, 8 channels x 4)	
	SED4D	Digital terminal board (single and dual-redundant, 16 channels x 2)	
	SBT4D	Terminal board for TC/mV: DIN rail mount type (Single and Dual-redundant, 16 channels x 1)	
	SBR4D	Terminal board for RTD input: DIN rail mount type (Single and Dual-redundant, 16 channels x 1)	
	SBA4D	Terminal board for Analog: DIN rail mount type (Single and Dual-redundant, 16 channels x 1)	

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

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

Product	Model	Module Type	Description
Terminal Board	SBD2D	Terminal board for Digital output: DIN rail mount type (Single and Dual-redundant, 4 channels x 1, for SDV521)	
	SBD3D	Terminal board for Digital output: DIN rail mount type (Single and Dual-redundant, 8 channels x 1, for SDV53□)	
	SBD4D	Terminal board for Digital: DIN rail mount type (Single and Dual-redundant, 16 channels x 1, for SDV144/SDV541)	
	S1BB4D	Terminal Board for Analog Input, 3-wire: DIN rail mount type	
Relay Board	SRM53D	Relay Board (8 × 2 dry contact output)	
	SRM54D	Relay Board (16 × 1 dry contact output)	
	SBM54D	Relay board for Digital output: DIN rail mount type (Single and Dual-redundant, 16 channels x 1, for SDV541)	
Control Bus Interface	VI702	Control bus interface card	(*3)
V net Router	AVR10D -□□□□□1	Duplexed V net router	AVR10D-□□□□□0 does not comply.
Cable, etc.	YCB301	ESB bus cable	
	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)	
	YCB146	T-shaped control bus connector	
	YCB128	Terminator for IRIG (GPS)	
	S2KLF10	F-SB bus cable	
	S2KPB10	Power supply cable for Base plate	

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

■ 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 S2SC70□-F, SSC60□-F, SSC50□, SSC57□, 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 (S2SC70□-F, SSC60□-F, SSC50□,SSC57□)
- Safety Node Unit (SNB10D)
- Unit for Optical Bus Repeater Module (SNT10D)
- Safety Control PC (SENG) installed control bus interface (VI702)

Power-line for S2SC70☐-F, SSC60☐-F, SSC50☐, SSC57☐, SNB10D, SNT10D and S2NN30D

Attach a noise filter in each power line of SPW48☐, S2PW50☐, FAN and external power supply unit. Alternatively, other devices such as noisecut 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.

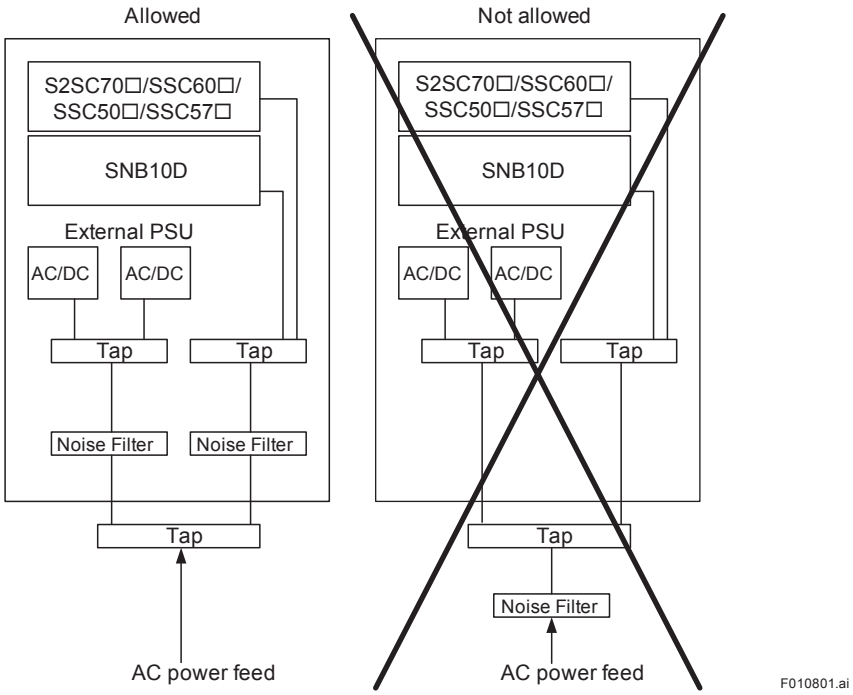


Figure Wiring for AC power cables

The following table shows example of a noise filter.

Category	Manufacturer	Model no.	Power Source
Noise filter	OKAYA Electric Industries Co., LTD	SUP-P30H-EPR-4	100 - 120 V AC, 220 - 240 V AC (*1)
		SUPH-EX10-ER-6	100 - 120 V AC, 220 - 240 V AC
	COSEL Co., LTD	NBH-20-432	24 V DC (*2)

*1: For S2PW50☐, SUPH-EX10-ER-6 can be used.
*2: 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

Noisecut transformer shall be installed in the cabinet and attached in the power-line cable of SENG in case of using VI702.
The following table shows applicable noisecut transformer.

Table Applicable noisecut transformer

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

*1: Purchase it through distributer.
*2: Sales was terminated. Use NCT-I1 when purchase noisecut transformer newly.

IMPORTANT

Lay the incoming wires to a noisecut transformer separately from its outgoing wires.

Minimize the wiring to the ground terminal of the noisecut 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 (1/3)

Component		Description	Ferrite Core Model (*1)	Quantity	Location (See the Figures)
Power supply	S2SC70☐-F Power module	AC/DC power cable	ZCAT3035-1330	3	(1)
	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	S2SC70☐-F Fan unit	AC/DC power cable	ZCAT3035-1330	3	(5)
	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 (2/3)

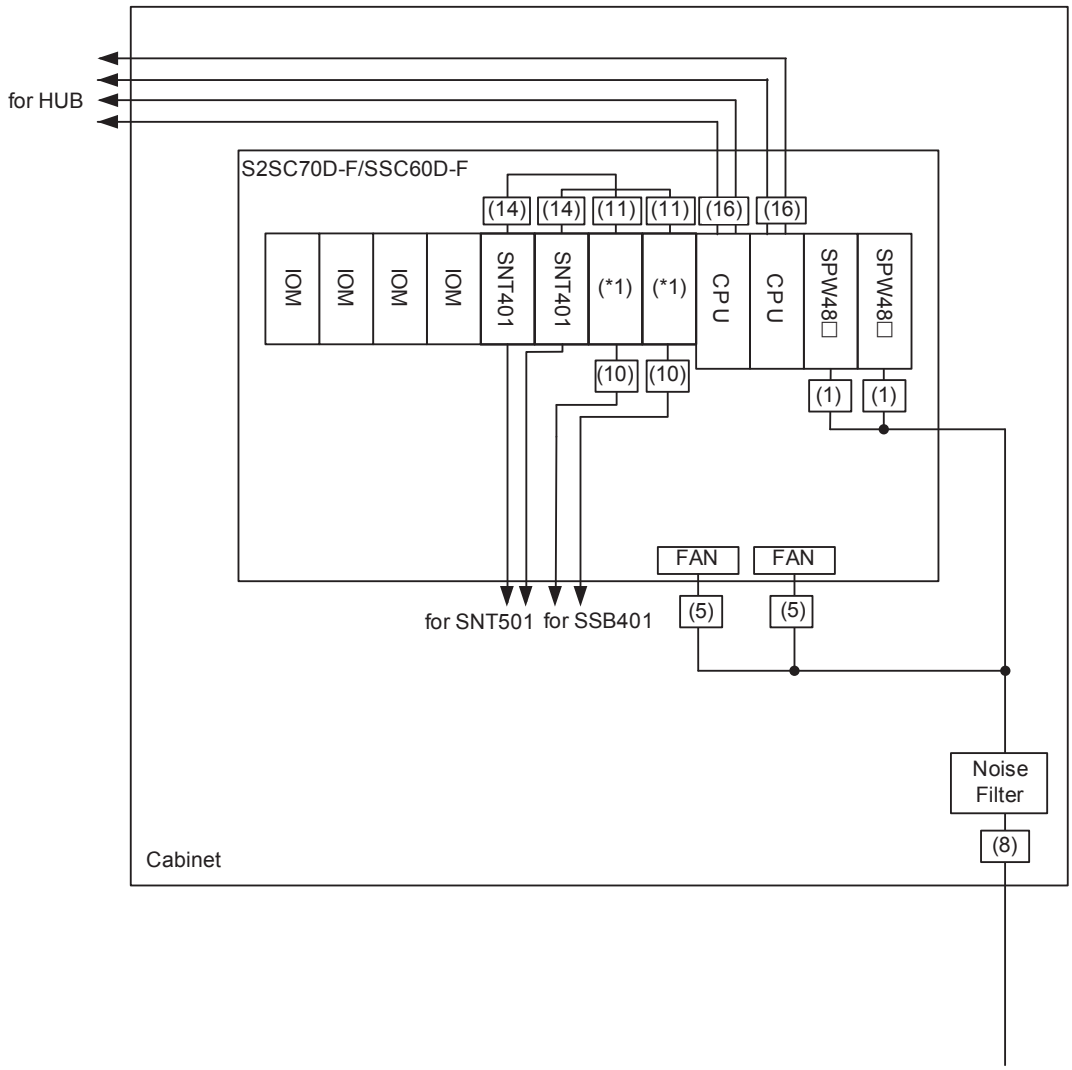
Component		Description	Ferrite Core Model (*1)	Quantity	Location (See the Figures)
External power supply (output side)	Power Supply (SDV531, SDV541)	DC power cable (Output side)	ZCAT3035-1330	3	(7)
			ZCAT2032-0930	1	
	Power Supply (SDV521, SDV53A)	DC power cable (Output side)	ZCAT3035-1330	1	
Noise filter (Input side)	AC power-line filter	AC power cable	ZCAT3035-1330	1	(8)
			ZCAT2032-0930	3	
			ZCAT3035-1330	1	(9)
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	— (*3)
	SSC50□-F Fan unit	Flat cable	ZCAT3035-1330	1	— (*3)
	SSC57□-F Fan unit	Flat cable	ZCAT3035-1330	1	— (*3)
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)
N-ESB bus coupler modules	S2EN402	N-ESB Bus cable	—	—	—
	S2EN404	N-ESB Bus cable	—	—	—

*1: Quantity "—", Ferrite core is not necessary.
*2: The part number of ZCAT3035-1330 is A1179MN, and ZCAT2032-0930 is A1193MN.
Models ZCAT3035-1330 and ZCAT2032-0930 are from TDK Corporation.
*3: The component is mounted on the standard model.

Table Cables that Need Ferrite Cores to be Attached to, and Ferrite Core Models and Quantities for Vnet/IP (3/3)

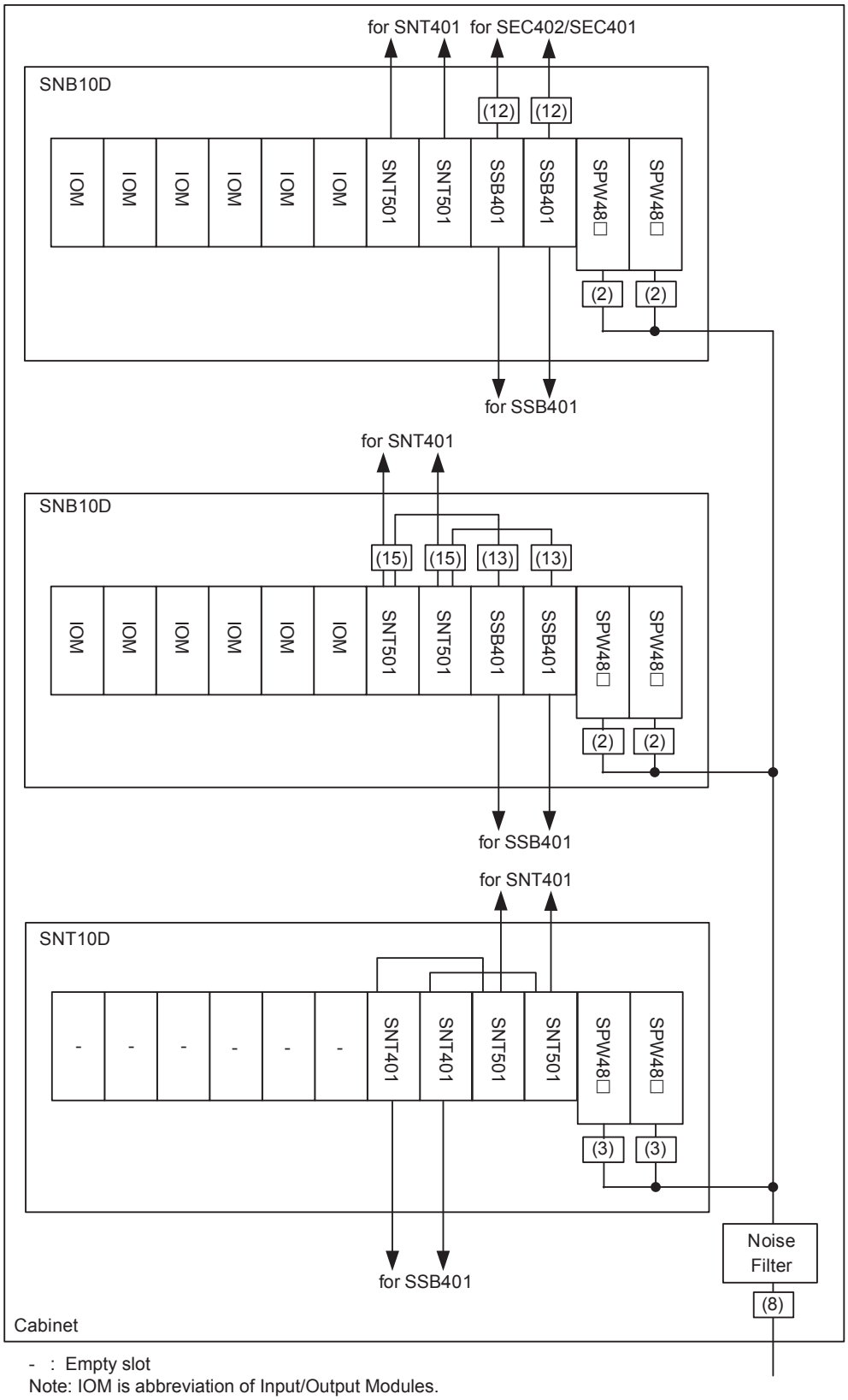
Component		Description	Ferrite Core Model (*1)	Quantity	Location (See the Figures)
Node Interface Unit	S2NN30D	N-ESB Bus/Optical ESB Bus cable	—	—	—
		Power supply input cable	—	—	—
		System power supply cable (S2KLF10)	—	—	—
		System power supply output cable (S2KPB10)	—	—	—
		External alarm input cable	—	—	—
Base Plate	S2BN1D	F-SB bus cable (S2KLF10)	—	—	—
		System power supply cable (S2KPB10)	—	—	—
		Field power supply cable	—	—	—
	S2BN4D	F-SB bus cable (S2KLF10)	—	—	—
		System power supply cable (S2KPB10)	—	—	—
		Field power supply cable	—	—	—
	S2BN5D	F-SB bus cable (S2KLF10)	—	—	—
		System power supply cable (S2KPB10)	—	—	—
		Barrier power cables	—	—	—
Terminal Boards	S1BB4D	Power supply cable	—	—	—
		Ready contact cable	—	—	—

*1: Quantity "—", Ferrite core is not necessary.



*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.

Figure Locations of Ferrite Core Installation for S2SC70D-F/SSC60D-F



- : 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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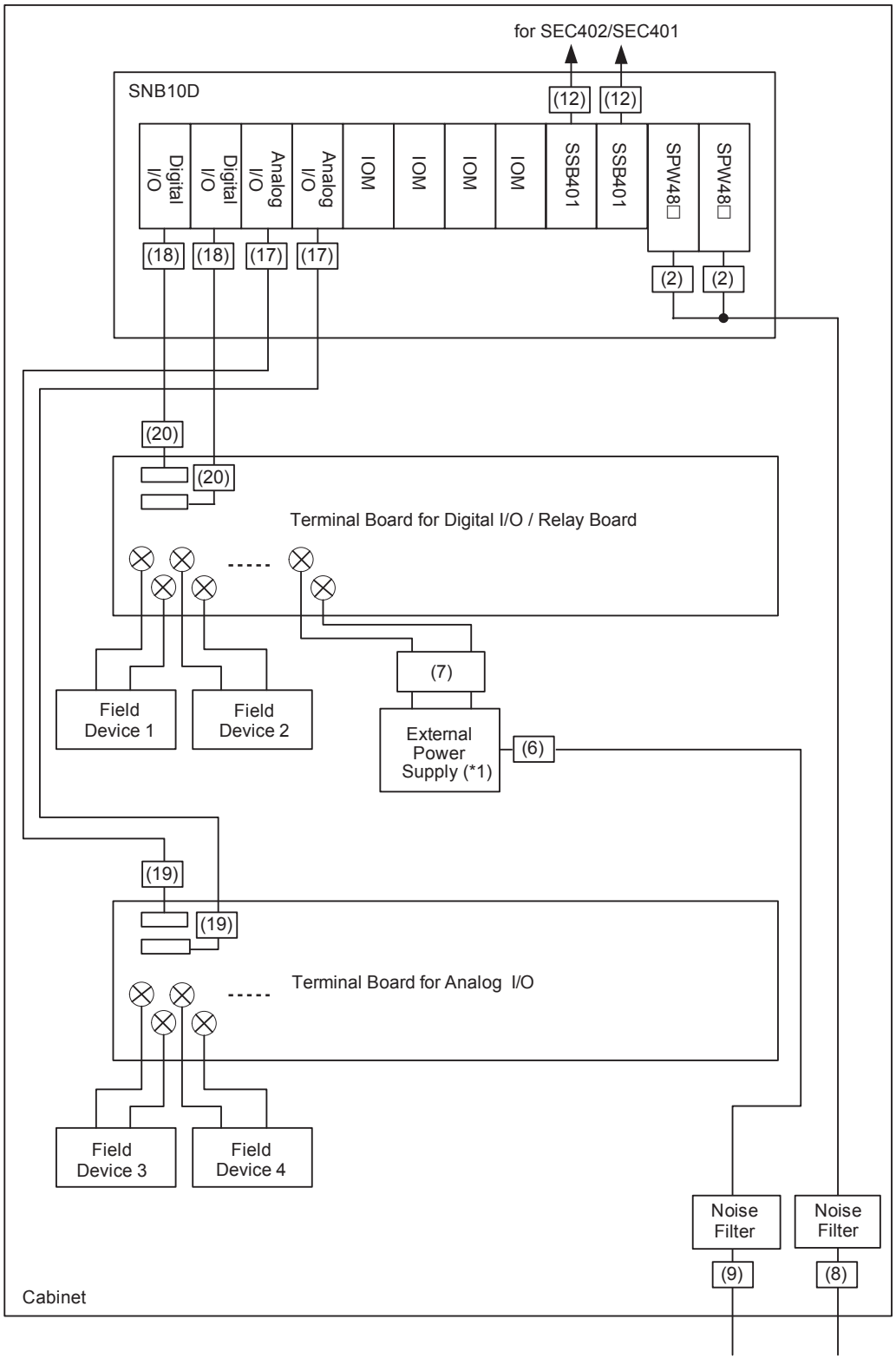
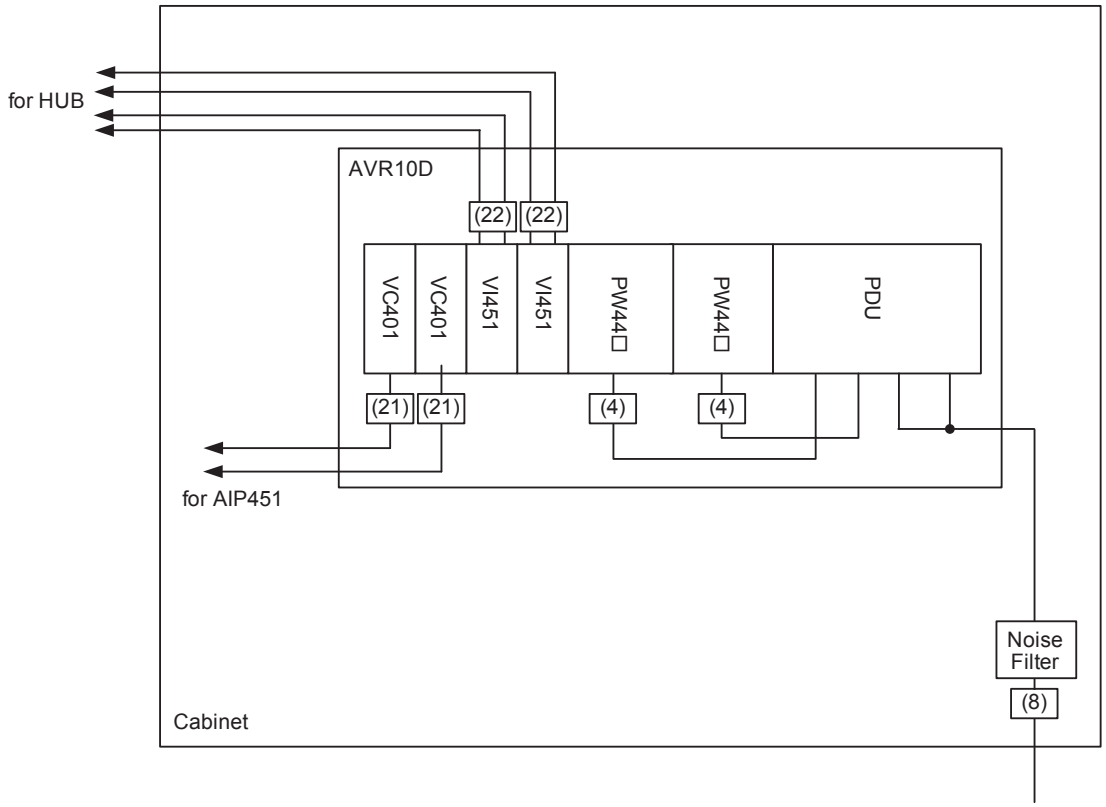
Figure Locations of Ferrite Core Installation for SNB10D and SNT10D



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.
*1: When supplying 24 V DC from outside of a cabinet, it isn’t necessary to install “External Power Supply”. But, when not installing this “External Power Supply”, it’s necessary to install (6) and (7).

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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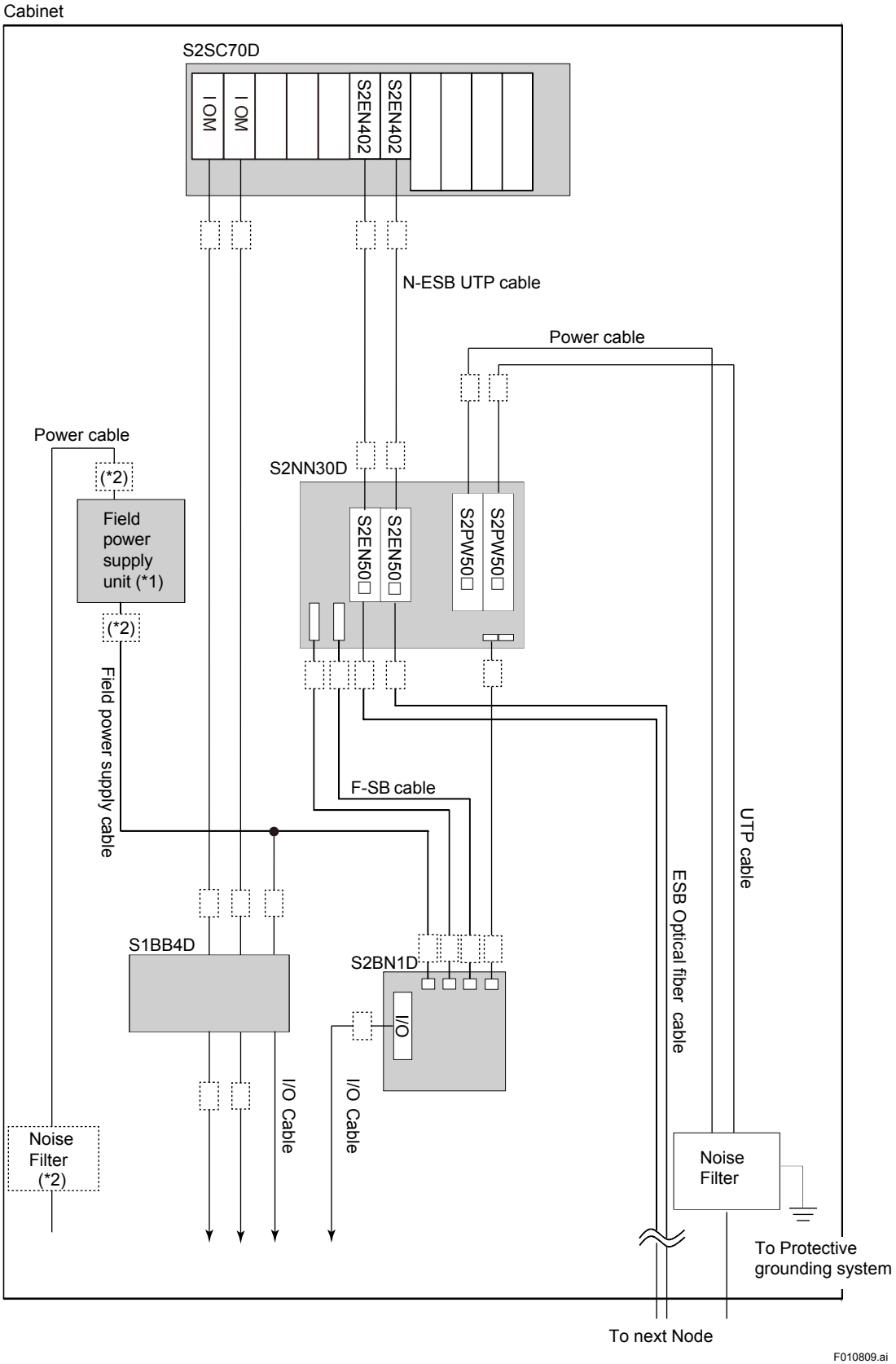
Figure Locations of Ferrite Core Installation for AVR10D



*1: The marine standard isn't acquired to use S2PW50□ by alone. Please don't use for field power supplies.
*2: Please follow directions on instructions of this external power unit about necessity of noise filters.
[ ] : Ferrite core is not necessary for the mounting positions shown in the dotted line boxes.

Figure Location of Ferrite Core Installation for N-IO (S2NN30D, S2BN1D, and S1BB4D)

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 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 cables to the cabinet frame or dummy plate using cable ties at the nearest possible place to each ferrite core.

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 S2SC70☐-F, SSC60☐-F, SSC50☐, SSC57☐ 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.

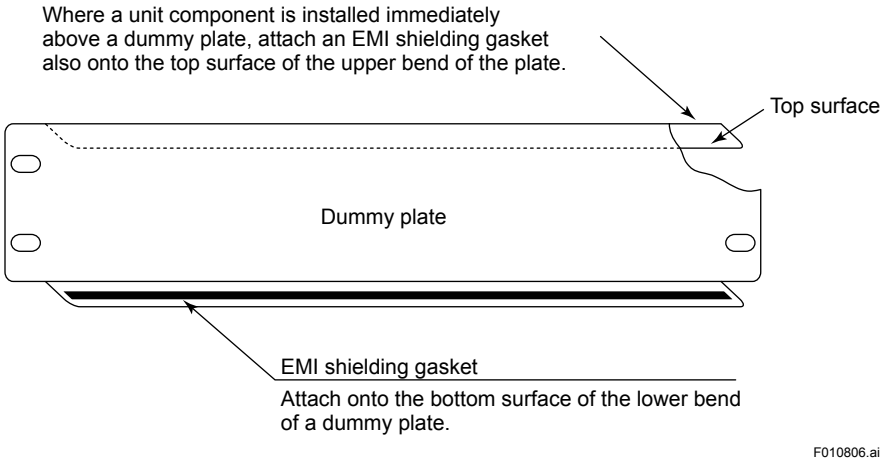


Figure Examples of Installing EMI Shielding Gasket to Dummy Plate

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.”

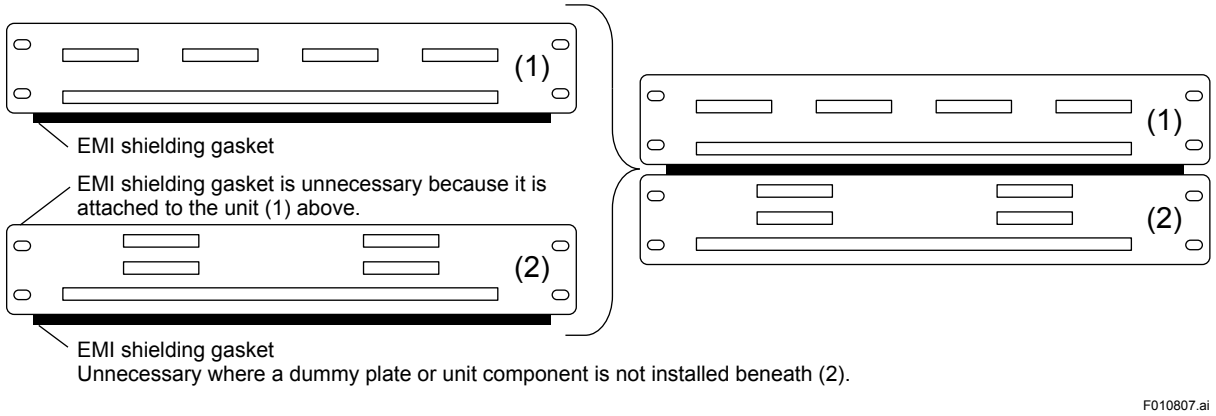


Figure Examples of Installing EMI Shielding Gasket to Unit Component

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.”

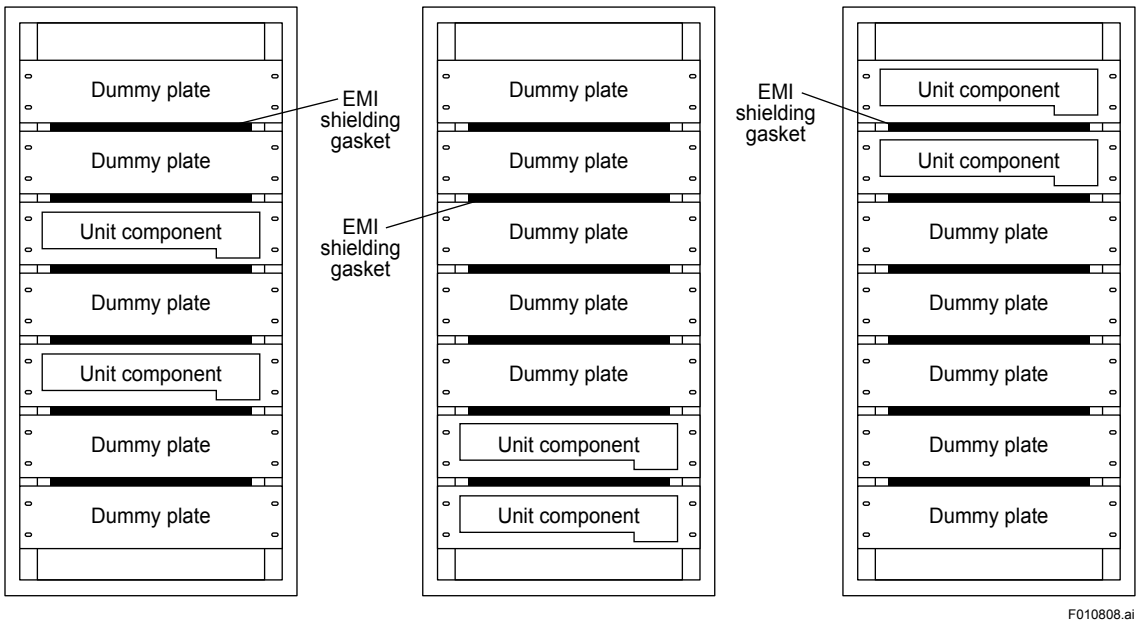


Figure Example of Installing Dummy Plates and EMI Shielding Gaskets in Cabinet

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	No	Yes	If damaged badly, inform Yokogawa.
	• Condensation or its trace on equipment exterior. (*1)	No	Yes	If yes, inform Yokogawa.
Interior	• Loose parts inside equipment.	No	Yes	If yes, remove them and check the surrounding.
	• Damage to equipment interior.	No	Yes	If damaged badly, inform Yokogawa.
	• Condensation or its trace on equipment interior. (*1)	No	Yes	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.
When using desiccating agent or corrosion inhibitor etc., please select the appropriate one. Also, please make sure that it does not affect the function and performance of the product before actually using it.

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.

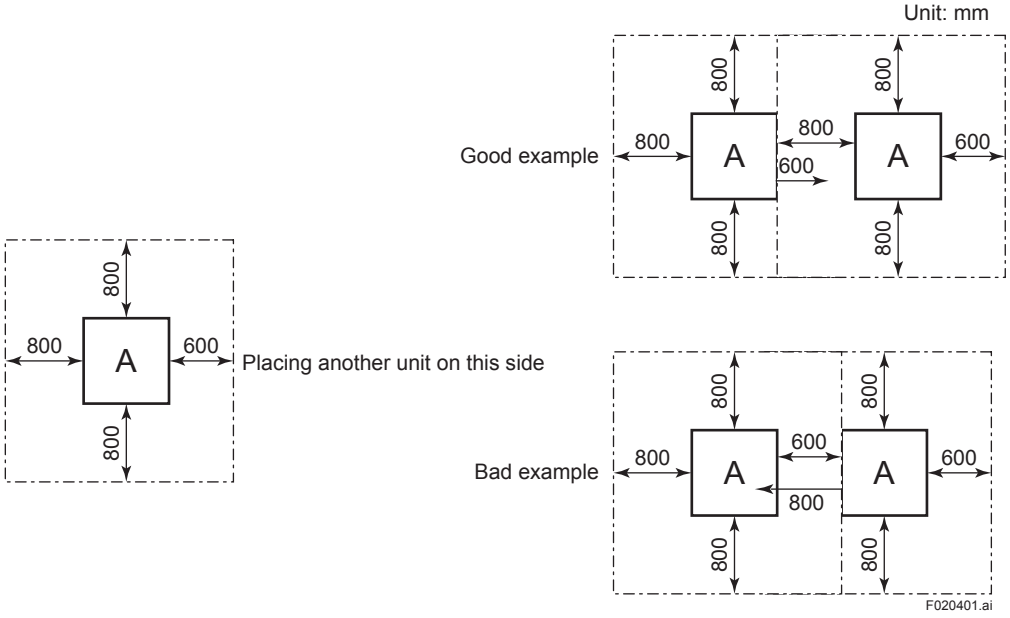


Figure Servicing Area when Installing Units Side-by-side

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.

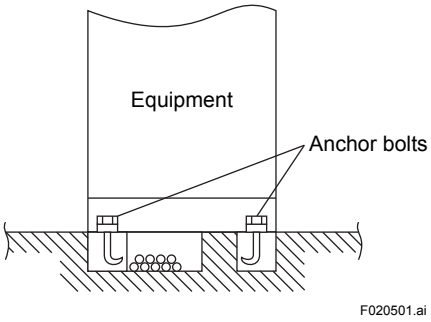


Figure Using Anchor Bolts

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.

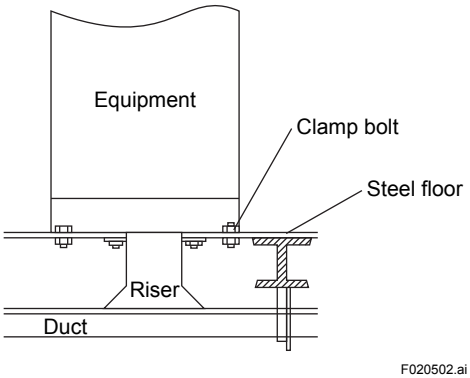


Figure Using Clamp Bolts

“Free-access” Floor

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

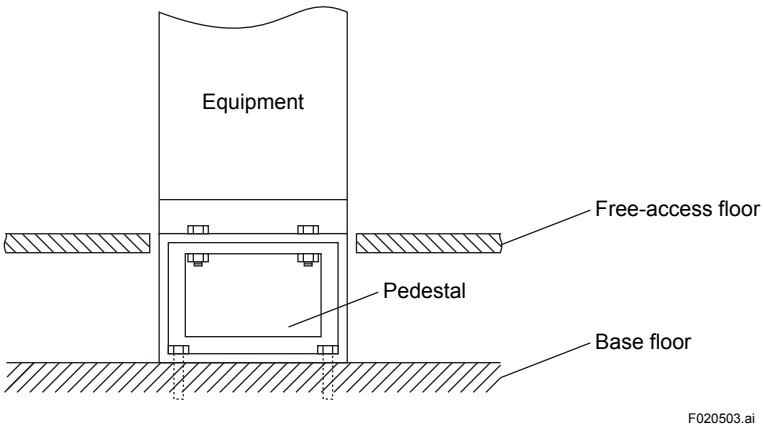


Figure Using Pedestal

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.

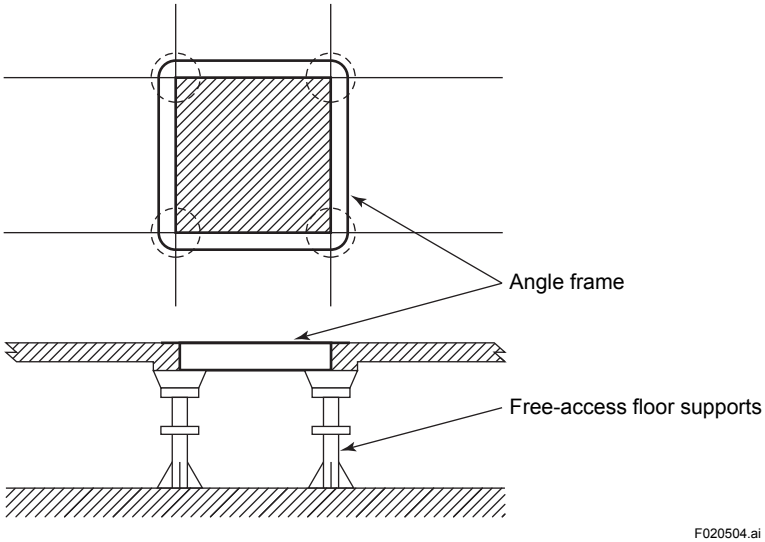


Figure Removing One Floor Tile

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

CAUTION

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

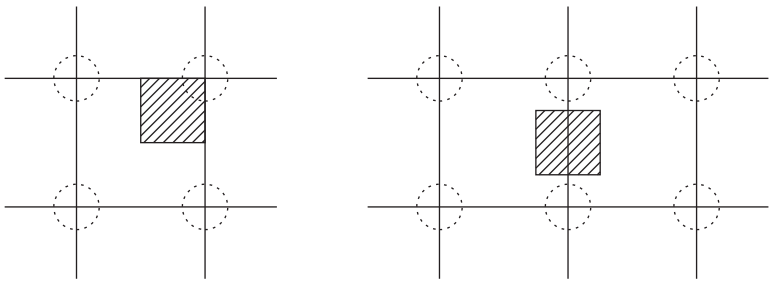


Figure Partially Cutting Floor Tile

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.

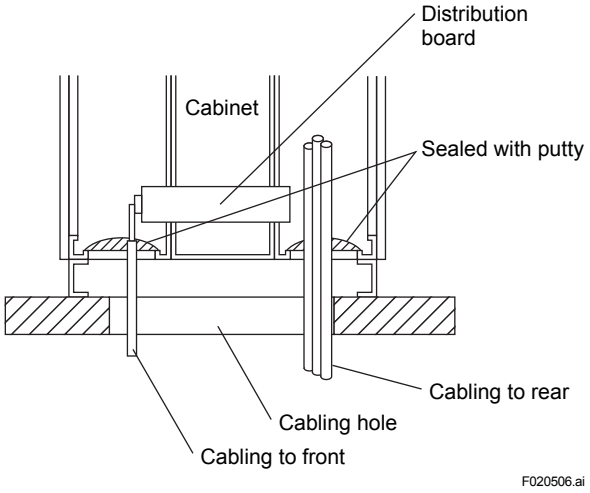


Figure Cabling through Maximum Size Hole

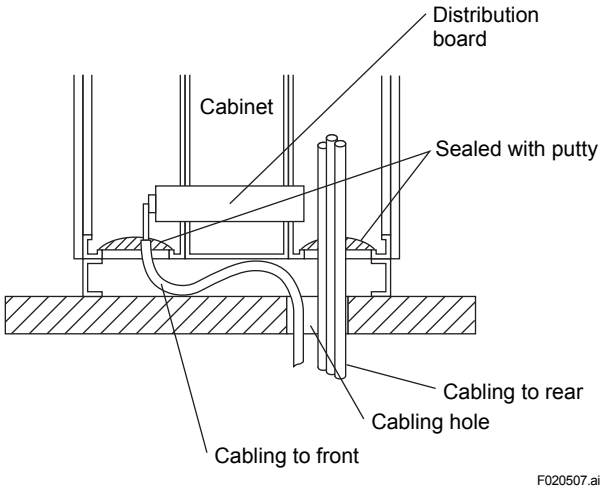


Figure Cabling through Minimum Size Hole

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)
S2SC70S and S2SC70D Safety Control Units;
SNB10D Safety Node Unit;
SNT10D Unit for Optical Bus Repeater Module;
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”.

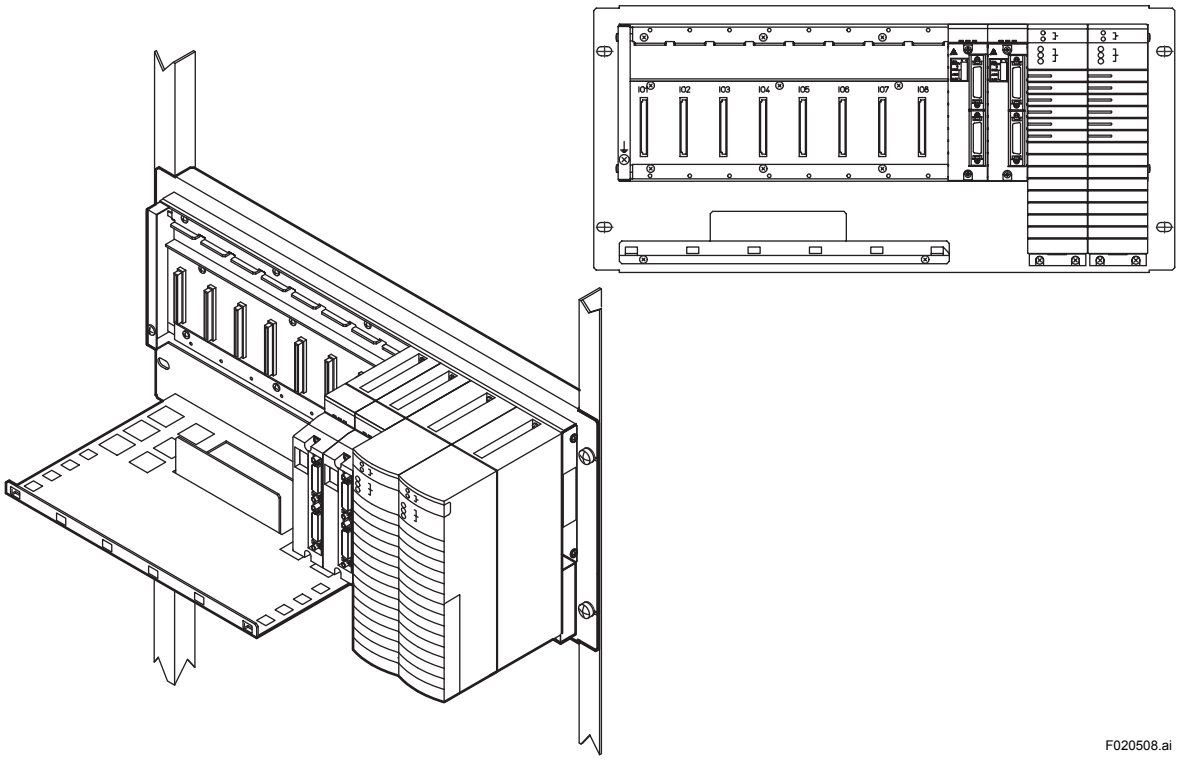


Figure Mounting SNB10D Safety Node Unit

Notes on Installation

CAUTION

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.

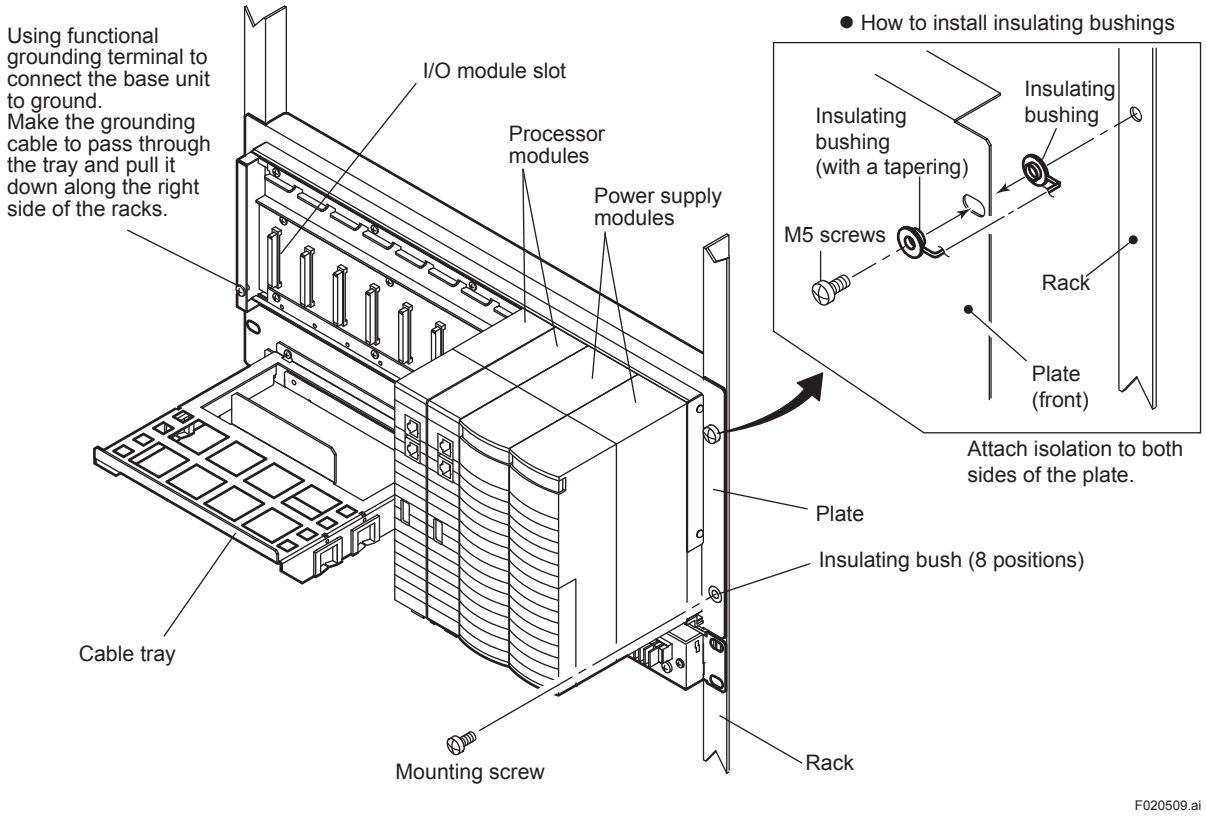


Figure Mounting SSC50D on Rack

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.

CAUTION

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.

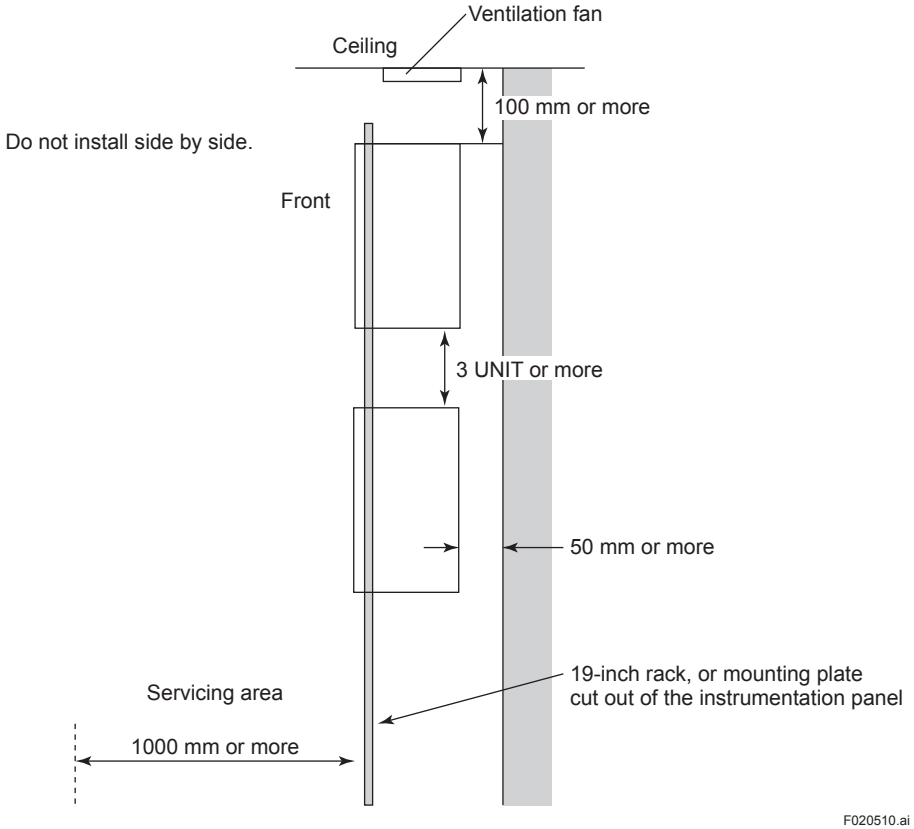


Figure Space Required for Rack-mount Equipment

2.5.3 DIN Rail Mountable Devices

The following devices can be mounted to a DIN rail.

Node interface unit: S2NN30D-□□□0□□□□□
Base plate with disconnecting terminal: S2BN1D-0□□□□
Terminal boards: SBA4D, S1BB4D, SBT4D, SBR4D, SBD2D, SBD3D, SBD4D
Relay boards: SBM54D

IMPORTANT

Install a DIN rail mountable device inside a metal cabinet.

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.

■ Notes on Installation

CAUTION

For installation, secure ample working space and work in a team for safety.

● Providing Space for Heat Dissipation

Leave space at the top and bottom of the device to permit heat dissipation.

- 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.
- Do not block the openings (ventilation holes) in the top and bottom surfaces of the device.
- A 1-unit (44.45 mm) or more space shall be provided between the Node Interface Unit and other base plates.

● Providing Area for Servicing

Leave an area for servicing.

- All the work to connect cables to DIN rail mountable devices and I/O modules will beperformed 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.

● Compatible DIN Rail

Table Compatible DIN Rail Symbols (DIN 60715, JIS C 2812, IEC 60715, EN50022)

Cross section shape type symbol	Width - height symbols	Material (chemical symbol)
TH	35-7.5	Fe or Al

Installation of DIN Rail

- Install a DIN rail in a metal mounting plate with screws at 120-mm or less intervals.
- When mounting a DIN rail mountable device to a DIN rail, confirm that the device is securely fixed after the mounting.
- A DIN rail for S2BN1D must be electrically insulated from a cabinet using insulating bushing.

Mounting Space

S2NN30D and S2BN1D require spaces, as shown below, to slide in to the positions when mounting to the DIN rail. Refer to the General Specifications (GS) for the external dimensions.

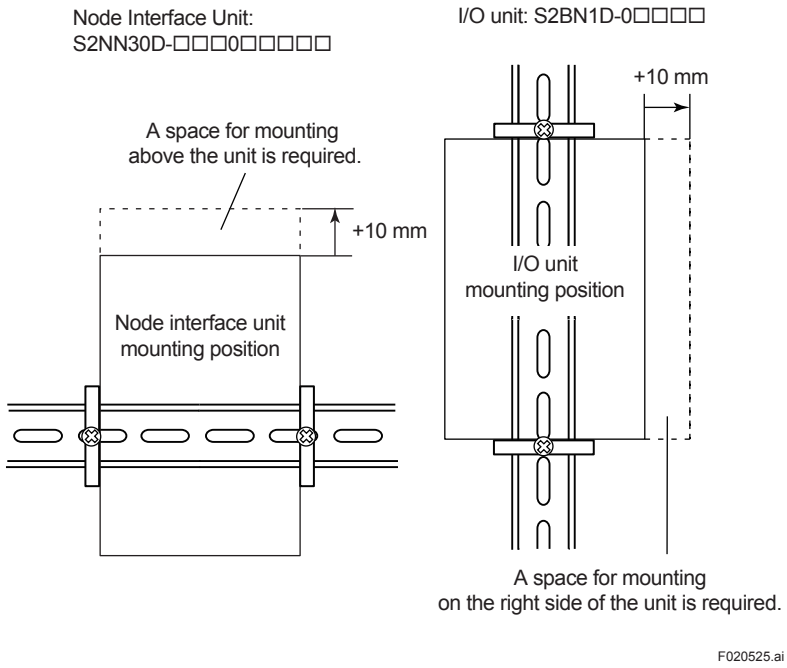


Figure Mounting Space (Front View)

Grounding

Be sure to ground the equipment using the ground terminal of the base plate. Even if there is electrical conduction between the base plate and wall surface via the mounting mechanism, the equipment must be grounded using the functional ground terminal.

Mounting

- When mounting S2BN1D I/O Units vertically on the DIN rail, insert stoppers on top and bottom of each unit. When those I/O units are mounted close by, only one stopper in between two I/O units will do. Another stopper is required for the I/O unit mounted on the top shelf.
- When mounting the units horizontally on the DIN rail, insert stoppers on both sides of the unit.

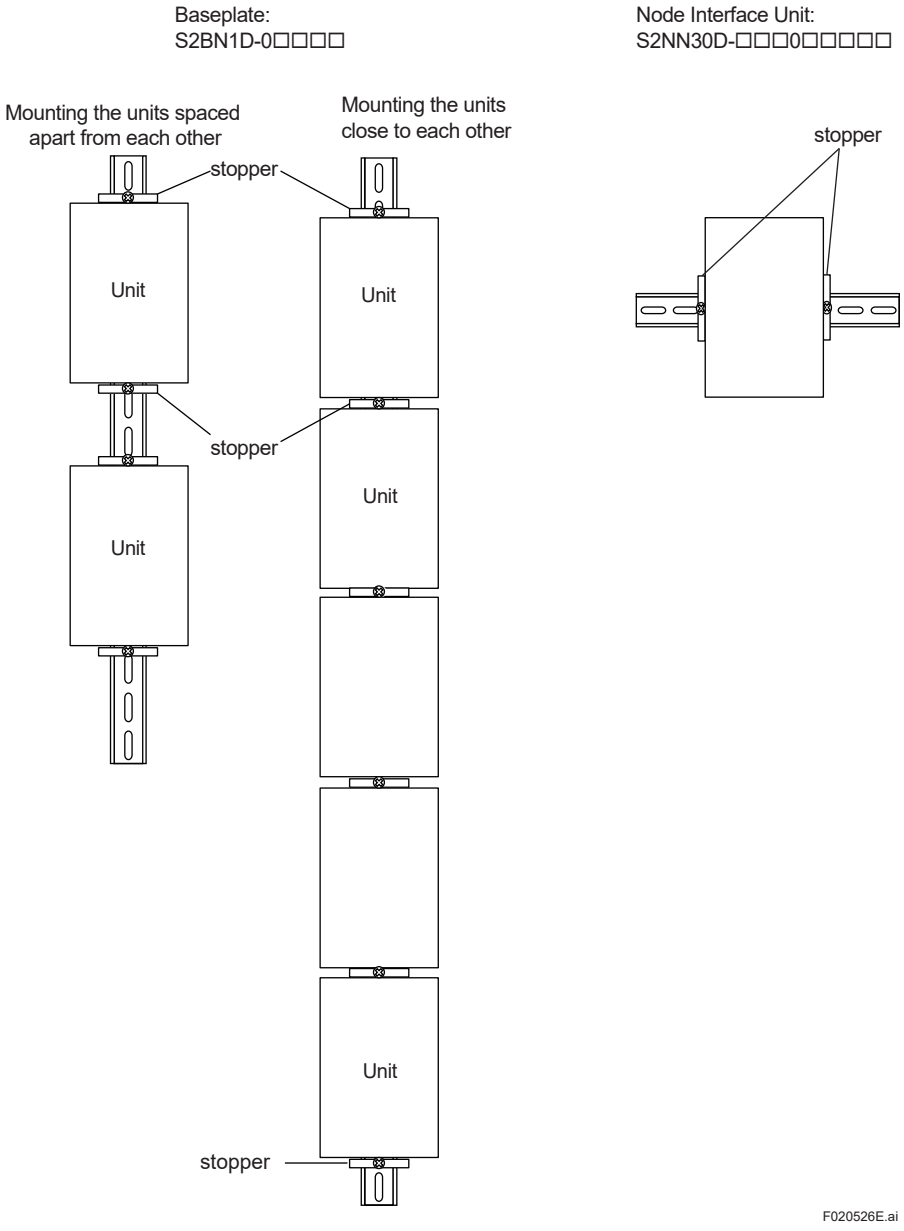


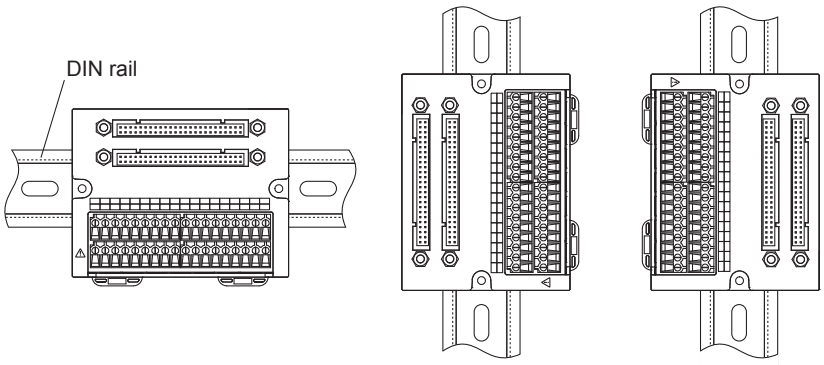
Figure Mounting stopper to the DIN rail

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.



Direction a Direction b Direction c F020511.ai

Remarks for Installating 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.

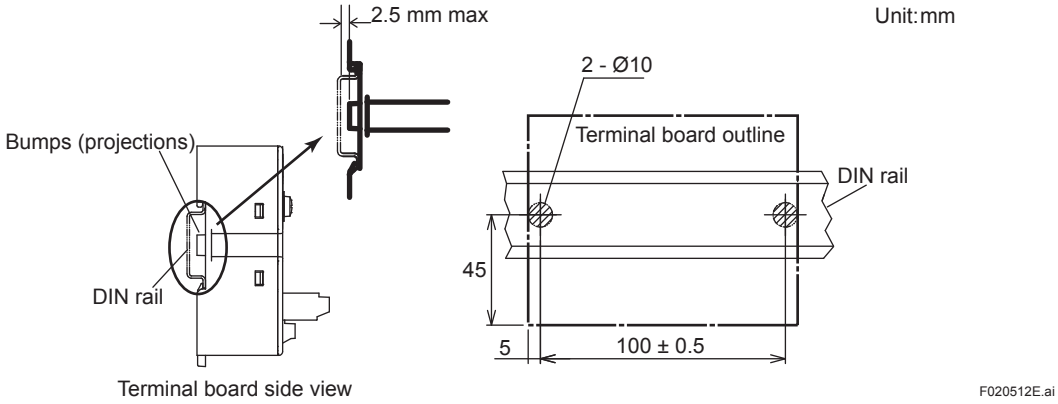


Figure Mounting SBA4D to DIN rail for terminal board

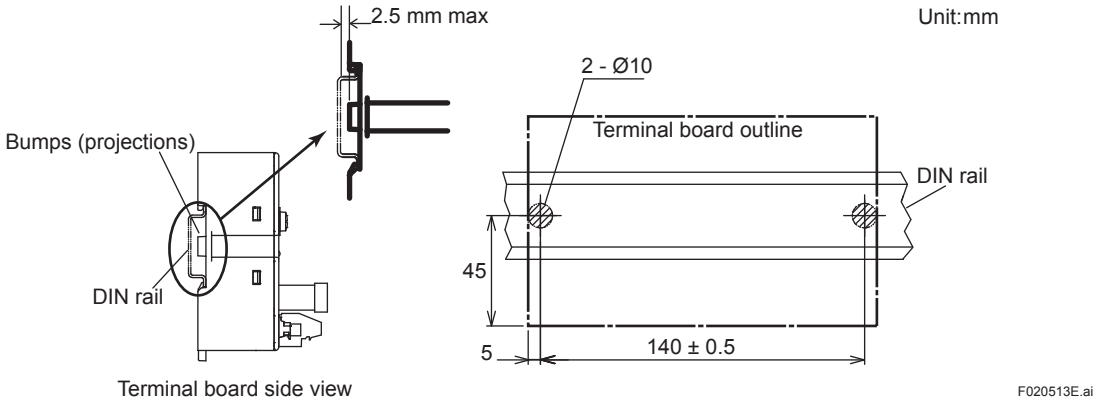


Figure Mounting SBD2D, SBD3D, and SBD4D to DIN rail for terminal board

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.

2.5.4 Wall Mountable Devices

The following devices can be mounted to a wall with screws.

Node interface unit:	S2NN30D-□□□□1□□□□
Base plate with disconnecting terminal:	S2BN1D-1□□□□
Barrier base plate:	S2BN4D-1□□□□
	S2BN5D-1□□□□

IMPORTANT

Install a wall mountable device inside a metal cabinet.

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.

DIN rail specifications:

■ Notes on Installation

● Providing Space for Mounting

S2BN4D need to be slide when this is mounted to a wall. For this reason, provide a space shown in the following figure. Refer to the General Specifications (GS 32P06P10-01EN) for the external dimensions.

Unit: S2BN4D-1□□□□

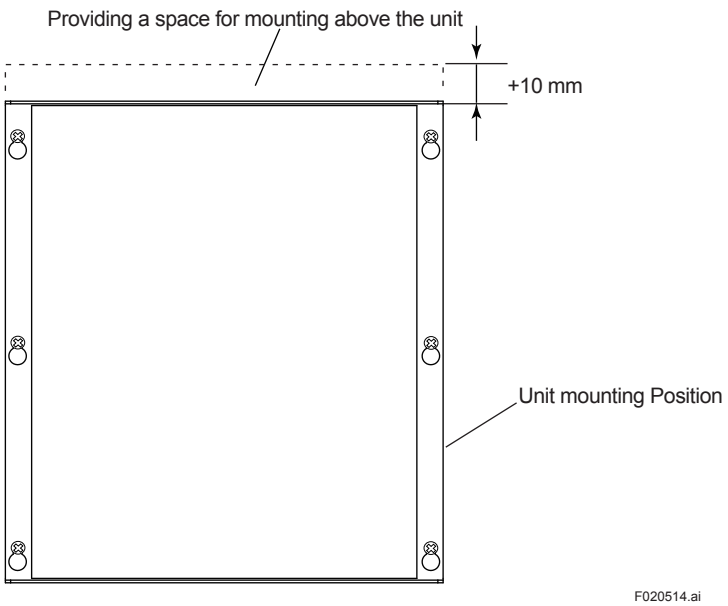


Figure Providing a Space for Mounting (Front View)

Providing Space for Heat Dissipation

Leave space to permit heat dissipation just as for a DIN rail mountable device.

Providing Area for Servicing

Leave an area for servicing just as for a DIN rail mountable device.

Grounding

Be sure to ground the equipment using the functional ground terminal provided on the base plate.

Mounting of Base Plate

- Mount a wall mountable device to a metal mounting plate using screws.
- To ground the S2BN4D at a single point, the back plate of S2BN4D must be insulated from mounting plate.

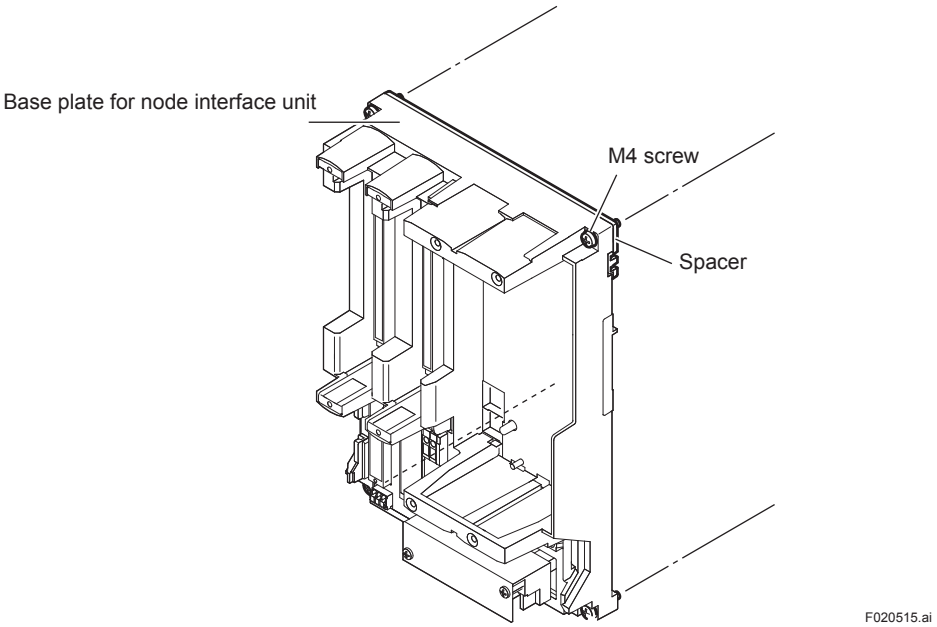


Figure Example of Mounting Node Interface Unit to Wall

Table Screw and Washer for Wall Mounting

Model	Screw diameter	Screw length	Washer Type/Washer Outer diameter	Tightening Torque (N•m)
S2NN30D	M4	Accessory (Retainer screw)		0.8 to 1.0
S2BN1D	M4	Accessory (Retainer screw)		0.8 to 1.0
S2BN4D (*1)	M4	— (*2)	Plane washer / 9 mm or smaller	1.2
S2BN5D	M4	16 mm or longer	(When the washer is not used)	1.2
		18 mm or longer	Plane washer / 8 mm or smaller	

*1: A back plate of S2BN4D is connected to functional grounding terminal. In order to ground at a single point, insulate the back plate from mounting plate using insulated supporter.
*2: The screw length depend on an insulated supporter specification. The screw length is decided using the thickness of the S2BN4D back plate (1.6 mm) and a washer.

SEE ALSO For the screw mounting dimensions for wall mounting, refer to the General Specifications (GS) for the corresponding device.

Remarks for Mounting on a Wall Surface

The following figure shows the screw installation dimensions for a wall 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.

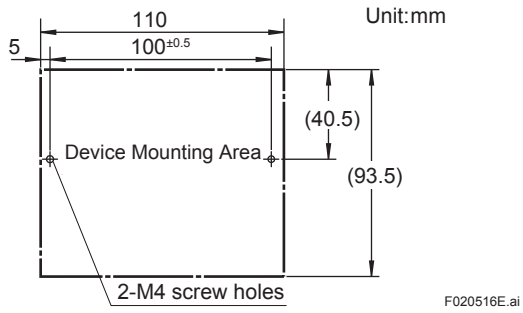


Figure Screw Installation Dimensions for the SBA4D

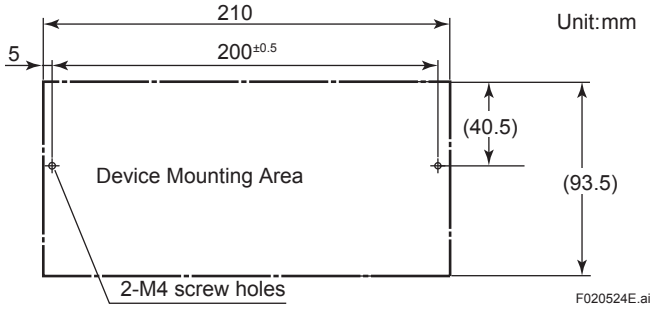


Figure Screw Installation Dimensions for the S1BB4D

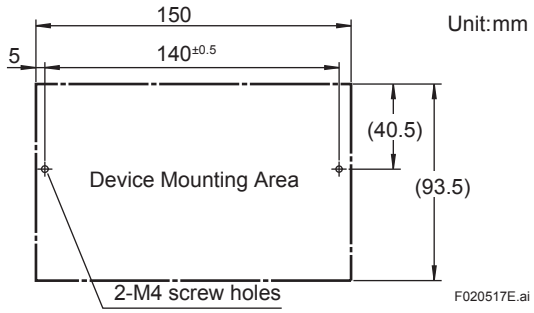


Figure Screw Installation Dimensions for the SBD2D, SBD3D, and SBD4D

Grounding

Ground the equipment at a single point using the functional ground terminal provided on the base plate.

Installation Direction

Mount the device to the wall with the screws in the vertically correct direction. Check the installation direction in General Specifications (GS).

2.5.5 Installation Guideline for Cabinet (FIO)

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 S2SC70☐/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

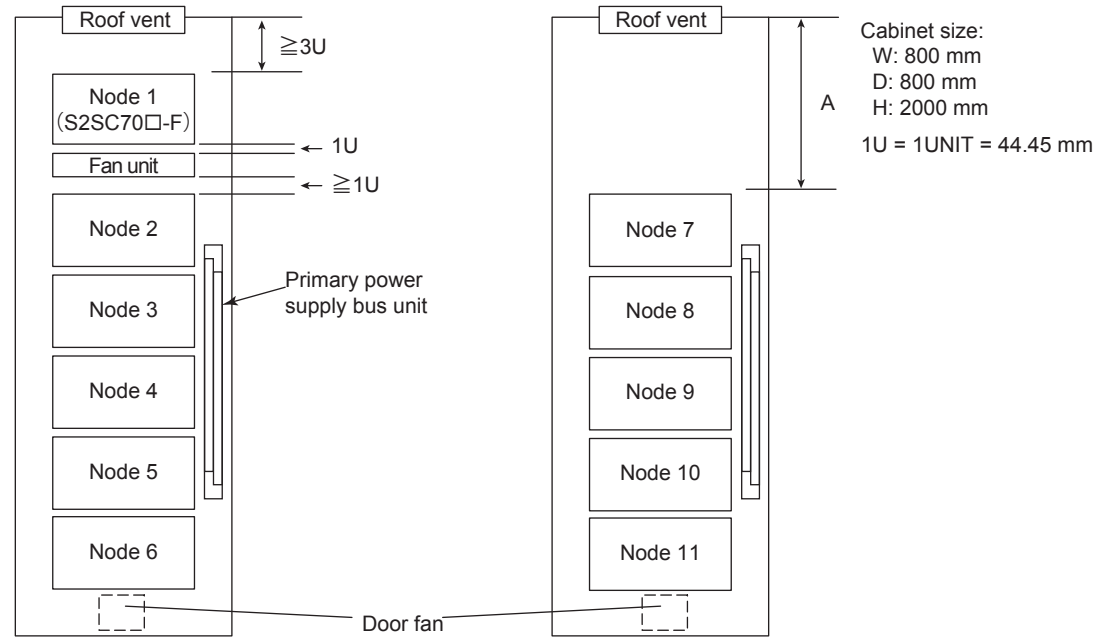


Figure Installation of S2SC70☐/SSC60☐/SSC50☐/SSC57☐ for Rittal cabinet (with Fan Unit)

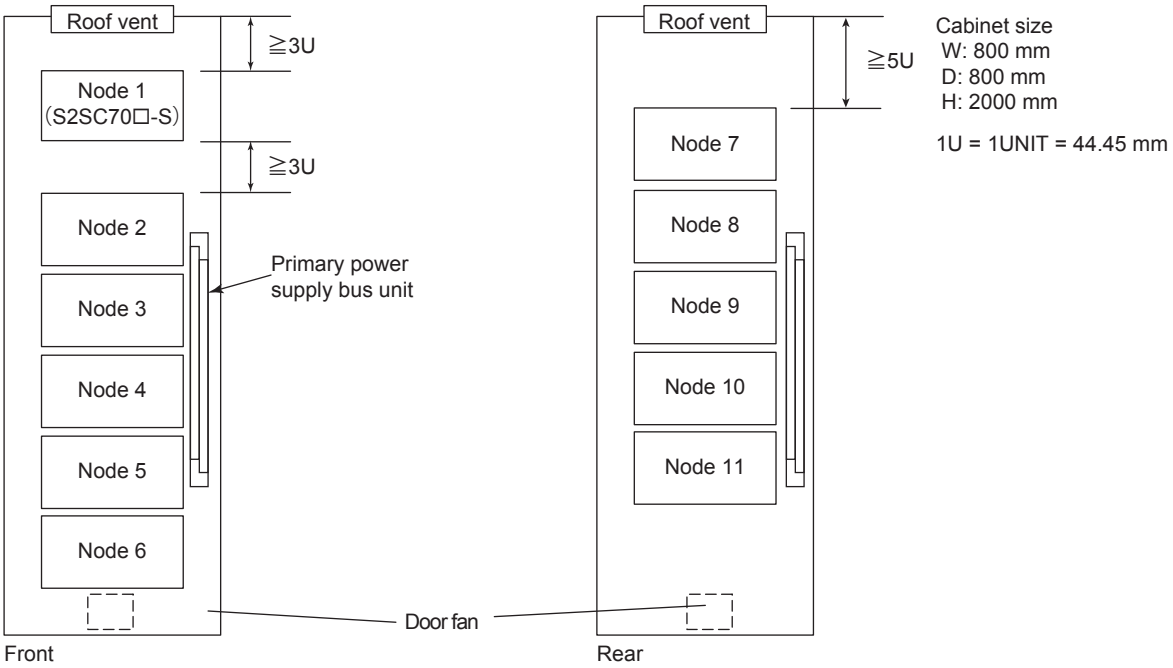


Figure Installation of S2SC70☐/SSC60☐/SSC50☐/SSC57☐ for Rittal cabinet (without Fan Unit)

- Fan specifications
  Door fan (on one side): Maximum air flow rate 230 m^3/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 S2SC70☐-F/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

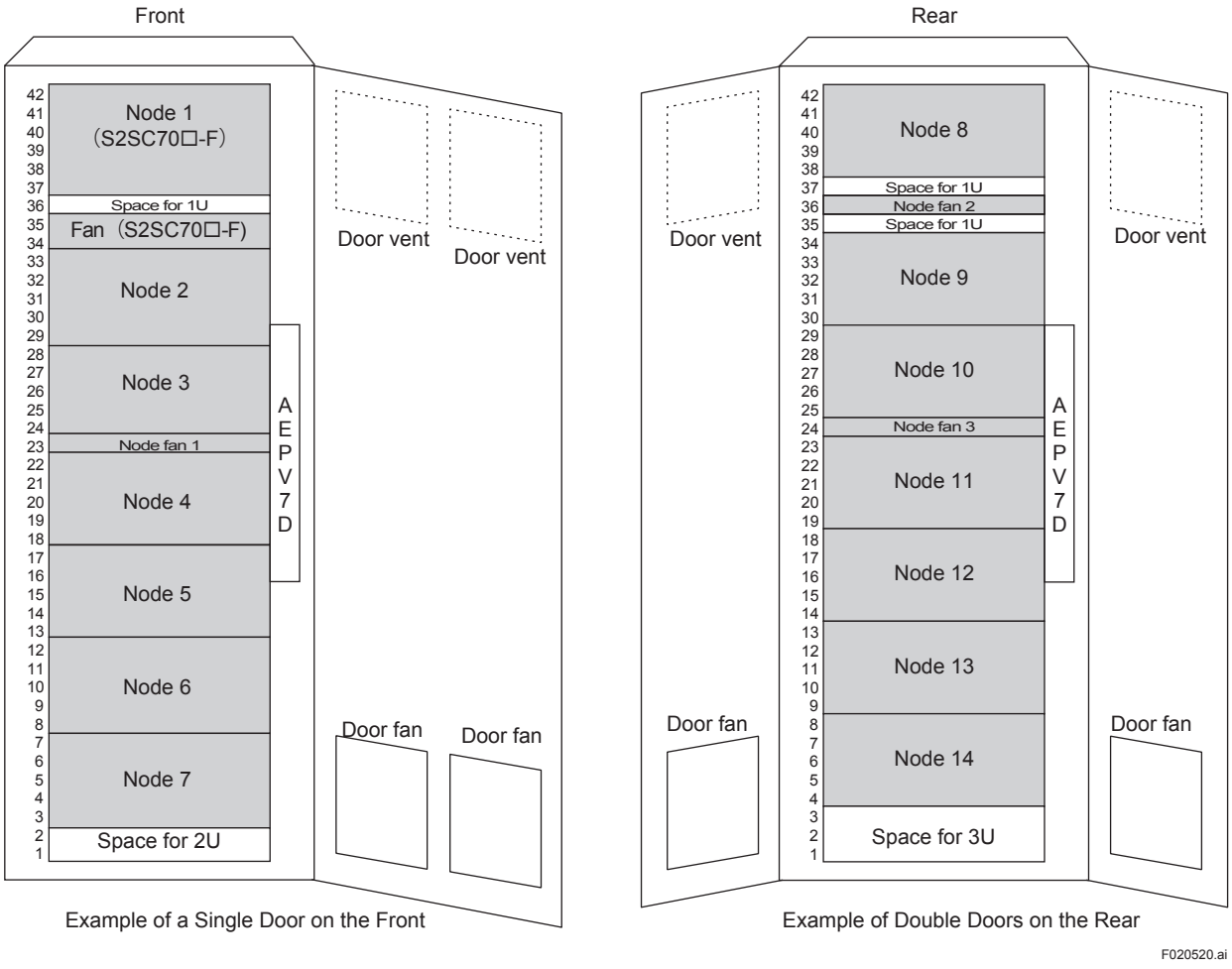


Figure Fan Configuration of Type 1 and Installation Positions in the Cabinet

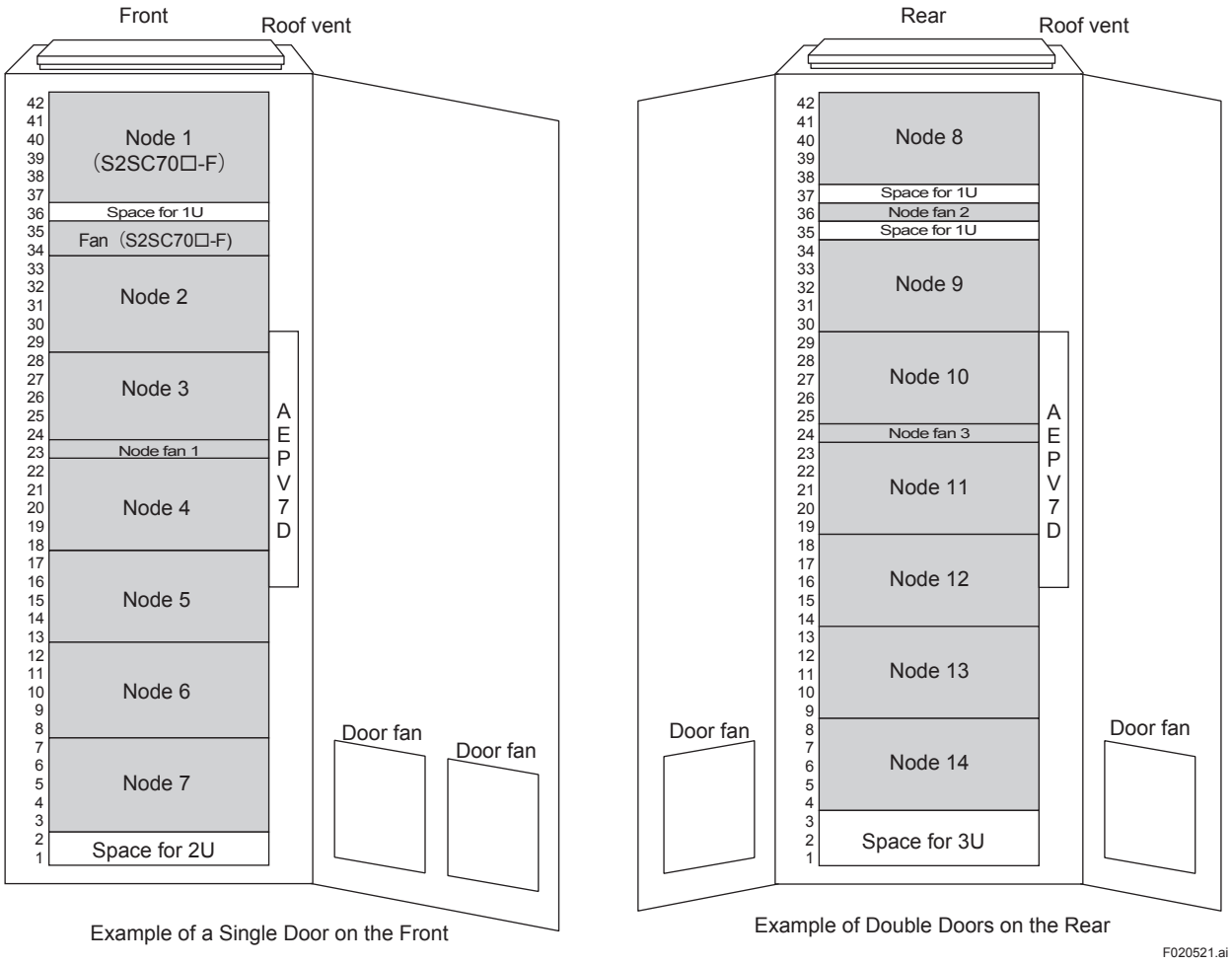


Figure Fan Configuration of Type 2 and Installation Positions in the Cabinet

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	Node11	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 m^3/h or more
  Node fan: Maximum air flow rate 480 m^3/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.

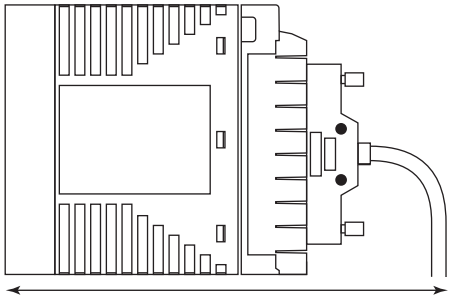
Notes on Installation

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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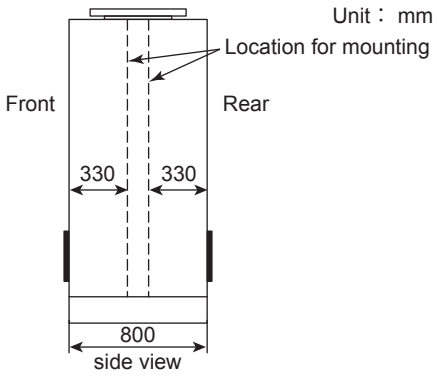
Location



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2.5.6 Installation Guideline for Cabinet (N-IO)

Installation Guideline for Rittal cabinet for N-IO

This section describes examples of the maximum number of N-IO system equipment (except for equipment for RIO System Upgrade) installed in general-purpose cabinets.

The following shows the common specifications to the examples of cabinets for N-IO system that are explained later.

Cabinet Specifications

The following cabinet is assumed to be used.

Table Cabinet Dimensions

W	D	H	Material
800 mm	800 mm	2000 mm (+100 mm) (*1)	Metal

*1: 100 mm is the height of the channel base.

The area of an air supply / air exhaust port

	Area
Air supply port	800 mm^2 or more
Air exhaust port	Same or more than the air supply port

The requirement of a door fan

	Air flow	Remarks
Door fan	230 m^3/h or more	• Mounting two push-fit fans on one side in case of a failure is recommended. • The air flow in the left shows the total air flow on each side.

Product examples

Table Product examples

	Manufacturer	Model
Cabinet	Rittal	TS8808 series
Door fan	Rittal	SK3239 series

Notes

The following shows the common notes to the examples.

- The ventilation for each modules shall not be blocked.
- The mounting plate for mounting the IOBP shall be made of metal, regardless of whether DIN rail or panel mounting.
- A DIN rail shall be made of metal.
- For mounting restrictions other than the above, refer to the General Specifications (GS).

Conventions

The following shows the common abbreviations used and their explanations.

Abbreviations	Explanations
SCU	Safety Control Unit
NIU	Node Interface Unit (for N-IO)
IOBP	I/O Base Plate
IOBP_IS	I/O Base Plate for Intrinsic Safety explosion protection
NIO node	Consists of NIU and IOBP/IOBP_IS.
Unit	Unit of 19 inch rack. 1 Unit = 44.45 mm
Side	One of the front and the back of a cabinet. (e.g., side, one side)

Example of Mounting Multiple SCUs for N-IO in a Cabinet

Temperature conditions

In this example, the ambient temperature is assumed to be the following.

Cabinet ambient temperature	40 °C or less

Maximum numbers of units that can be mounted

Type	Model	Number of units that can be mounted per side
SCU	S2SC70D S2SC70S (Except for S2SC70□-S)	Up to 4

Heat-generating devices other than the above shall not be mounted in the cabinet.

Mounting conditions

- SCU shall be mounted with a 3-unit or more space from the top-shelf mounting position of the cabinet.
- A 1-unit or more space shall be provided between the fan unit of a SCU and the SCU on the bottom shelf.
- Devices that block the convective air flow from the fan unit of a SCU or door fans to each module shall not be mounted.

The following shows how to mount multiple SCUs for N-IO in a cabinet:

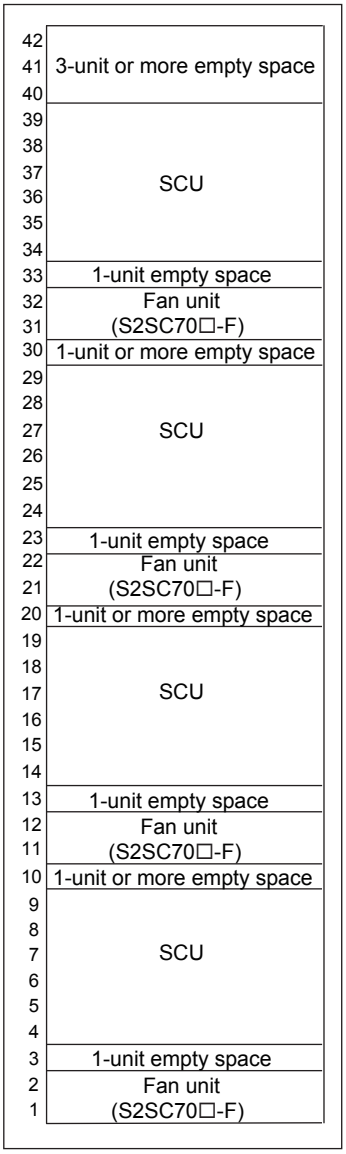

Figure Example of Mounting Multiple SCUs for N-IO in a Cabinet

Example of Mounting an SCU for N-IO and N-IO Nodes in a Cabinet

Temperature conditions

In this example, the ambient temperature is assumed to be the following.

Cabinet ambient temperature	40 °C or less

Maximum numbers of units that can be mounted in case of this example

Type	Model	Number of units that can be mounted per side
SCU	S2SC70S/S2SC70D (Except for S2SC70☐-S)	Up to 1
NIU	S2NN30D	Up to 1
IOBP	S2BN1D	Up to 6 (2 rows × 3 shelves)

Heat-generating devices other than the above shall not be mounted in the cabinet.

Mounting conditions

- The SCU on the top shelf shall be mounted with a 100-mm or more space from the cabinet ceiling.
- A 1-unit (= 44.45 mm) or more space shall be provided between NIU and IOBP.
- A circulation fan unit shall be mounted on the shelf below the SCU with a 1-unit space. A 1-unit or more space shall be provided under the circulation fan unit.
- Suitable length of signal cables and power cables should be used.

The following shows how to mount an SCU for N-IO and N-IO nodes in a cabinet:

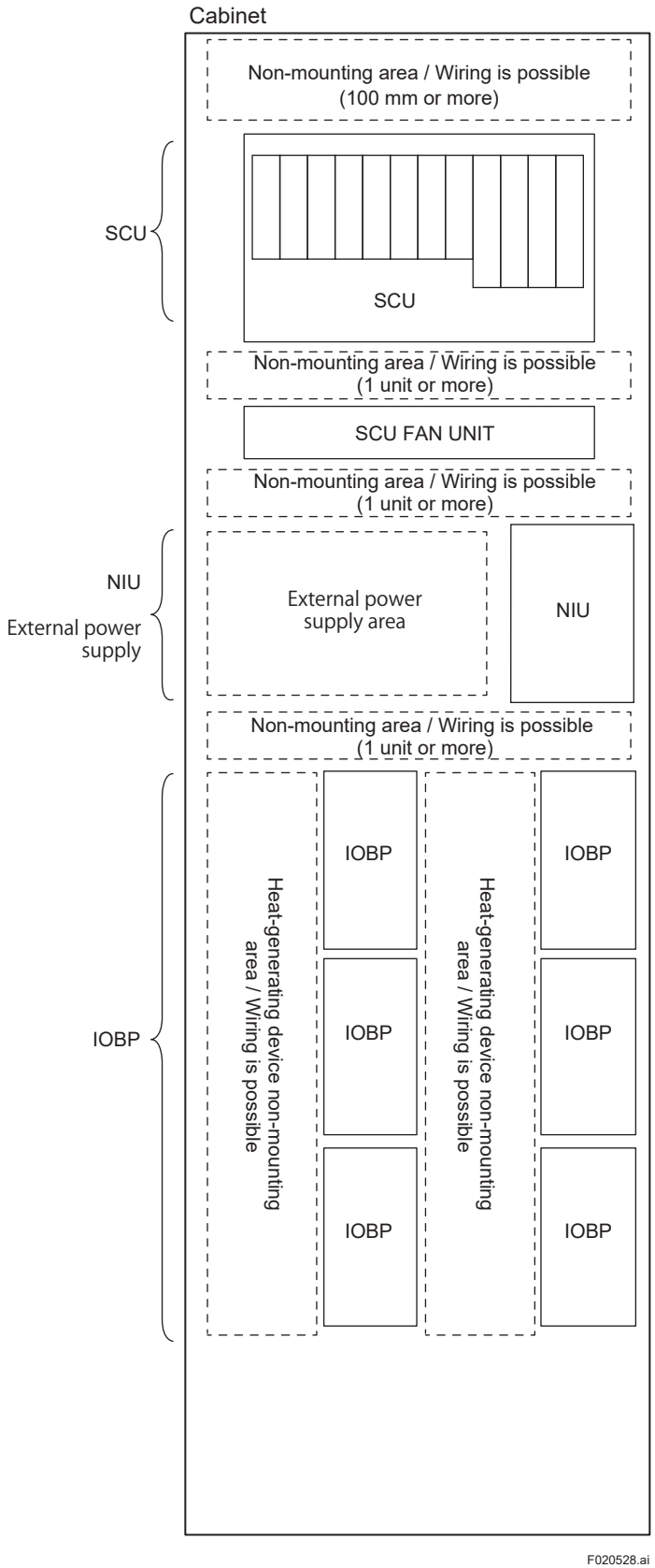

Figure Example of Mounting an SCU for N-IO and N-IO Nodes in a Cabinet

Example of Mounting N-IO Nodes (Non-Intrinsic Safety Barrier) in a Cabinet

Temperature conditions

In this example, the ambient temperature is assumed to be the followings.

Cabinet ambient temperature	50 °C or less

Maximum numbers of units that can be mounted in case of this example

Type	Model	Number of units that can be mounted per side
NIU	S2NN30D	Up to 2
IOBP	S2BN1D	Up to 10 (2 rows × 5 shelves)

Heat-generating devices other than the above shall not be mounted in the cabinet.

Mounting conditions

- The NIU shall be mounted with a 100-mm or more space from the cabinet ceiling.
- A 1-unit (= 44.45 mm) or more space shall be provided between NIU and IOBP.
- Suitable length of signal cables and power cables should be used.

The following shows how to mount N-IO nodes (Non-Intrinsic Safety barrier) in a cabinet:

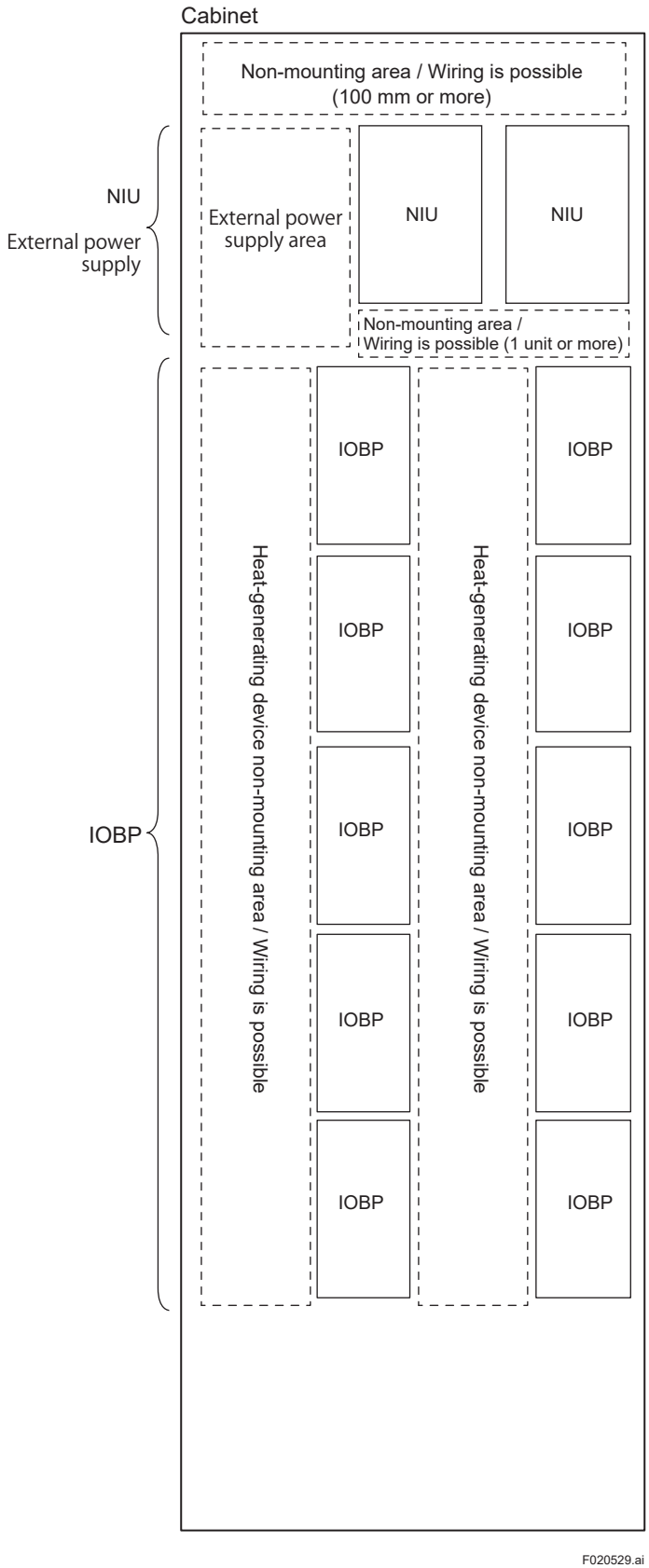

Figure Example of Mounting N-IO Nodes (Non-Intrinsic Safety barrier) in a Cabinet

Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Cabinet

Temperature conditions

In this example, the ambient temperature is assumed to be the followings.

Cabinet ambient temperature	50 °C or less

Maximum numbers of units that can be mounted in case of this example

Type	Model	Number of units that can be mounted per side
NIU	S2NN30D	Up to 2
IOBP_IS	S2BN4D or S2BN5D	Up to 8 (2 rows × 4 shelves) Up to 10 (2 rows × 5 shelves)

Heat-generating devices other than the above shall not be mounted on the same mounting plate.

IOBP cannot be mounted.

Mounting conditions

- The NIU shall be mounted with a 100-mm or more space from the cabinet ceiling.
- A 1-unit (= 44.45 mm) or more space shall be provided between NIU and IOBP_IS.
- Suitable length of signal cables and power cables should be used.
- Mounting the devices in the cabinet should be in line according to the intrinsic safety standard.

The following shows how to mount N-IO nodes (Intrinsic Safety barrier) in a cabinet:

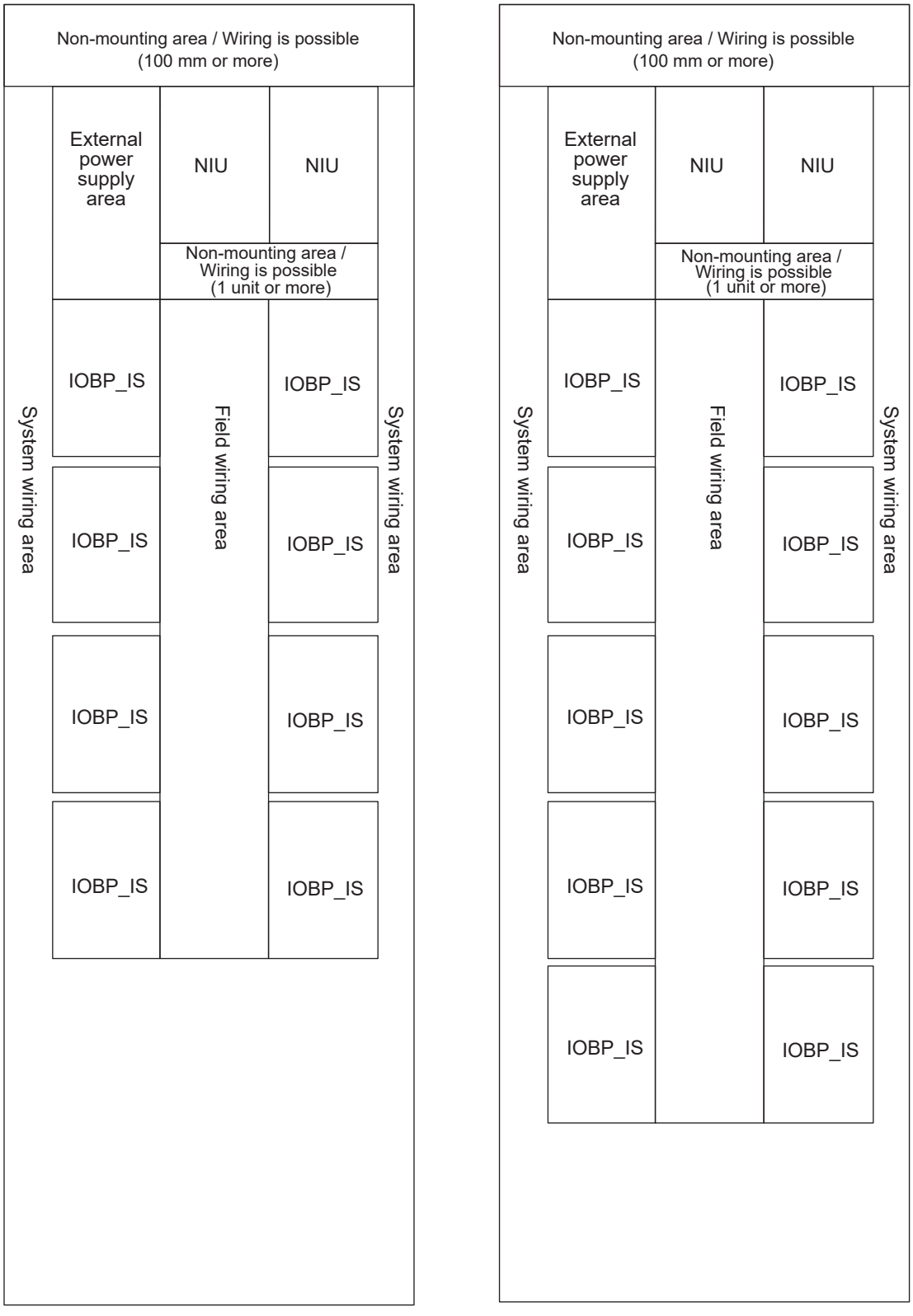

Figure Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Cabinet

Junction Box for N-IO System

This section describes examples of the maximum number of N-IO system equipment (except for equipment for RIO System Upgrade) installed in general-purpose junction boxes.

The following shows the common specifications to the examples of junction boxes for N-IO system that are explained later.

Junction Box Specifications

The following junction box is assumed to be used.

Table Junction Box Dimensions

W	D	H	Material
800 mm	300 mm	1000 mm	Metal

Product examples

Table The area of an air supply/air exhaust port

	Area
Air supply port	—
Air exhaust port	—

—: Not required

Table The requirement of a door fan

	Air flow
Door fan	—

—: Not required

Table Product examples

	Manufacturer	Model
Junction Box	Rittal	AE1180 series

Notes

The following shows the common notes to the examples.

- The ventilation for each system shall not be blocked.
- The mounting plate for mounting the IOBP and IOBP_IS shall be made of metal, regardless of whether DIN rail or panel mounting.
- A DIN rail shall be made of metal.
- For mounting restrictions other than the above, refer to the General Specifications (GS).
- When using a DIN rail, be sure to install a DIN rail on the mounting plate.
  Fixing at the both ends of a DIN rail and not fixing at the middle.

Conventions

The following shows the common abbreviations used and their explanations.

Abbreviations	Explanations
NIU	Node Interface Unit or Base Plate for Node Interface Unit
IOBP	Base Plate
IOBP_IS	Base Plate Intrinsic Safety explosion protection
Unit	Unit of 19 inch rack. 1 Unit = 44.45 mm

Example of Mounting N-IO Nodes (Non-Intrinsic Safety Barrier) in a Junction Box

Temperature conditions

In this example, the ambient temperature is assumed to be the followings.

Junction Box ambient temperature	50 °C or less

Maximum numbers of units that can be mounted

	Type	Model	Number of units that can be mounted per side
Per junction box	NIU	S2NN30D	Up to 1
	IOBP	S2BN1D	Up to 4 (2 rows × 2 shelves)
	Other	Heat-generating device (*1)	heat generation: 40 W or less

*1: The device to be mounted shall be selected from those that have the ambient temperature range of +15 °C or more.

Heat-generating devices other than the above shall not be mounted in the junction box.

In this example, IOBP_IS cannot be mounted.

Mounting conditions

- Mount the NIU on the upper left in the junction box basically.
- Do not mount the IOBP so that its heat-generating part (adaptor or I/O) is located immediately under the N-ESB Bus module (S2EN501). The IOBP may be mounted immediately under the power supply of the NIU (S2PW50x).
- The NIU shall be mounted in the left upper location of the junction box with a 2-unit or more space from the ceiling.
- A 1-unit or more space shall be provided between the NIU and IOBP.
- To mount heat-generating devices other than NIU and IOBP shall be mounted with 30-mm intervals on the right of the NIU on the top shelf. The specifications of the devices shall be observed.

The following shows how to mount N-IO nodes (Non-Intrinsic Safety barrier) in a junction box:

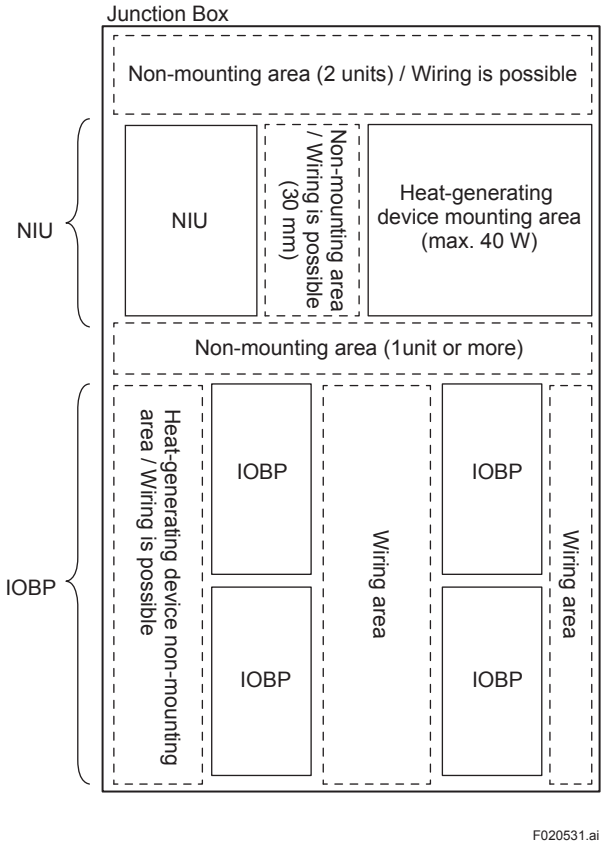

Figure Example of Mounting N-IO Nodes (Non-Intrinsic Safety Barrier) in a Junction Box

Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Junction Box

Temperature conditions

In this example, the ambient temperature is assumed to be the following.

Junction Box ambient temperature	50 °C or less

Maximum numbers of units that can be mounted

	Type	Model	Number of units that can be mounted per side
Per junction box	NIU	S2NN30D	Up to 1
	IOBP_IS	S2BN4D or S2BN5D	Up to 2 (2 rows × 1 shelf)
	Other	Heat-generating device (*1)	heat generation: 20 W or less

*1: The device to be mounted shall be selected from those that have the ambient temperature range of +15 °C or more.

Heat-generating devices other than the above shall not be mounted in the junction box.

In this example, IOBP cannot be mounted.

Mounting conditions

- Do not mount the IOBP_IS so that its heat-generating part (Barrier or I/O) is located immediately under the N-ESB Bus module (S2EN501). The IOBP_IS may be mounted immediately under the power supply of the NIU (S2PW50x).
- The NIU shall be mounted with a 2-unit or more space from the ceiling of the junction box.
- A 2-unit or more space shall be provided between the NIU and IOBP_IS.
- To mount heat-generating devices other than NIU and IOBP_IS shall be mounted with 30-mm intervals on the right of the NIU on the top shelf. The specifications of the devices shall be observed.

The following shows how to mount N-IO nodes (Intrinsic Safety barrier) in a junction box:

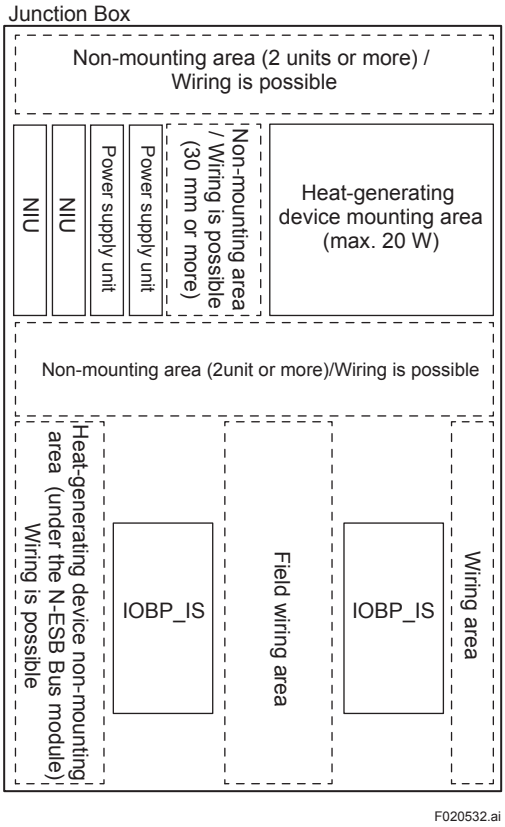

Figure Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Junction Box

CAUTION

The wiring that will be intrinsic safety circuits must be installed so that they are electrically separated from the wiring of non-intrinsic safety circuits, including the in-cabinet wiring. Install the wiring according to the IEC 60079-14 standards or the requirements for explosion-proof wiring of the country where the system is used.

Example of Mounting N-IO Nodes (Mixture of Intrinsic Safety Barrier and Non-Intrinsic Safety Barrier) in a Junction Box

Temperature conditions

In this example, the ambient temperature is assumed to be the following.

Junction Box ambient temperature	50 °C or less

Maximum numbers of units that can be mounted

	Type	Model	Number of units that can be mounted per side
Per junction box	NIU	S2NN30D	Up to 1
	IOBP	S2BN1D	Up to 2 (1 row × 2 shelves)
	IOBP_IS	S2BN4D or S2BN5D	Up to 1 (1 row × 1 shelf)
	Other	Heat-generating device (*1)	heat generation: 20 W or less

*1: The device to be mounted shall be selected from those that have the ambient temperature range of +15 °C or more.

Heat-generating devices other than the above shall not be mounted in the junction box.

Mounting conditions

- Do not mount the IOBP/IOBP_IS so that its heat-generating part (Barrier or I/O) is located immediately under the N-ESB Bus module (S2EN501). The IOBP/IOBP_IS may be mounted immediately under the power supply of the NIU (S2PW50x).
- The NIU shall be mounted with a 2-unit or more space from the ceiling of the junction box.
- A 2-unit or more space shall be provided between the NIU and IOBP/IOBP_IS.
- To mount heat-generating devices other than NIU and IOBP/IOBP_IS shall be mounted with 30-mm intervals on the right of the NIU on the top shelf. The specifications of the devices shall be observed.

The following shows how to mount N-IO nodes (mixture of Intrinsic Safety barrier and Non-Intrinsic Safety barrier) in a junction box:

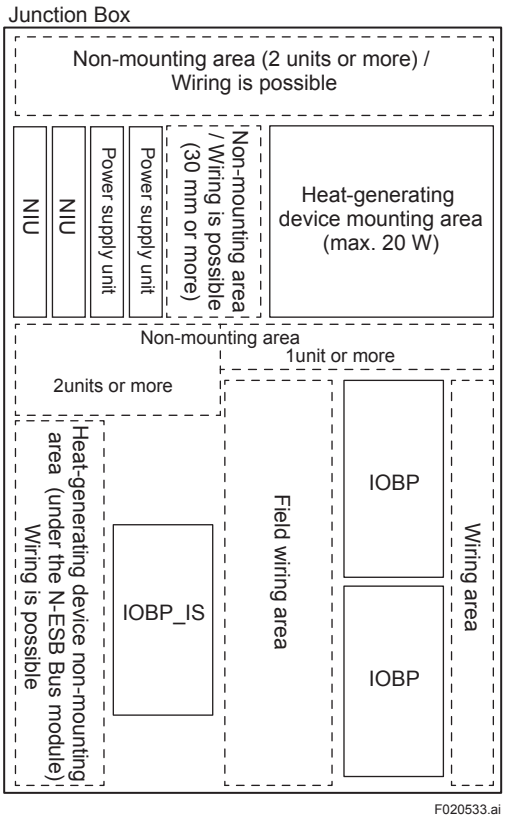

Figure Example of Mounting N-IO Nodes (Mixture of Intrinsic Safety Barrier and Non-Intrinsic Safety Barrier) in a Junction Box

CAUTION

The wiring that will be intrinsic safety circuits must be installed so that they are electrically separated from the wiring of non-intrinsic safety circuits, including the in-cabinet wiring. Install the wiring according to the IEC 60079-14 standards or the requirements for explosion-proof wiring of the country where the system is used.

2.5.7 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.

2.5.8 Installing Control Network Interface Card

This section describes how to install VI702 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 32P06C10-01EN or IM 32Q06C10-31E.

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
S1BB4D	Input Power Cables	An ambient temperature plus +30 °C
	Ready terminal	An ambient temperature plus +20 °C
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
S2BN1D	Field Power Cables	An ambient temperature plus 20 °C or more
S2BN4D	I/O Cables	An ambient temperature plus 20 °C or more
S2BN5D	Grounding Cables	An ambient temperature plus 20 °C or more
S2PW503/S2PW504	Input Grounding Cables	An ambient temperature plus 30 °C or more

Signal Cables

Nominal conductor cross-sectional area:
For FIO Node: 0.75 to 2.00 mm^2
For N-IO Node: 0.75 to 2.50 mm^2 (AWG 20~14)
Sleeve for spring clamp terminals:
0.5 to 1.5 mm^2 (AWG 20~16)
For SED2D: 0.75 to 5.5 mm^2

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

Alarm and Control Circuit Cables

Nominal conductor cross-sectional area: 0.13 to 2.5 mm^2
Node Interface Unit External Alarm input terminal: 0.5 to 2.5 mm^2 (AWG 20~14)
Other than above: 0.5 to 1.25 mm^2

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)

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 mm^2
For rack-mounted 24 V DC-driven equipment: Minimum 2.0 mm^2
For N-IO I/O Base plates S2BN1D (Field Power Supply terminal): 3.5 to 5.5 mm^2
For N-IO Barrier Base plates (Barrier Power Supply terminal): 0.5 to 1.5 mm^2
Node Interface Unit: 1.25 mm^2 (AWG 16) Double Insulation structure
For cabinets AC 100-120/220-240 V-driven: Minimum 8.0 mm^2
For cabinets DC 24 V-driven equipment: Minimum 14.0 mm^2

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

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:
For Node Interface Unit: Minimum 2.0 mm^2 (AWG14)
For N-IO I/O Base plates: Minimum 2.0 mm^2 (AWG14)
For N-IO Barrier Base plates: Minimum 2.0 mm^2 (AWG14)
Grounding cables connecting cabinets
AC 100-120/220-240/V-driven to protective grounding system:
Minimum 5.5 mm^2
Grounding cables connecting cabinets DC 24 V-driven to protective grounding system:
Minimum 8.0 mm^2

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

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

CAUTION

- 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.

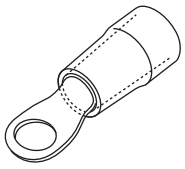

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Figure Solderless Terminal with Insulating Sheath

Sleeve for pressure clamp terminal and spring 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.

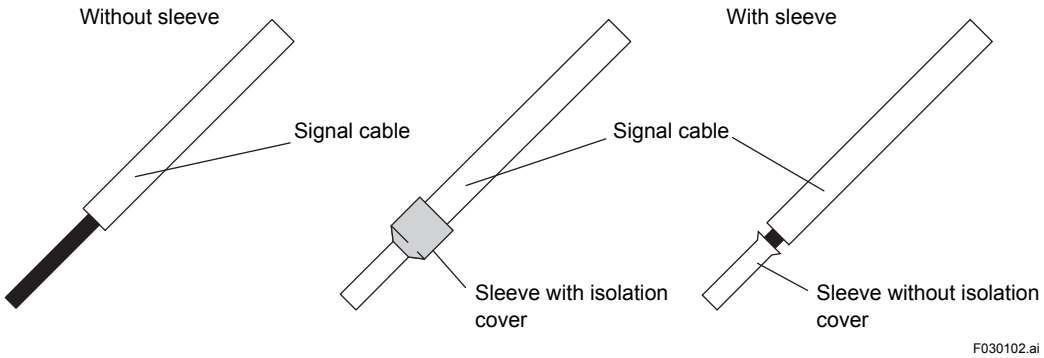

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Figure Sleeve for Pressure Clamp Terminal and spring clamp terminal

CAUTION

- 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.
- Use a sleeve which meet the DIN 46228 standards.

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.

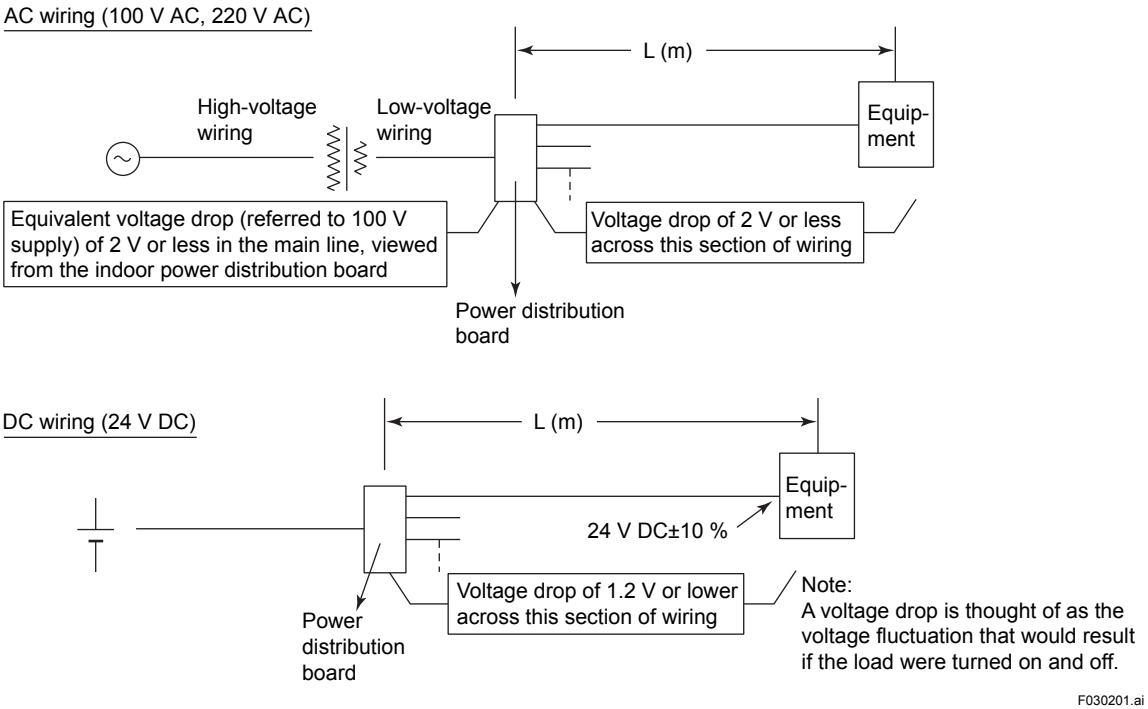

Figure Maximum Cable Length Calculation Conditions

[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

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

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(b) 24 V DC model

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

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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).

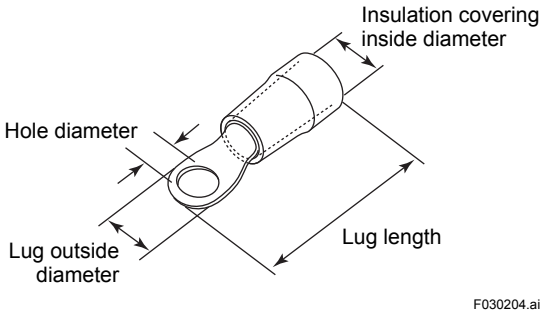


Figure Solderless (crimp-on) Lug

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

CAUTION

- 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.

Sleeve Terminal Processing

Perform the following terminal processing for the primary power supply input with pressure clamp terminal.

Use a sleeve which meet the DIN 46228 standards.

CAUTION

- Use sleeves and a tool that are from the same manufacturer.
- Use sleeves and a tool that are suitable for the cable thickness.
- Connect the cable properly by inserting the wires all the way into the pressure clamp terminals.

Strip the cable coating at the end of the cable and then attach a sleeve. The sleeve specifications differ depending on the cable thickness. The sleeve specifications are shown in the following table.

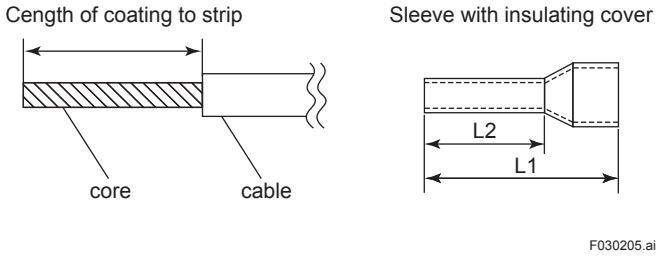


Figure Terminal Processing

Table Cable termination example of Sleeve with Insulating Cover

Nominal crosssectional area (mm^2)	Length to strip (mm)	Sleeve dimensions (mm)		Weidmüeller model No.
		L1	L2	
1.25 (AWG16)	10	14	8	H1.5/14

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).

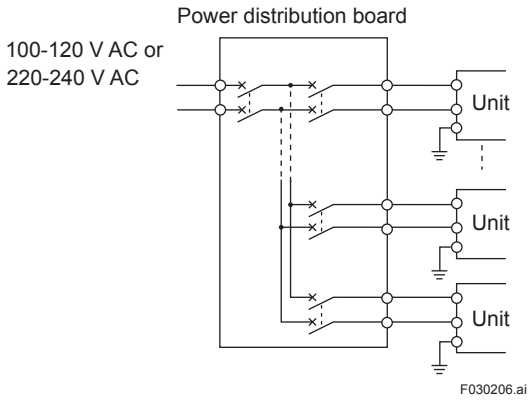


Figure AC Power Distribution Board

24 V DC Power Distribution Board

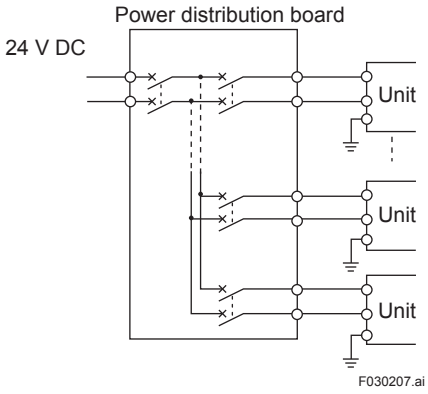


Figure 24 V DC Power Distribution Board

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

Terminal Connection

The power supply terminals and the grounding terminals of each equipment are as follows.

Table The power supply terminals and the grounding terminals of each equipment

Category	Model	Power supply Type	Power supply terminal	Grounding terminal	Grounding Type
Field Control Unit	S2SC70S/D	Power Supply Input	M4 Screw	M4 Screw	Functional grounding
	SSC60S/D, SSC50S/D, SSC57S/D	Power Supply Input			
Node unit	SNB10D	Power Supply Input			
Unit	SNT10D	Power Supply Input			
Router	AVR10D	Power Supply Input			
	AW810D	Power Supply Input			
Node Interface Unit	S2NN30D	Power Supply Input	Pressure clamp	M4 Screw	• Functional grounding (24 V DC) • Protective grounding (Other than 24 V DC)
		Base Plate		M4 Screw	Functional grounding
I/O Unit	S2BN1D	Power Supply Input	Dedicated cable model: S2KPB10 (M4 Screw)	M3 Screw	Functional grounding
		Field Power Supply Input	M4 Screw		
	S2BN4D	Power Supply Input	Dedicated cable model: S2KPB10 (M4 Screw)	M4 Screw	Grounding for explosion protection
		Barrier Power Supply Input	M4 Screw		
	S2BN5D	Power Supply Input	Dedicated cable model: S2KPB10 (M4 Screw)	M4 Screw	Grounding for explosion protection
		Barrier Power Supply Input	M4 Screw		
Power supply bus unit	AEPV7D (Style 2 or the future models)	Power Supply Input	M4 Screw	M4 Screw	• Functional grounding (24V DC) • Protective grounding (Other than 24V DC)
		Power Supply Output	Dedicated 5 pins connector		

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.

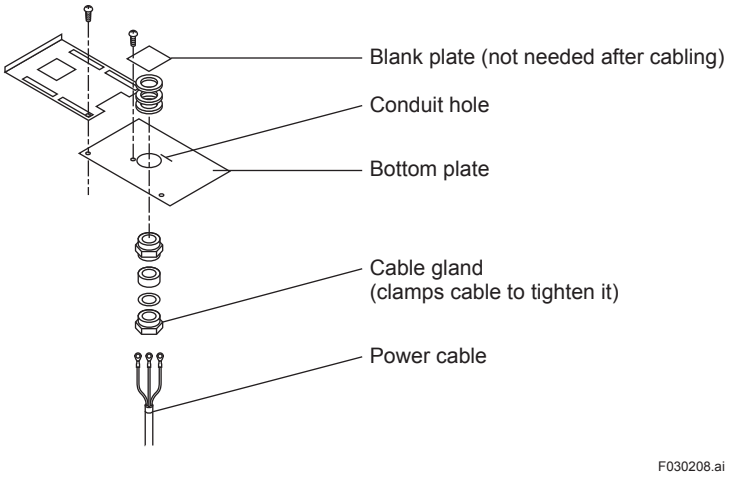


Figure Conduit Hole & Cable Gland

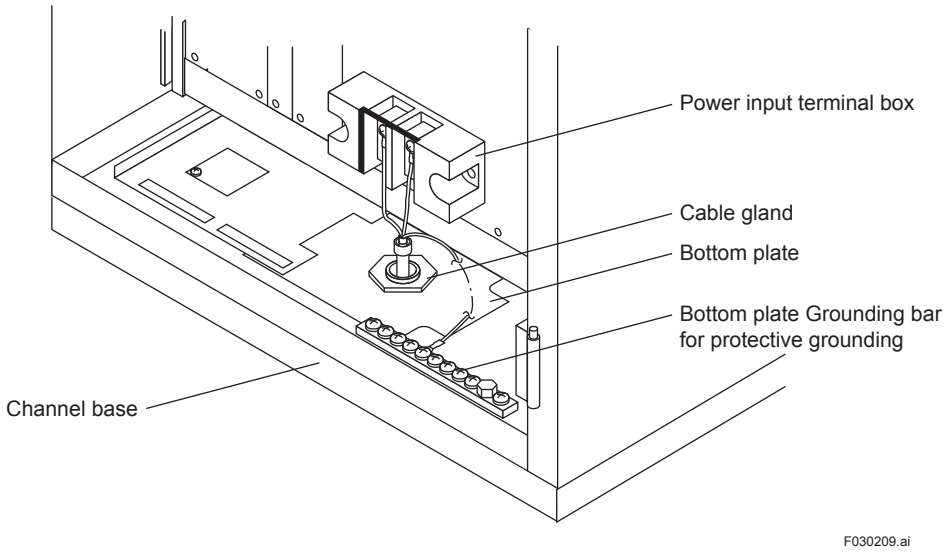


Figure Conduit Cabling

3.3 Connecting Ground Cable

Connect ground cables for the ProSafe-RS as follows:

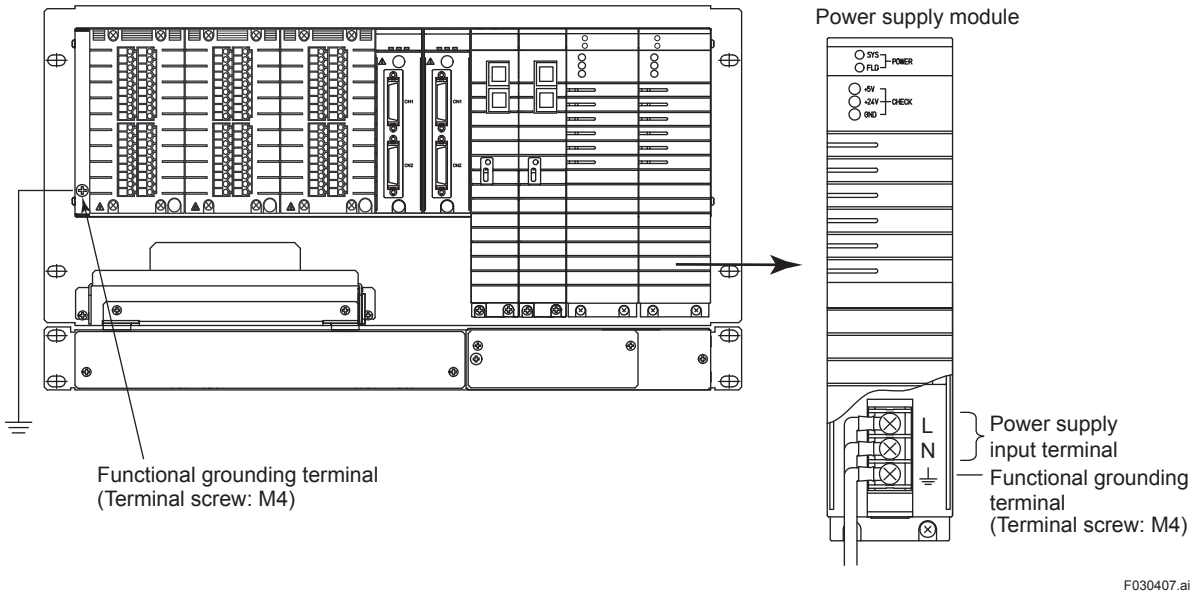
CAUTION

- 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.

S2SC70S/S2SC70D Safety Control Unit



Note: The same cable connections can be applied to SSC60S/SSC60D/SSC50S/SSC50D/SSC57S/SSC57D.

Figure S2SC70S/S2SC70D Cable Connections

SNB10D Safety Node Unit

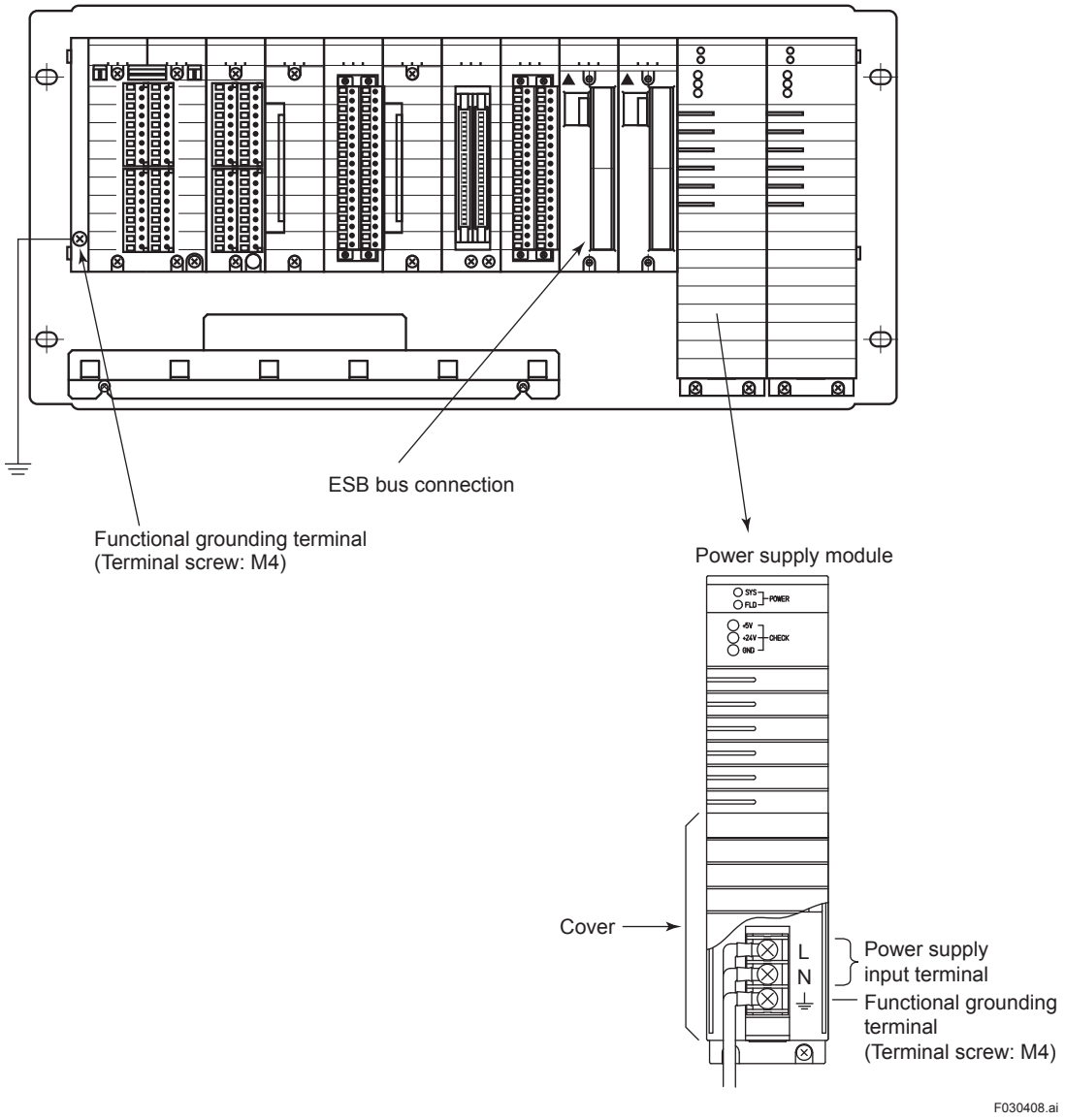


Figure SNB10D Power Cable Connection

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

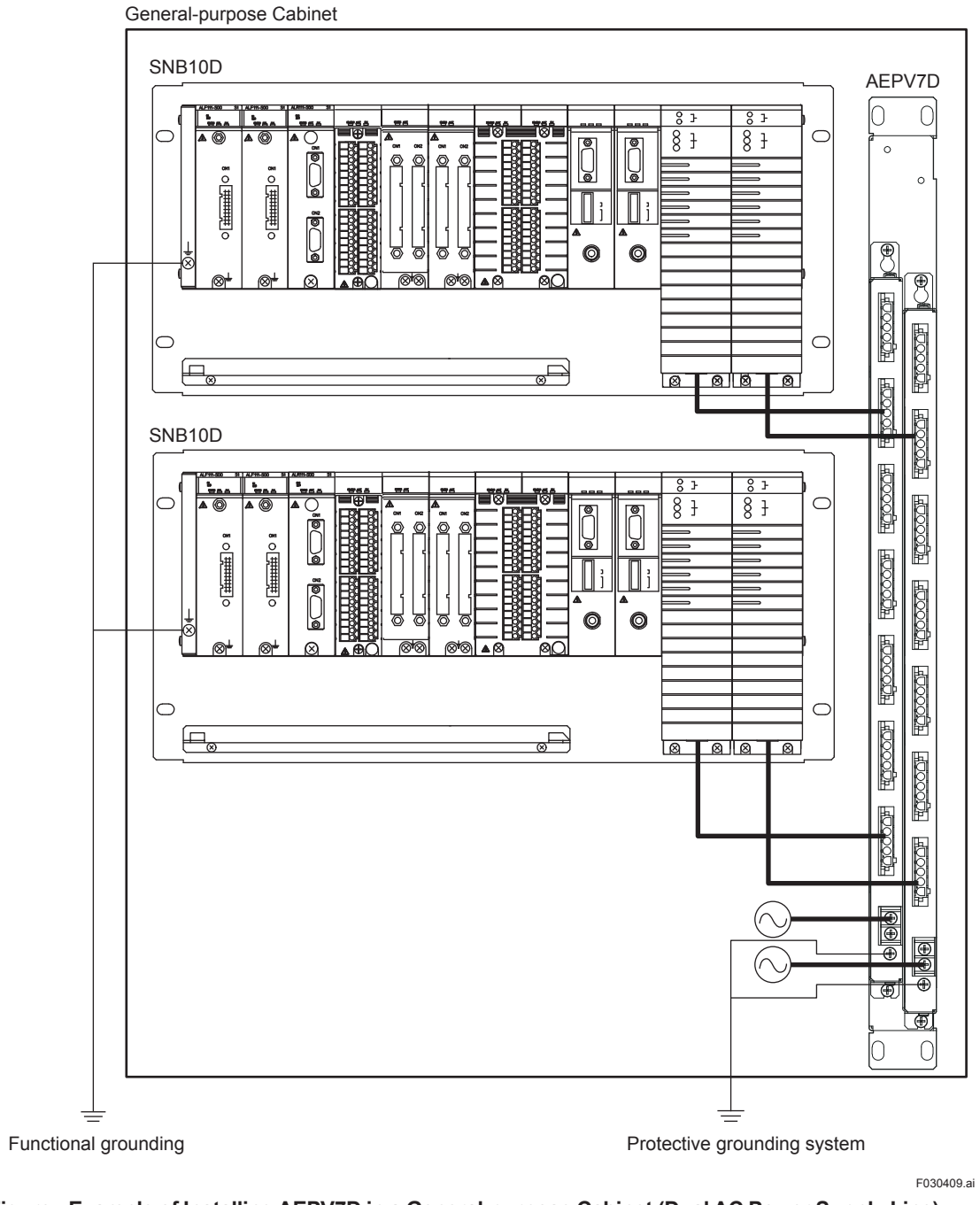


Figure Example of Installing AEPV7D in a General-purpose Cabinet (Dual AC Power Supply Line)

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

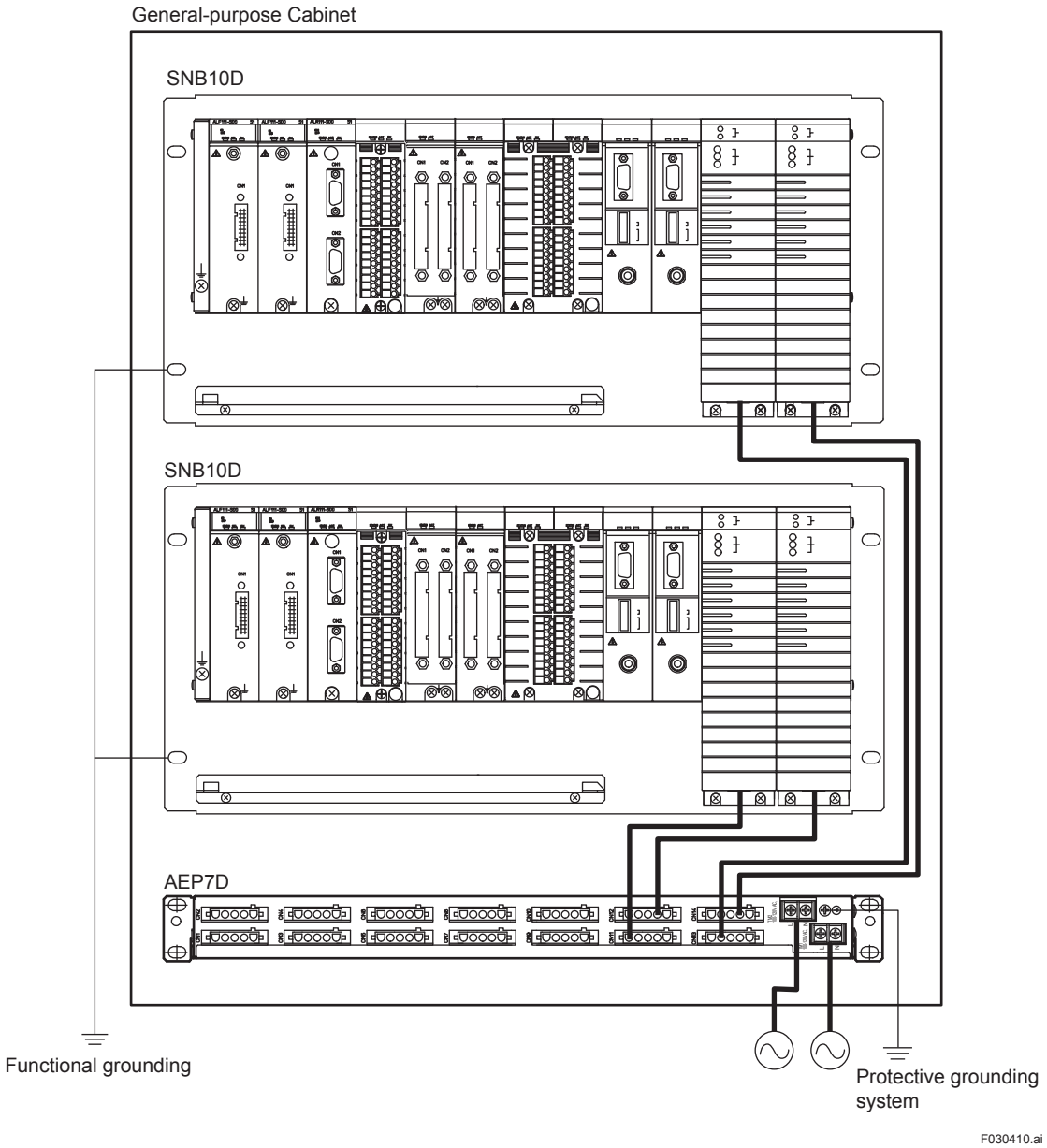


Figure Example of Installing AEP7D in a General-purpose Cabinet (Dual AC Power Supply Line)

SNT10D Unit for Optical Bus Repeater Module

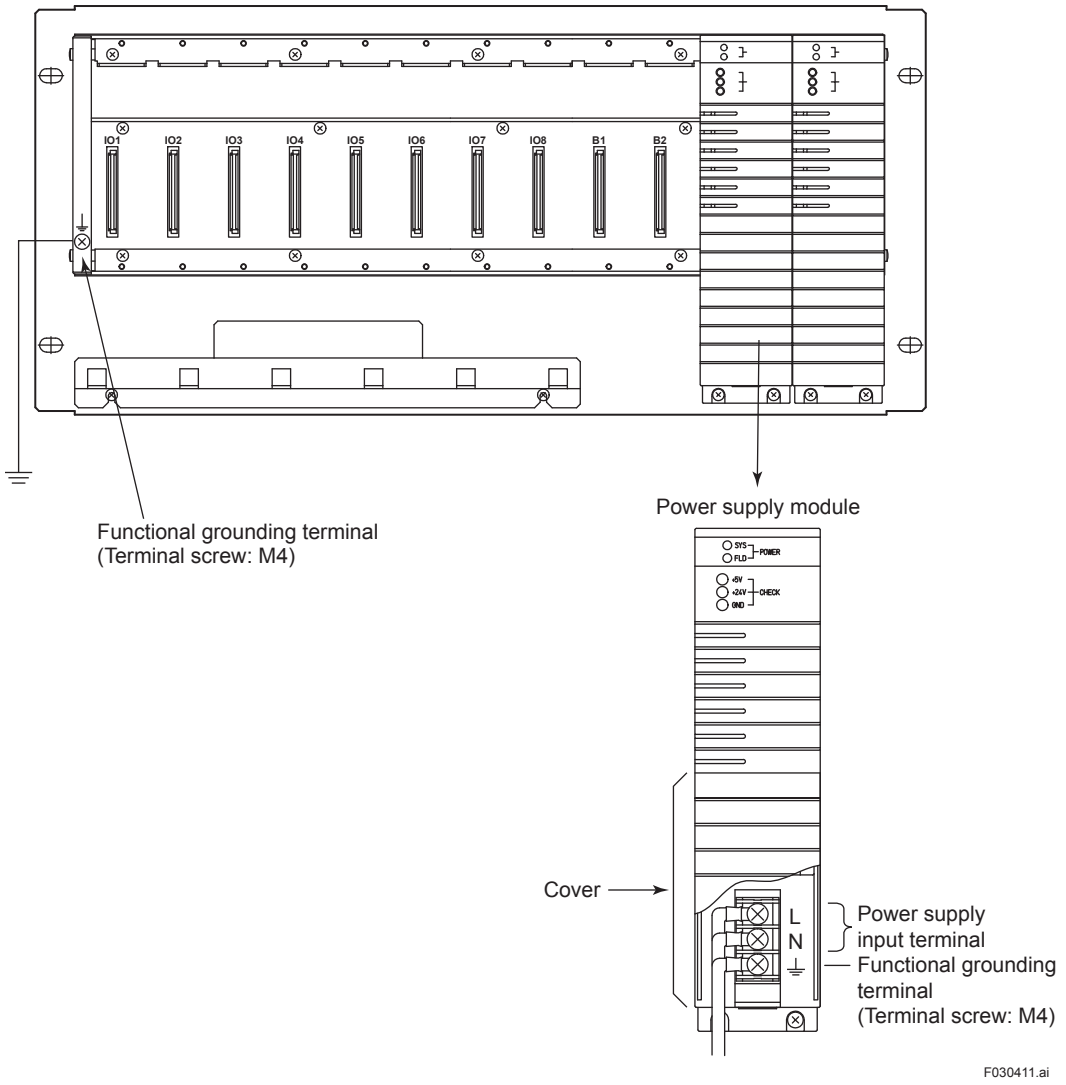


Figure SNT10D Power Cable Connection

S2NN30D Node Interface Unit

Connecting Power Supply with NIU and IOU

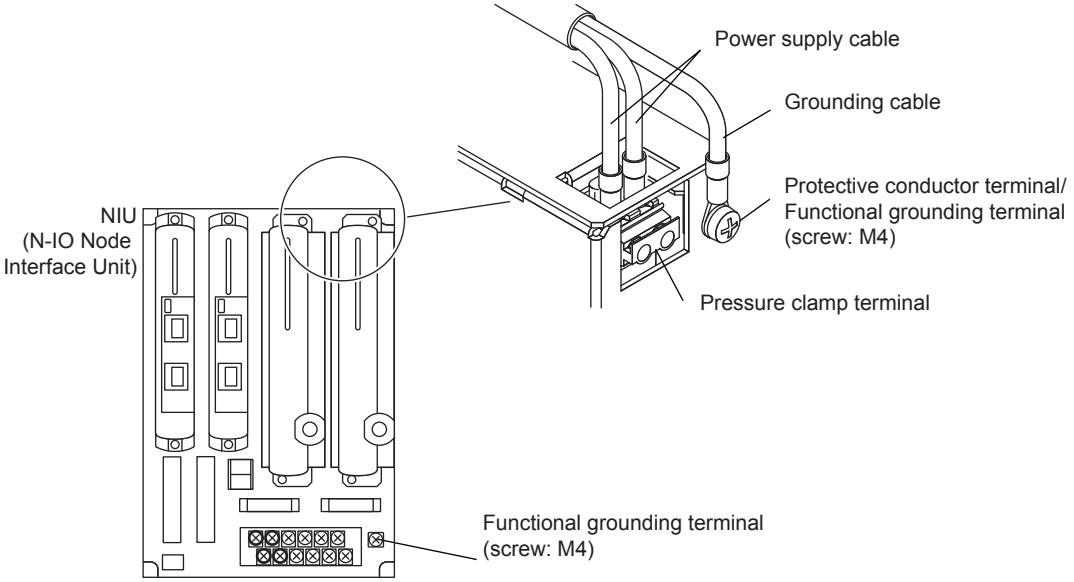
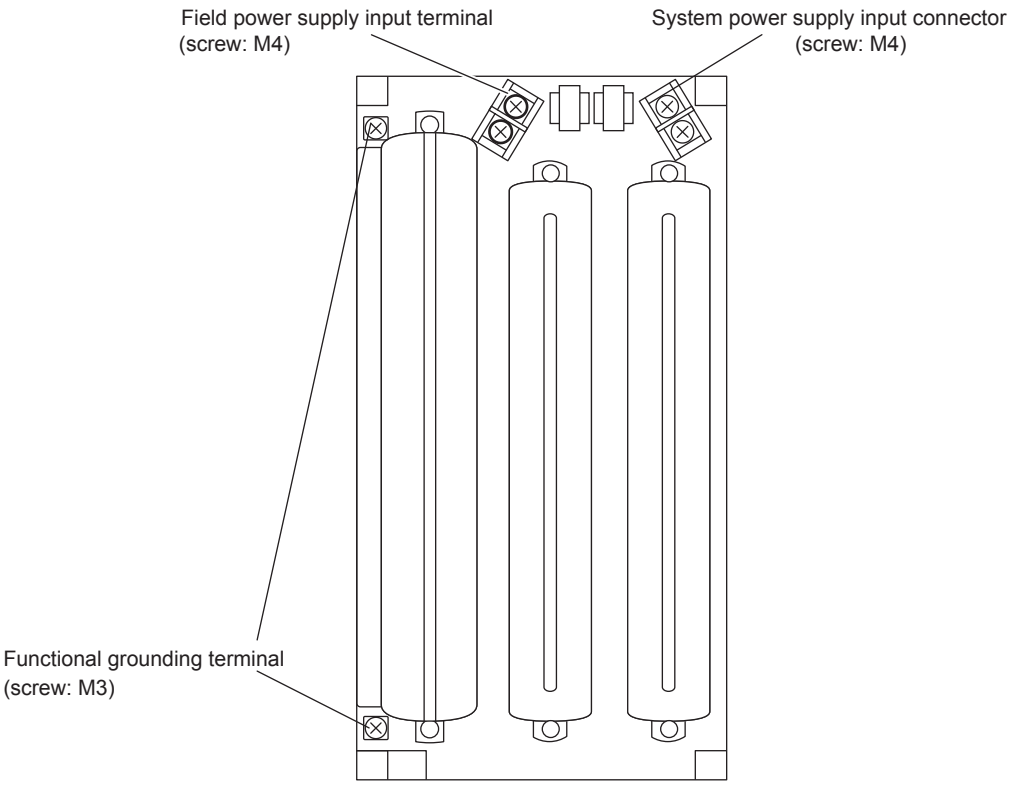


Figure Connecting Power Supply with Node Interface Unit

S2BN1D Base Plate with disconnecting terminal



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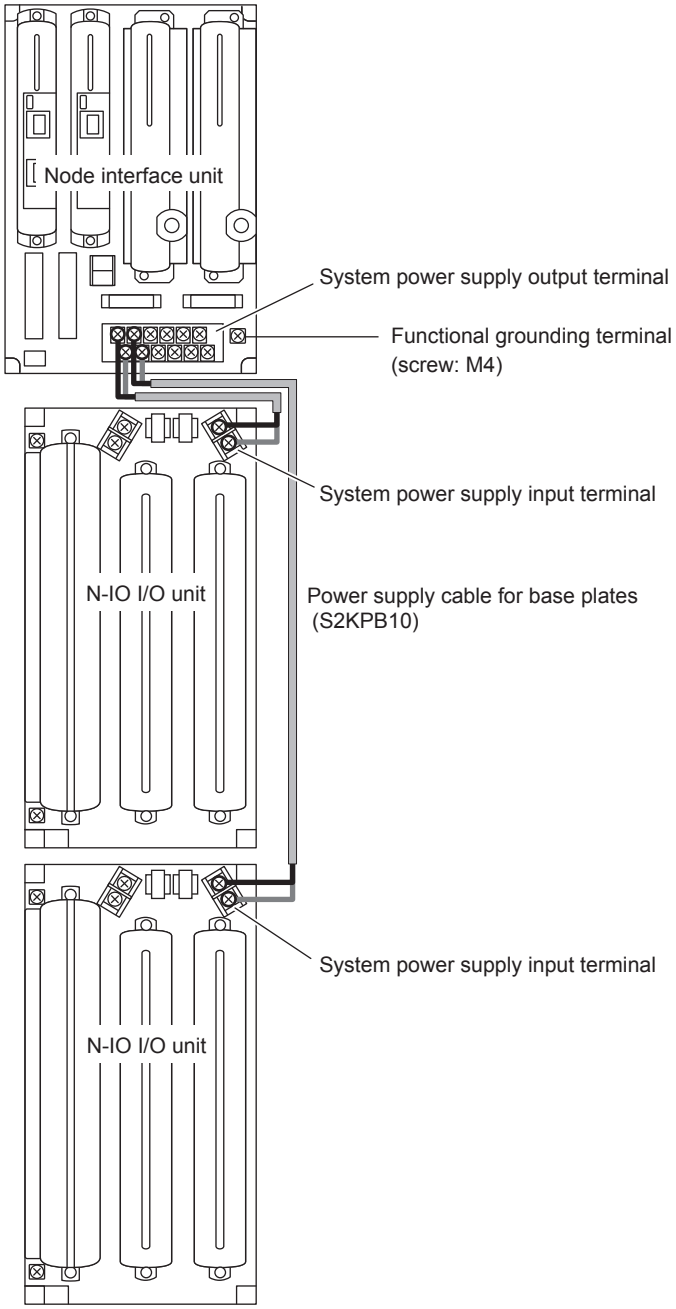
Connecting Power Supply with Node Interface Unit and I/O Units



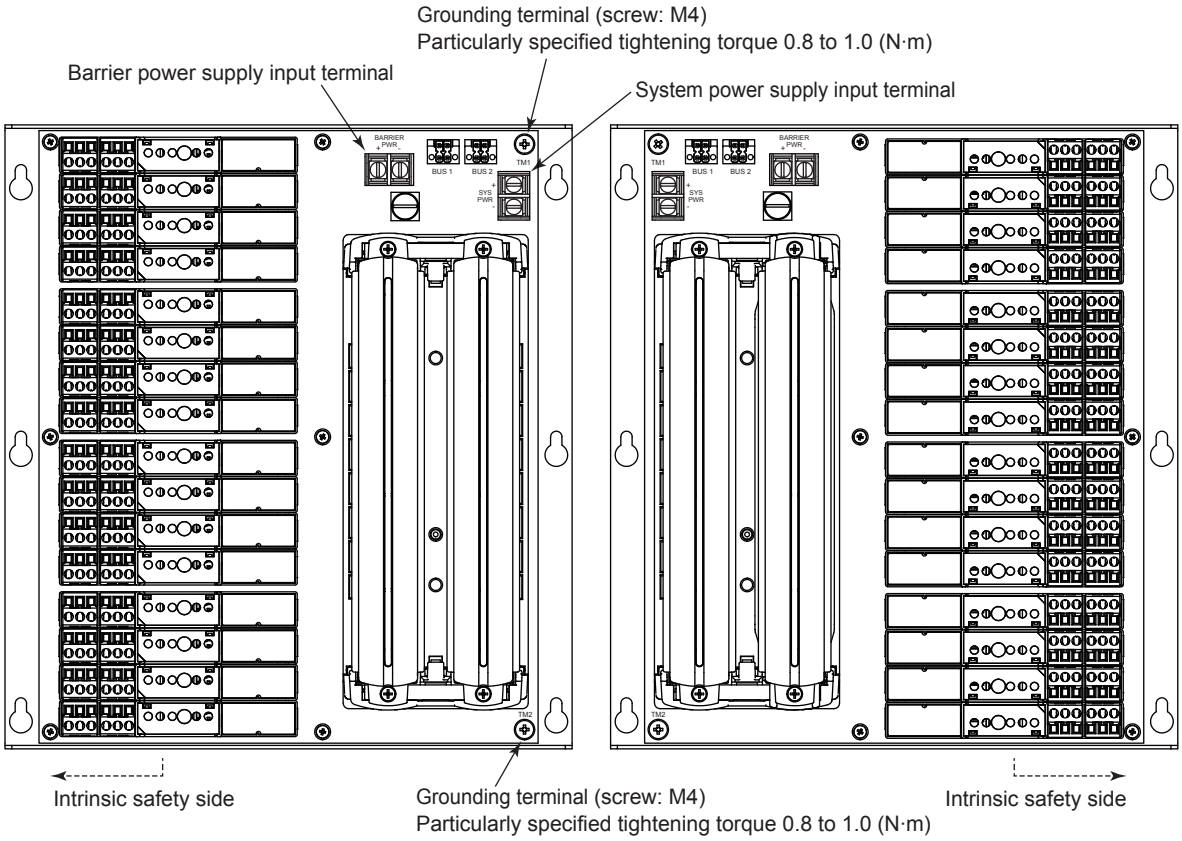
CAUTION

NIU and N-IO I/O Units can be installed in only the same cabinet.

When connecting a Power Supply Cable for Base Plate to a N-IO node, ensure to keep the minimum bending radius of the cable.

The minimum bending radius of the Power Supply Cable is six-fold of the diameter of the cable.

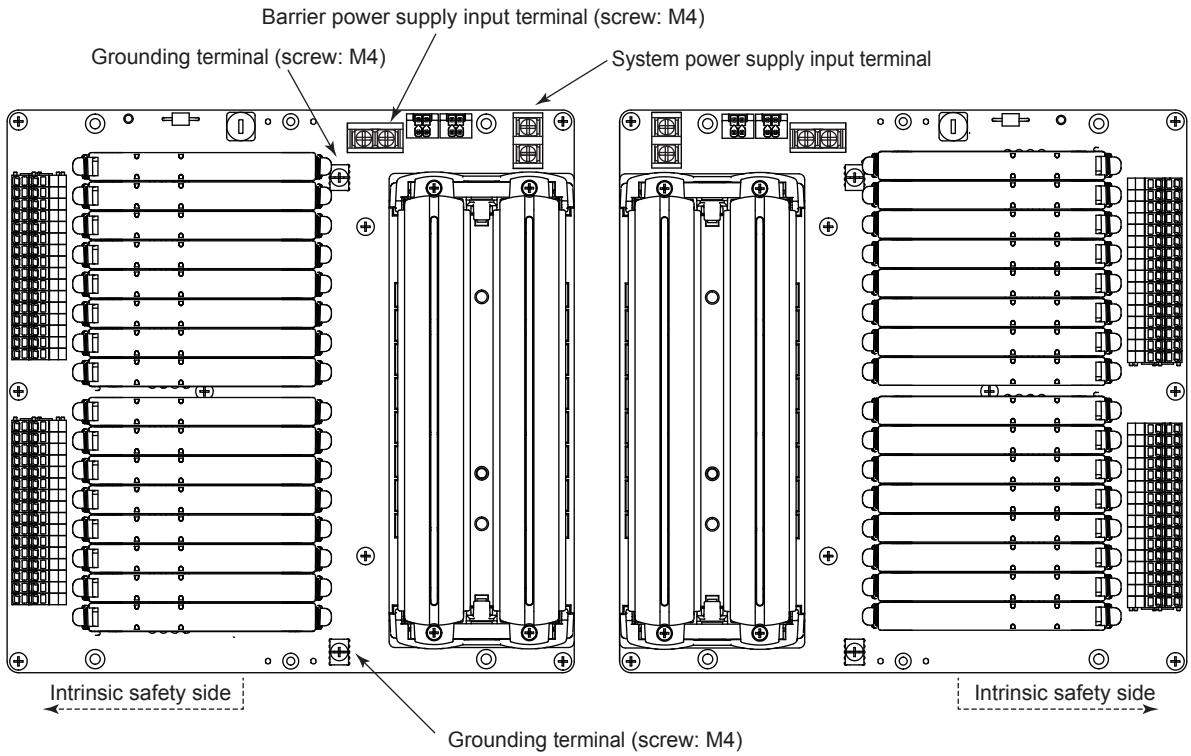
S2BN4D Base Plate for Barrier (MTL)



CAUTION

For preventing over current from the power supply caused by device malfunction, please install over current protection devices such as fuses and breakers in the previous position of the devices.

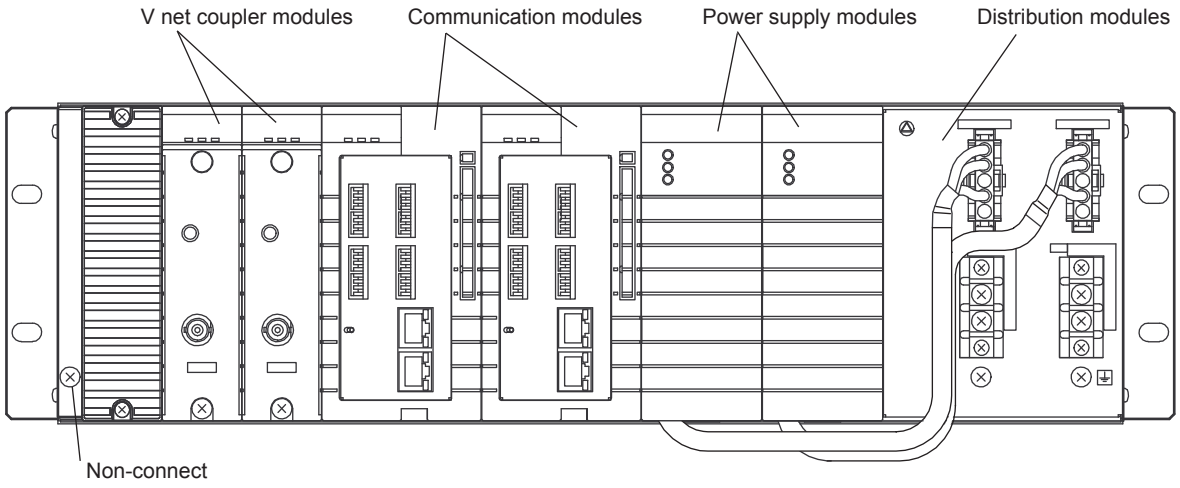
S2BN5D Base Plate for Barrier (P+F)



CAUTION

- For preventing over current from the power supply caused by device malfunction, please install over current protection devices such as fuses and breakers in the previous position of the devices.
- To avoid the influences of external noise, the cable length outside the cabinet connected to Barrier power supply input connector shall be less than 3 m.

AVR10D Duplexed V net Router



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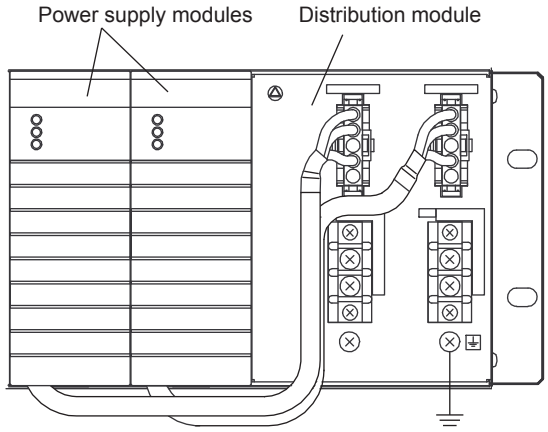
Cabling for Power Supply

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



L, N: Power input terminal (AC power source) (Terminal screw: M4)
+, -: (24 V DC)
Functional grounding terminal (Terminal screw: M4)

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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).

AW810D Wide Area Communication Router

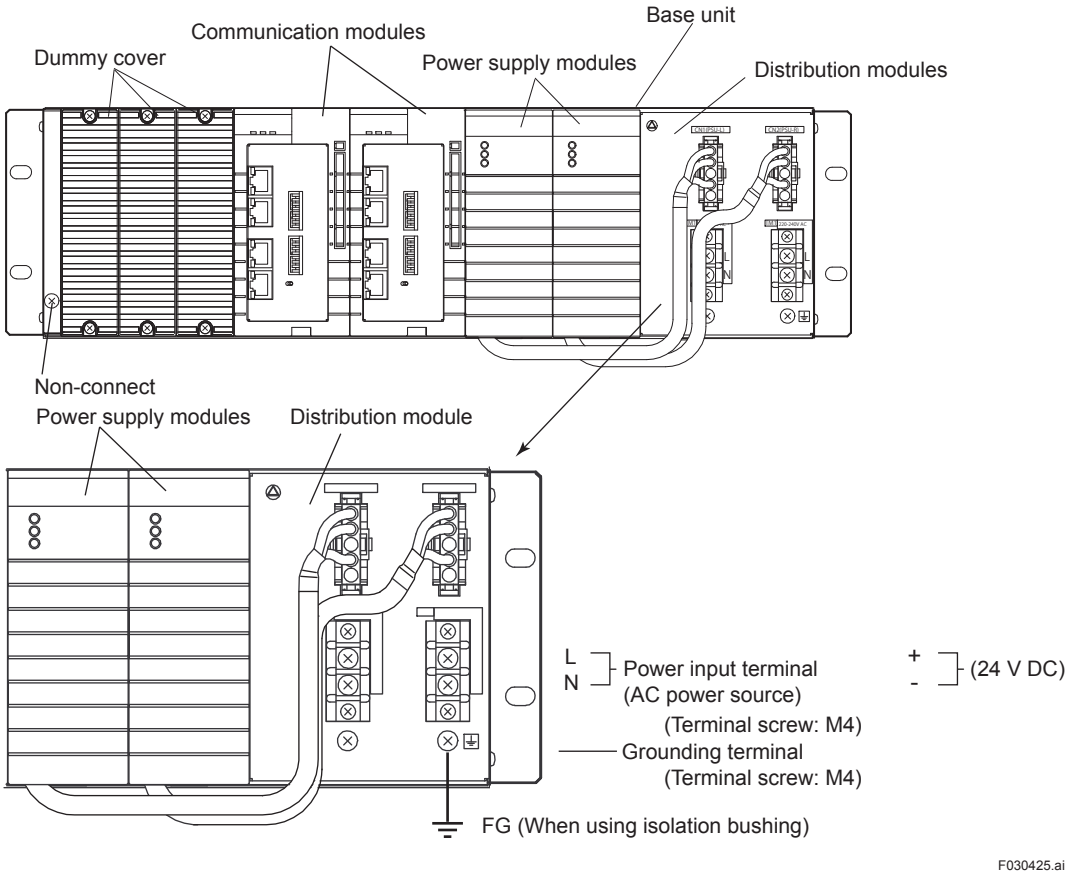


Figure AW810D Wide Area Communication Router Power Cable Connection

IMPORTANT

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

SEA4D Analog Terminal Board

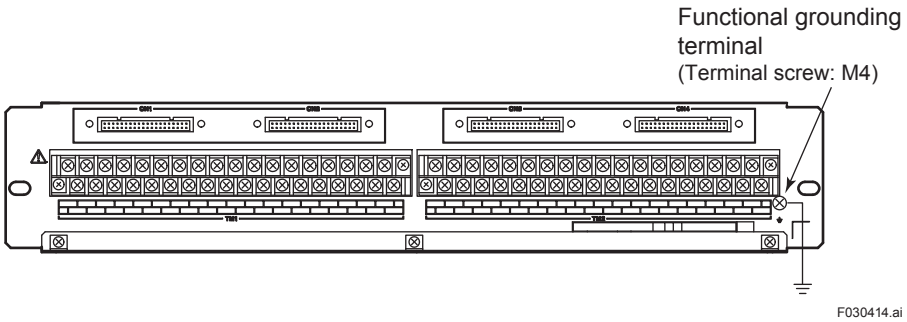


Figure SEA4D Ground Cable Connection

SED2D Digital Terminal Board

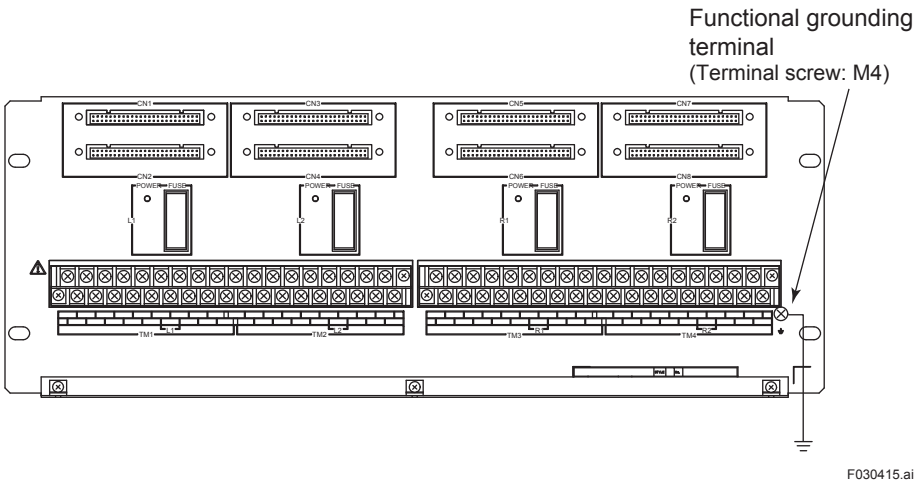


Figure SED2D Ground Cable Connection

SED3D Digital Terminal Board

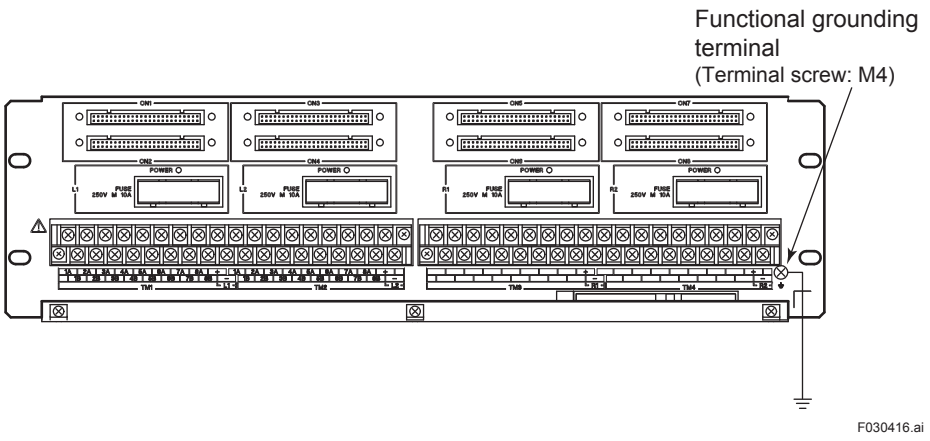


Figure SED3D Ground Cable Connection

SED4D Digital Terminal Board

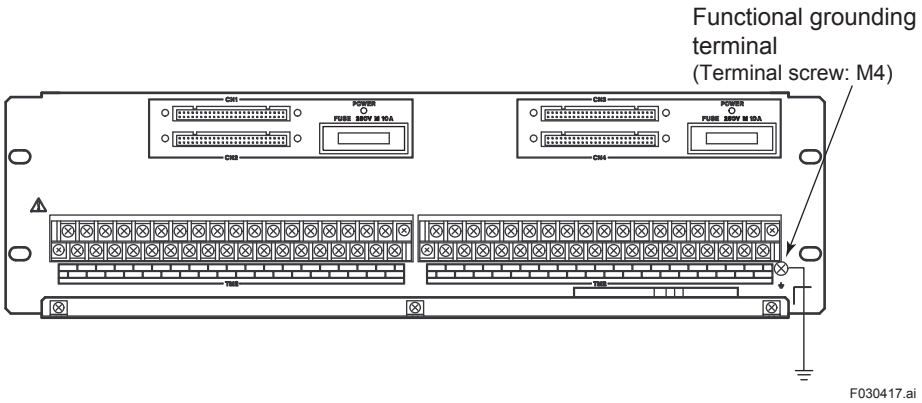


Figure SED4D Ground Cable Connection

SWD2D Digital Terminal Board

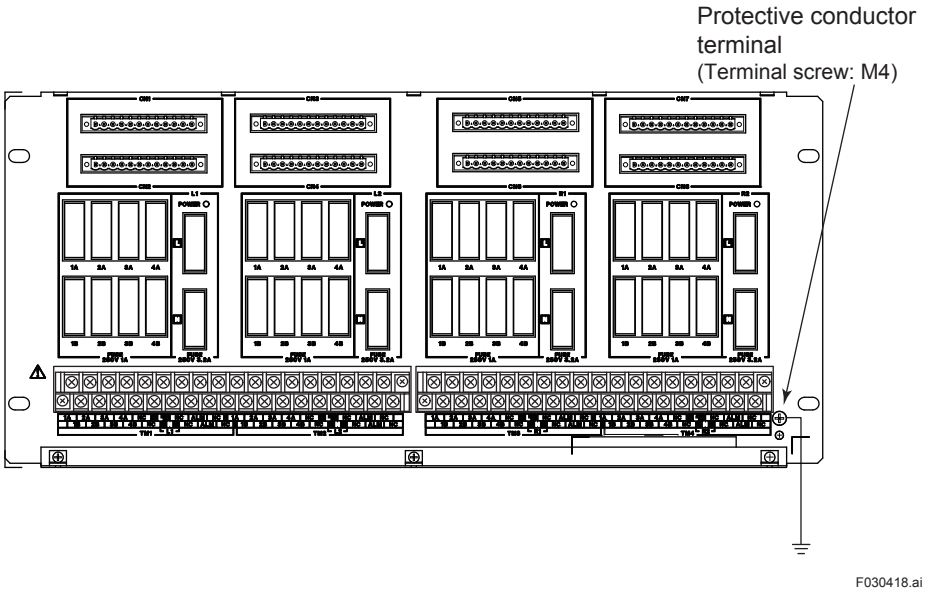


Figure SWD2D Ground Cable Connection

TIP

Terminal Boards of DIN rail mount type such as SBA4D, SBT4D, SBR4D, SBD2D, SBD3D, SBD4D and S1BB4D don't have a grounding terminal.

SRM53D Relay Board for Digital Output

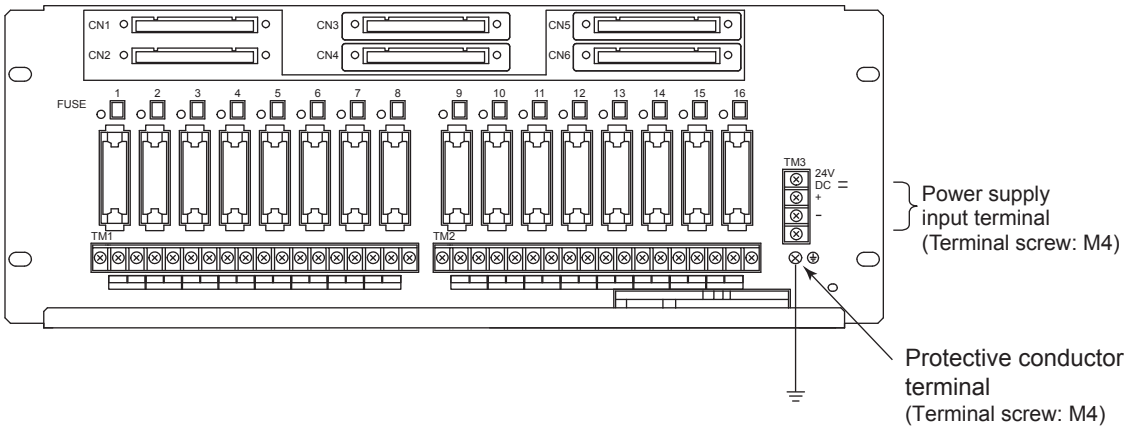


Figure SRM53D Ground Cable Connection

SRM54D Relay Board for Digital Output

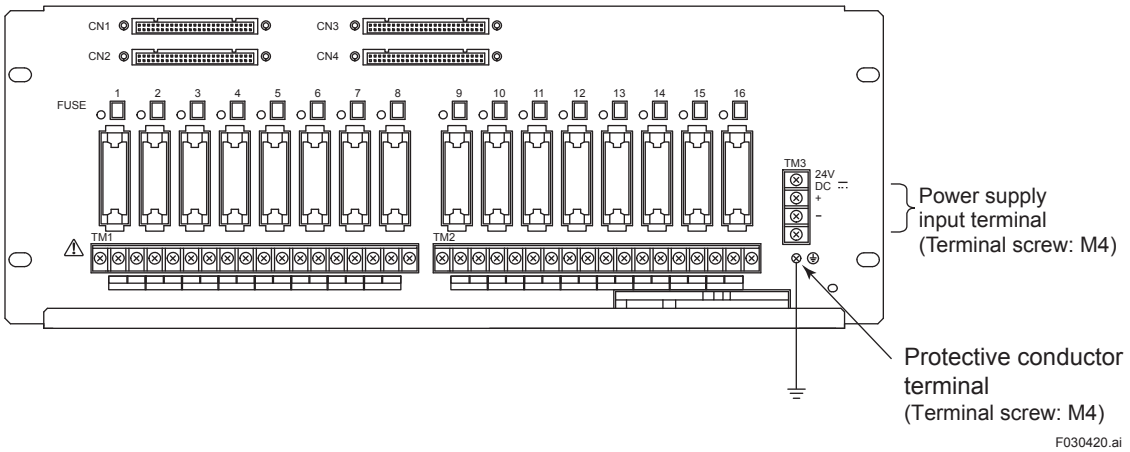


Figure SRM54D Ground Cable Connection

SBM54D Relay Board for Digital Output: DIN rail mount type

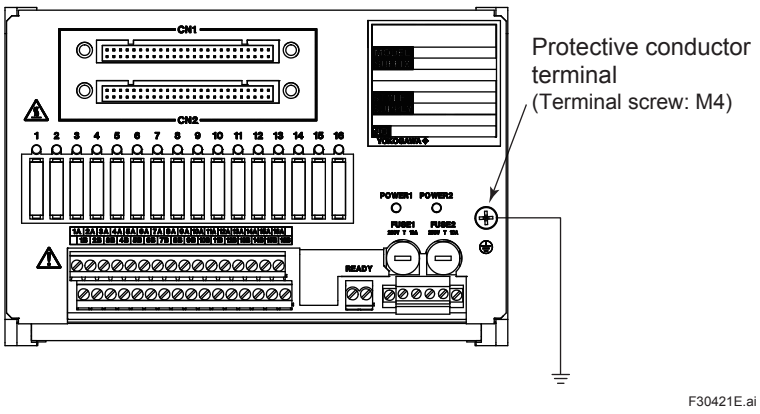


Figure SBM54D Ground Cable Connection

Example of System Cabinet Installation and Grounding Wiring

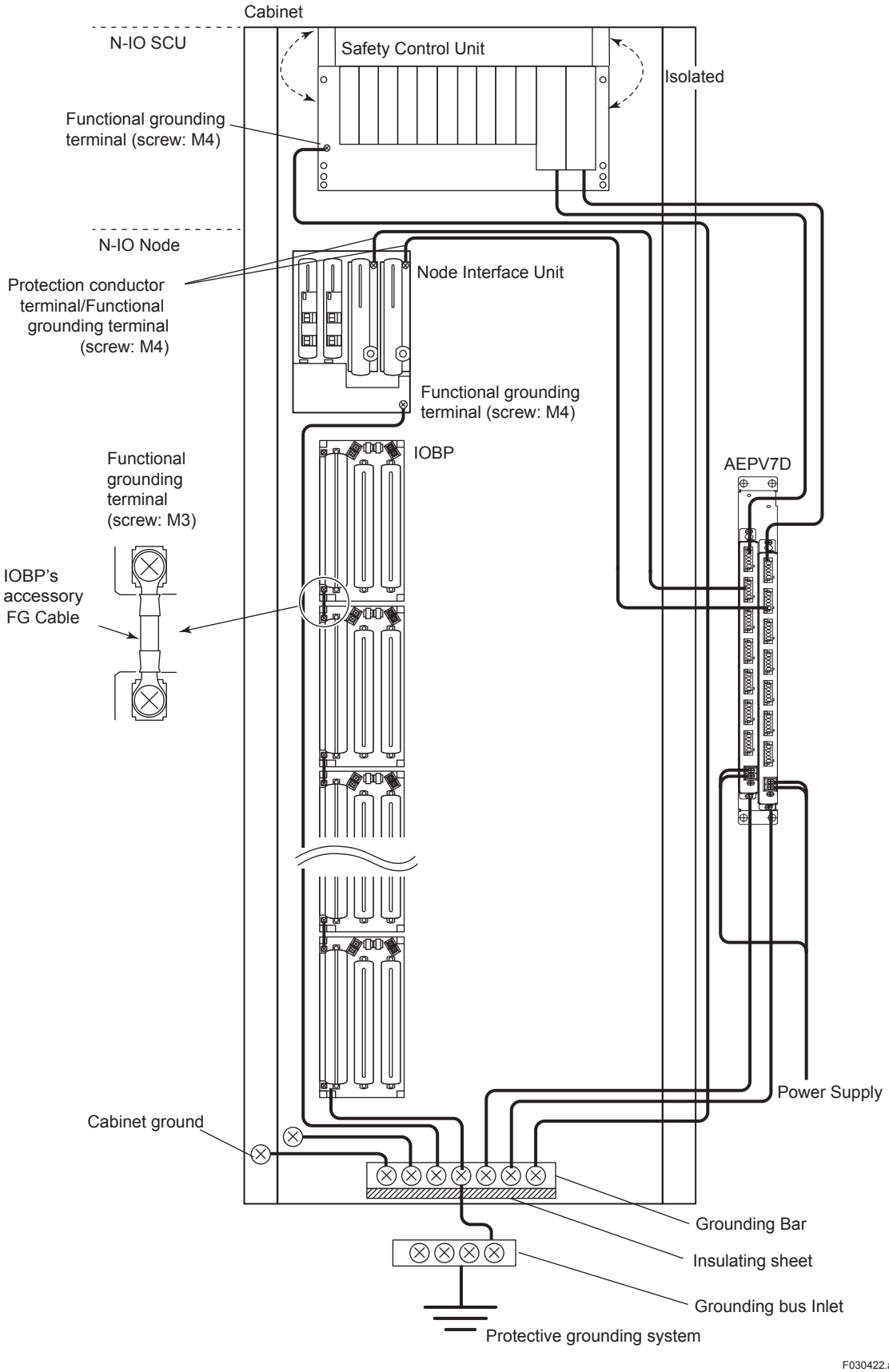


Figure N-IO system devices installation and grounding wiring (Cabinet)

WARNING

The wiring that will be intrinsic safety circuits must be installed so that they are electrically separated from the wiring of non-intrinsic safety circuits, including the in-cabinet wiring. Install the wiring according to the IEC 60079-14 standards or the requirements for explosion-proof wiring of the country where the system is used.

Example of Junction Box Installation and Grounding Wiring

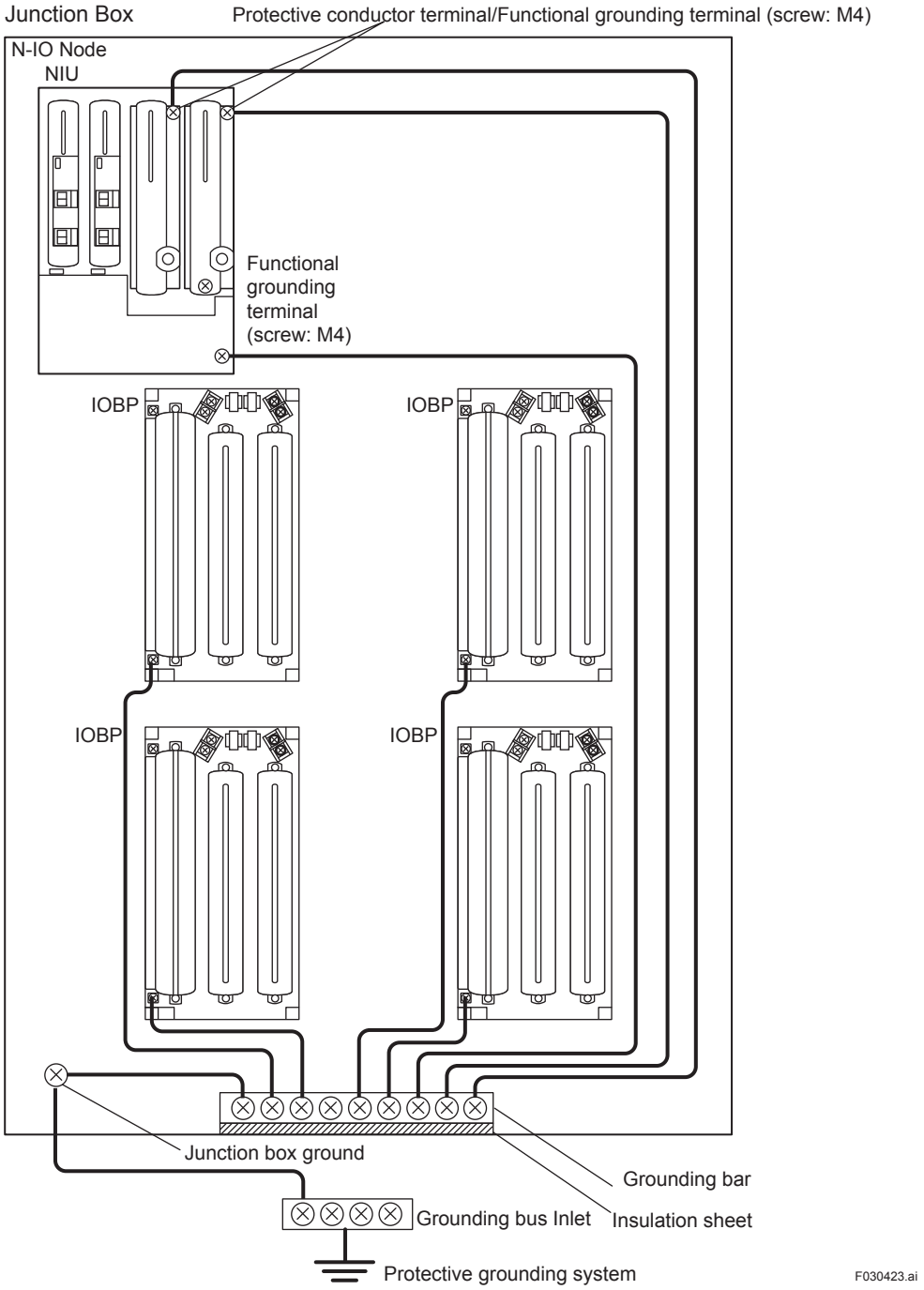
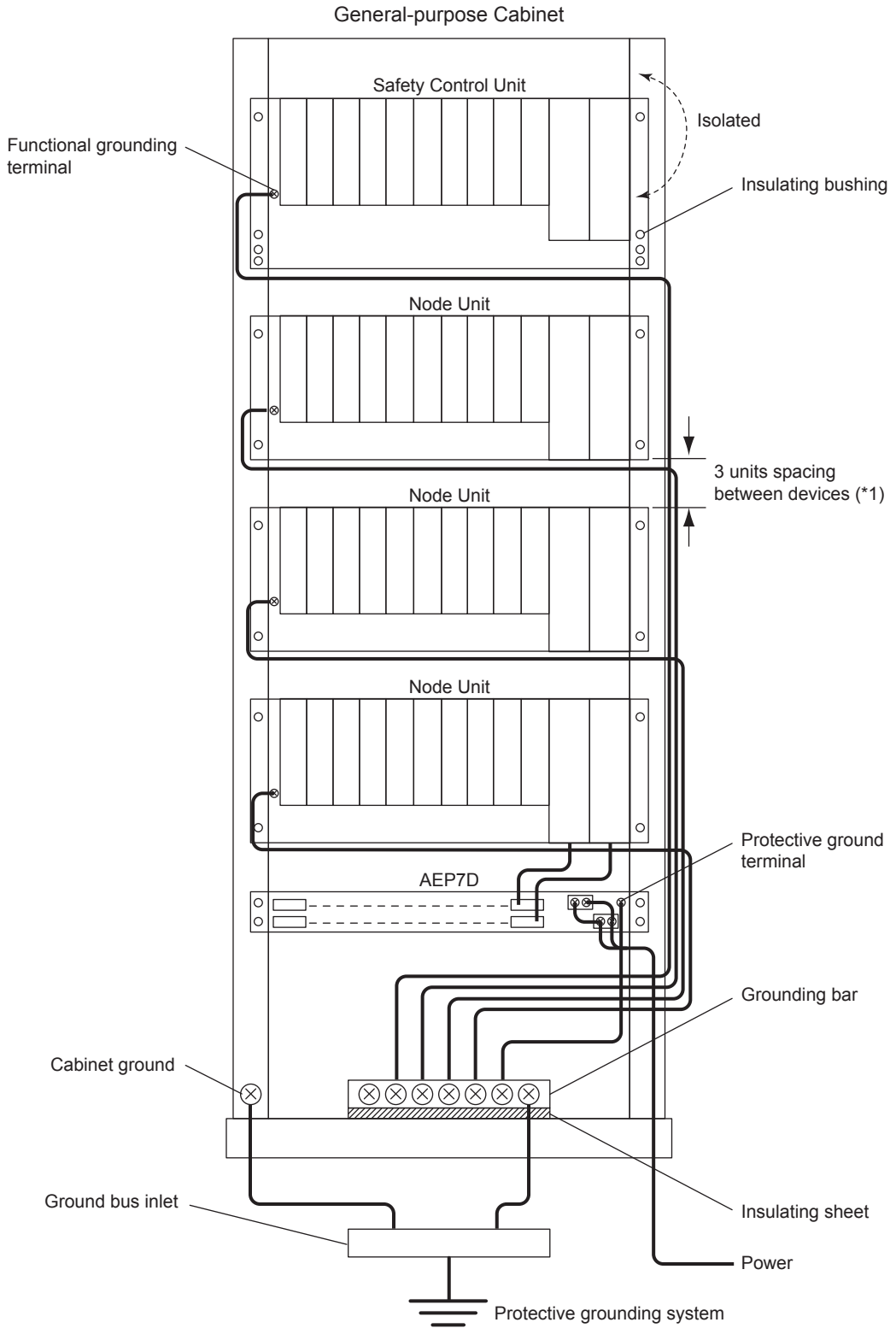


Figure Example of N-IO Node devices Installation and grounding wiring

19-inch Rack-mount Devices and Wiring (For FIO)

An example of wiring when SCU, Node Unit, ANB10 or ANB11 is mounted to a general-purpose cabinet in the following:



*1: Keep a space of 3U or more for heat radiation.

Figure 19-inch Rack-mount Devices and Wiring

3.5 Connecting Signal Cable

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

CAUTION

Do not ground the secondary side of the field power supply connected to the digital input module SDV144 style code S1 to S3.

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.

When mixing AI and DO in the same multi-core cable (N-IO I/O Unit)

When mixing analog input (AI) signal and digital output (DO) signal in the same multi-core cable, take the following influence from DO pulse diagnostics or ON/OFF operation into consideration.

- The accuracy for Analog input function may be worse by several tens of μA depending on the type, length of a cable and DO load current.
- A delay may occur in updating the HART event.

Solderless Lug

CAUTION

- 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

CAUTION

- 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.
- When the door is attached or detached for cable connection, be sure to then OFF the power of the main unit before connecting or disconnecting a cable.

Spring Clamp Terminal

CAUTION

- The ProSafe-RS uses a spring clamp terminal for signal connection of N-IO.
- For cable connection with a sleeve attached, use a sleeve and a clamp tool from the same manufacturer.
- Use a clamp tool which suits the cable thickness.

Channel Fuse

CAUTION

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.

CAUTION

- 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.

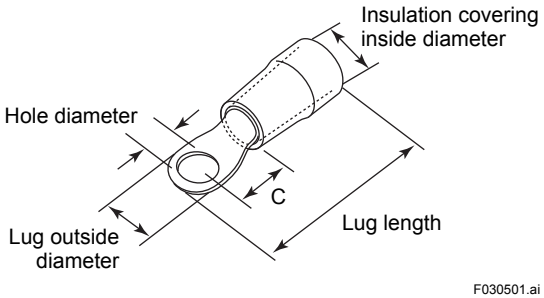


Figure Solderless Lug

Pressure Clamp Terminal (for Pressure Clamp Terminal Block) (other than N-IO)

- 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, and 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, and S1BB4D

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	10 mm	14 mm	8 mm	H0.5/14	6 mm	6 mm	H0.5/6
0.75 mm^2	10 mm	14 mm	8 mm	H0.75/14	6 mm	6 mm	H0.75/6
1 mm^2	10 mm	14 mm	8 mm	H1/14	6 mm	6 mm	H1/6
1.5 mm^2	10 mm	14 mm	8 mm	H1.5/14	7 mm	7 mm	H1.5/7
2.5 mm^2	11 mm	14 mm	8 mm	H2.5/14D	7 mm	7 mm	H2.5/7

Pressure Clamp Terminal, Spring Clamp Terminal (for N-IO Node)

At the end of the signal cables to the following applicable interface, provide the following cable termination:

Table Applicable Interface

Products	Models	Interface	Sleeve Normal cross sectional area (mm^2)
Node Interface Unit	S2NN30D	External alarm input terminal	0.5 ~ 2.5
I/O Unit	S2BN1D S2BN4D S2BN5D	I/O signal terminal	0.5 ~ 2.5

- When using a sleeve
  At the cable end, peel off the coating and attach a sleeve. The specifications of the sleeve differ, depending on the cable thickness. Provide cable termination according to the following figure and tables:

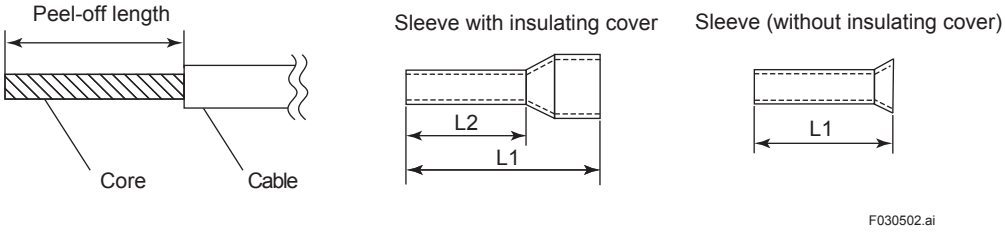


Figure Cable termination (for pressure clamp terminals)

Table When sleeves with insulating cover are used

Nominal cross sectional area (mm^2)	Peel-off length (mm)	Sleeve dimensions (mm)		Weidmuller model No.
		L1	L2	
0.5	10	14	8	H0.5/14
0.75	10	14	8	H0.75/14
1.0	10	14	8	H1.0/14
1.5	10	14	8	H1.5/14
2.5	11	14	8	H2.5/14D

Table When sleeves without insulating cover are used

Nominal cross sectional area (mm^2)	Peel-off length (mm)	Sleeve dimensions (mm)	Weidmuller model No.
		L1	
0.5	6	6	H0.5/6
0.75	6	6	H0.75/6
1.0	6	6	H1.0/6
1.5	7	7	H1.5/7
2.5	7	7	H2.5/7

- When not using a sleeve
  The peel-off length should be 8 mm for pressure clamp terminals and 7 mm for spring clamp terminals.

MIL Connector Cover SCCC0☐

SCCC01 (for flat ribbon cables)

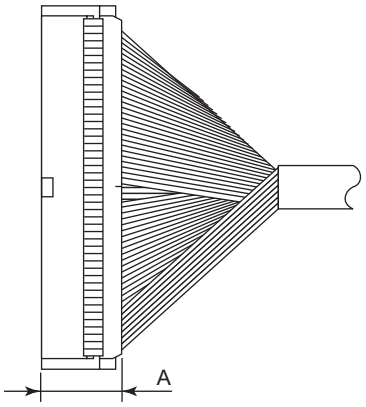
When using the SCCC01, use connectors conforming to the following requirements:

- 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 mm – B ≤ A ≤ 15.8 mm

  where, A = connector height

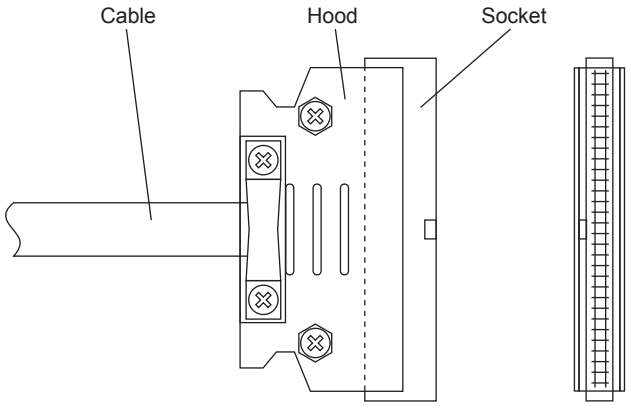
  B = engagement length



F030503.ai

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

SCCC02 (for separate cables)



F030504.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 (for FIO)

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 DIN 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 N·m.

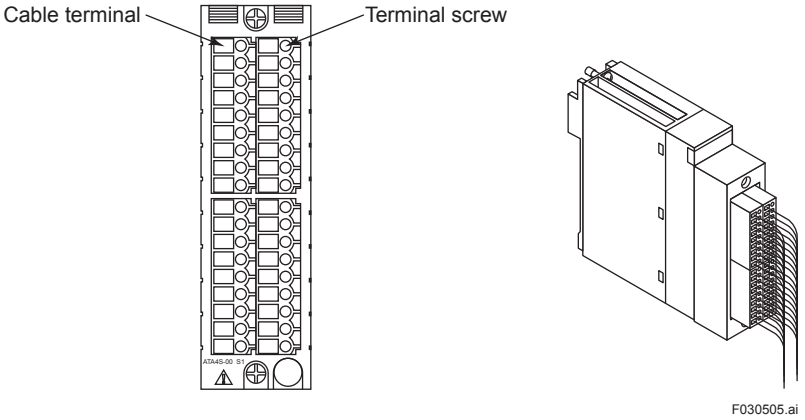


Figure Connecting Signal Cable to Terminal

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.

S2SC70S/S2SC70D/SSC60S/SSC60D/SSC50S/SSC50D/SSC57S/SSC57D and SNB10D Cable Connections

The following shows SNB10D unit cable connections.

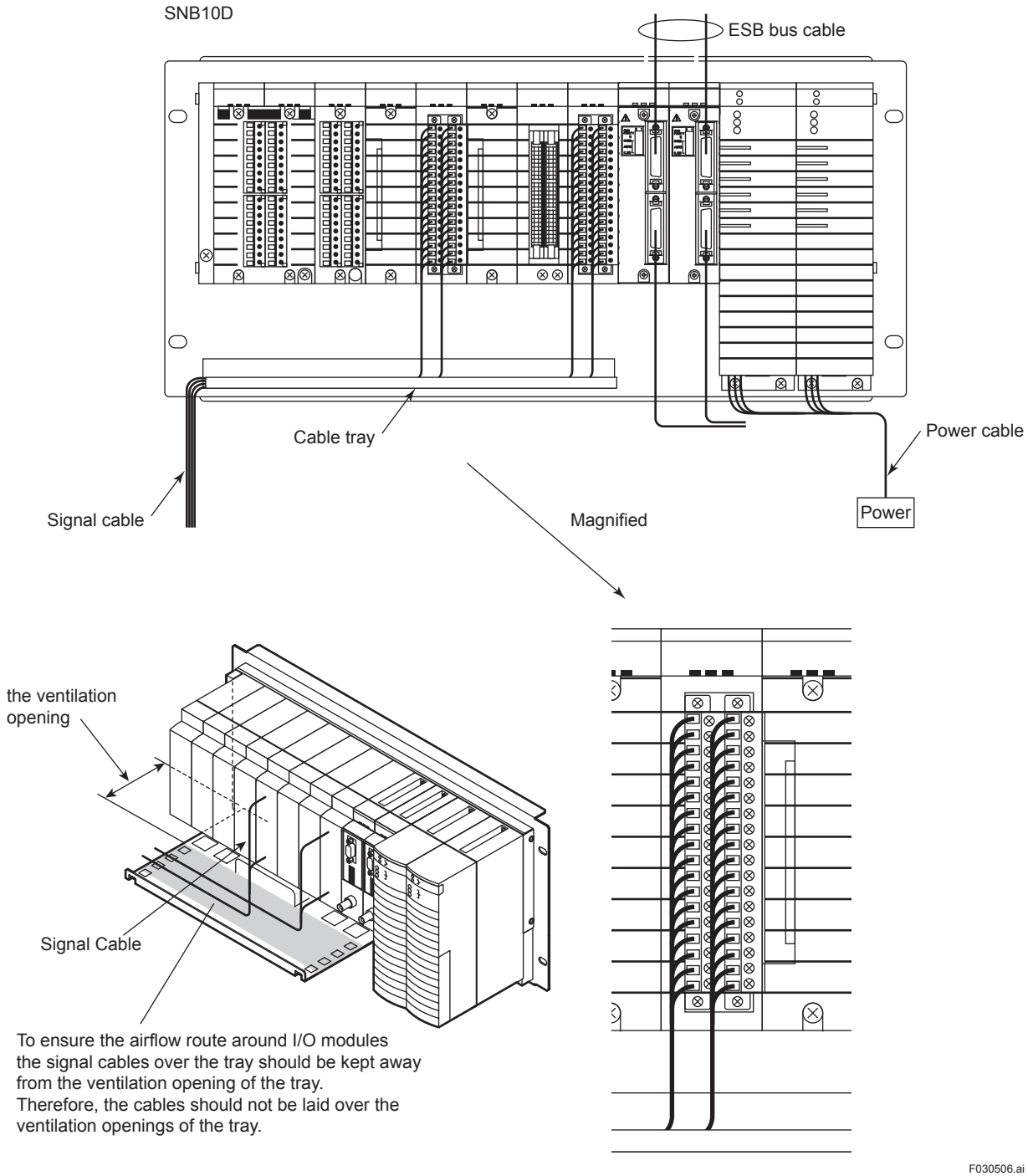


Figure SNB10D Unit Cable Connections

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.

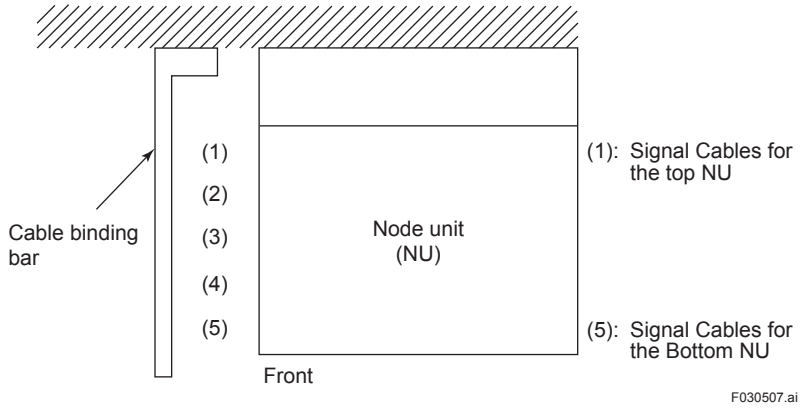


Figure Signal Cabling

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.

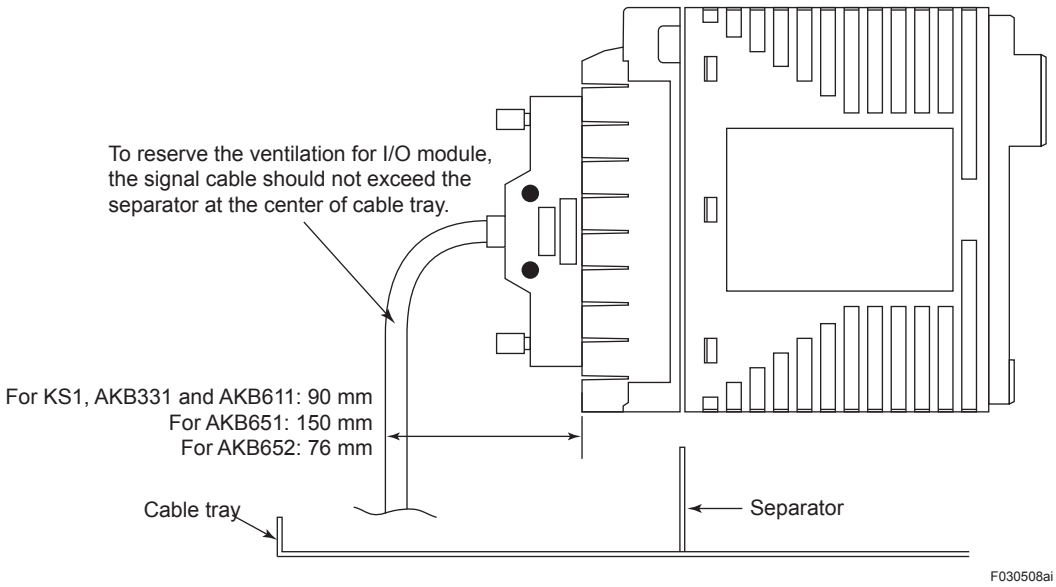


Figure I/O Module with Signal Cable Interface Adapter Cabling

Connecting Signal Cables to Terminals (for N-IO)

Connecting cables to pressure clamp terminals

Follow these steps to connect cables to pressure clamp terminals:

1. Open the cover of the terminal block of the base plate for N-IO I/O.
2. Confirming the cable polarity, insert the cable to the pressure clamp terminal. Tighten the screw using the special tool (a screwdriver conforming to the DIN 5264B standard a tip width of 0.6 mm and a shaft diameter of 3.5 mm) with a fastening torque of 0.5 N·m.
3. Pull the cable gently to check that it is fixed securely.
4. Close the cover of the terminal block of the base plate for N-IO I/O.

Connecting cables to spring clamp terminals

Follow these steps to connect cables to spring clamp terminals:

1. Open the cover of the terminal block of the base plate for N-IO I/O.
2. Pressingly expand the spring clamp terminal with a flat-blade screwdriver.
3. Insert a cable without pulling out the screwdriver.
4. Pull out the flat-blade screwdriver.
5. Pull the cable gently to check that it is fixed securely.
6. Close the cover of the terminal block of the base plate for N-IO I/O.

N-IO Signal Cabling

IMPORTANT

The signal cable for the top IOBP 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.

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

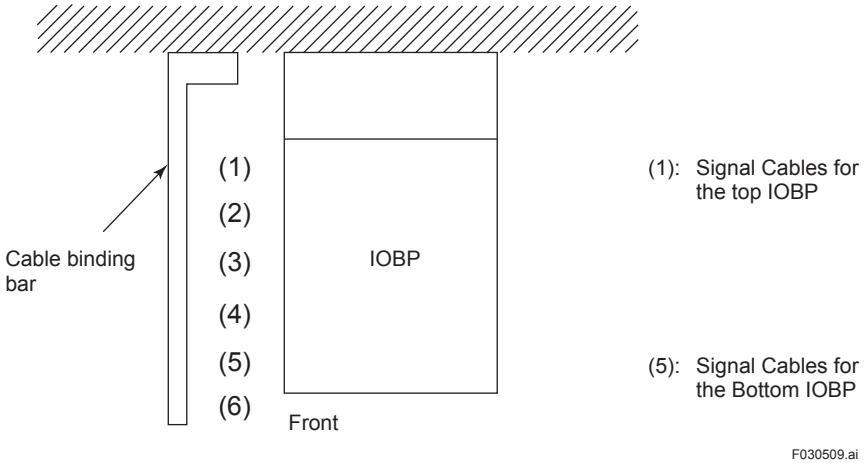
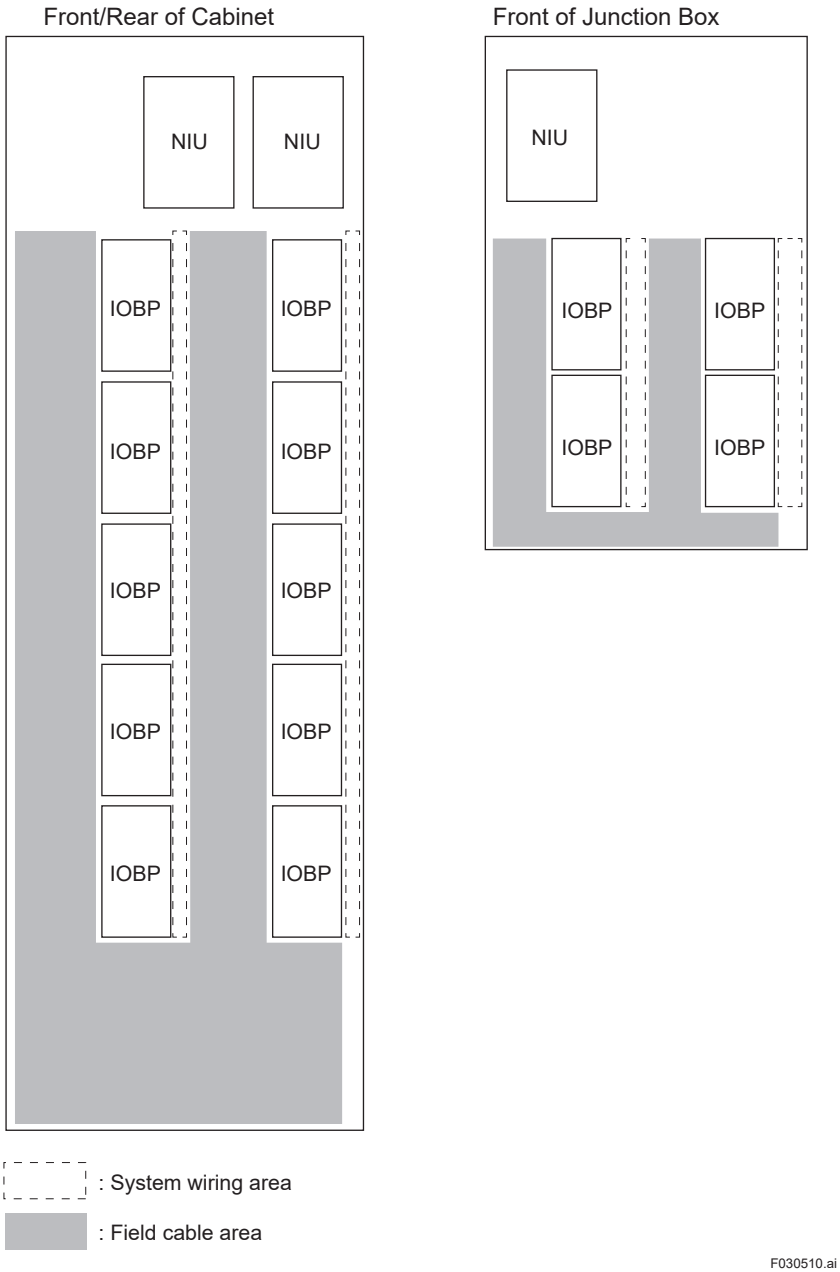


Figure Cabling

Routing Signal Cables (for N-IO)

Field Cable Area

Signal cables from the field enter the Cabinet at the bottom and connected to individual IOBP units in the routes shown in Figure below.



NIU: Node Interface Unit
IOBP: N-IO I/O Base Plate

Figure Area for Signal Cable from Field

Example of Node Interface Unit and I/O Unit cable wiring (Cabinet)

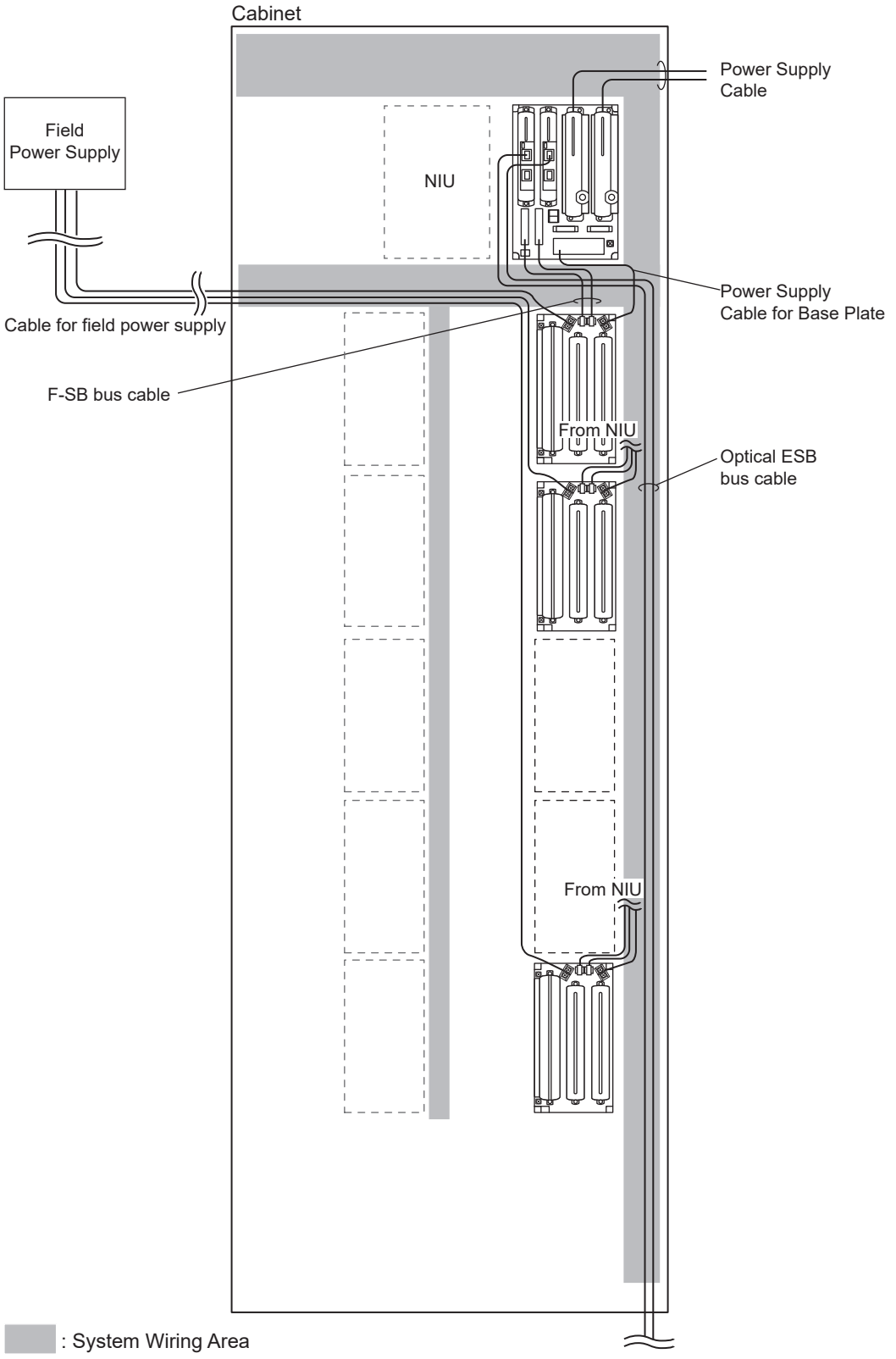
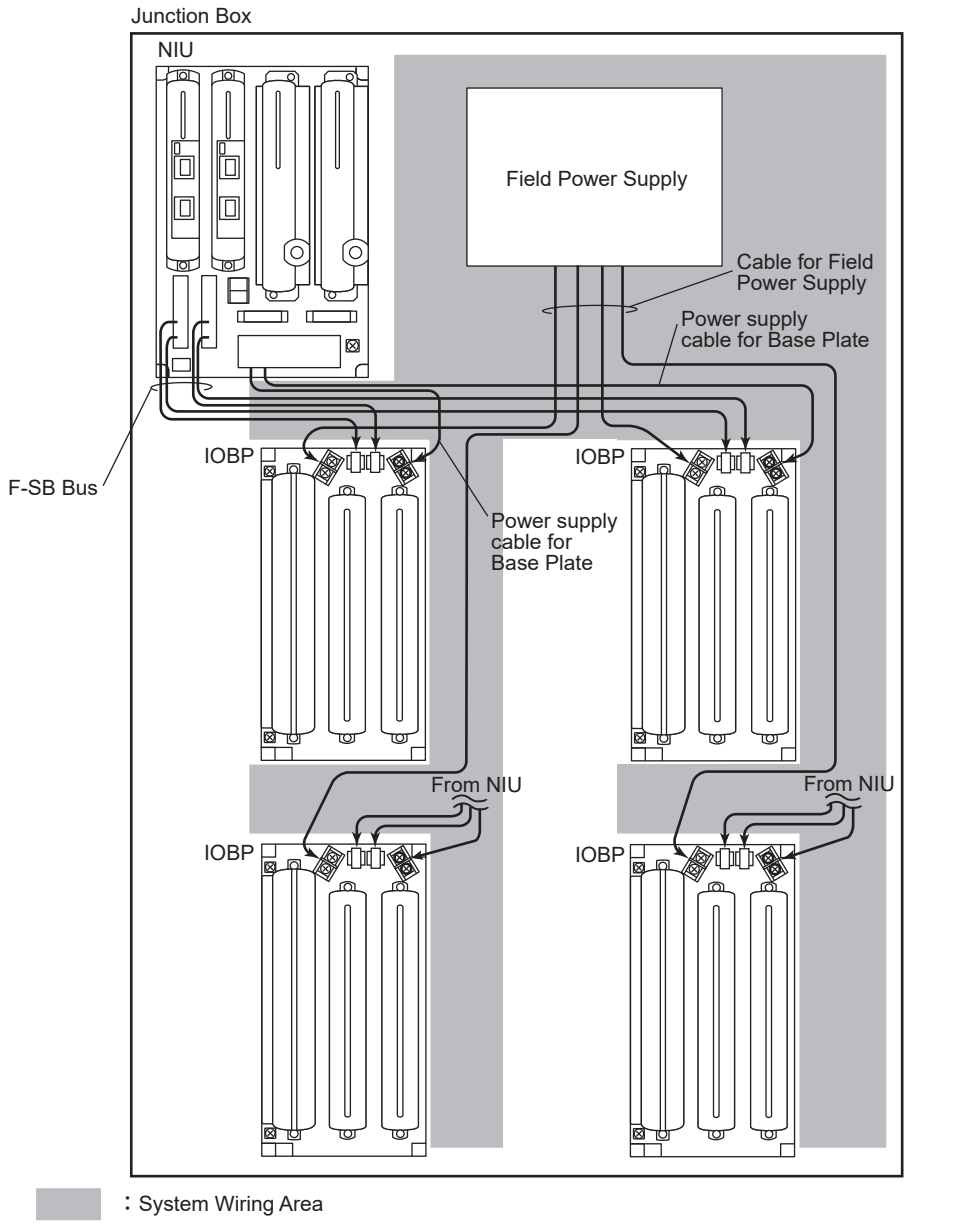


Figure Example of Node Interface Unit and I/O Unit Cable Wiring (Cabinet)

Example of Node Interface Unit and I/O Unit Cable Wiring (Junction Box)



IOBP: N-IO I/O Unit

Figure Example of Node Interface Unit and I/O Unit Cable Wiring (Junction Box)

WARNING

The wiring that will be intrinsic safety circuits must be installed so that they are electrically separated from the wiring of non-intrinsic safety circuits, including the in-cabinet wiring. Install the wiring according to the IEC 60079-14 standards or the requirements for explosion-proof wiring of the country where the system is used.

Connecting external alarm input terminal with Node Interface Unit

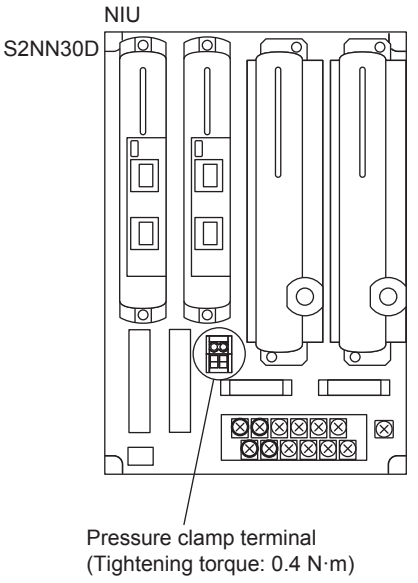


Figure Connecting external alarm input terminal with Node Interface Unit

3.6 Connecting Signal Cables to I/O Modules (for FIO)

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).”

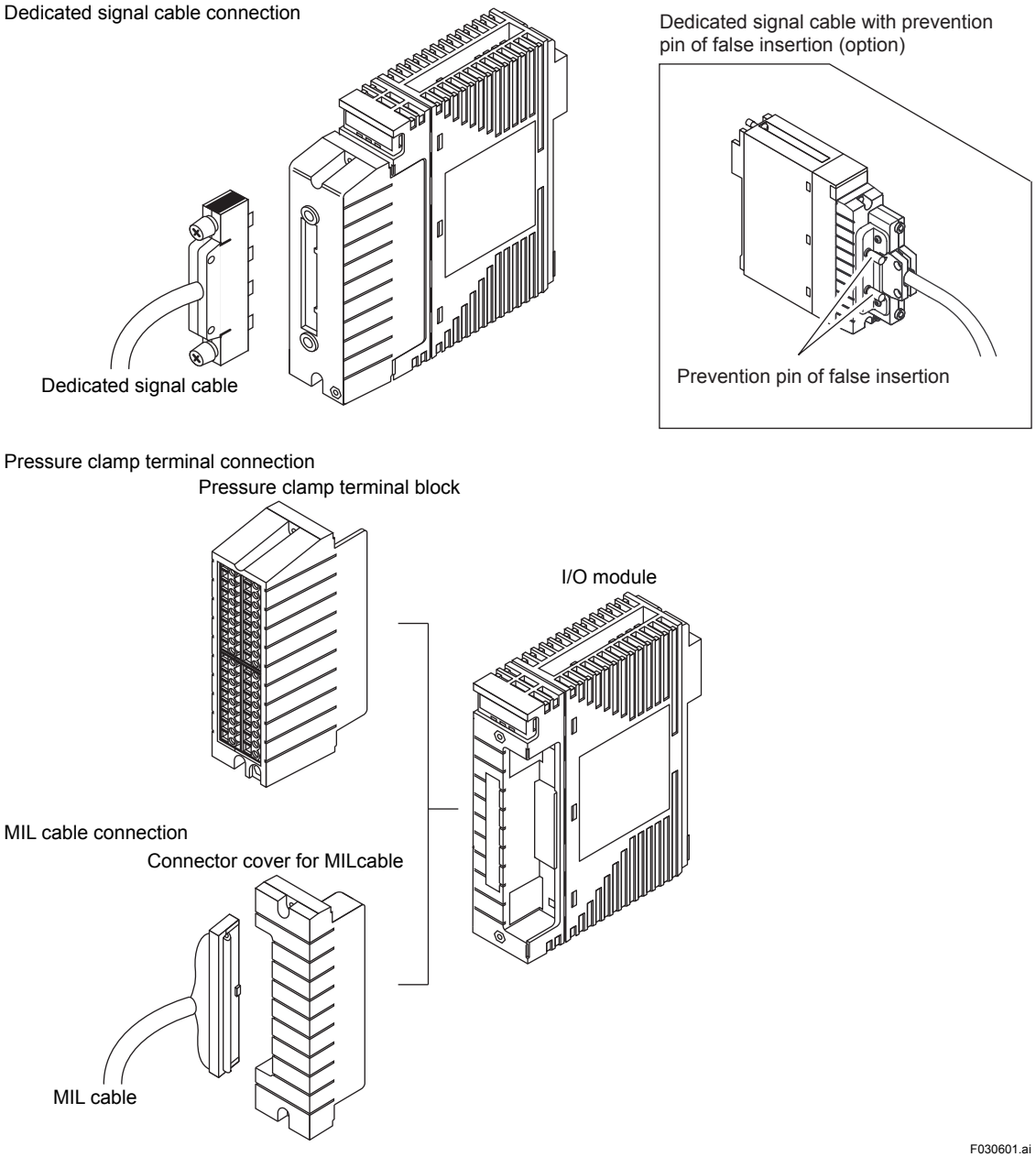


Figure Terminals for Field Wiring

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 to20 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)	
S2LP131	Fire and gas communication module	One port	–	–	X (RJ-45) (*9) (*10)	

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 is available from ProSafe-RS R3.02.00 or later with S2SC70□, SSC60□, SSC50□ or SSC57□.
*9: S2LP131 is available from R4.03.10 or later with S2SC70□.
*10: The cables and connectors must comply with PROFINET standards.

CAUTION

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

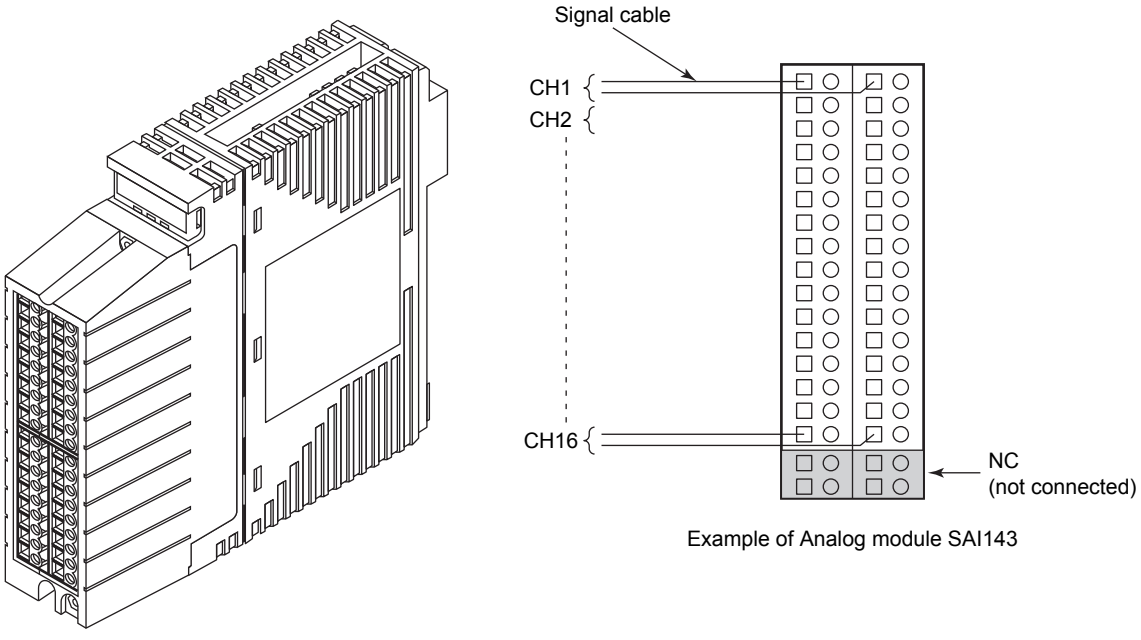


Figure I/O Module with Pressure Clamp Terminal

Dual-redundant Pressure Clamp Terminal

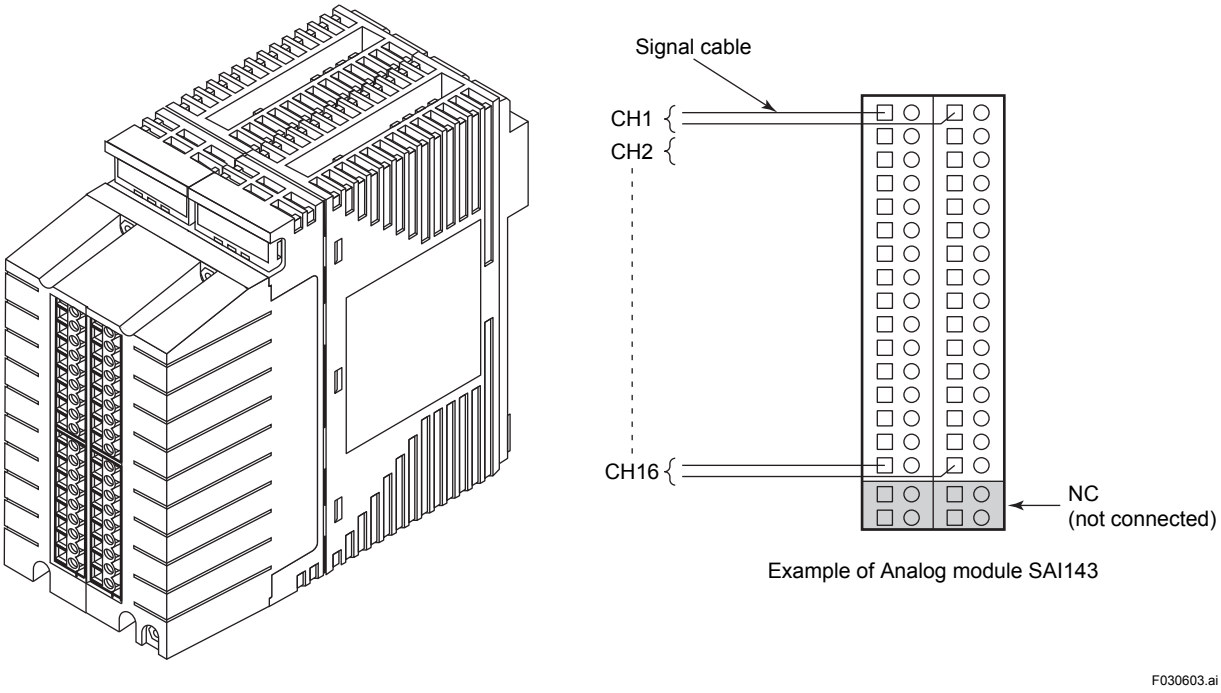


Figure I/O Module with Dual-redundant Pressure Clamp Terminal

Signal Cable Interface Adapter

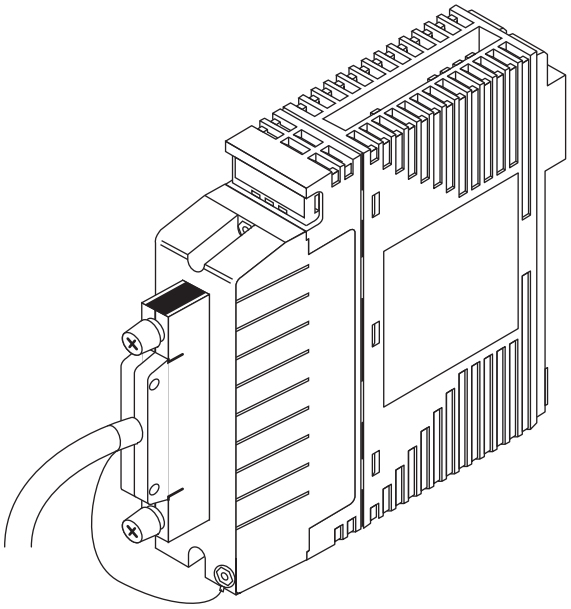


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Figure I/O Module with Signal Cable Interface Adapter

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	Two-wire transmitter input +	Current input -
	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.

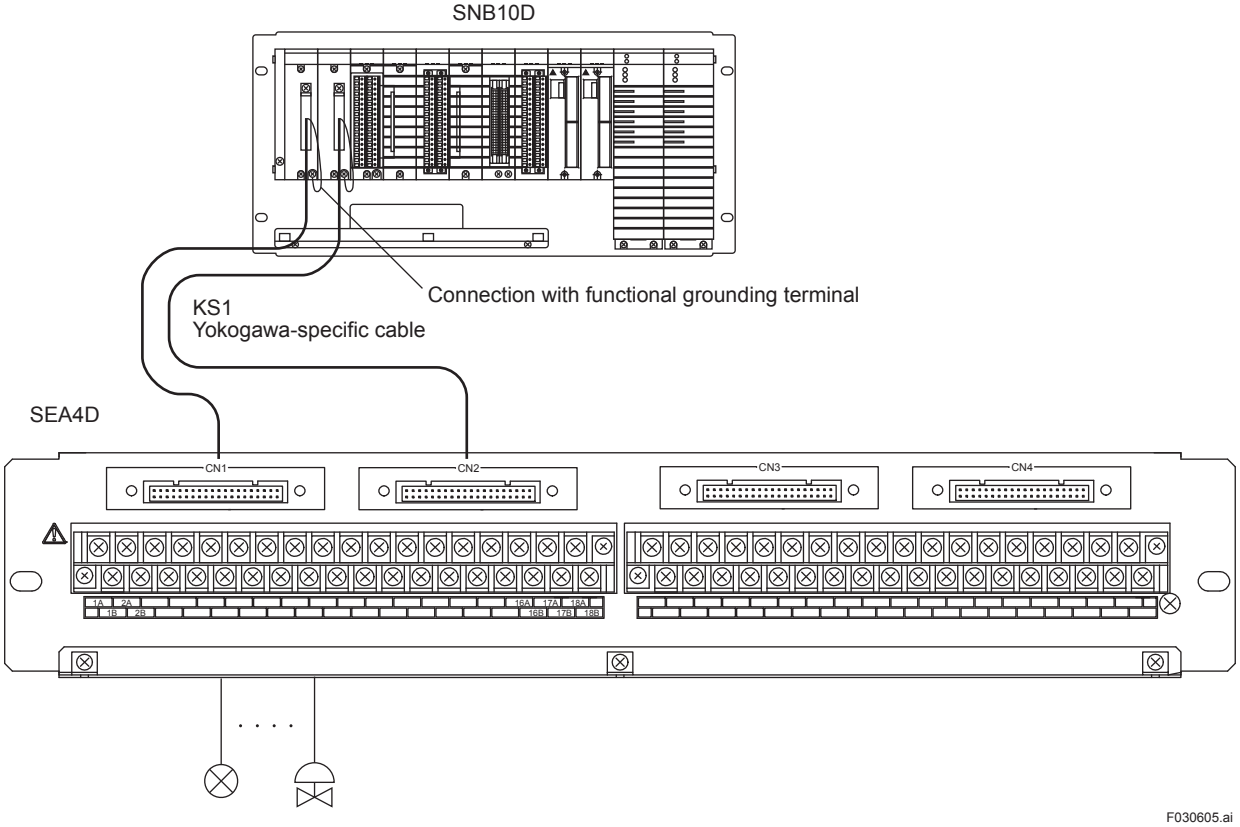

Figure Example of Terminal Board Connection with Dual-redundant I/O Module

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.

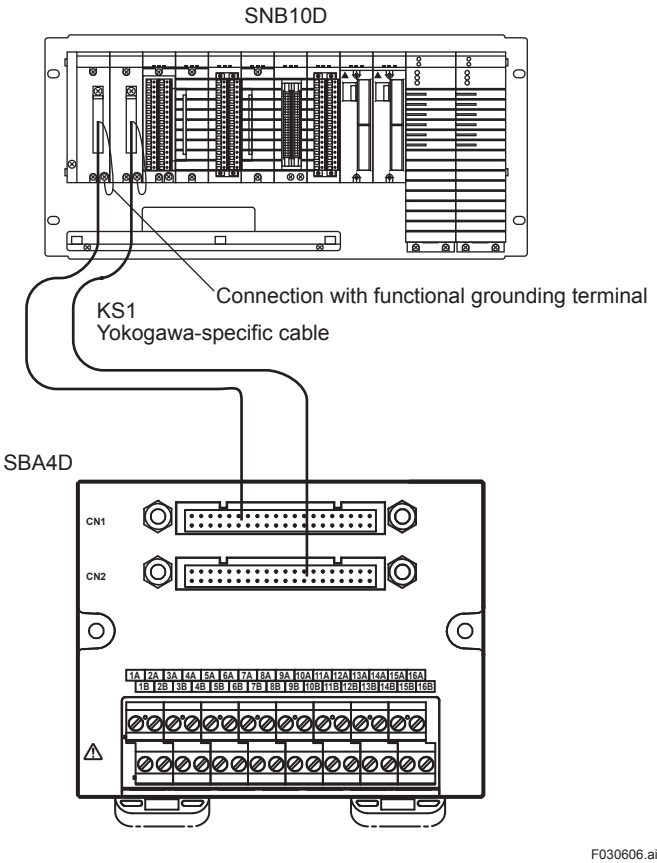

Figure Connecting Analog I/O Modules to SBA4D Terminal Board (for Dual-redundant Use)

Example of Connection to S1BB4D

S1BB4D terminal board allows SAI143 module in both single and dual-redundant configurations.

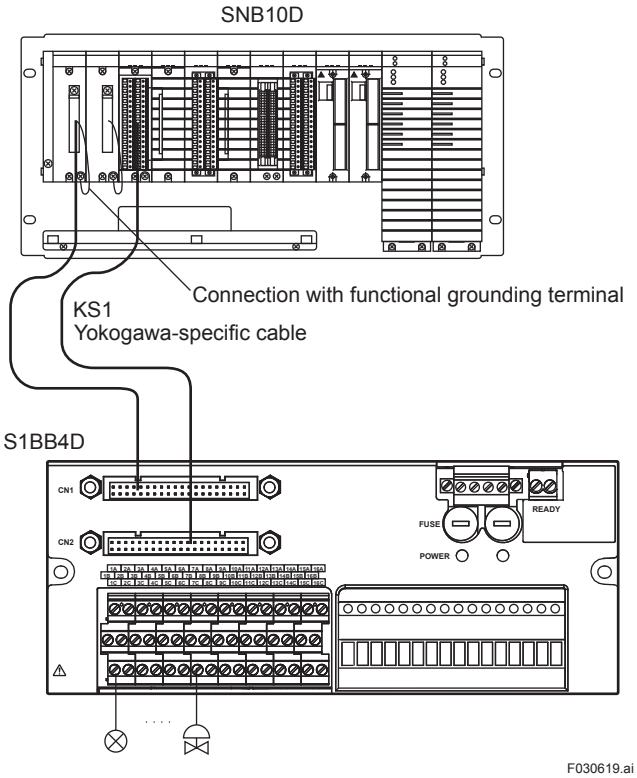

Figure Connecting Analog I/O Modules to S1BB4D Terminal Board (for Dual-redundant Use)

Example of Connection to SBT4D

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

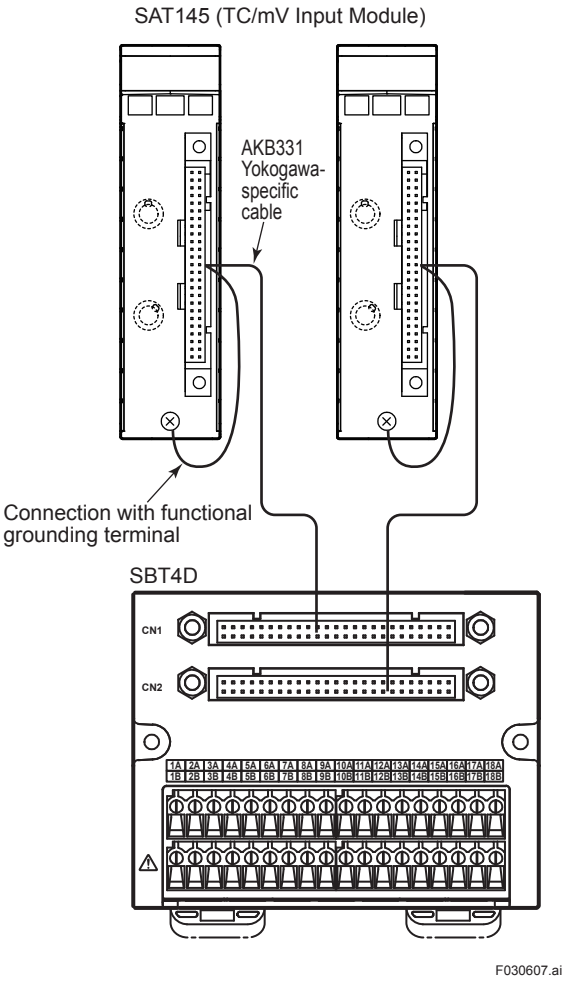

Figure Connecting TC/mV Input Modules to SBT4D Terminal Board (for Dual-redundant Use)

Example of Connection to SBR4D

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

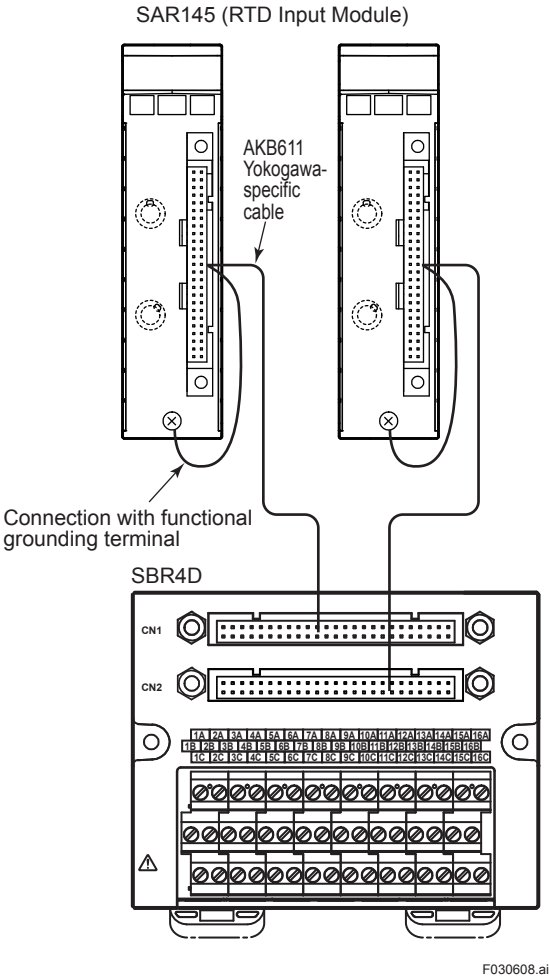

Figure Connecting RTD Input Modules to SBR4D Terminal Board (for Dual-redundant Use)

Example of Connection to SED2D

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

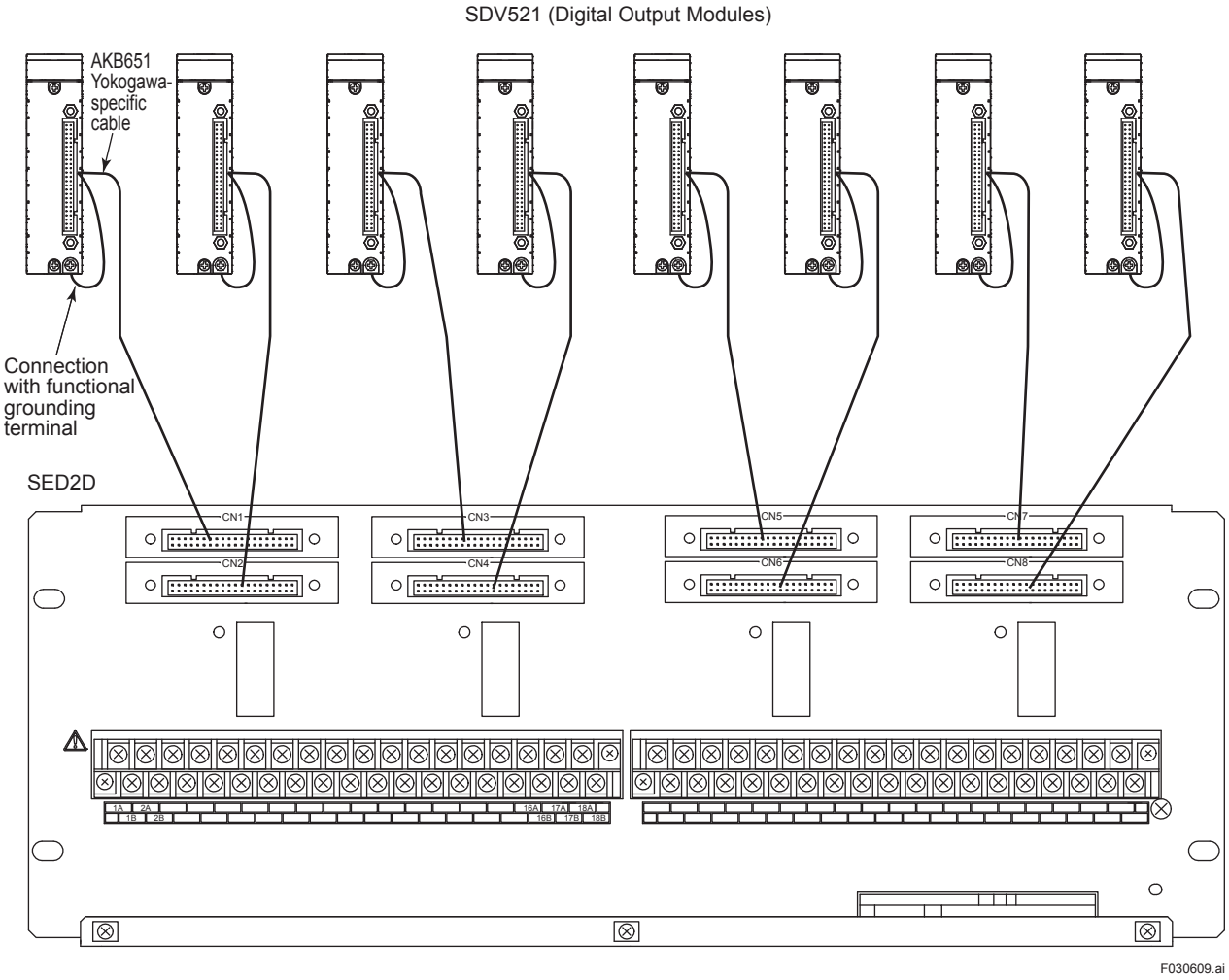

Figure Connecting Digital Output Modules to SED2D Terminal Board (for Dual-redundant Use)

Example of Connection to SBD2D

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

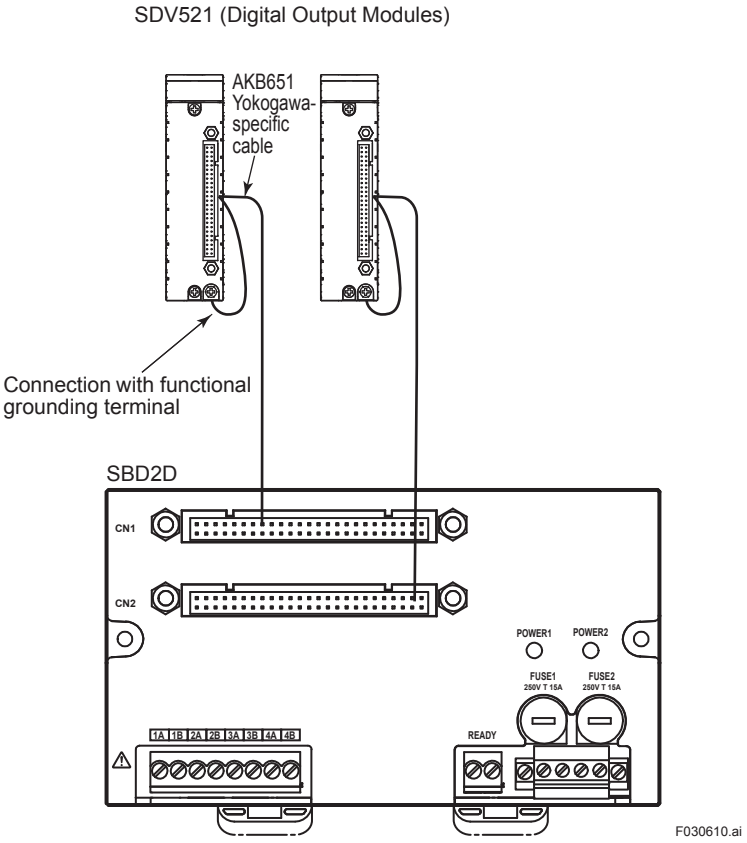

Figure Connecting Digital Output Modules to SBD2D Terminal Board (for Dual-redundant Use)

Example of Connection to SED3D

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

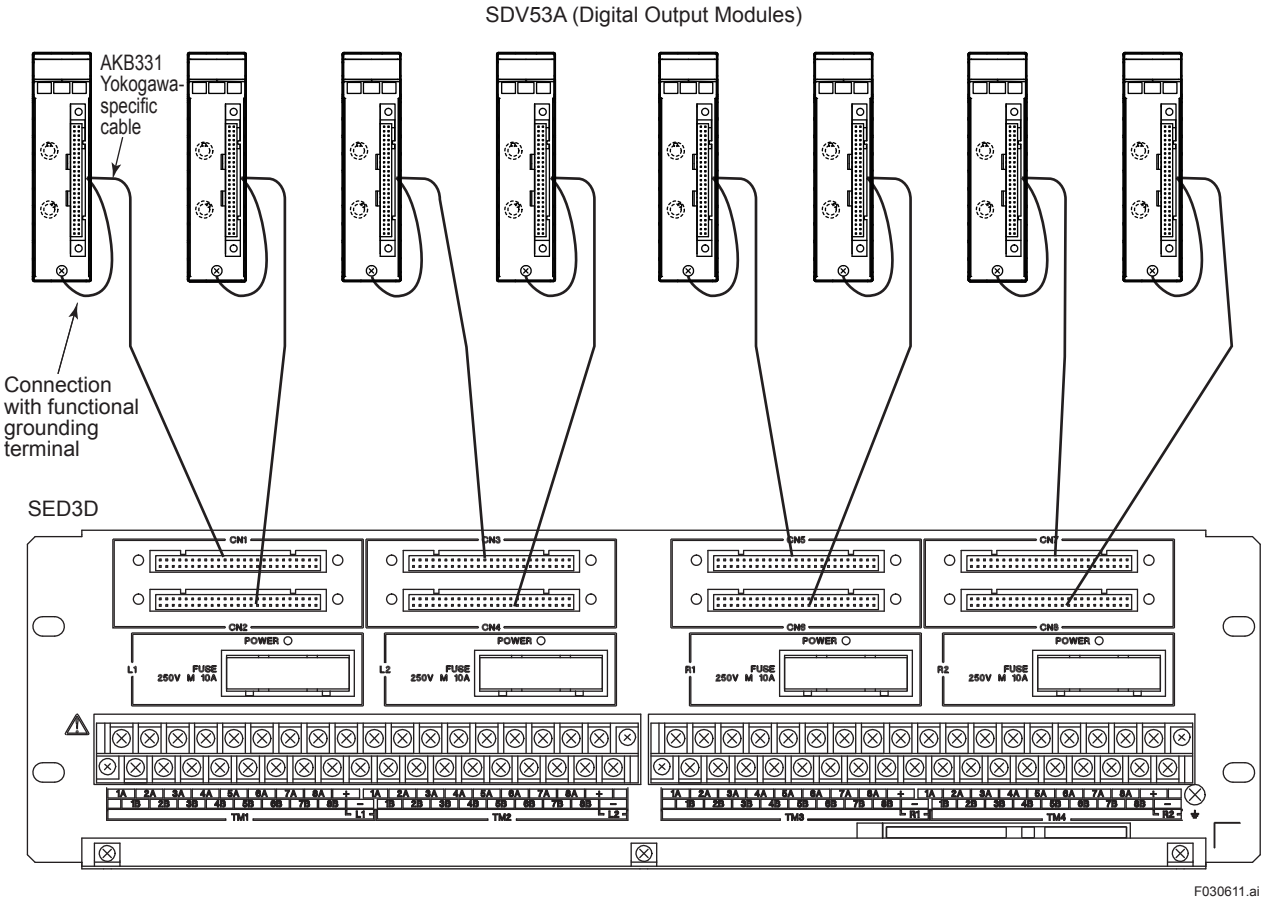

Figure Connecting Digital Output Modules to SED3D Terminal Board (for Dual-redundant Use)

Example of Connection to SBD3D

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

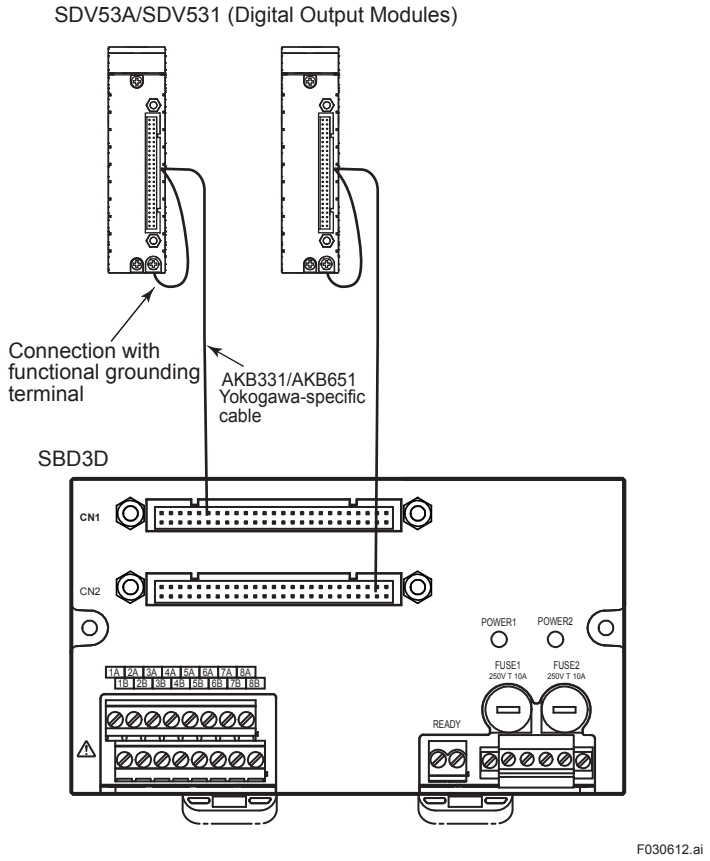

Figure Connecting Digital Output Modules to SBD3D Terminal Board (for Dual-redundant Use)

Example of Connection to SED4D

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

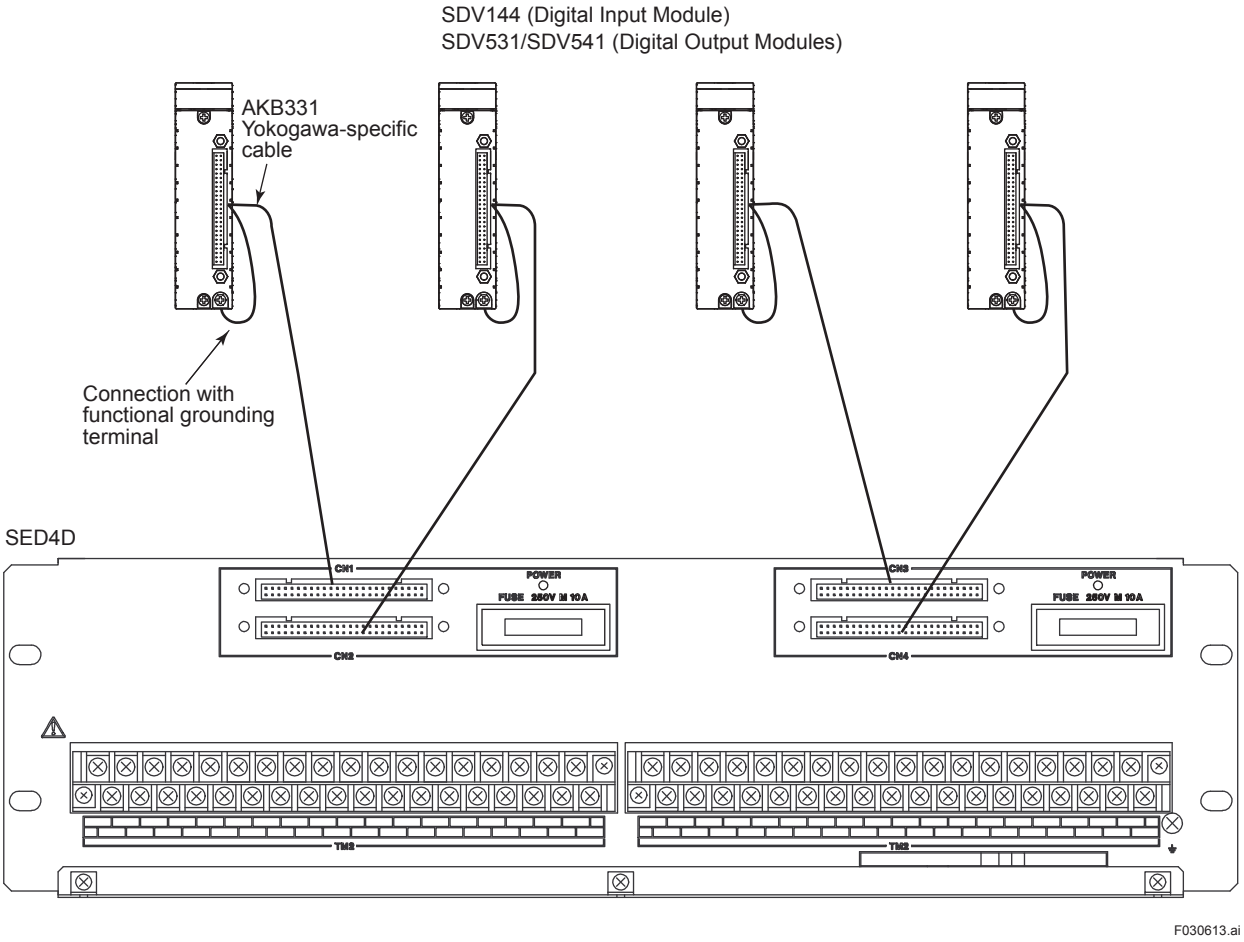

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Figure Connecting Digital Input/Output Modules to SED4D Terminal Board (for Dual-redundant Use)

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

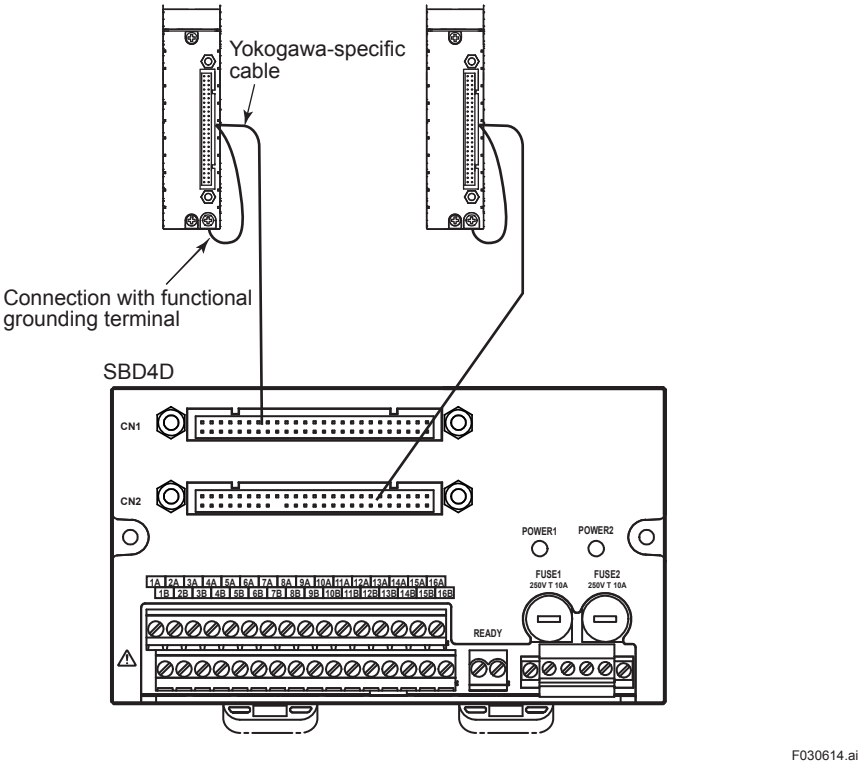

Figure Connecting Digital I/O Modules to SBD4D Terminal Board (for Dual-redundant Use)

Example of Connection to SWD2D

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

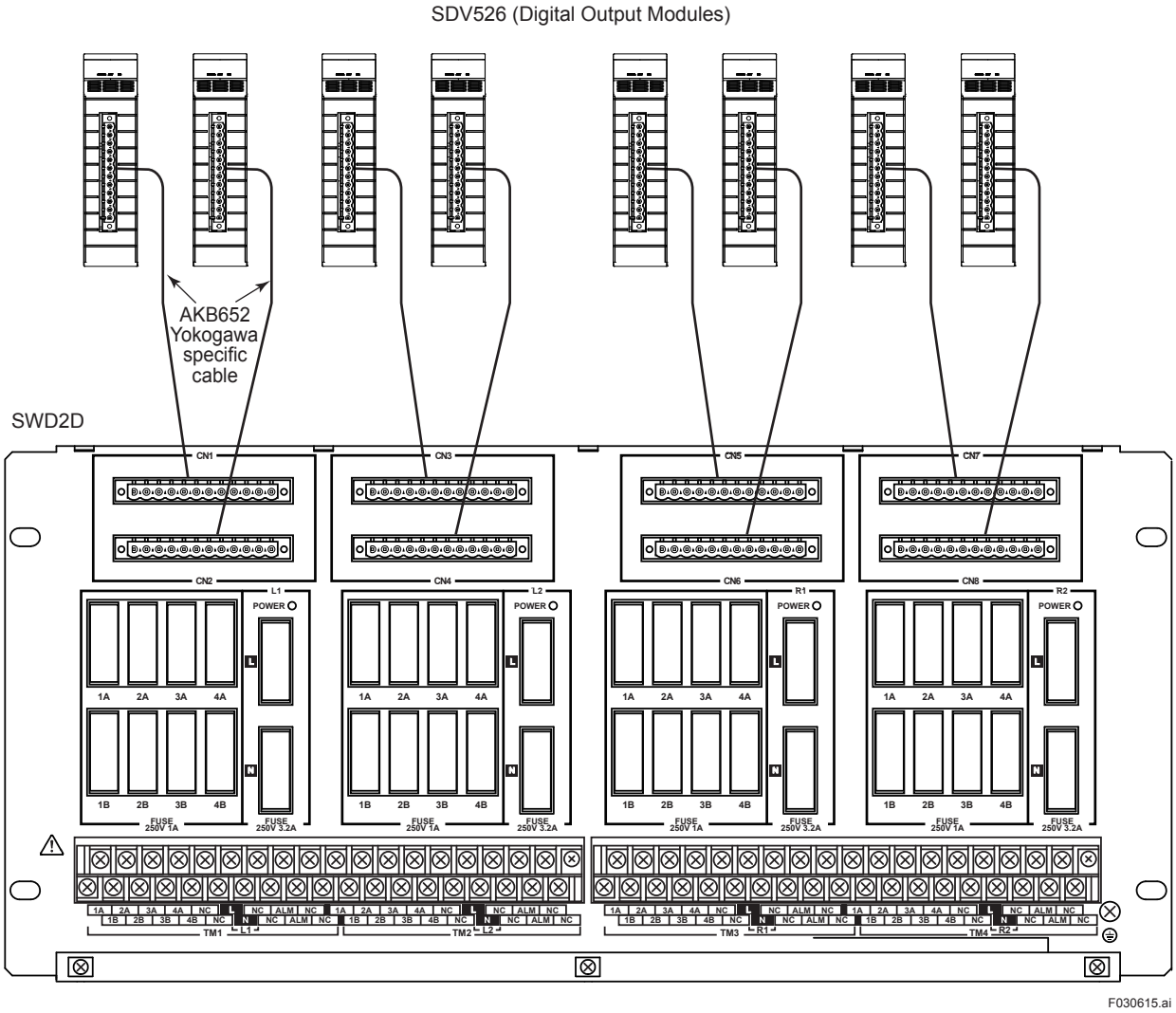

Figure Connecting Digital Output Modules to SWD2D Terminal Board (for Dual-redundant Use)

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.

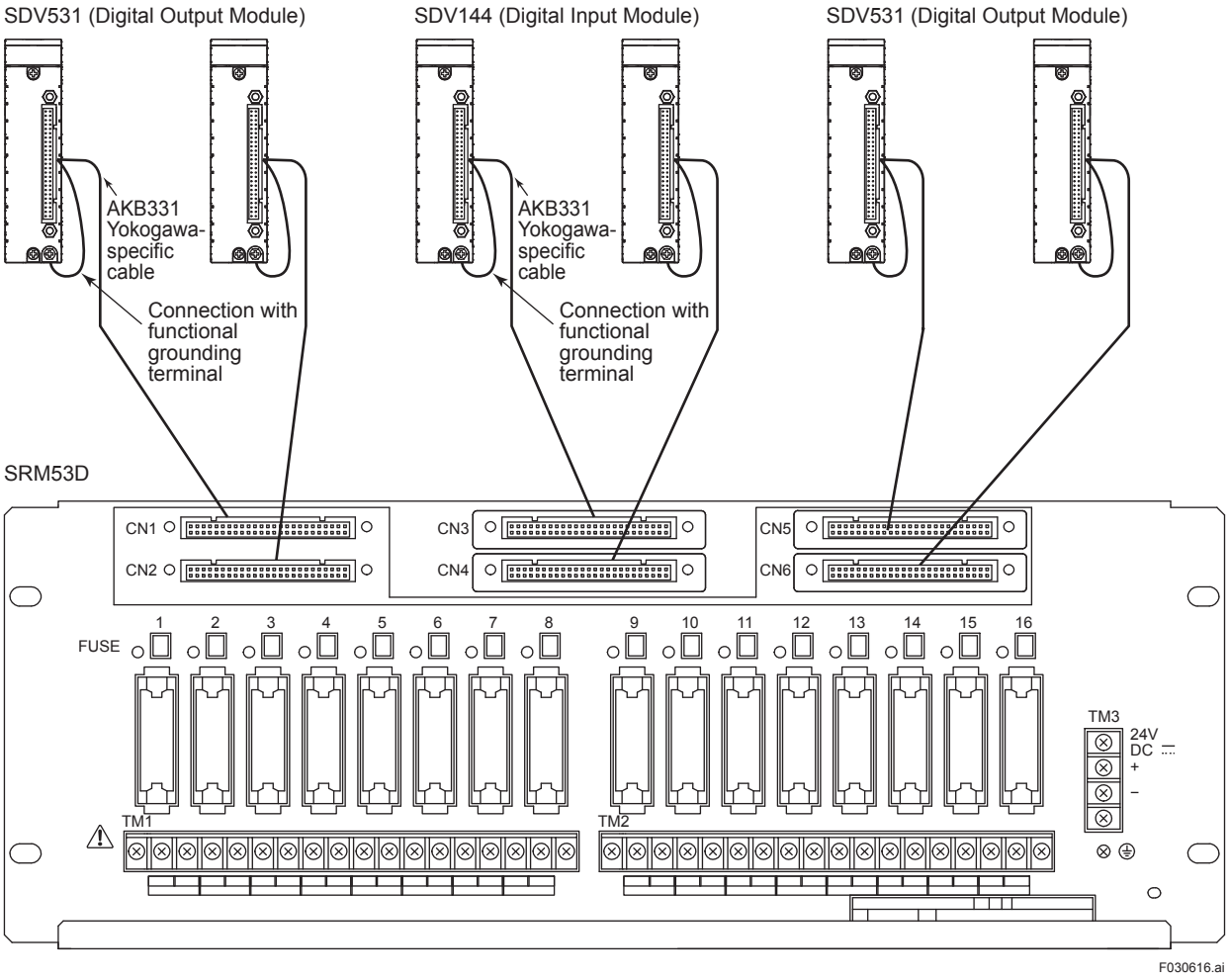

Figure Connecting Digital I/O Modules to SRM53D (for Dual-redundant Use)

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.

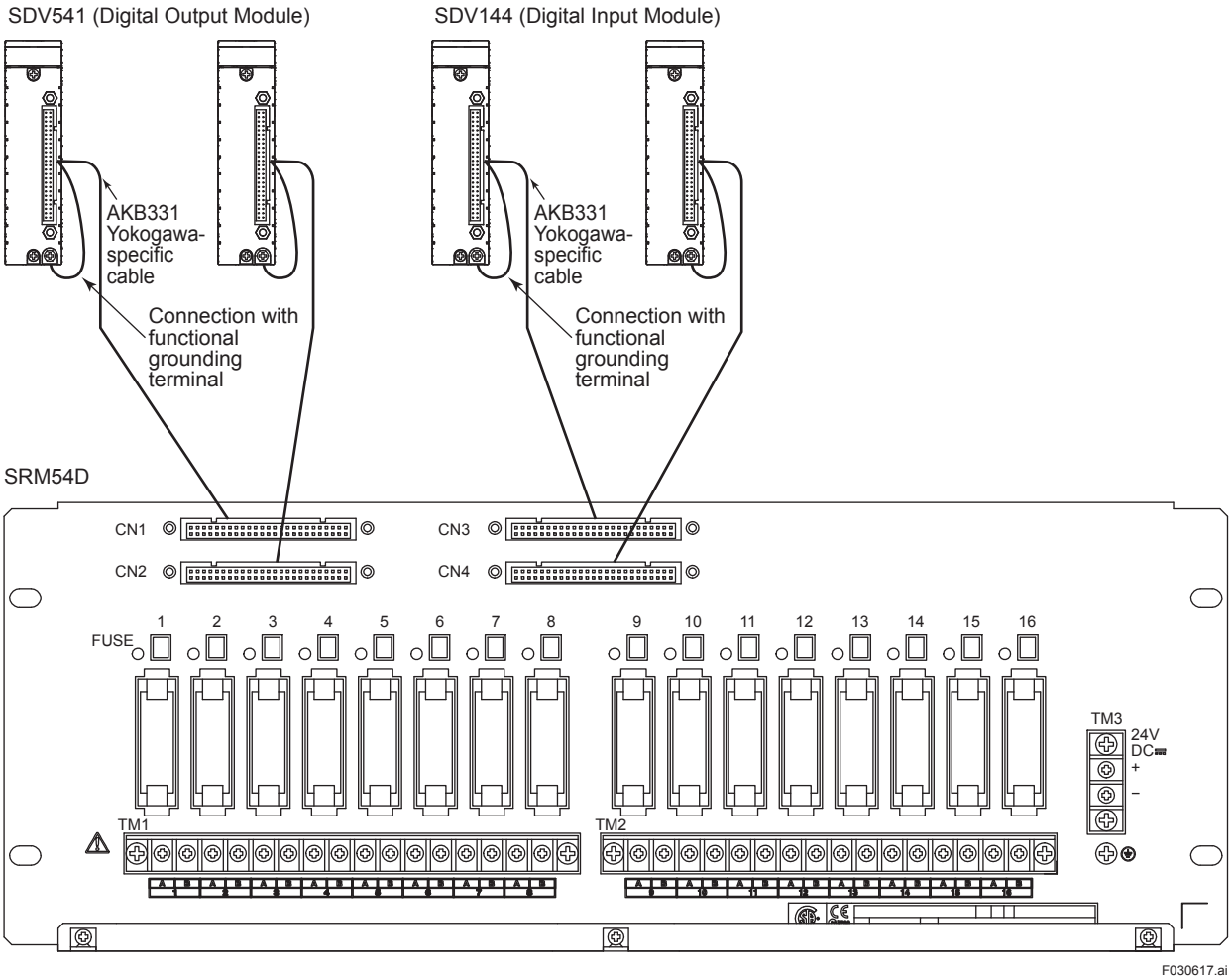

Figure Connecting Digital I/O Modules to SRM54D Relay Board (for Dual-redundant Use)

Example of Connection to SBM54D Relay Board

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

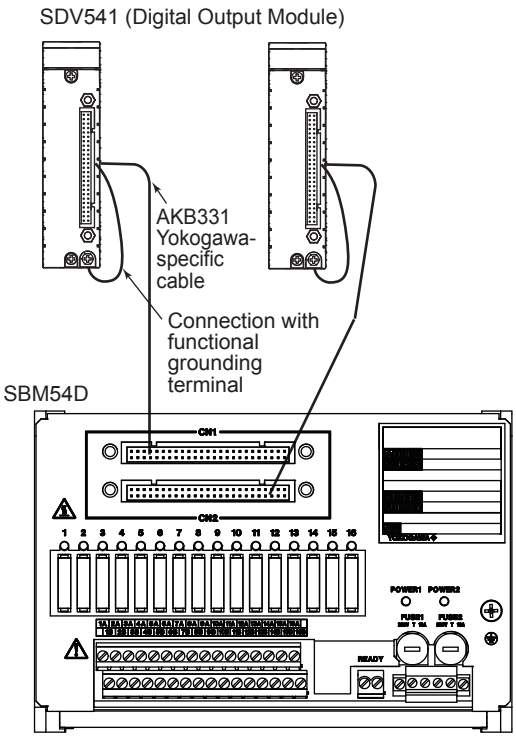

Figure Connecting Digital Output Modules to SBM54D Relay Board (for Dual-redundant Use)

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:
Appendix 1.3.4 "Setting for the DI channel" of the Engineering Guide Vol. 1 (IM 32P01C10-01EN).

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

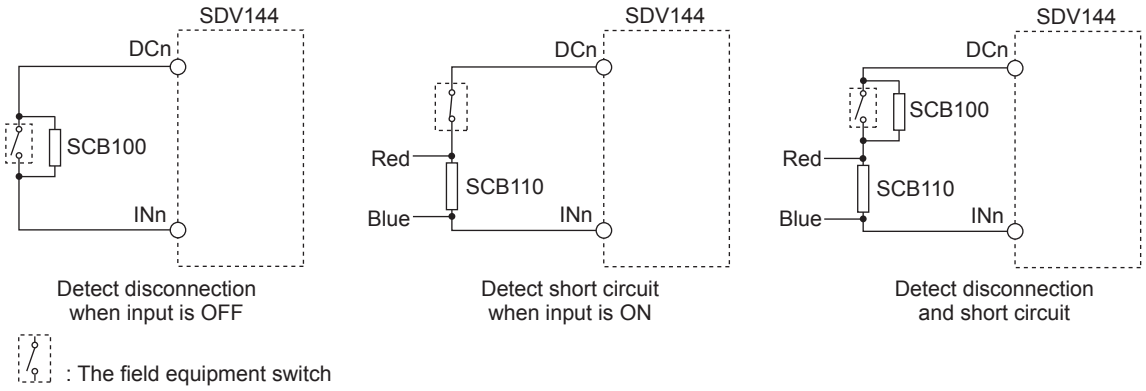


Figure Connecting Wiring Check Adapters

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 Signal Connections of N-IO I/O Unit

This section describes connecting to the N-IO I/O unit.

3.7.1 N-IO I/O Unit Types

■ I/O Modules that can be used with Base Plate

The following table shows I/O Modules installable with Base Plate.

Table I/O Modules Installable with Base Plate

Base plate model	Description	Base Plate		
		S2BN1D	S2BN4D	S2BN5D
S2MMM843	Analog Digital I/O Module	X	X	X
S2MDV843	Digital I/O Module	X	X	X

X: Mountable

3.7.2 Base Plate

■ Terminal type that can be select with Base Plate

The following table shows terminal types can be select with S2BN1D Base Plate.

Table Terminal type Compatible with S2BN1D Base Plate

Base plate model	Suffix code	Terminal type
S2BN1D (Base Plate with disconnecting terminal)	-□1□□□	Pressure clamp terminal
	-□2□□□	Spring clamp terminal

■ Connecting Signal Cables with S2BN1D

● S2BN1D

Terminal number	Signal type
□A	Analog Digital I/O (AI_□/AO_□/DI_□/DO_□)
□B	Common (COM)

□: Channel number

Base Plate Terminal Numbers (Spring Clamp Terminals)

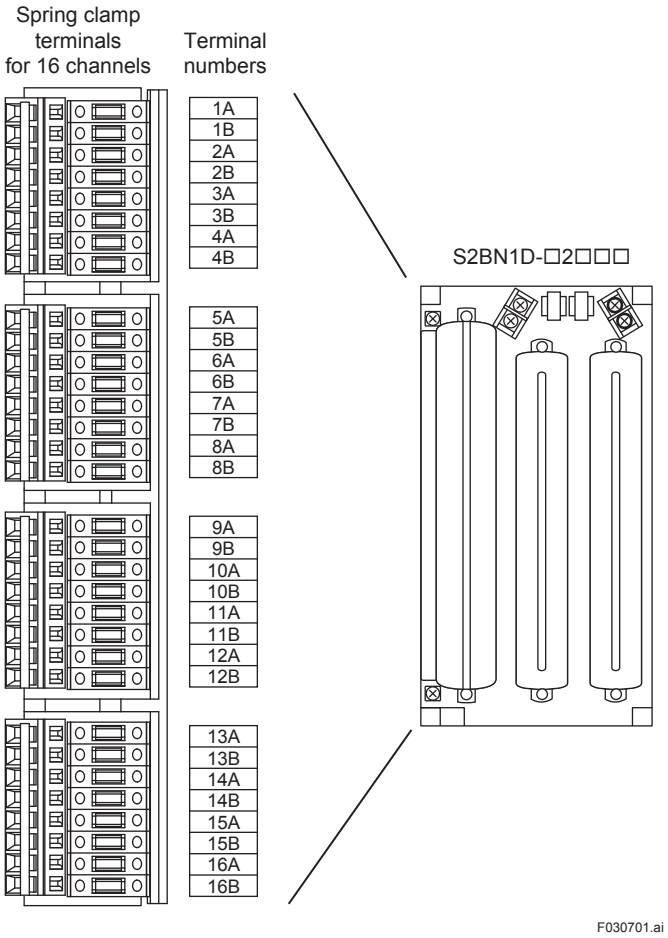


Figure S2BN1D-□2□□□ Base Plate for Adaptor

Base Plate Terminal Numbers (Pressure Clamp Terminals)

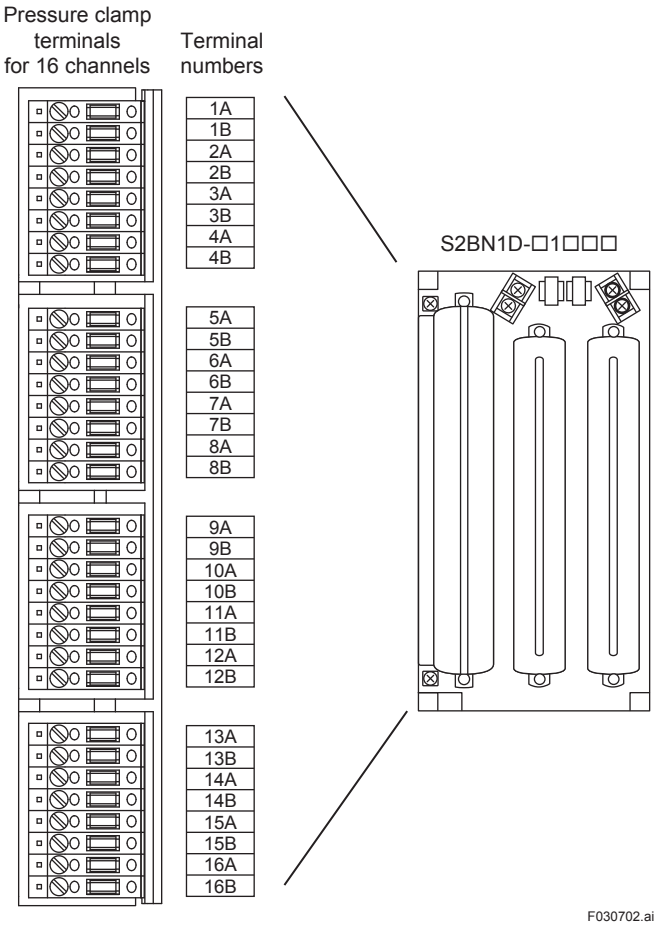


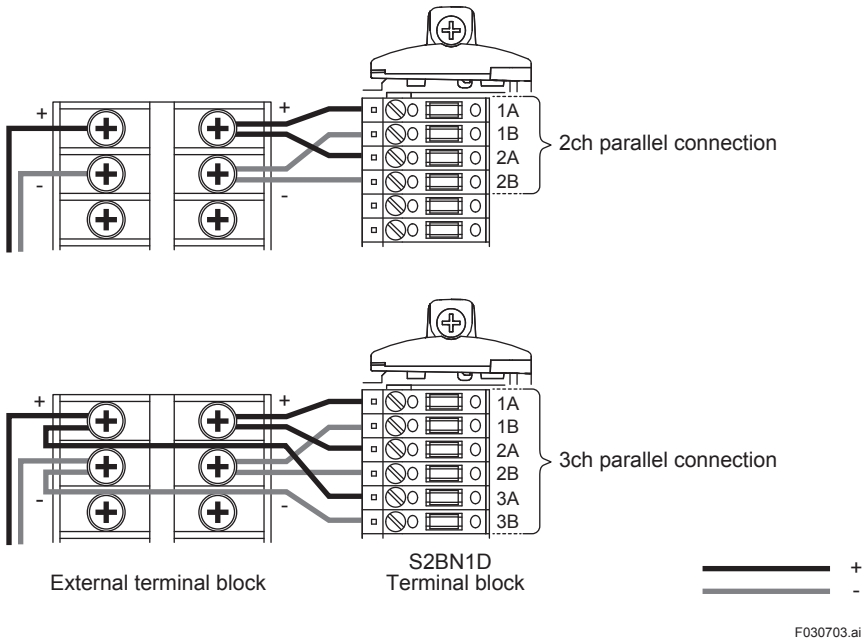
Figure S2BN1D-□1□□□ Base Plate

Parallel connection with adjacent channels (S2BN1D)

The maximum load current per channel is 0.66 A. A load current device with more than 0.66 A can be connected by using parallel connection with adjacent channels.

- The 2 channels parallel connection allows a maximum load current of 1.3 A.
- The 3 channels parallel connection allows a maximum load current of 2.0 A.

To use parallel connection, connect the base plate terminals on the external terminal board. The following figure shows an example of parallel connection.



Connecting Wiring Check Adapters

Connect the wiring check adapters to detect disconnected or short-circuited field wiring between the digital input channel 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:
Appendix 1.3.4 "Setting for the DI channel" of the Engineering Guide Vol. 1 (IM 32P01C10-01EN).

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

Example of Connecting Wiring Check Devices

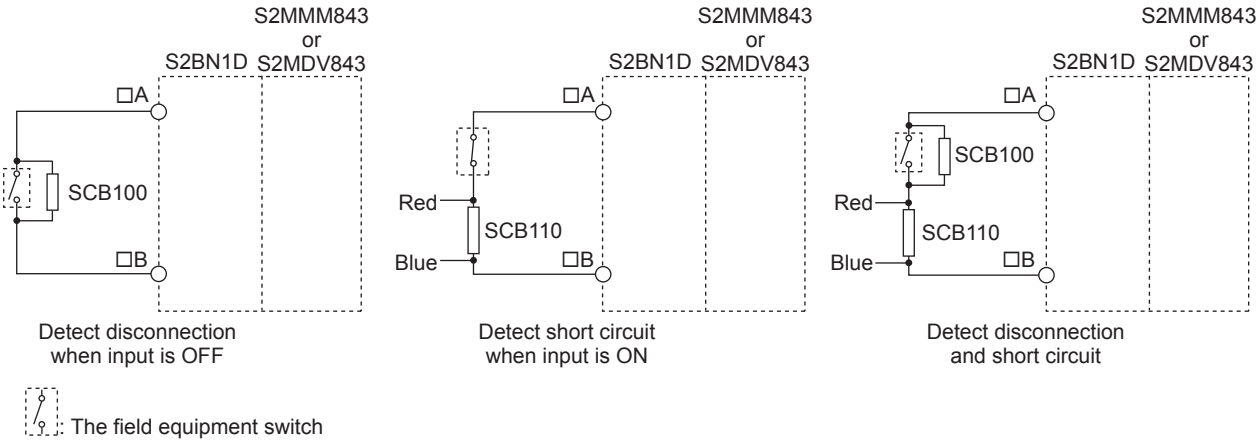

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Figure Connecting Wiring Check Adapters

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.

3.7.3 Base Plate for Barrier

Base Plate for Barrier Types and Terminal Types

The following table shows relation between Base Plate for Barrier Types and Terminal Types.

Table Base Plate for Barrier Types and Terminal Types

Base plate model	Suffix code	Field wiring direction	Terminal type	Terminal position
S2BN4D Base Plate for Barrier (MTL)	-□□□C□	Left	Pressure clamp terminal	On barrier module
	-□□□D□	Right		
S2BN5D Base Plate for Barrier (P+F)	-□□□C□	Left	Spring clamp terminal	On base plate
	-□□□D□	Right		

Installable Barriers with Base Plate for Barrier

The following table shows Modules installable with Base Plate for Barrier.

Table Modules Installable with Base Plate for Barrier

Base plate model	Model of installable barrier
S2BN4D Base Plate for Barrier (MTL)	Refer to the General Specifications (GS).
S2BN5D Base Plate for Barrier (P+F)	Refer to the General Specifications (GS).

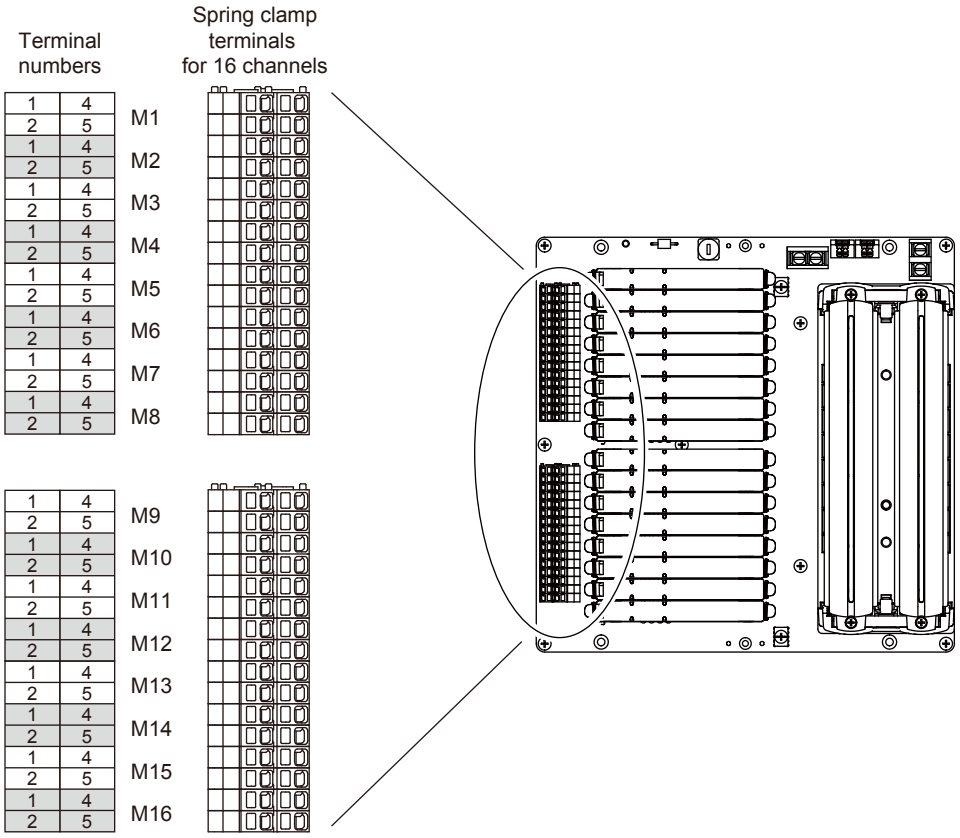
Base Plate for Barrier Terminal Numbers

S2BN4D (Pressure Clamp Terminals)

The S2BN4D Base Plate for Barrier do not have signal terminals because signal terminals are provided on intrinsic safety barriers.

Information about the terminal numbers of the signal terminals provided on the intrinsic safety barriers, refer to the manufacture's catalog.

S2BN5D Base Plate for Barrier (Spring Clamp Terminals)



Connecting Signal Cables with Base Plate for Adapter (S2BN5D)

The signal connections of the base plate for adaptor (model: S2BN5D) differ depending on the signal type. The following table shows the terminal numbers and signal types.

Table Terminal Numbers and Signal Types (S2BN5D)

Intrinsic safety barriers	Terminal number	Signal type (*1)					
		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
For analog input	1	Two-wire transmitter input +	Current input +	—	—	—	—
	2	—	—	—	—	—	—
	4	Two-wire transmitter input −	—	—	—	—	—
	5	—	Current input −	—	—	—	—
For analog output	1	Analog output +	—	—	—	—	—
	2	—	—	—	—	—	—
	4	Analog output −	—	—	—	—	—
	5	—	—	—	—	—	—
For digital input	1	Digital input+	—	—	—	—	—
	2	—	—	—	—	—	—
	4	Digital input −	—	—	—	—	—
	5	—	—	—	—	—	—
For digital output	1	Digital output +	—	—	—	—	—
	2	—	—	—	—	—	—
	4	Digital output −	—	—	—	—	—
	5	—	—	—	—	—	—
For temperature input	1	RJC connection	—	RTD four-wire type current source +	RTD three-wire type current source +	RTD two-wire type current source +	Skid resistance current source +
	2	Thermocouple input +	Voltage input +	RTD four-wire type input +	—	—	—
	4	RJC connection	—	RTD four-wire type current source -	RTD three-wire type current source -	RTD two-wire type current source -	Skid resistance current source -
	5	Thermocouple input -	Voltage input -	RTD four-wire type input -	RTD three-wire type input -	—	Skid resistance input -

*1: "—" denotes that the terminal is not used. Do not connect any signal to it.

3.8 Connecting Bus Cable

There are three types of control network bus named as Vnet/IP, and Vnet/IP-Upstream for the ProSafe-RS system.
Vnet/IP or Vnet/IP-Upstream is used for SSC60S/SSC60D, SSC50S/SSC50D and SSC57S/SSC57D. 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.

3.8.1 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

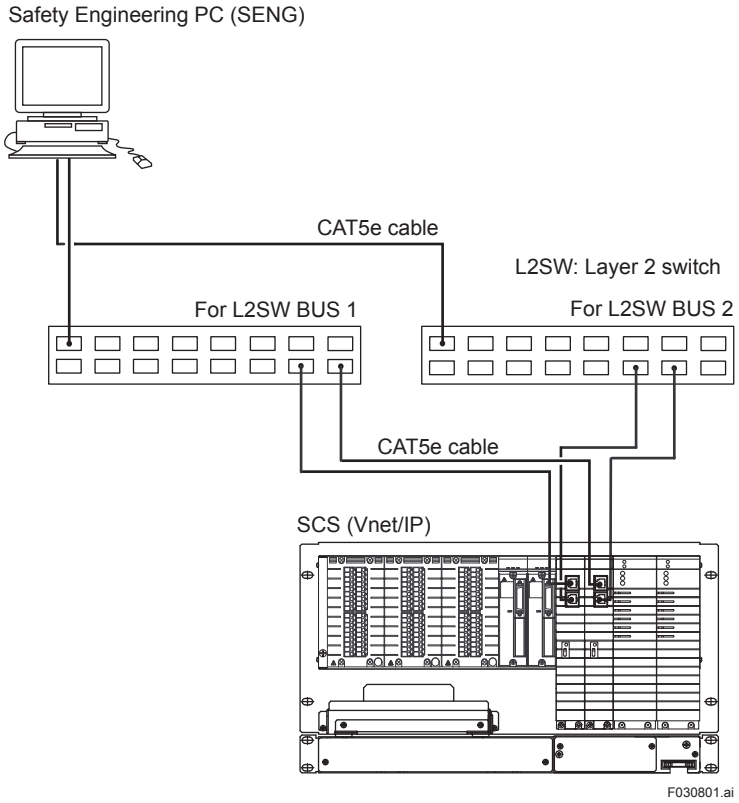


Figure Example of SENG and SCS Connection

Example of Connection between V net Router and SCS

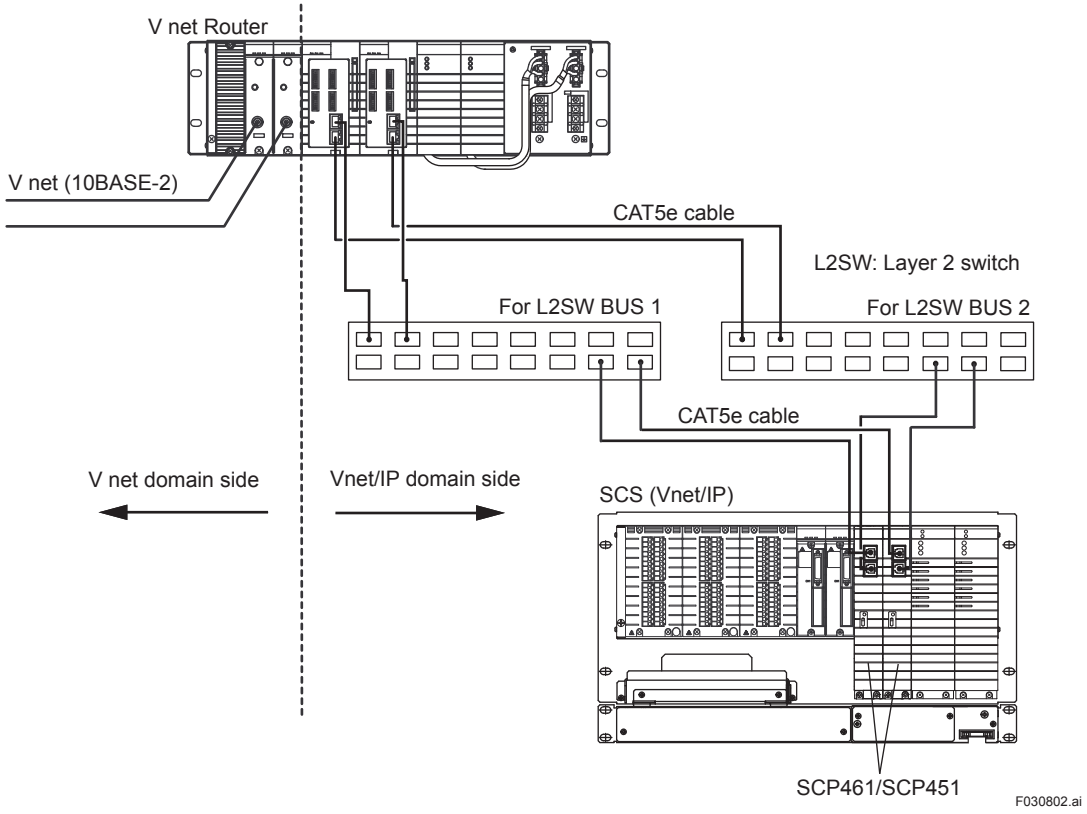


Figure Example of Connection between V net Router and SCS

Example of Connection between AW810D and SCS

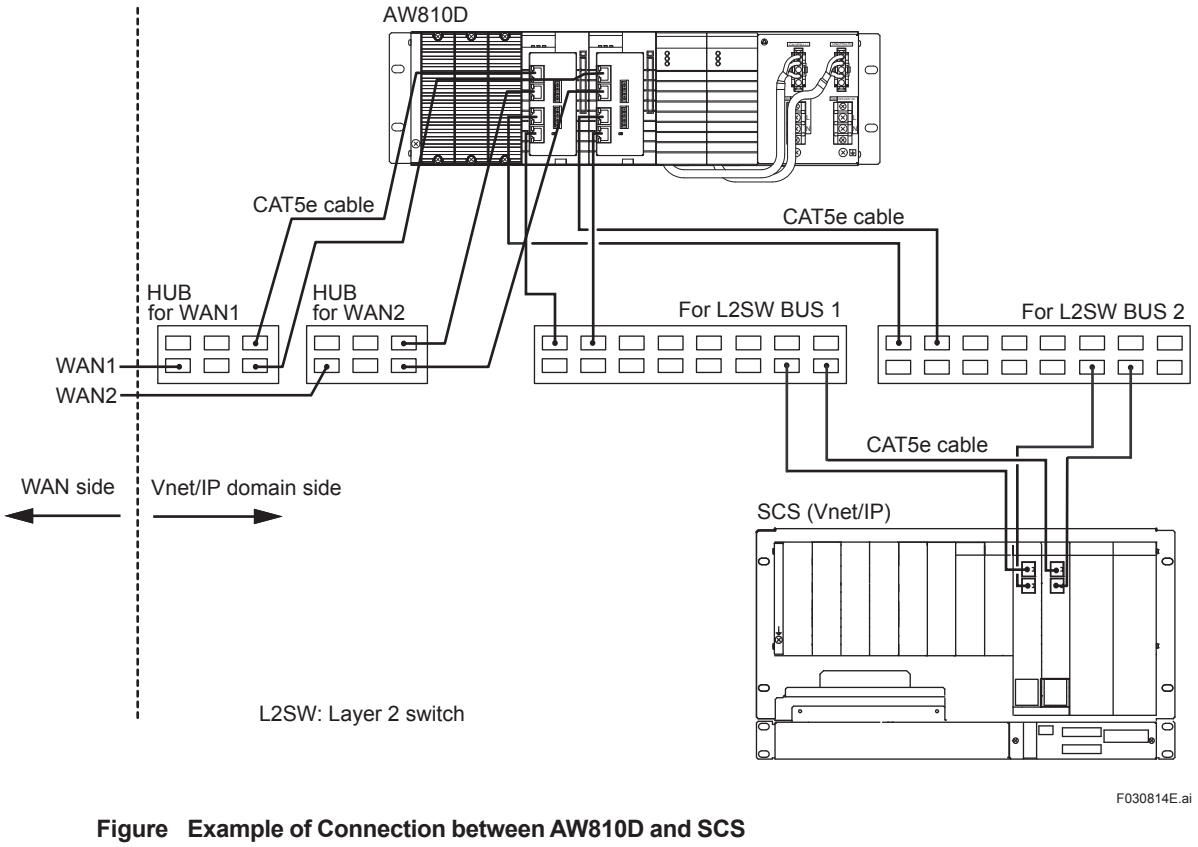


Figure Example of Connection between AW810D and SCS

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.

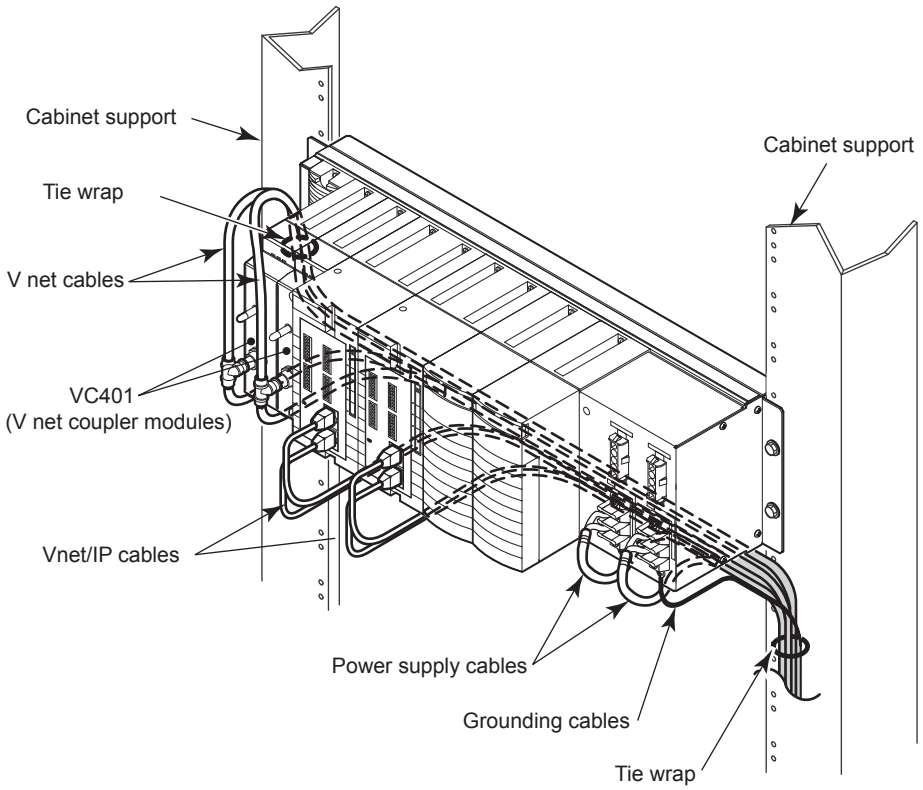
Handling communication module for V net router (VI451) of Duplexed V net router (AVR10D) and connecting cable

- 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 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.

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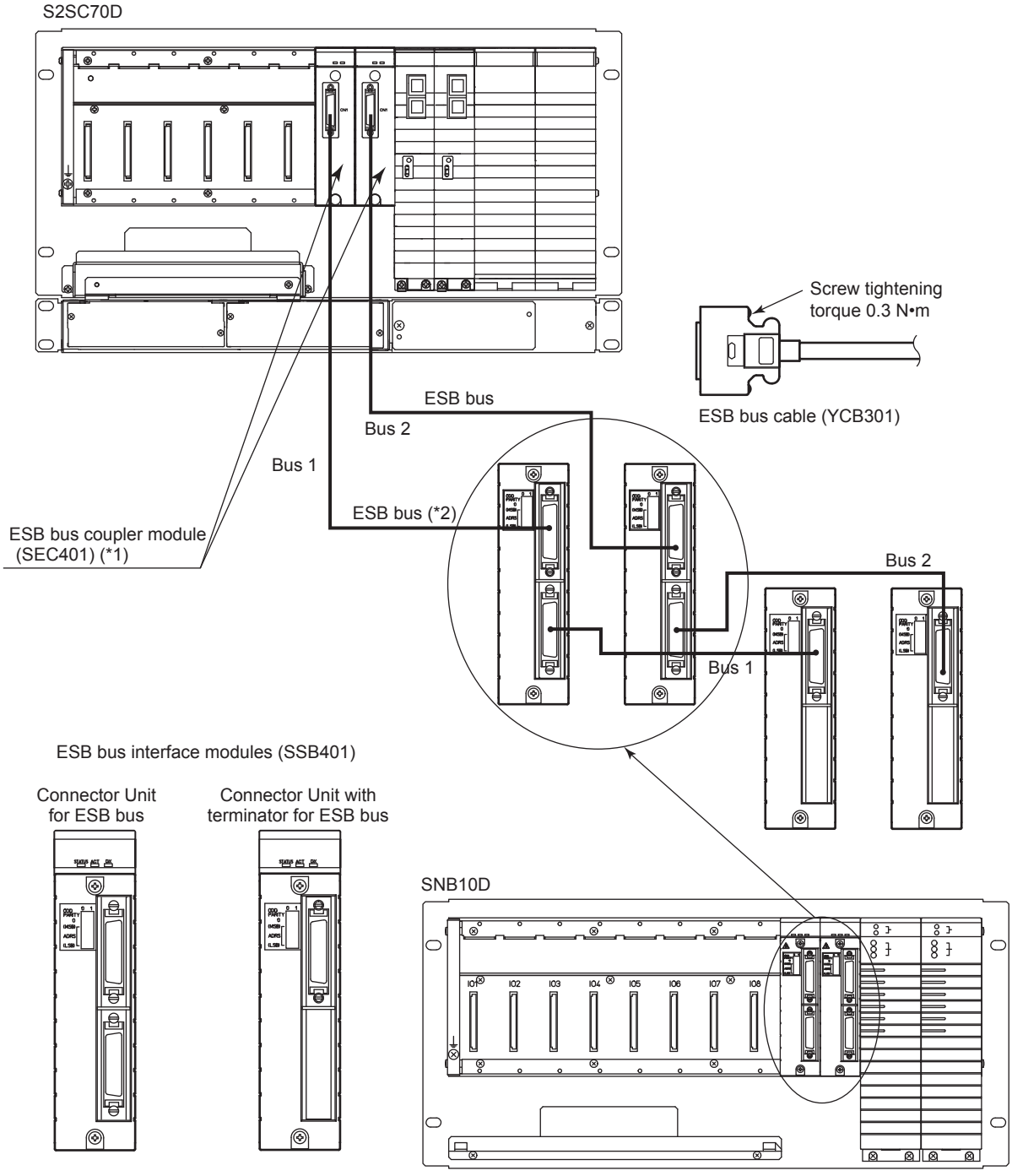
Figure Cabling Diagram for the AVR10D System

3.8.2 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 S2SC70☐, SSC60☐, SSC50☐, and SSC57☐.



*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.

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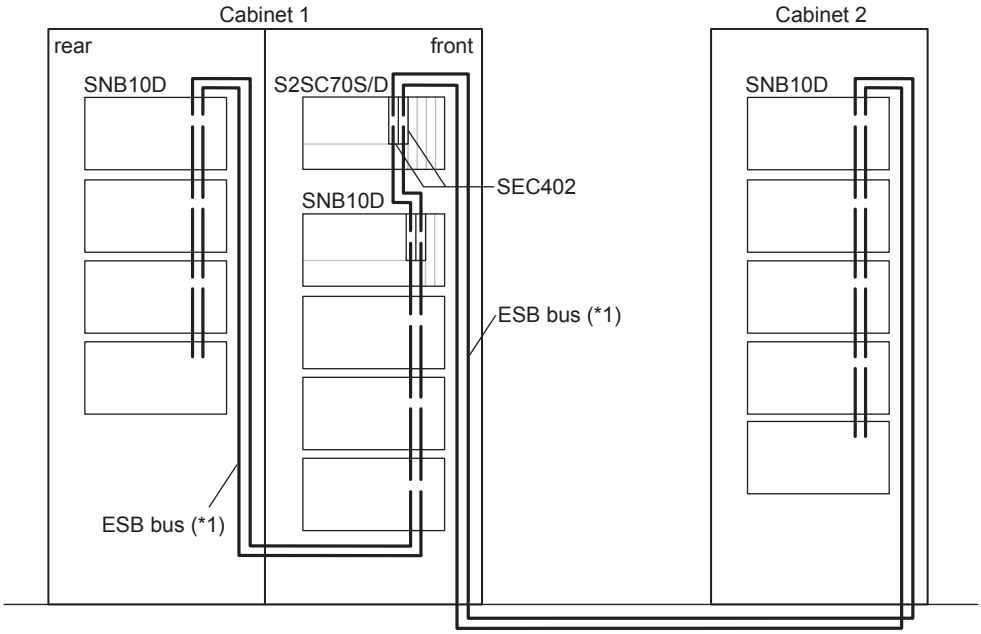
Figure ESB bus Connection (SSC60D)

Using SEC402 ESB bus coupler module, up to 13 SNB10D safety node units (*1) can be connected to S2SC70☐/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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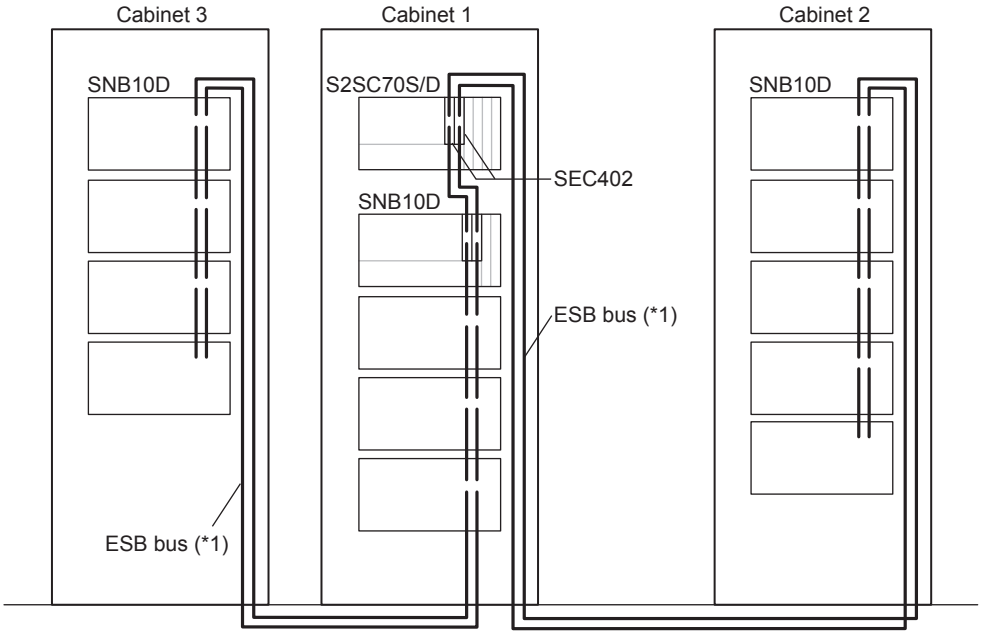
Figure ESB bus Connection when Two Cabinets are Used



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

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Figure ESB bus Connection when Three Cabinets are Used

3.8.3 N-ESB Bus

The following figure shows a connection example of the N-ESB bus.

Connect UTP straight Cable of Cat5e (two) from N-ESB bus Coupler Module (S2EN402, S2EN404) to N-ESB bus Module (S2EN501).

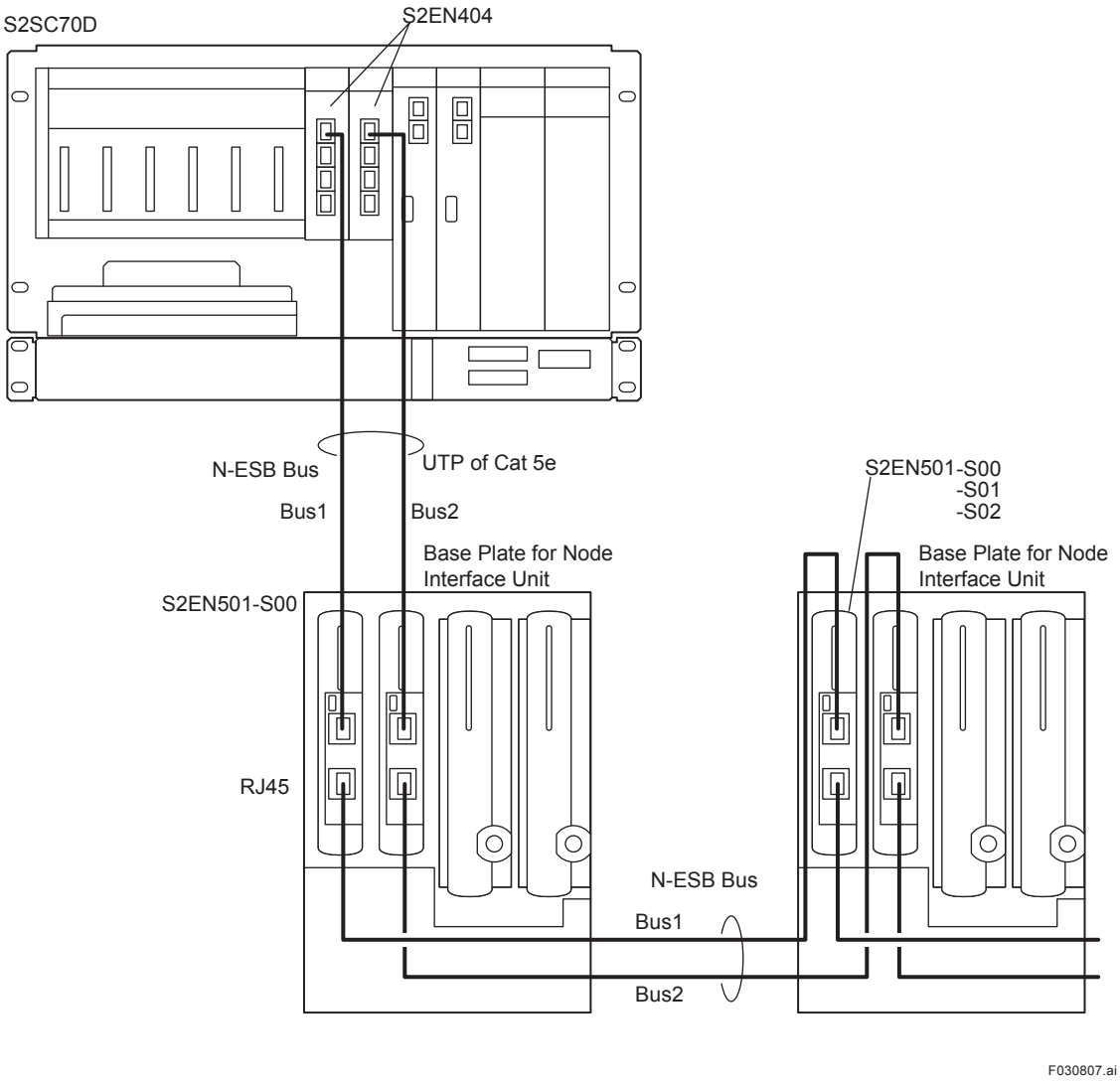


Figure Example of N-ESB Bus Connection

IMPORTANT

An N-ESB bus cable for the ProSafe-RS can be routed only in the cabinet or within the cabinets bayed together. An optical ESB bus cable must be used instead of an N-ESB bus cable when a cable is routed outside of the cabinet.

3.8.4 Optical ESB Bus

■ S2EN40☐

The following figure shows a connection example of the optical ESB Bus of the N-IO system.

Use a N-ESB Bus Module (S2EN501) equipped with an optical module to connect between an NIU and NIU.

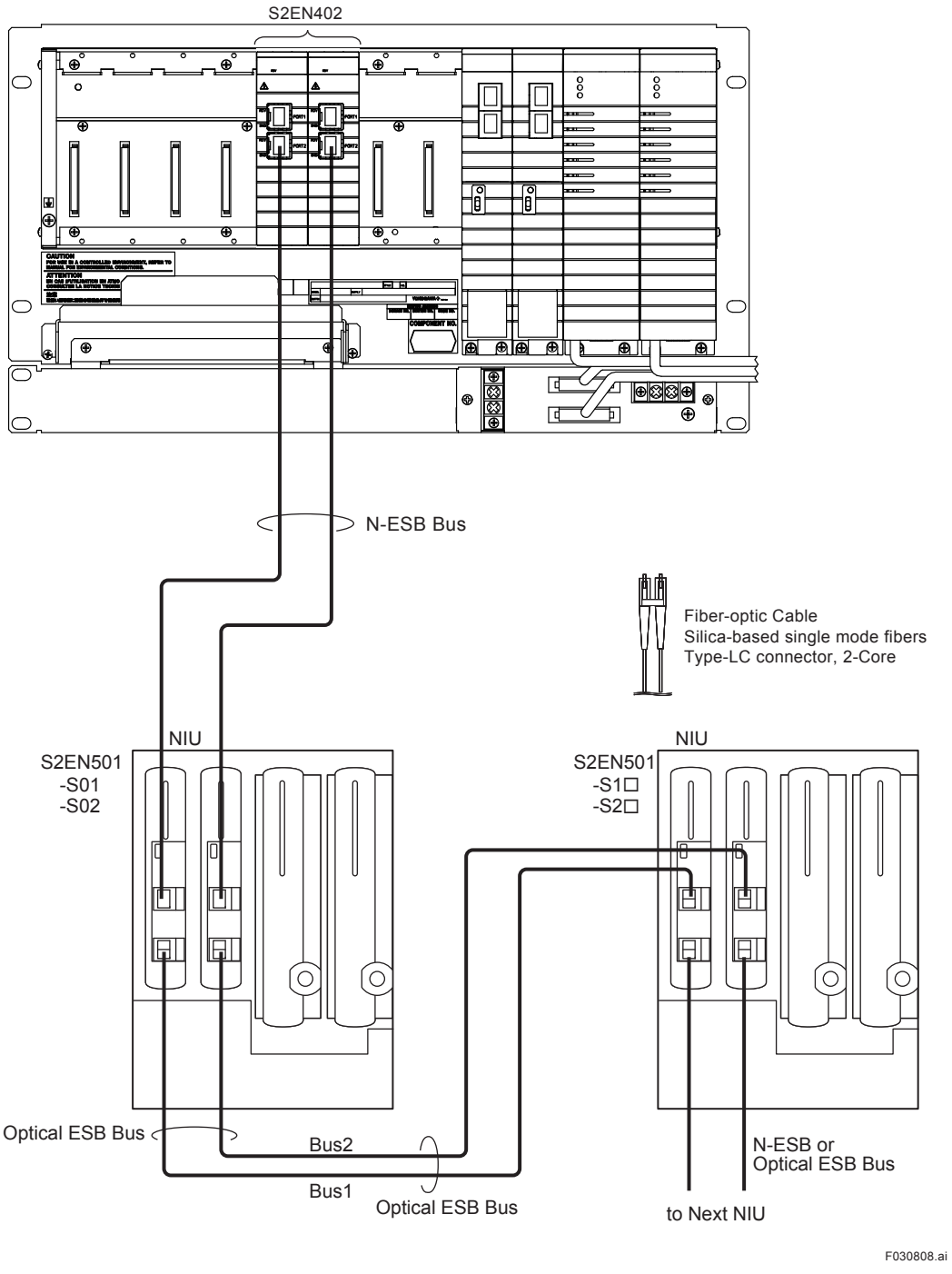


Figure Optical ESB Bus (N-IO) Connection (When Chain Connection)

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 S2SC70☐, SSC60☐, SSC50☐ or SSC57☐ is used for the safety control unit, SNT401, SNT411, SNT501 and SNT511 are available.

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 S2SC70☐/SSC60☐/SSC50☐/SSC57☐ (safety control unit) or SNT10D (unit for Optical ESB bus repeater module) to SNT501/SNT511 installed on SNB10D (safety node unit).

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

Example of not using SNT10D

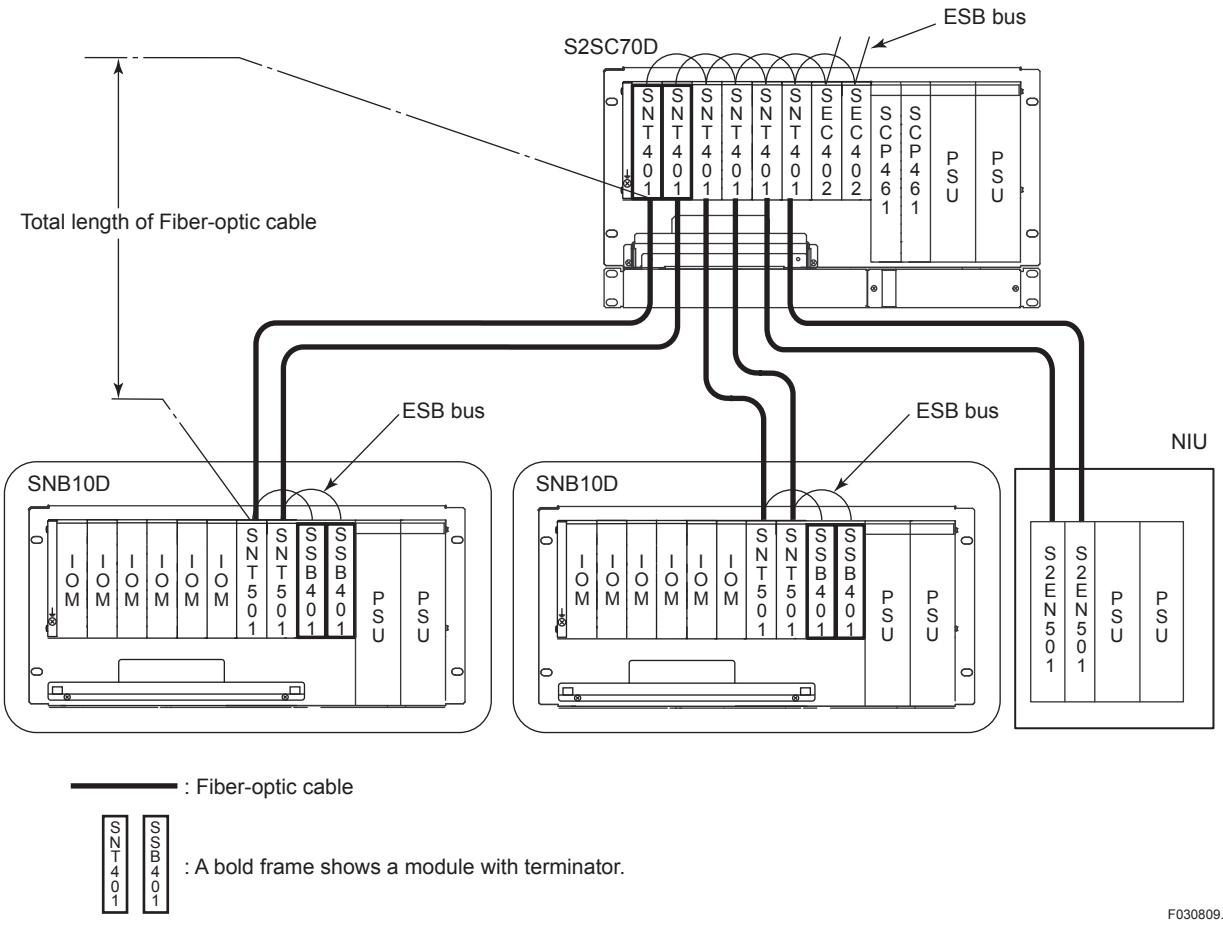
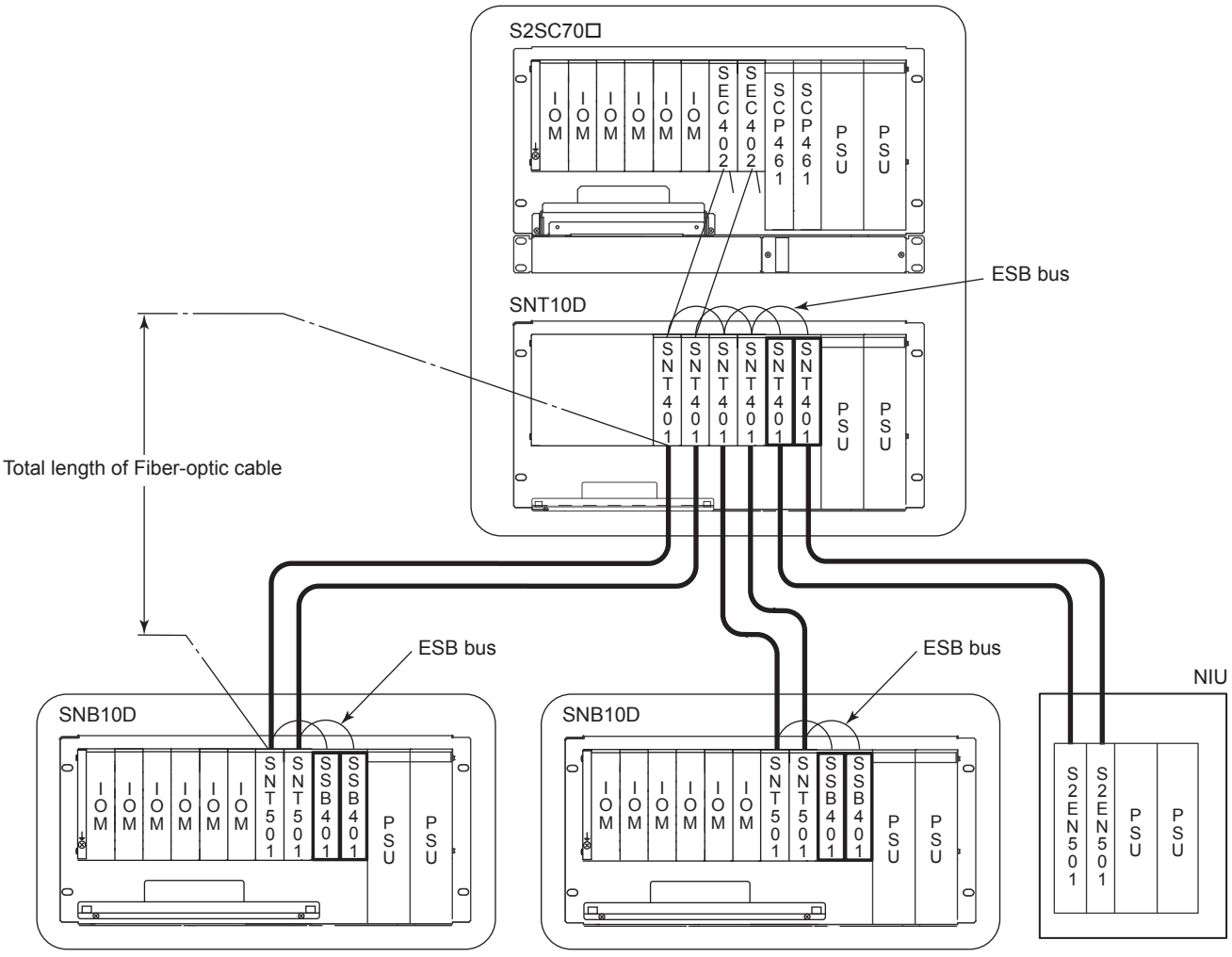


Figure Star Type Connection: Not Using SNT10D

Example of using SNT10D



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 S2SC70☐/SSC60☐/SSC50☐/SSC57☐ 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☐ 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.

Example of not using SNT10D

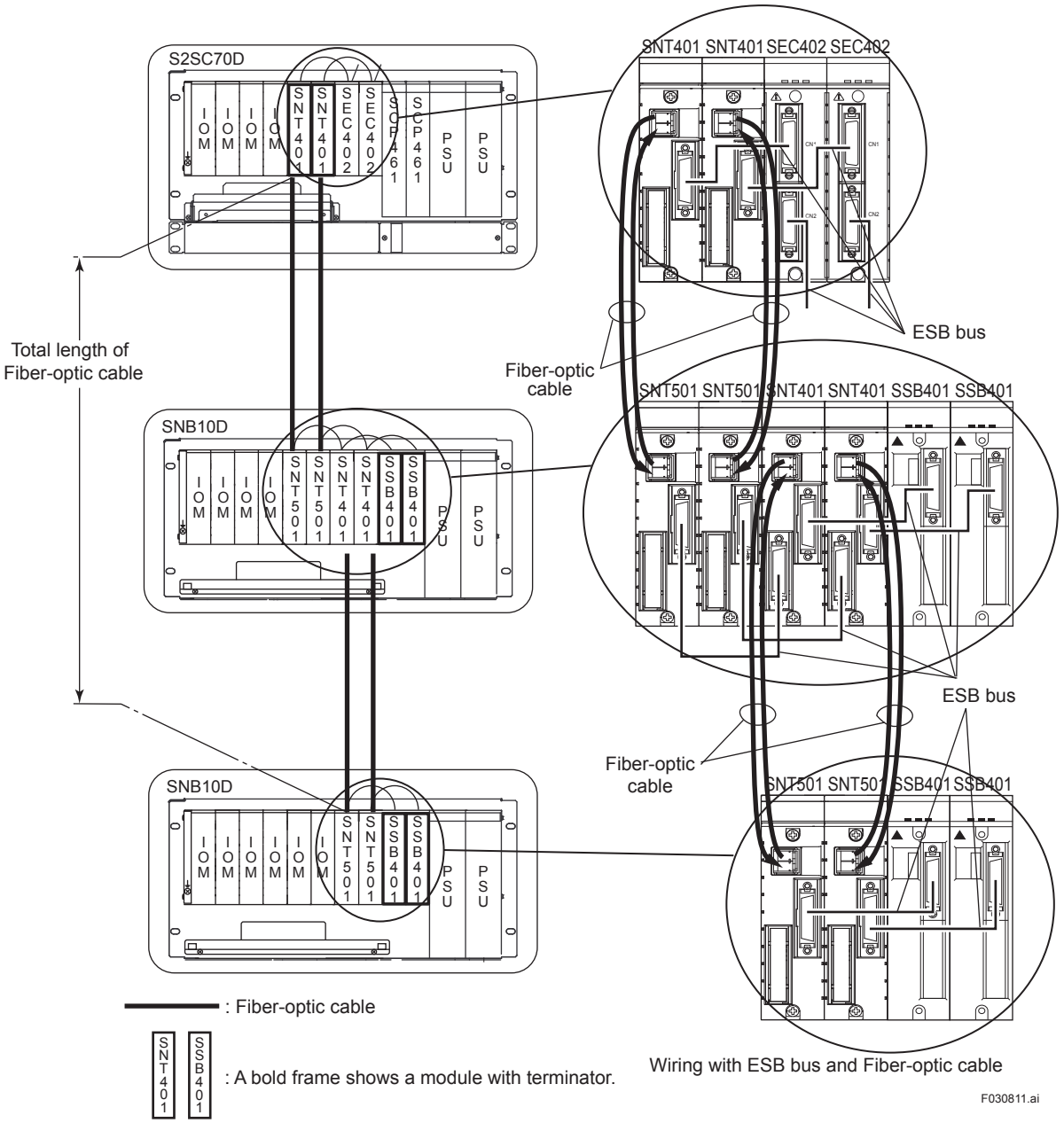


Figure Chain Type Connections: Not Using SNT10D

Where an SNT10D Unit Is Used

The SNT10D is used for S2SC70☐, SSC60☐, SSC50☐, SSC57☐, 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.

Example of using SNT10D

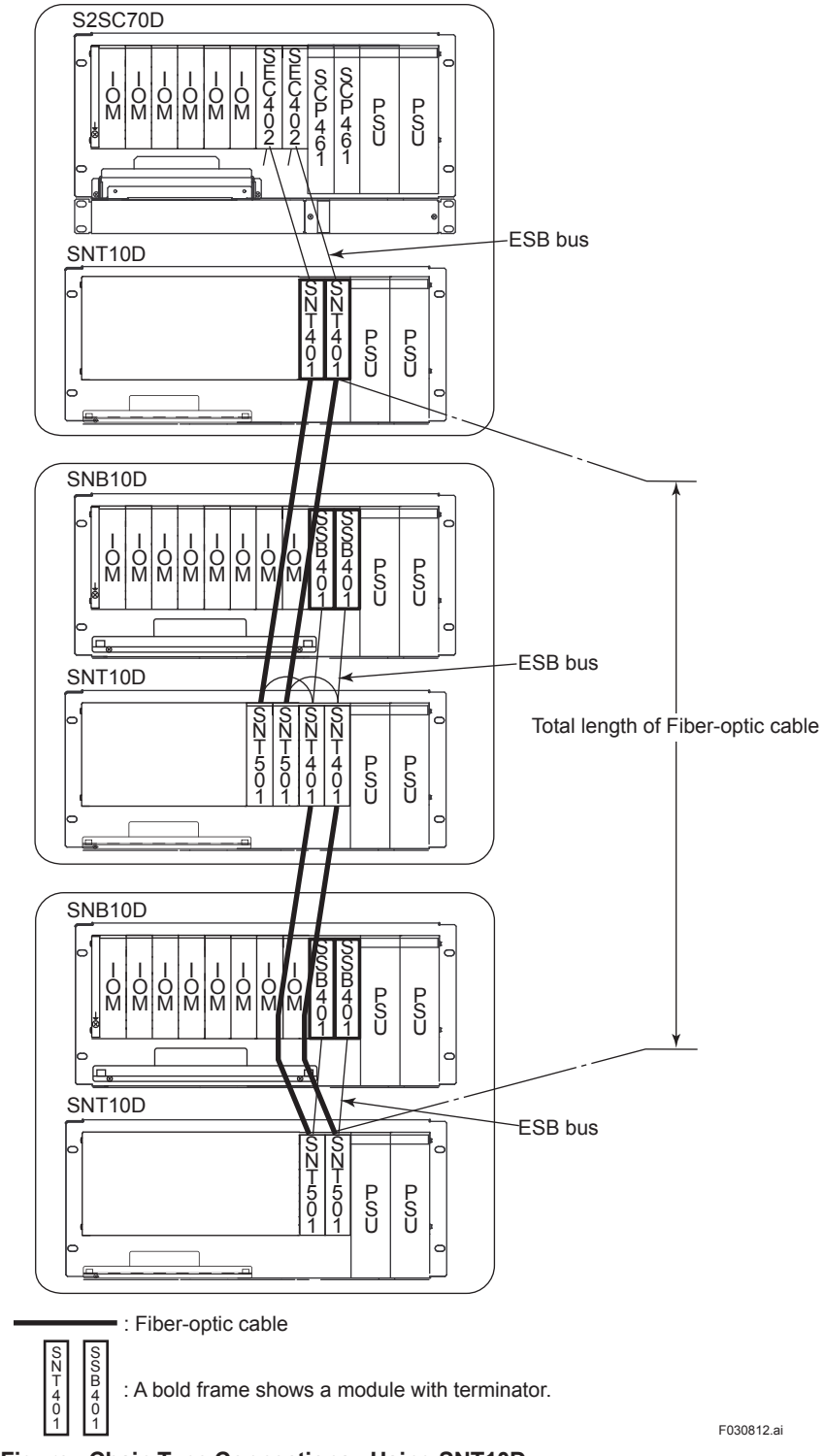


Figure Chain Type Connections: Using SNT10D

Fiber-optic Cable for Optical ESB

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

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

3.8.5 F-SB Bus (for N-IO Node)

The following figure shows a conne.

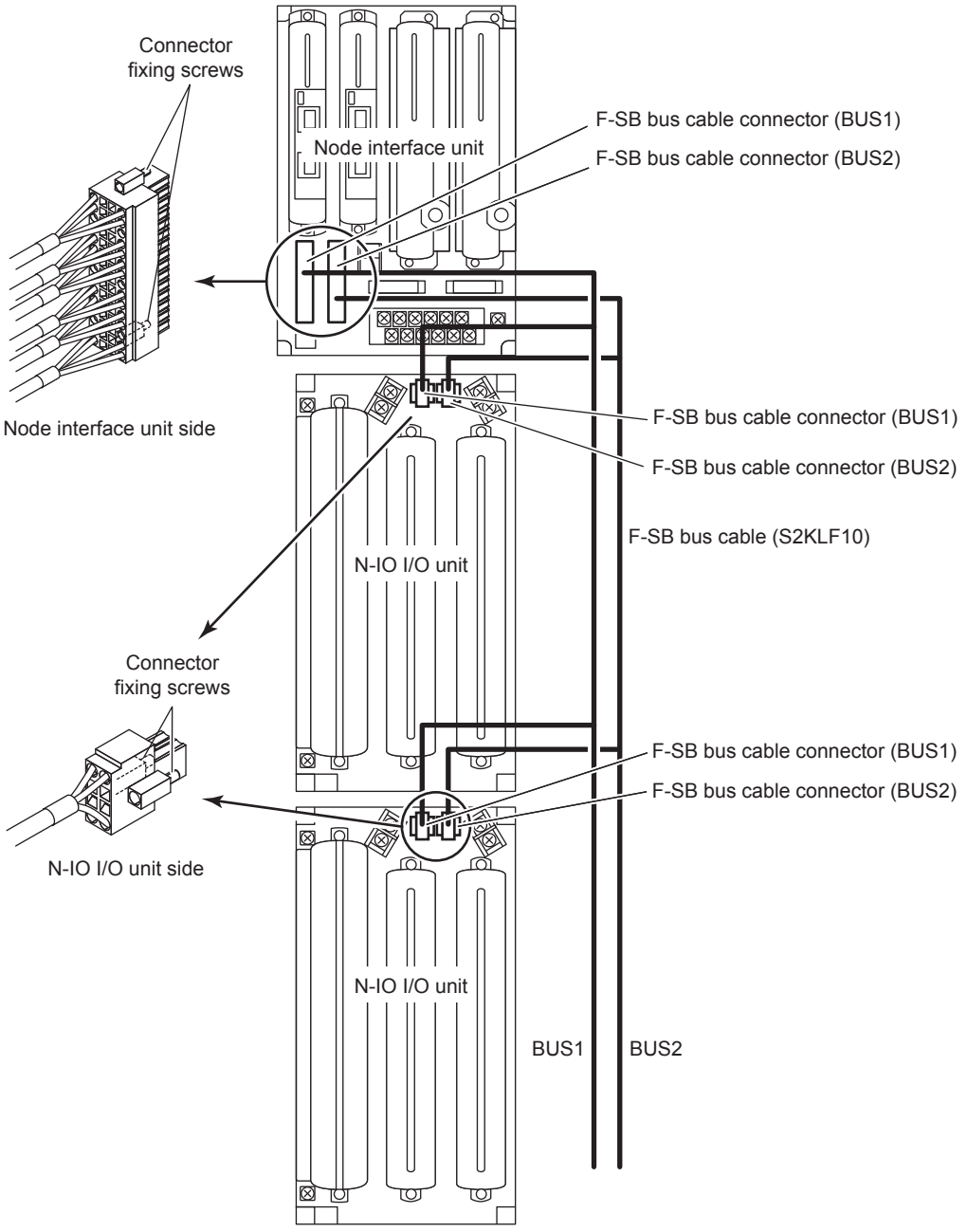


Figure F-SB Bus Connection

CAUTION

NIU and N-IO I/O Units can be installed in only the same cabinet.

When connecting a F-SB bus cable to N-IO node, ensure to keep the minimum bending radius of the cable.

The minimum bending radius of the F-SB bus cable is six-fold of the diameter of the 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	
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	

*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		
S2SC70S-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	
S2SC70S-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	
S2SC70D-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	
S2SC70D-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	
AW810D Wide Area Communication 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	
S2NN30D Node Interface Unit	100-240	50 or 60 ± 3	190 VA	90 x 10^3 (25 W)
	24 V DC		150 W	
S2BN1D Base Plate	24 V DC		24 W	51 x 10^3 (14 W)
S2BN4D Base Plate for Barrier (MTL) System Power	24 V DC		24 W	51 x 10^3 (14 W)
S2BN4D Base Plate for Barrier (MTL) Barrier Power	24 V DC		38.4 W	83 x 10^3 (23 W)
S2BN5D Base Plate for Barrier (P+F) System Power	24 V DC		24 W	51 x 10^3 (14 W)
S2BN5D Base Plate for Barrier (P+F) Barrier Power	24 V DC		28.8 W	58 x 10^3 (16 W)

*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
S2SC70S-S Safety Control Unit	62	5	124	5	30	23
S2SC70S-F Safety Control Unit (Wide range temperature type)	82	9	168	8	40	23
S2SC70D-S Duplexed Safety Control Unit	62	5	124	5	30	23
S2SC70D-F Duplexed 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
AW810D Wide Area Communication Router	47	1	48	0.5	10	2
S2NN30D Node Interface Unit	40	—	80	—	60	—

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, 90º 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 FIO 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 channels, Module isolation)	320	550
SAI143-H	Analog input module (4 to 20 mA, 16 channels, Module isolation, HART communication)	320	550
SAV144	Analog input module (1 to 5 V/1 to 10 V, 16 channels, Module isolation)	300	140
SAI533	Analog output module (4 to 20 mA, 8 channels, Module isolation, HART communication)	320	300
SAT145	TC/mV input module (16 channels, Isolated Channels)	400	200
SAR145	RTD input module (16 channels, Isolated Channels)	500	200
Digital Input/Output Module			
SDV144	Digital input module (non-voltage contact, 16 channels, Module isolation)	290	140
SDV521	Digital output module (24 V DC/2 A, 4 channels, Module isolation)	280	140
SDV526	Digital output module (100-120 V AC, 4 channels, Module isolation)	500	50
SDV531	Digital output module (24 V DC, 8 channels, Module isolation)	280	140
SDV53A	Digital output module (48 V DC, 8 channels, Module isolation)	290	150
SDV541	Digital output module (24 V DC, 16 channels, 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	500	-
SNT511	Optical ESB Bus Repeater Slave Module 5 km - 50 km	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	-
S2LP131	Fire and gas communication module (1-port) (*2)	800	-
Bus Interface Module			
SEC402	ESB Bus Coupler Module (2-Port)	500	-
SEC401	ESB Bus Coupler Module	500	-
S2EN402	N-ESB Bus Coupler Module (2-Port)	500	-
S2EN404	N-ESB Bus Coupler Module (4-Port)	500	-

*1: ALE111 is available from ProSafe-RS R3.02.00 or later with S2SC70☐, SSC60☐, SSC50☐ or SSC57☐.
*2: S2LP131 is available from ProSafe-RS R4.03.10 or later with S2SC70☐.

Maximum Power Consumption of N-IO

Mode	Name	Max current consumption 24 V DC (A)
S2BN1D	Base Plate (Field Power Supply)	11 A
S2BN4D	Base Plate for Barrier (Barrier Power Supply)	1.6 A
S2BN5D	Base Plate for Barrier (Barrier Power Supply)	1.8 A

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
S2SC70S/S2SC70D Safety Control Unit (for 100 V AC power supply)	6.3/250	15/250
S2SC70S/S2SC70D Safety Control Unit (for 220 V AC power supply)	6.3/250	15/250
S2SC70S/S2SC70D 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
S2NN30D Node Interface Unit (100-240 V AC system)	5/250 (fuse)	15/250
S2NN30D Node interface Unit (24 V DC)	12/250 (fuse)	30/24
S2BN1D Base Plate with disconnecting terminal	—	—
S2BN4D Base Plate for Barrier (MTL): Barrier Power Input (24 V DC)	2.5/250 (fuse)	—
S2BN5D Base Plate for Barrier (P+F): Barrier Power Input (24 V DC)	3.15/250 (fuse)	—

*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 (S2SC70☐, SSC60☐, SSC50☐, SSC57☐, 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 40ºC or lower
Power Supply Module (220-240 V AC power supply)	SPW482	8 years	X	Average ambient temperature of 40ºC or lower
Power Supply Module (24 V DC power supply)	SPW484	8 years	X	Average ambient temperature of 40ºC or lower
Battery Pack	S9185FA	3 years	X	Average ambient temperature of 30ºC or lower (*1)
		1.5 years	X	Average ambient temperature of 40ºC or lower (*1)
		9 months	X	Average ambient temperature of 50ºC 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 40ºC 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 60ºC or lower
	A1159EM	4 years	X	Fan only Average ambient temperature of 60ºC 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 40ºC or lower
Power Supply Module (220 - 240 V AC power supply)	SPW482	8 years	X	Average ambient temperature of 40ºC or lower
Power Supply Module (24 V DC power supply)	SPW484	8 years	X	Average ambient temperature of 40ºC or lower
Aluminum Electrolytic Capacitor	–	8 years	–	For SPW481, SPW482, and SPW484 power supply module Average ambient temperature of 40ºC 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, AW810D)

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

–: Cannot be replaced.

S2NN30D

Table Periodic Replacement Parts Having Defined Life Spans

Part names	Part numbers	Recommended Replacement Interval	Replacement by user	Remarks
Power Supply Unit (100-240 V AC)	S2PW503	8 years	Yes	Average ambient temperature 40 °C or less
Power Supply Unit (24 V DC)	S2PW504	8 years	Yes	Average ambient temperature 40 °C or less
Bus Module	S2EN501-S1□□□□ S2EN501-S2□□□□ S2EN501-S□1□□□ S2EN501-S□2□□□	4 years	Yes	In the G3 environment, replacement is recommended due to corrosion of the SFP and SFP connectors.

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	☐ No water intrusion from cable ducts. ☐ No wind/rain blowing in ☐ Air-conditioned ☐ Cable ducts and cabinet bottoms covered to prevent entry of wind, dust, moisture ☐ Cabinets and surroundings cleaned ☐ No dust entering from air vents ☐ Free of salty, ferrous, corrosive gas ☐ No direct sunlight on equipment
Equipment	☐ No condensation or traces on cabinet interior/exterior ☐ No discoloration or rust on cabinet interior/exterior ☐ 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.) ☐ 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 whiles pulling cables, may result in condensation.

Revision Information

- Title : ProSafe-RS Installation Guidance
- Manual No. : TI 32P01J10-01EN

Mar. 2018/6th Edition
1.2 Control Room Environment ["ground" is change to "grounding"]
1.3 Notes for the field power supply unit of N-IO is added.
1.5.1 Eamples of Spark-killer and Diode Installation [Title is changed]
1.8 S2LP131 is added.
2.5.3 Figure Mounting stopper to the DIN rail is revised.
2.5.6 Example of Mounting an SCU for N-IO and N-IO Nodes in a Cabinet
[Mounting conditions are corrected.]
Example of Mounting N-IO Nodes (Non-Intrinsic Safety Barrier) in a Cabinet
[Mounting conditions are corrected.]
Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Cabinet
[Mounting conditions are corrected.]
3.5 Figure Area for Signal Cable from Field is revised.
Figure Example of Node Interface Unit and I/O Unit Cable Wiring (Cabinet) is revised.
Figure Example of Node Interface Unit and I/O Unit Cable Wiring (Junction Box) is revised.

Nov. 2017/5th Edition
1.2 S2LP131 is added.
1.7 S2LP131 is added.
1.8 Clerical error correction.
2.3 Notice for storage is added.
3 Figure of SBM54D is revised.
3.6.2 S2LP131 is added.
4. S2LP131 is added.
Clerical error correction.

June 2017/4th Edition
1.2 Safety Standards [CSA] is revised.
1.8 Clerical error correction.
3.2 Clerical error correction.
3.5 Clerical error correction.
3.8.3 Notice for N-ESB bus is revised.

Apr. 2017/3rd Edition
1.2 Clerical error correction.
1.5.1 Example of spark-killer installation for N-IO is added.
1.7 S2MDV843 is added.
1.8 S2MDV843 is added.
3.2 Clerical error correction.
3.7 S2MDV843 is added.
Clerical error correction.

Oct. 2016/2nd Edition
Safety Precautions [Symbol definitions were revised]
Symbol Marks of this Technical Information [Symbol marks were chaged]
1. System Installation Requirements
1.2 Control Room Environment
Installation Specification [Alt. 3000m was added]
Applied Standards
EMC Conformity Standards [The errors on notes were corrected]
Standard for Hazardous (Classified) Locations [Standards were added]
Marine Standards [DNV GL was added]
Installation Environment Specifications
Table Installation Environment Specifications [Alt. 3000m was added]

1.8 Compliance with Marine Standards [DNV GL was added] [N-IO models were added]
Table Marine Standard-compliant ProSafe-RS Components
[The suffix code limitation was added to AVR10D]
2. Transportation, Storage and Installation
2.5 Installation
2.5.3 DIN Rail Mountable Devices [Models were added]
2.5.4 Wall Mountable Devices [Mounting method of S2BN4D was revised]
[Grounding method was revised]
2.5.6 Installation Guidelin for Cabinet (N-IO) [Section was added]

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