

Technical Information

STARDOM FCN/FCJ Installation Guide



TI 34P02Q91-01E

Introduction

About This Document

This document provides guidance for installation of the FCN/FCJ autonomous controllers.

IMPORTANT

Notation in this document:

- The term “FCN/FCJ” refers to all autonomous controllers.
 - The term “FCN” refers to the module consisting type autonomous controllers.
 - The term “FCN-500” refers to the autonomous controllers with NF501/NF502 CPU module.
 - The term “FCN-RTU” refers to the low power autonomous controllers with NF050 CPU module.
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Structure of This Document

This document consists of the following chapters:

Chapter 1: Installing FCN-500

Guides you to successful installation of an FCN autonomous controller.

Chapter 2: Installing FCN-RTU

Guides you to successful installation of an FCN-RTU low power autonomous controller.

Chapter 3: Common Guide

Describes precautions and guidance commonly applicable to FCN/FCJ controllers.

Chapter 4: Connecting I/O Modules

Describes connections between I/O modules and external devices.

Chapter 5: Reference

Dimensional Drawings

Safety Precautions

Safety, Protection, and Modification of the Product

- In order to secure the protection and safety of the system controlled by the product and the product itself, observe the safety precautions described in this instruction manual. We assume no liability for safety if users fail to observe these instructions when operating the product.
- If this instrument is used in a manner not specified in this manual, the protection provided by this instrument 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 instruction manual to indicate that there are precautions for safety:



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



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.

Warning and Disclaimer

The product is provided on an “as is” basis. YOKOGAWA shall have neither liability nor responsibility to any person or entity with respect to any direct or indirect loss or damage arising from using the product or any defect of the product that YOKOGAWA can not predict in advance.

Notes on Hardware

Appearance and Accessories

Check the following when you receive the product:

- Appearance
- Standard accessories

Contact our sales representative or your local distributor if the product’s coating has come off, it has been damaged, or there is shortage of required accessories.

Model and Suffix Codes

The name plate on the product contains the model and suffix codes. Compare them with those in the general specification to make sure the product is the correct one. If you have any questions, contact our sales representative or your local distributor.

Products with Explosion Protection

For information about the explosion protection of this product, please read the latest edition of “STARDOM FCN/FCJ Installation Guide” (TI 34P02Q91-01E).

You can download this document from the following URL:

<https://partner.yokogawa.com/>

Symbol Marks

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.

Clicking a reference displayed in green can call up its source, while clicking a reference displayed in black cannot.

Cautions for Safely Applying the Device

Standard

**SEE
ALSO**

Different standards are applied according to the types of equipment. Regarding the latest conformity standard for each model, refer to the hardware general specifications (GS) for each equipment.

Table Compliant Standards

	Item	Standards
Safety standards (*1)	CSA	CAN/CSA-C22.2 No.61010-1 CAN/CSA-C22.2 No.61010-2-201 CAN/CSA-C22.2 No.61010-2-030
	CE Marking Low Voltage Directive	EN 61010-1 EN IEC 61010-2-201 EN IEC 61010-2-030
	UKCA Marking Safety Regulation	EN 61010-1 EN IEC 61010-2-201 EN IEC 61010-2-030
	EAC Marking	CU TR 004
	Morocco Compliance Marking (C ₊ Marking)	NM EN 61010 1 NM EN 61010 2 201 NM EN 61010 2 030
EMC standards	CE Marking	EN 55011 Class A Group 1 (*14) EN 61000-6-2 (*1)(*4)(*12) EN 61000-3-2 EN 61000-3-3 (*5)
	UKCA Marking EMC Regulation	EN 55011 Class A Group 1 (*14) EN 61000-6-2 (*1)(*4)(*12) EN 61000-3-2 EN 61000-3-3 (*5)
	RCM	EN 55011 Class A Group 1 (*14)
	KC Marking	Korea Electromagnetic Conformity Standard
	EAC Marking	CU TR 020
	Morocco Compliance Marking (C ₊ Marking)	NM EN 55011 Class A Group 1 (*7) NM EN 61000 6 2 NM EN 61000 3 2 NM EN 61000 3 3
Standards for Hazardous Location Equipment (*6)	US (FM) Nonincendive (*2) (*8)	Class I Division 2, Groups A, B, C, D T4 FM 3600:2018 FM 3611:2018 FM 3810:2018 ANSI/UL 121201:2017 ANSI/UL 61010-1:2012 ANSI/UL 61010-2-30:2012 ANSI/UL 61010-2-201:2014
	ATEX Ex "ec" (*3) (*7) (*9)	⊕II 3 G Ex ec nC II C T4 Gc X (*15) EN IEC 60079-0:2018 EN IEC 60079-7:2015 + A1:2018 EN 60079-15:2010 EN IEC 60079-15:2019
	UKEX Ex "ec" (*3) (*7) (*9)	⊕II 3 G Ex ec nC II C T4 Gc X (*15) EN IEC 60079-0:2018 EN IEC 60079-7:2015 + A1:2018 EN 60079-15:2010 EN IEC 60079-15:2019

Standards for Hazardous Location Equipment (*6)	Canada (CSA) Non-Incendive (*2) (*10)	Class I Division 2, Groups A, B, C, D T4 C22.2 No.213-17 CAN/CSA-C22.2 No.61010-1-12 + Amd1-18 CAN/CSA-C22.2 No.61010-2-030:18 CAN/CSA-C22.2 No.61010-2-201:18
	IECEX Ex "ec" (*2) (*13)	Ex ec IIC T4 Gc IEC 60079-0 Ed. 7.0 (2017) IEC 60079-7 Ed. 5.1 (2017)
	Emirates Conformity Assessment Scheme (ECAS-Ex) Ex "ec" (*2)(*17)	Ex ec IIC T4 Gc IEC 60079-0 Ed. 7.0 (2017) IEC 60079-7 Ed. 5.1 (2017) UAE.S IEC 60079-0 UAE.S IEC 60079-7
Marine Standards (*16)	ABS (American Bureau of Shipping)	Marine Vessel Rules, Part4, Chapter 9.
	BV (Bureau Veritas)	Rules for the Classification of Steel ships, Part C Chapter 3 Section 6
	LR (Lloyd's Register)	Type Approval System Test Specification Number 1
	DNV	Environmental test specification for electrical, electronic and programmable equipment and systems
Restriction of Hazardous Substances	RoHS Directive (*18)	EN IEC 63000:2018
	RoHS Regulation	EN IEC 63000:2018
	UAE RoHS Directive	UAE Cabinet Decision No. 10 of 2017

- *1: 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.
- *2: To be compliant with these standards, the FCN/FCJ hardware needs to be installed in a lockable metal cabinet.
- *3: In hazardous areas where the use of category 3 G equipment or EPL Gc equipment is required, FCN/FCJ needs to be installed in a lockable metal cabinet that provides a degree of protection not less than IP54 in accordance with EN 60079-15 or IEC 60079-15.
- *4: For lightning surge immunity, a device such as a lightning arrester needs to be installed externally. Some module can select a pressure clamp terminal block with surge absorber. For details, see Terminal Block, GS 34P02Q41-01E.
- *5: Fulfilling the specified magnitude for the voltage drop determined by the cable wiring length is required.
- *6: Refer to table of next page for modules with hazardous location safety approval.
- *7: When FCN is used for regions where the ATEX/UKEX applies, the Instruction Manual, IM 34P02Q11-02E "Explosion Protection of FCN/FCJ Products" is required for safer installation and wiring.
- *8: Refer to 3.4 "FM Nonincendive" for the products meeting FM NI.
- *9: Refer to 3.5 "ATEX Ex 'ec'" to allow the products to meet the ATEX Ex "ec".
- *10: Refer to 3.6 "CSA Non-Incendive" for the products meeting CSA NI.
- *12: When using the NFCP050 or NFLP121, mount ferrite cores as shown below in order to meet the EMC standards.
- NFCP050 (CPU module): Mount two ferrite cores "A1193MN" to Ethernet cable of the NFCP050 side.
 - NFLP121 (PROFIBUS-DP Communication module) : Mount one ferrite core "A1193MN" to PROFIBUS-DP cable of the NFLP121 side.
- *13: Refer to 3.7 "IECEX Ex "ec"" for the products meeting IECEx Ex "ec".
- *14: A Class A hardware device is designed for use in the industrial environment. Please use this device in the industrial environment only.
- *15: This marking is the explosion-proof specification for FCN. The marking of each module is either "⊕ II 3G Ex ec A II C T4 Gc X" or "⊕ II 3G Ex ec nC II C T4 Gc X". Symbol 'X' denotes the specific condition of use. See IM 34P02Q11-02E "Explosion Protection of FCN/FCJ Products" for detail.
- *16: Refer to TI 34P02Q93-01E for the products meeting the Marine Standards.
- *17: Refer to 3.8 "ECAS-Ex Ex "ec"" to allow the products to meet the ECAS-Ex Ex "ec".
- *18: Including the confirmation of 10 restricted substances defined in the Commission Delegated Directive(EU) 2015/863 amending Annex II to Directive 2011/65/EU.

"Administration on the Control of Pollution Caused by Electrical and Electronic Products" in the People's Republic of China.

The Product information required by the law is disclosed in the Yokogawa's website. Please refer to the following site.

<http://www.yokogawa.com/dcs/CNRoHS/>

Table List of FCN/FCJ's Modules and Modules Conforming to Explosion Protection Standards (1/2)

Type	Model	Function	Explosion protection		
			US (FM) NI Canada (CSA) NI	ATEX Ex ^{te,c} UKEX Ex ^{te,c}	IECEx Ex ^{te,c} ECAS-Ex Ex ^{te,c}
Base module	NFBU200	Base Module (long)	✓	✓	✓
	N2BU051	Base module (short, for E2 bust)	✓	✓	-
	NFBU050	Base module (short)	✓	✓	✓
	N2BU030	Base module (compact)	✓	✓	-
Power supply module	NFPW441	Power supply module for FCN (100 - 120 V AC input)	✓	-	-
	NFPW442	Power supply module for FCN (220 - 240 V AC input)	-	-	-
	NFPW444	Power Supply Module (24 V DC input)	✓	✓	✓
	NFPW426	Power Supply Module 12 VDC input, 24 VDC input)	✓	✓	✓
CPU module	NFCP501	CPU module for FCN (with 2 Ethernet ports)	✓	✓	✓
	NFCP502	CPU module for FCN (with 4 Ethernet ports)	✓	✓	✓
	NFCP050	CPU module for FCN-RTU	✓	✓	✓
E2 bus /SB bus module	N2EB100	E2 bus interface module	✓	✓	-
	NFSB100	SB bus repeat module for FCN	✓	✓	-
Analog I/O Modules (*1)	NFAI141	Analog Input Module (4 to 20 mA, 16-channel, Non-Isolated)	Δ(*2)	✓	Δ(*2)
	NFAV141	Analog Input Module (1 to 5 V, 16-channel, Non-Isolated)	✓	✓	-
	NFAI841	Analog I/O Module (4 to 20 mA input, 4 to 20 mA output, 8-channel input/8-channel output, Non-Isolated)	Δ(*2)	✓	Δ(*2)
	NFAB841	Analog I/O Module (1 to 5 V input, 4 to 20 mA output, 8-channel input/8-channel output, Non-Isolated)	✓	✓	-
	NFAI143	Analog Input Module (4 to 20 mA, 16-channel, Isolated)	✓	✓	✓
	NFAI543	Analog Output Module (4 to 20 mA, 16-channel, Isolated)	✓	✓	✓
	NFAV144	Analog Input Module (-10 to +10V, 16-channel, Isolated)	✓	✓	-
	NFAV544	Analog Output Module (-10 to +10V, 16-channel, Isolated)	✓	✓	-
	NFAT141	TC/mV Input Module (16-channel, Isolated)	✓	✓	-
	NFAR181	RTD Input Module (12-channel, Isolated)	✓	✓	✓
	NFAI135	Analog Input Module (4 to 20 mA, 8-channel, Isolated channels)	✓	✓	-
	NFAI835	Analog I/O Module (4 to 20 mA, 4-channel input/ 4-channel output, Isolated channels)	✓	✓	✓
	NFAP135	Pulse Input Module (8-channel, Pulse count, 0 to 10 kHz, Isolated channels)	✓	✓	-
	NFAF135	Frequency Input Module (8-channel, Contact ON/OFF, Voltage pulse, 0.1 Hz to 10 kHz, Isolated channels)	✓	✓	-
Digital I/O Modules (*1)	NFDV151	Digital Input Module (32-channel, 24 V DC, Isolated)	✓	✓	✓
	NFDV161	Digital Input Module (64-channel, 24 V DC)	-	-	-
	NFDV532	Pulse Width Output Module (4-channel : Up Pulse/Down Pulse, 24 V DC, Isolated)	-	-	-
	NFDV551	Digital Output Module (32-channel, 24 V DC, Isolated)	✓	✓	✓
	NFDV561	Digital Output Module (64-channel, 24 V DC)	-	-	-
Turbomachinery I/O modules	NFDR541 -T□□	Relay Output Module (16-channel, 24 to 125 V DC/100 to 240 V AC, Isolated)	✓	✓	-
	NFGS813	Servo Module	-	-	-
	NFGP813	High Speed Protection Module	-	-	-

Table List of FCN/FCJ's Modules and Modules Conforming to Explosion Protection Standards (2/2)

Type	Model	Function	Explosion protection		
			US (FM) NI Canada (CSA) NI	ATEX Ex ¹ "ec" UKEX Ex ¹ "ec"	IECEx Ex ¹ "ec" ECAS-Ex Ex ¹ "ec"
Communication Modules	NFLC121	CANopen Communication Module (1-port, 10kbps to 1Mbps)	–	–	–
	NFLF111	FOUNDATION™ Fieldbus communication module (4-port)	✓	✓	–
	NFLP121	PROFIBUS-DP Communication Module (1-port, 9.6kbps to 12Mbps)	–	–	–
	NFLR111	RS-232-C Communication Module (2-port, 300 bps to 115.2 kbps)	✓	✓	–
	NFLR121	RS-422/RS-485 Communication Module (2-port, 300 bps to 115.2 kbps)	✓	✓	–
Pressure Clamp Terminal Block	NFTA4S	Pressure Clamp Terminal Block for Analog (16-channel)	✓	✓	✓
	NFTT4S	Pressure Clamp Terminal Block for Thermocouple/mV (16-channel)	✓	✓	–
	NFTR8S	Pressure Clamp Terminal Block for RTD (12-channel)	✓	✓	✓
	NFTB5S	Pressure Clamp Terminal Block for Digital Input (32-channel)	✓	✓	✓
	NFTD5S	Pressure Clamp Terminal Block for Digital Output (32-channel)	✓	✓	✓
	NFTI3S	Pressure Clamp Terminal Block for Isolated Analog Module and Pulse Module (for NFAI135, AFAP135: 8-channel, NFAI835: 4-channel input, 4-channel output)	✓	✓	✓
	NFTC4S	Pressure Clamp Terminal Block for Digital (16-channel, with dedicated connector, without surge absorber)	✓	✓	–
Terminal Board	NFTF9S	Pressure Clamp Terminal Block for FOUNDATION Fieldbus	✓	✓	–
	AEGS1D	Terminal Board for Servo	–	–	–
Terminal Block	AEGP1D	Terminal Board for High Speed Protection	–	–	–
	TAS40	MIL Connector Terminal Block (40 Pole Plug Types)	✓	✓	✓
Cable	TAS50	MIL Connector Terminal Block (50 Pole Plug Types)	✓	✓	✓
	NFCB301	SB Bus Cable	✓	✓	–
	KMS40	MIL Connector Cable (40 Pole Plug Types)	✓	✓	✓
SB Bus T-joint	KMS50	MIL Connector Cable (50 Pole Plug Types)	✓	✓	✓
	NFSBT01	SB Bus T-joint	✓	✓	–
Dummy Cover	NFSBT02	SB Bus T-joint with Built-in Terminator	✓	✓	–
	NFDCV01	Dummy Cover for I/O Module Slot	✓	✓	✓
	NFDCV02	Dummy Cover for Power supply Module Slot	✓	✓	✓
	NFCCC01	MIL Cable Connector Cover	✓	✓	✓

*1: To use I/O modules as hazardous location equipment (non-incendive), use the specified pressure-clamp terminal blocks.

*2: I/O modules with suffix code "with HART communication" do not conform to the explosion-proof standards.

✓: Conforming

Δ: Conforming conditionally

–: Not applicable

SEE ALSO

- For more information about power supply system, refer to Safety Precautions 1.2 "FCN-500 Power Supply Equipment", and 2.2 "FCN-RTU Power Supply Equipment."
- For choosing proper cables and wiring methods, refer to 1.3 "Wiring (FCN-500)", and 2.3 "Wiring (FCN-RTU)."

Installation method

Please follow the guidance below on how to use this device in order to guarantee the satisfactory safety and performance.

- Close the cabinet door of the device.
- Confirm that all the empty slots in the cabinet are covered by covers provided.
- Confirm that all cables are firmly fixed with the screws.
- Install the rack type devices in the cabinet and lock the cabinet doors for safety.
- Prepare a special breaker for this device in the same room in order to disconnect the power supply when abnormality occurs. Use this breaker to shutdown equipment devices power supply when device abnormality occurs.

Requirements for Installation

When installing the devices, the requirements for the device should be satisfied.

Install the device under the following conditions:

Installation height: Altitude up to 2000 m.(FCN-500),
 Altitude up to 3000 m (FCN-RTU)

Installation category based on IEC 61010: II (*1)

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

*1: Installation category is the specification of the impulse withstanding voltage which is called as overvoltage category. II indicates an electrical device.

*2: Pollution degree is the level of foreign body adhesion such as the solid, liquid, and gas which decrease withstanding voltage. 2 means general indoor atmosphere.

Measurement Categories

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

The category of the equipment applies to "O (Other)" 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

Applicable Standard EN IEC 61010-2-030 CAN/CSA-C22.2 No.61010-2-030	Description
O (Other) (*1)	For measurements performed on measuring circuits without a MEASUREMENT CATEGORY.
Measurement category II	For measurements performed on circuits directly connected to the low-voltage installation.
Measurement category III	For measurements performed in the building installation.
Measurement category IV	For measurements performed at the source of the low-voltage installation.

*1: Measurement category I defined in IEC/EN 61010-1:2001 and CAN/CSA-C22.2 No.61010-1-04 has been changed to "O : others" in EN IEC 61010-2-030 and CAN/CSA-C22.2 No.61010-2-030.

Wiring Power Cable



WARNING

Connect the power cables according to the procedure in this document. Use the power cables which comply with the safety standards of the country where the device is installed.

SEE ALSO

For more information about wiring power cables, refer to 1.3.1 "Power Supply Wiring (FCN-500)", and 2.3.1 "Power Supply Wiring (FCN-RTU)."

Earth Wiring



WARNING

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

SEE ALSO

For more information about earth wiring, refer to 1.3.2 "Wiring the Ground", and 2.3.2 "Wiring the Ground."

Battery



WARNING

- Must use Yokogawa designated batteries.
- When mounting and changing batteries, make sure to follow the procedure in "FCN/FCJ Guide (IM34P02Q01-01E)".

SEE ALSO

For Battery, refer to C6.3.1 "FCN CPU Module Batteries." in "FCN/FCJ Guide (IM 34P02Q01-01E)"

I/O Devices

IMPORTANT

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

Cards, Cables, Connectors



WARNING

When power is ON, Do not install or remove the cards, cables, connectors not listed in this manual.

Tightening Torque of Screws

IMPORTANT

Unless otherwise specified, recommended tightening torque is shown in following table.

Nominal diameter D	M2.6	M3	M3.5	M4	M5	M6	M8	M10
Tightening torque (N • m)	0.35	0.6	0.8	1.2	2.8	3.0	12.0	24.0

Precautions regarding Electric Shock



WARNING

- Always turn off the power supply of the equipment that will be handled when exchanging power modules.
- Turn off the field-side power supply when wiring the hazardous voltage applied signal wires.
- Handle the PI terminal of AEGP1D with care as it may cause electric shock due to the hazardous voltage input.

TIP

Hazardous voltage is defined as follows in safety standards.
 higher than 30 V AC, higher than 60 V DC (EN 61010)
 higher than 30 V AC, higher than 60 V DC (CSA 61010)

Precautions regarding Explosions



WARNING

- Maintenance operations cannot be performed while power is supplied unless it is verified that there are no explosive gases in the environment.
-

Drawing Conventions

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

Transportation

This section describes the precautions required to prevent accidents and damage when transporting STARDOM hardware products. These precautions apply when the equipment is contained in our original packing.

**SEE
ALSO**

See “Table Equipment Installation Specifications” in Section 1.2 Control Room Environment for ambient temperature, humidity, vibration and impact.

Loading

- Do not load crates 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.

Transportation

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

Keep all products upright during transport.

Unpacking

In unpacking the received cargoes and equipment, inspect them according to inspection list below.

Table Inspection List

Inspection Items	Result		Measures Required
• 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.	No	Yes	If yes, inform Yokogawa.
• Loose parts inside equipment.	No	Yes	If yes, remove them and check the surrounding.
• Damage to equipment interior.	No	Yes	If yes, inform Yokogawa.
• Condensation or its trace on equipment interior.	No	Yes	If yes, inform Yokogawa.



CAUTION

Condensation may cause a fatal system failure in the STARDOM products. 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.



CAUTION

Be careful not to let the products fall when you handle them.

When they are hit hard, the interior of them can be damaged, although there is no damage in the exterior.

If you accidentally drop an product, stop using it immediately and report it to Yokogawa.

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, stronger waterproof, condensation-proof, and dust-proof measures are required.

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.

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.

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 remain 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 replace from time to time.

When using desiccating agent or corrosion inhibitor etc., please select the appropriate one.

Copyright and Trademark Notices

Trademark Acknowledgments

- STARDOM and FAST/TOOLS are trademarks of YOKOGAWA.
- All other company and product names mentioned in this manual are trademarks or registered trademarks of their respective companies.
- We do not use TM or ® mark to indicate those trademarks or registered trademarks in this manual.

STARDOM FCN/FCJ Installation Guide

TI 34P02Q91-01E 43rd Edition

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1. FCN-500

The following describes details and various operation procedures for FCN-500 hardware system design and construction necessary for stable FCN-500 operation.

- **Installation environment**
- **Power supply systems and equipment**
- **Wiring (Noise reduction grounding systems, wire routing)**

Perform FCN-500 installation following the steps below.

1. Install base module
2. Install power supply module, CPU module, I/O module, SB bus repeat module, and dummy cover
3. Install grounding cable, power supply cable, and signal cable

IMPORTANT

Do not use “power supply module for FCN-RTU (NFPW426)” for FCN.

FCN-500 Installation Specification

The conditions of the installation location must be appropriate for stable operation of the system. The table below shows the conditions required for installation location (and some conditions for transportation and storage) of the FCN-500.

Table FCN-500 Installation Environment Specification

Item		Specification		Related standard
		NFCP501-□0□ NFCP502-□0□ NFPW441 NFPW442	NFCP501-□1□ NFCP502-□1□ NFBU200 N2BU051 NFBU050 N2BU030 NFPW444	
Ambient temperature	Operation	0 to 55°C (*1)	-20 to 70°C (*1) (*2)	
	Transportation	-40 to 85°C		
Ambient humidity	Operation	5 to 95% RH (No condensation)		
	Transportation	5 to 95% RH (No condensation)		
Ambient temperature fluctuation	Operation	Within ±10°C/h		JEIDA29 Class B
	Transportation	Within ±20°C/h		
Dust		0.3 mg/m ³ or less		
Protection class		IP20		IEC 529
Resistance to corrosive gas		ANSI/ISA S71.04 Class G2 (Standard) (ANSI/ISA S71.04 Class G3, option)		ANSI/ISA S71.04
Resistance to vibration		0.15 mm P-P (5 to 58 Hz)		IEC 68-2-6
		1 G (58 to 150 Hz)		
Resistance to shock		15 G 11 ms (during power-off, for sine half-waves in XYZ-directions)		IEC 68-2-27
Altitude		2000 m or less		
Noise	Electric field	3 V/m or less (26 MHz to 1 GHz)		
	Magnetic field	30 A/m or less (AC), 400 A/m or less (DC)		
	Electrostatic discharge	4 kV or less (contact discharge), 8 kV or less (air discharge)		
Grounding		Apply the grounding system which is defined by the rules and standards of the country or the region.		
Cooling		Natural air cooling		
Installation		19-inch rack installation, DIN rail installation		

*1: The ambient temperature is rated at the air intake under modules.

*2: It depends on additional I/O modules. Refer to General Specifications "FCN Autonomous Controller Hardware (FCN-500)", GS 34P02Q14-01E.

IMPORTANT

- 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.
 - The temperature specification during operation indicates the criterion of the temperature at the air intake of the bottom portion of modules. Do not block ventilation holes, as it may hinder the air-cooling capabilities of the unit. When installing the FCN in a cabinet, note that the temperature specification is not in respect to the ambient temperature of the cabinet. Provide cooling fans in the cabinet if needed.
 - Avoid exposing the FCN to direct sunlight.
 - Prevent condensation under any circumstance.
 - The dust level of the room should not exceed 0.3 mg/m³. Under any circumstance, avoid iron flakes, carbon particles, or any other type of dust that are conductive.
 - Avoid existence of corrosive gases such as hydrogen sulfide, sulfurous acid gas, chlorine, and ammonia.
 - For vibration at the installation location, see also “FCN Vibration Criteria” within this Chapter.
 - For radio device noise to the FCN, see “Radio Device Noise to FCN” within this Chapter.
-

FCN-500 Vibration Criteria

Ensure that if the frequency of vibration at the installation location is 58 Hz or less, the total amplitude is maintained less than 0.15 mm. If the vibration frequency is greater than 58 Hz, find a location that will meet the following condition:

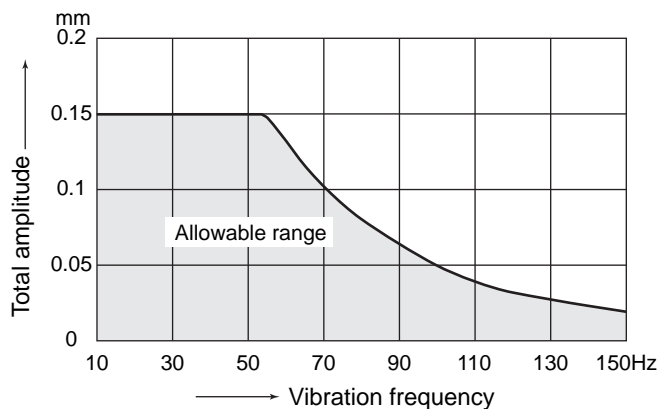
$$\text{Acceleration (m/s}^2\text{)} = 2\pi^2 \times A \times F^2 \times 10^{-3} < 9.8 (=1G)$$

where

A : Total amplitude (mm)

F : Frequency (Hz)

The range of allowable total amplitude is shown below.



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Figure Allowable Vibration Range

Radio Device Noise to the FCN-500

The following shows general requirements when using a radio device such as transceivers; however, as a general rule, close the cabinet door when using a radio device:

- Transceivers that have 3 W of output power or less should be at least 1 m away.
Transceivers that have 10 W of output power or less should be at least 2 m away.
- Radio devices that have 1 W of output power or less including cellular phones and cordless phones should be at least 1 m away.

IMPORTANT

To comply with the applicable EMC standard, at least one ferrite core (A1193MN) must be installed on the PROFIBUS cable near the NFLP121.

1.1 Installing the Base Module

The FCN-500 is designed to be attached to 19-inch racks, DIN rails, and general-purpose control panels. Note the following when installing an FCN-500 to cabinets, control panels, etc.

Installation Direction

The FCN-500 is designed to be cooled by natural air. Install an FCN-500 so that the ventilation air flows upward from its bottom to its top as shown below.

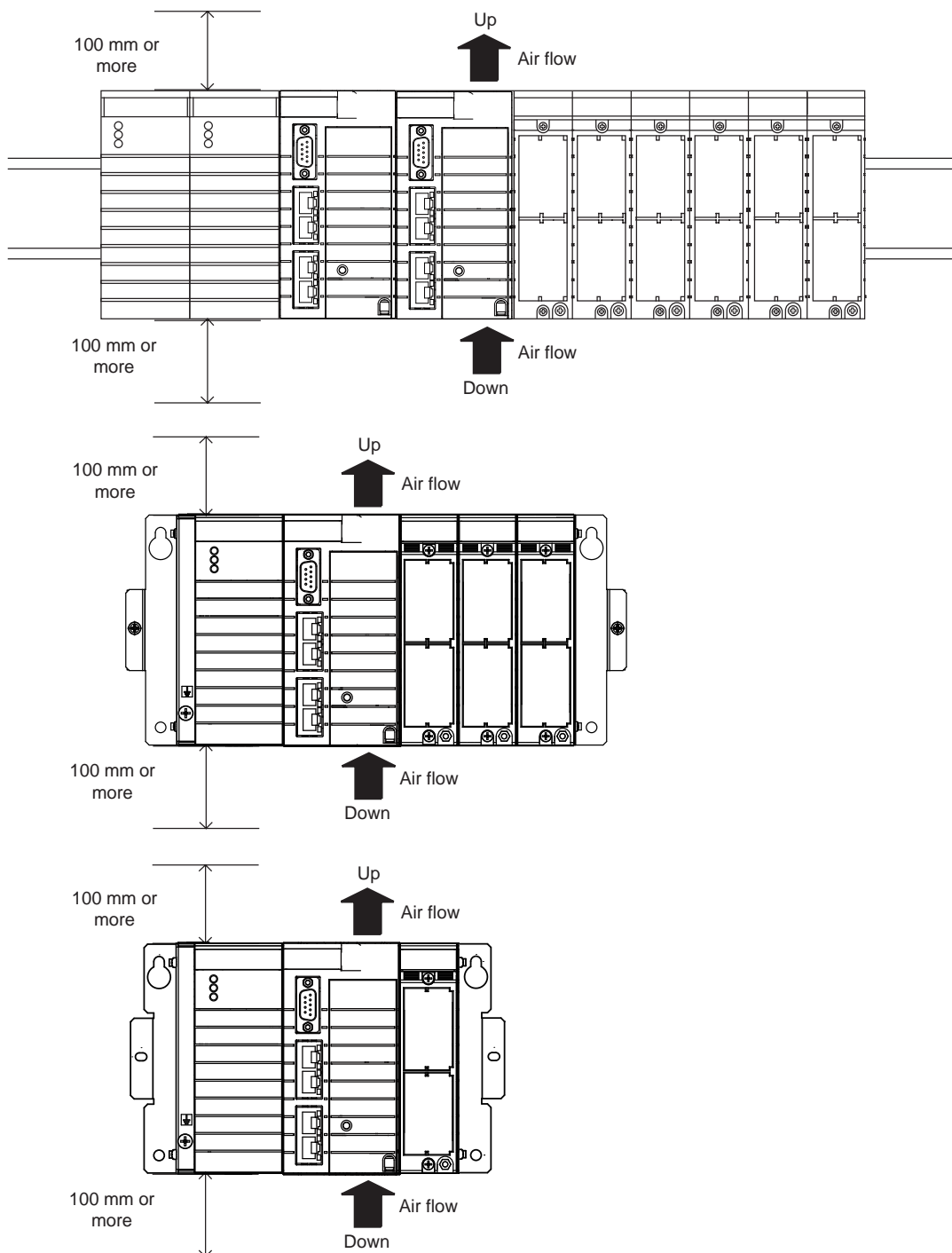


Figure Installing the FCN Base Module

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IMPORTANT

- Be sure to turn off the power before installing or removing the FCN-500 base module. If the FCN-500 power supply are installed in duplex, turn off the power for both power supply modules.
- Do not install the unit blocking the ventilation holes on the top and bottom.
- To prevent the cooling air current from being blocked, be sure to place the unit at least 100 mm away from other devices.
- Do not expose to direct sunlight.
- If installing an extension unit to a 19-inch rack directly beneath the FCN-500, be sure to leave a space of 2U or more.
- All access to the FCN-500 is performed from the front. Secure a space between 100 and 150 mm from the front panel of the unit to the cabinet door to provide enough space for the cables. (The bending radius will differ depending on the material of the cable. Verify the specification of the wire.)
- Secure a space on the front side of the FCN-500's-CPU module for installing or removing the SD card, Battery Unit.

Dimensions

Refer to the dimensions shown below and take sufficient allowances when installing an FCN-500.

19-inch Rack Mounting

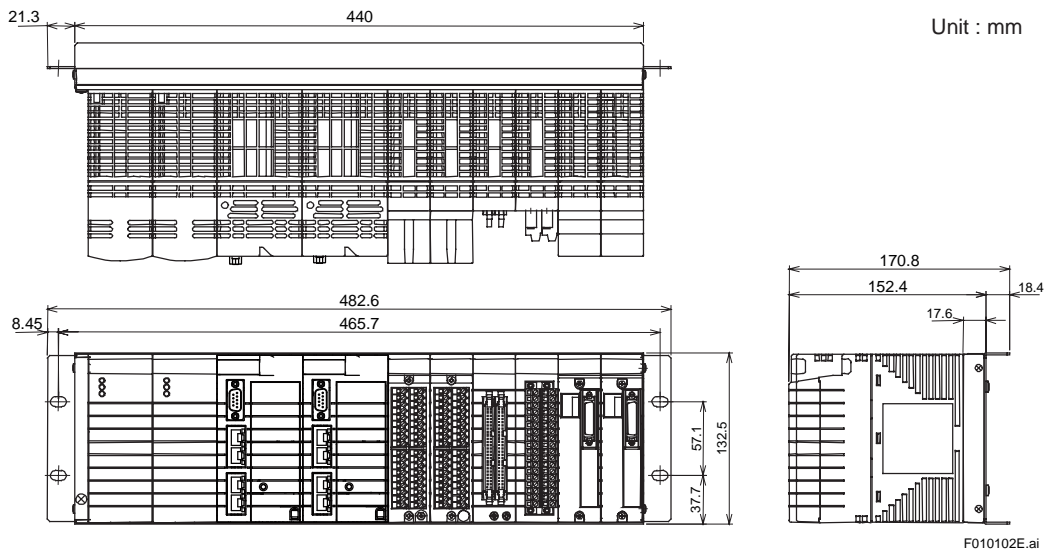


Figure Dimensions of 19-inch Rack-mounting FCN-500 with NFBU200

DIN Rail Mounting

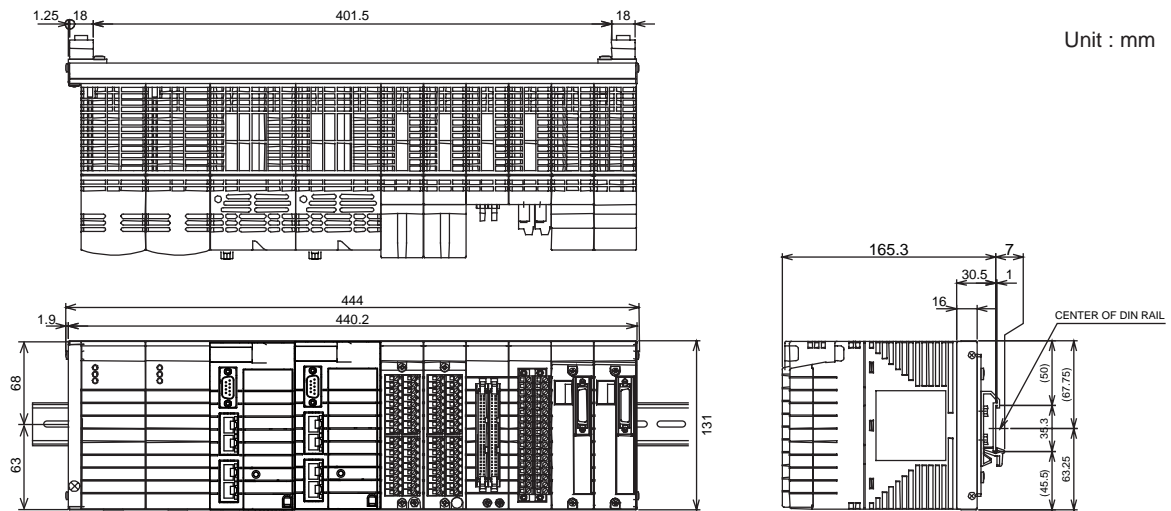


Figure Dimensions of DIN Rail-mounting FCN-500 with NFBU200

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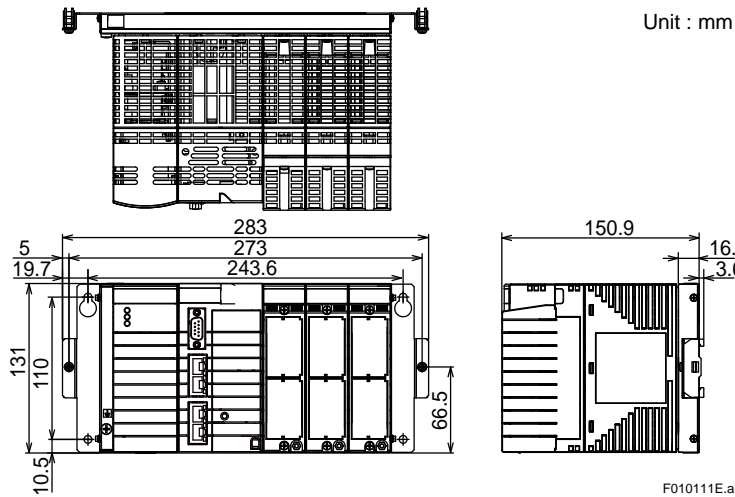


Figure Dimensions of DIN Rail-mounting FCN-500 with N2BU051/NFBU050

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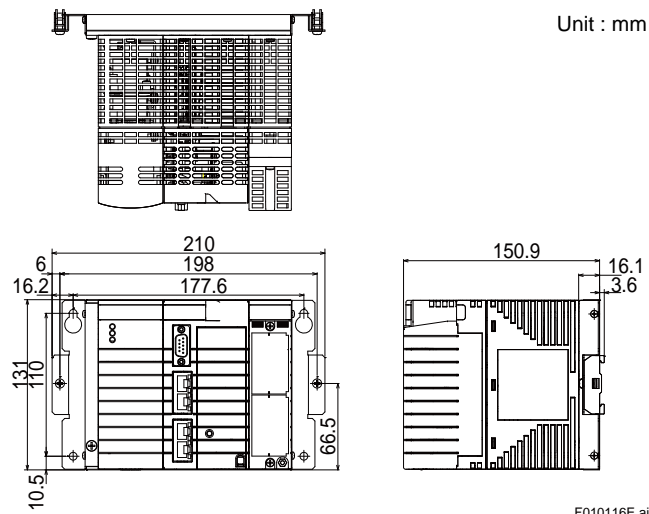


Figure Dimensions of DIN Rail-mounting FCN-500 with N2BU030

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Depth Required for Installation Location

Installation of an FCN-500 requires enough cabinet depth for bends in cables to be connected in addition to the depth corresponding to the dimension from the rear of the base module to the other modules' front panels. $(d1 \text{ or } d2)+D+L$

The following table shows the data for estimating the required depth.

Table Module Depths

Module	Depth of Module	Depth Needed for Cable Bend (L)	Remarks
Base module	17.6 mm (d1)	–	When mounted on a 19-inch rack
	30.5 mm (d2)	–	When mounted on a DIN rail
Power supply module	133.0 mm (D)	–	The power supply cable runs downward from the bottom.
CPU module	129.0 mm (D)	Add the larger radius of appropriate bends in Ethernet and RS cables where applicable.	Check the specifications of the cable(s) used.
E2 bus interface module	94.0 mm (D)	Add the larger radius of appropriate bends in E2 bus cables where applicable.	Check the specifications of the cable(s) used.
SB bus repeat module	129.0 mm (D)	110 mm	
I/O module (with pressure clamp terminal block)	134.8 mm (D)	Add the radius of appropriate bends in signal cables.	Check the specifications of the cable(s) used.
I/O module (with MIL connector cable)	94.0 mm (D)	Add the radius of appropriate bends in the MIL connector cable.	Check the specifications of the cable(s) used.
RS-232-C Communication Module	116.1 mm (D)	110 mm	When AKB13x is used.
		Add the radius of appropriate bends in signal cables.	Check the specifications of the cable(s) used.
RS-422/RS-485 Communication Module	129.4 mm (D)	–	Attach the cable horizontally to the module.
CANopen Communication Module	112.0 mm (D)	Add the radius of appropriate bends in signal cables.	Check the specifications of the cable(s) used.
PROFIBUS-DP Communication Module	112.0 mm (D)	Add the radius of appropriate bends in signal cables.	Check the specifications of the cable(s) used.

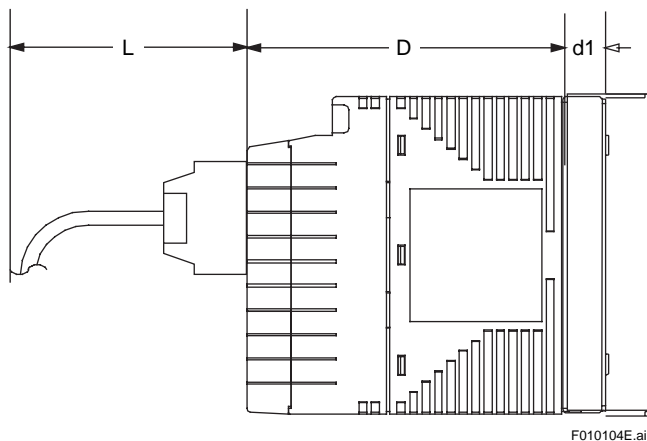
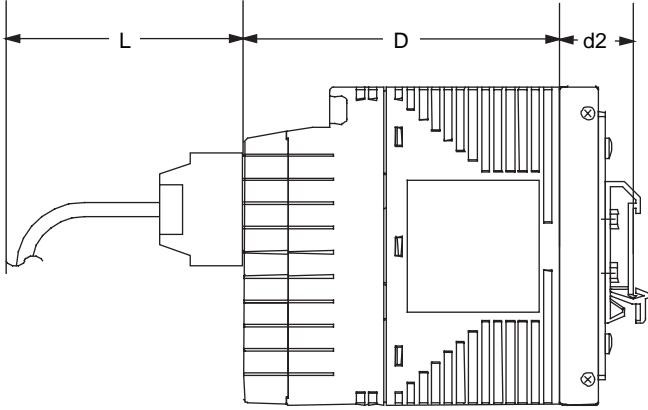


Figure Estimating Depths Secured for Modules on 19-inch Rack-mounted Base Module



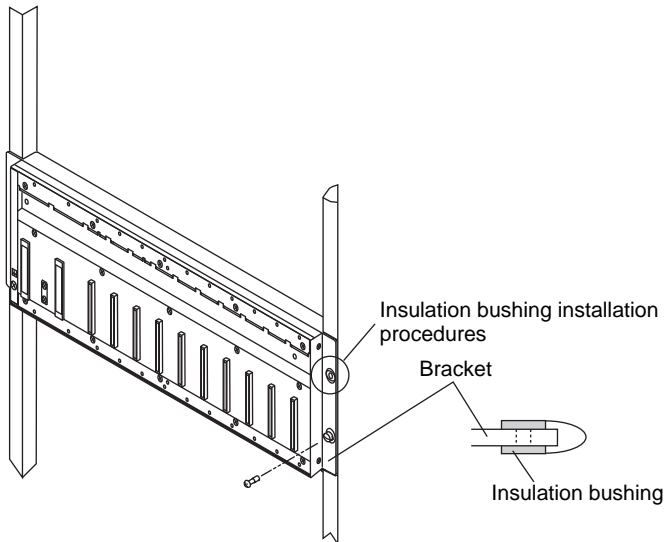
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Figure Estimating Depths Secured for Modules on DIN Rail-mounted Base Module

Installing Base Module of FCN-500

Installing to a 19-Inch Rack

When installing the base module NFBU200 to a 19-inch rack or general-purpose control panel, install the supplied insulation bushings sandwiching the base module as shown in the diagram. Attach the base module to the 19-inch rack (cabinet) using the screws supplied.



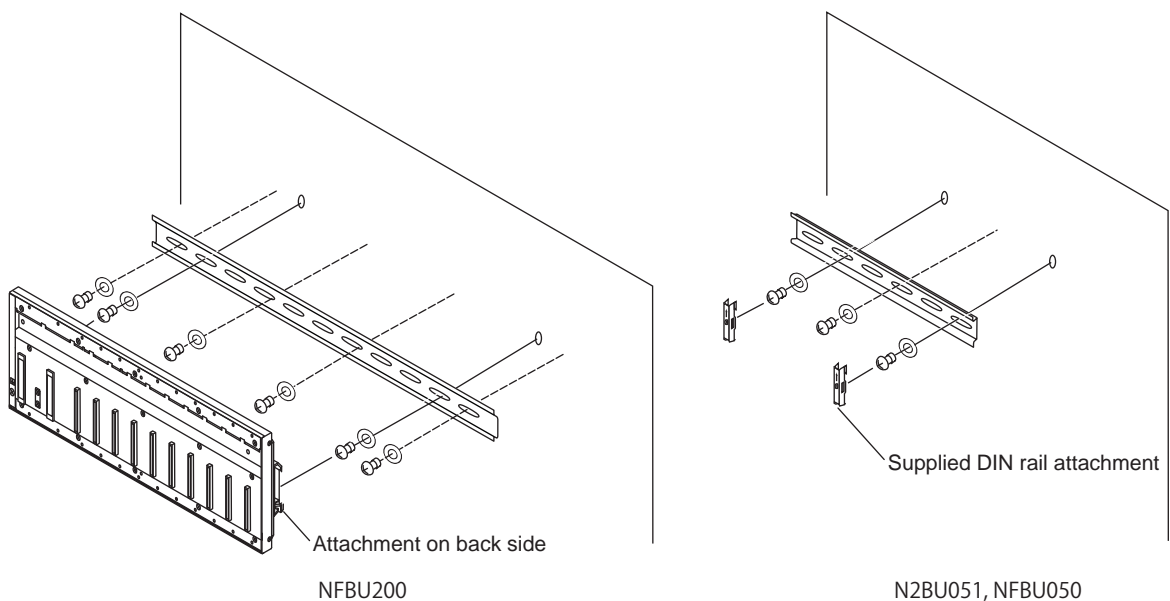
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Figure Installing the FCN Base Module to a 19-inch Rack

Precaution of Installing DIN Rails to Panel

DIN rail may be deformed due to the controller's weight and cable's tension.

Please screw DIN rail to the panel in at least two positions where attachments on the back side (supplied DIN rail attachments) are placed. Reinforcements, such as more screws or attachment of larger washer to the screws, are highly recommended since some DIN rails are lack of the rigidity.



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Figure Installing the DIN Rail to the Panel

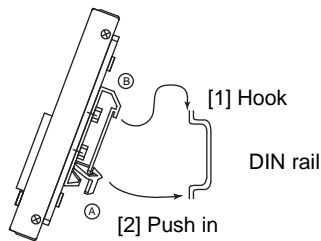
Installing to DIN Rails

• Base Module (long)

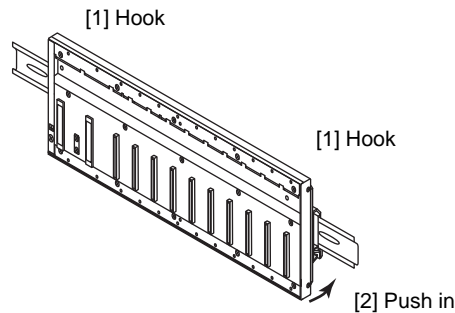
Follow the procedures below to install the base module NFBU200 (DIN rail type) to DIN rails using the attachments on the back side.

1. Hook the tab on the upper area of the DIN rail as shown in the diagram
2. Push in the base module

Attachment to the DIN rail



Side view of the unit



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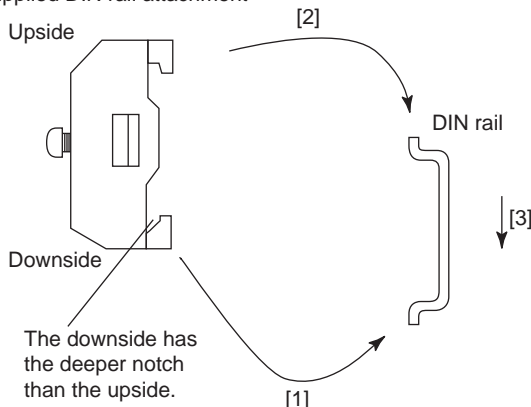
Figure Installing the FCN Base Module (long) to the DIN Rail

• Base Module (short, compact)

Follow the procedures below to install the base module N2BU051/NFBU050 or N2BU030 to DIN rails.

1. Snap the supplied DIN Rail Attachment to the DIN rail. (See figure below) Attach one on each side
2. Attach the base module by aligning the screws of the attachment to the installation holes on the left and right of the base module.
3. Tighten the screws and secure the base module to the DIN rail. Pay attention not to drop nuts of the attachment to the DIN rail.

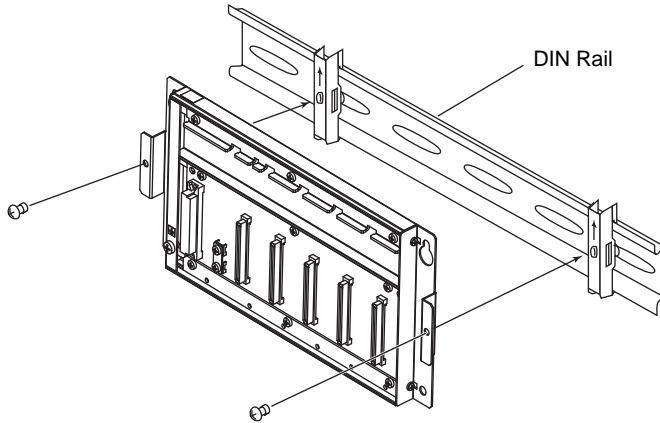
Supplied DIN rail attachment



- [1] Hook the nail on the attachment to the bottom of the DIN rail
- [2] Hook the top nail by pulling the attachment upwards
- [3] Bring it down slightly while hooking both nails of the installed jig

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Figure Installing the Attachment to the DIN Rail



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Figure Installing Base Module (short) on the DIN Rail



CAUTION

Attach the supplied DIN Rail Attachment correctly; if attached upside down, it might get out of place.

Take off the modules from DIN rail during the transportation otherwise they may fall from DIN rail.

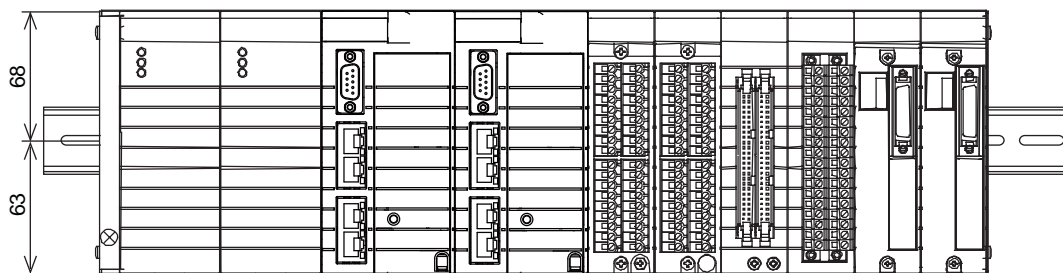
TIP

Use a DIN 60715, JIS C 2812, IEC 60715, and EN50022-compliant rail.

Confirm that the devices are firmly mounted after mounting when devices are mounted on the DIN rails.

Install the modules to DIN rails while keeping the installation direction.

Reference



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Figure Dimensions of DIN Rail-mounted by NFBU200

Installing to Panel

Follow the procedures below to install the short or compact base module to a panel.

1. Refer to the dimension diagram and create four holes to screw tapped M4 or M5 screws to a depth of 8 mm.
2. Secure the unit at four locations using the M4 or M5 screws.
3. Insulate the base module from the cabinet using insulation bushings, and then install the base module to the cabinet.

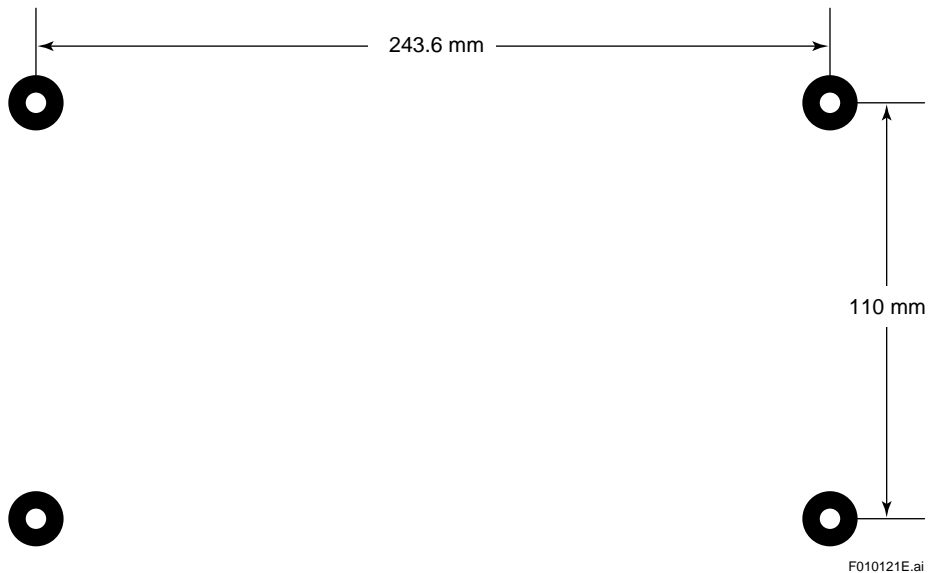


Figure Short base module Installation Screw Hole Interval Dimension Diagram

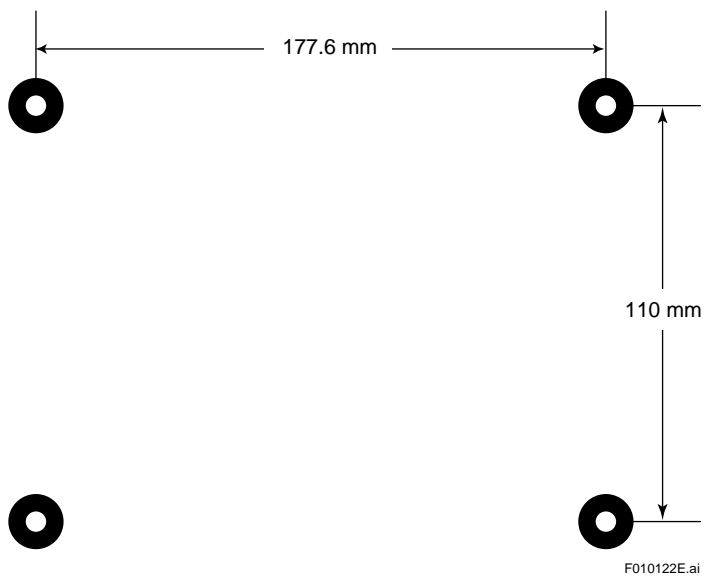


Figure Compact base module Installation Screw Hole Interval Dimension Diagram

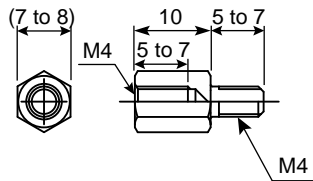
Installing to Panel (for FCJ replacement)

When reusing holes for FCJ, follow the procedures below to install the compact base module to the panel.

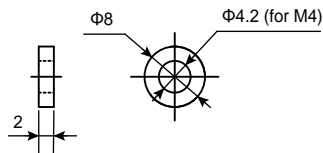
1. Install the commercially available hexagonal spacers (quantity 2) and spacers (quantity 2) to the panel.

Recommended parts.

- Hexagon Male-Female Spacer (Standoff)
Height: 10 mm, Surface width: 7 to 8 mm, Male thread part length: 5 to 7 mm or more, Female thread depth: 5 to 7 mm, Material: Brass(C3602) strength or more.



- Spacer
Height: 2 mm, Material: Brass(C3602) strength or more.



- M4 screw

2. Secure the unit at two locations using the M4 screws.
3. Insulate the compact base module from the cabinet using insulation bushings, and then install the compact base module to the cabinet.

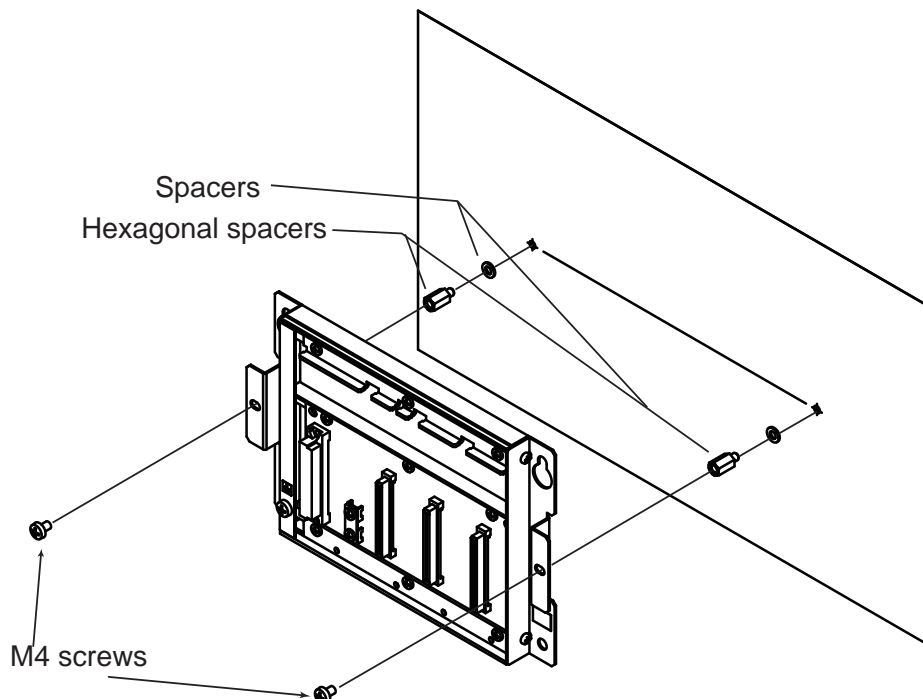


Figure Board Installation

**CAUTION**

- Take off the modules from the panel during the transportation otherwise they may fall from the panel.
 - Installation notes:
There should be no clearance between the surface of the control panel and the part to be pressed.
The thickness is at 2.5 mm or more, and must be sufficient for screw mounting..
Provide washers between the sheet metal part of the product and the M4 screws as necessary.
 - If there is vibration, it is recommended to fix the body with 4 screws.
-

Installing Modules

The following describes installation and removal procedures of modules to the base module.

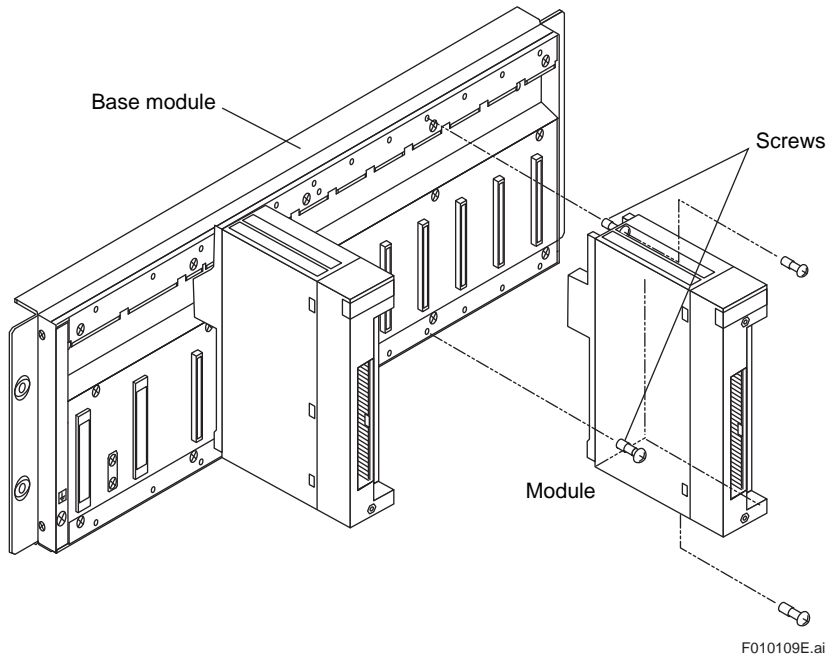


Figure Attaching Modules to the Base Module

Installation Procedures

1. Attach the module to the base module using screws.
2. Use a torque of approximately 0.5 Nm for the tightening torque of the screws.
3. Attach the external connection cables and terminal block.

Removal Procedures

1. Remove the external connection cables and terminal block.
2. Remove the screws that hold the module.
3. Pull out the module forward from the Base unit.

IMPORTANT

- Install I/O Module Dummy Covers (Model name: NFDCU01) on open I/O module slots.
 - Install Power Supply Module Dummy Covers (Model name: NFDCU02) on open power supply module slots.
-

Installing Other Modules on to the Base Module

This section describes the procedure for installing the power supply, CPU, I/O, E2 bus interface and SB bus repeat modules onto a base module.

IMPORTANT

It is necessary to configure a base module (NFBU200 only) before installing each module. For setting procedures of a base module, refer to A1.2, "Base Module" in "FCN/FCJ Guide (IM 34P02Q01-01E)".

Installation Position of Each Module

This section describes the positioning of the modules during installation to the base module.

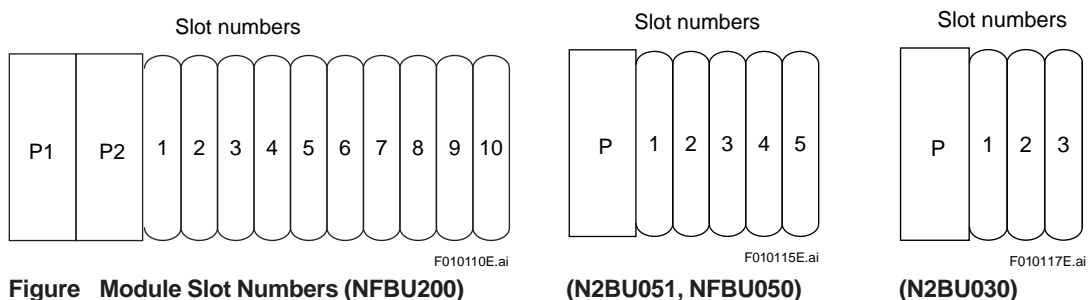


Figure Module Slot Numbers (NFBU200)

(N2BU051, NFBU050)

(N2BU030)

Table Installation Position Allowed for Each Module in FCN-500 with Single Power Supply, Single CPU, and Single E2 bus/SB Bus (NFBU200)

Module	Allowed position	Remarks
Power supply module	P1 or P2	Normally installed into P2.
CPU module (*1)	Slot1-2	Occupies 2 slots per module.
E2 bus interface module or SB bus repeat module	Slot10	
I/O module	Slot1 to 10 (*2)	(*3)

Table Installation Position Allowed for Each Module in FCN-500 with Duplex Power Supply, Duplex CPU, and Duplex E2 bus/SB Bus (NFBU200)

Module	Allowed position	Remarks
Power supply module	P1 and P2	–
CPU module (*1)	Slot1-2, 3-4	Occupies 2 slots per module.
E2 bus interface module or SB bus repeat module	Slot9, 10	–
I/O module	Slot1 to 10 (*2)	(*3)

Table Installation Position Allowed for Each Module in FCN-500 (N2BU051)

Module	Allowed position	Remarks
Power supply module	P	–
CPU module	Slot1-2	–
E2 bus interface module	Slot4 (*4), 5	–
I/O module	Slot1 to 5 (*2)	(*3)

Table Installation Position Allowed for Each Module in FCN-500 (NFBU050)

Module	Allowed position	Remarks
Power supply module	P	–
CPU module	Slot1-2	–
I/O module	Slot3 to 5	(*3)

Table Installation Position Allowed for Each Module in FCN-500 (N2BU030)

Module	Allowed position	Remarks
Power supply module	P	–
CPU module	Slot1-2	–
E2 bus interface module	Slot2 (*4), 3	–
I/O module	Slot1 to 3 (*2)	(*3)

*1: The CPU module can only be installed in a control unit.

*2: The I/O module can be installed in a slot where no CPU module(s), E2 interface module(s) or SB bus repeat module(s) is(are) installed.

*3: Some I/O modules have limits for the installation. For details, see the following.

*4: The E2 bus interface module can be installed for duplexed E2 bus.

Restrictions and Precautions on Installation

Limitations of Installation for NFAT141 (the combination of Thermocouple input and Pressure clamp terminal)

To keep the reference junction compensation accuracy (GS 34P02Q31-01E), make sure to meet the following conditions. The pressure clamp terminal should not be affected by radiated heat.

- Do not install a heat-radiating unit beneath the NFAT141 installed unit.
- Do not install NFAT141 in a place where airflow impinges directly.
- Do not install NFAT141 next to the CPU modules (NF501/NF502), power supply modules (NFPW44x).
- The installable modules next to the NFAT141 are as follows. When installing other than following I/O modules, make an empty slot (one or more) in each side.

Installable modules: NFAT141, NFAR181, NFAV141, NFAV144

NFLR111/NFLR121 (Serial Communication Module)

A total of up to eight NFLR111/NFLR121 Serial Communication Modules can be installed for each FCN-500.

NFLF111/NFLC121/NFLP121 (Communication Module)

A total of up to eight NFLF111/NFLC121/NFLP121 Modules can be installed for each FCN-500.

Limitations of Installation for I/O Modules

When you install the following I/O modules, ensure that the required power volume does not exceed the rated power output of the power supply module. For the amount of current that each I/O module requires (5 V DC and 24 V DC), refer to the applicable general specifications.

1.2 FCN-500 Power Supply Equipment

Proper power equipment must be used for stable system operation. This section describes the following:

- Power supply system
- Supplied Power Source
- Field power supply specifications
- Grounding

1.2.1 Power Supply System

This section describes the power supply system for an FCN-500.

System Separation

Power supply system for FCN-500 should be separated from other systems. For example, the power supply system for the I/O signal circuit should be isolated by an insulation transformer.

Installation of Breakers, Switches, etc.

Power supply module for FCN-500 has no switch. An external breaker or an external switch should be installed for maintenance and safety.

IMPORTANT

To conform the power supply system for FCN-500 to the safety standards, use a safety standard compliant breaker or switch.

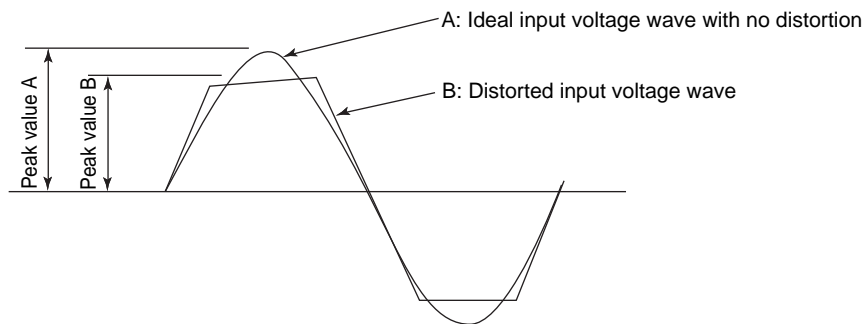
1.2.2 Supplied Power Source

The following items must be taken into consideration for stable FCN-500 operation.

Warping of the Supplied Power Source (AC)

Power failure may be detected even if the effective value is the same when the peak of the input voltage waveform is decreased, resulting in the high value of the wave to be chipped. This may be caused by the output impedance of the supply source or a drop of voltage due to the impedance of wiring. If the input voltage that meets the following condition is supplied, the rated instantaneous power failure sense delay time may not be maintained, which may cause instantaneous power failure. Therefore, a solution so that stable power can be supplied by the power source must be applied.

Peak value of the input voltage < Lower limit of Input voltage $\times \sqrt{2} \times 0.99$



A: Ideal input voltage wave with no distortion
B: Distorted input voltage wave

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Figure Distortion of Input Voltage Waveform

Inrush Current

An input current much larger than normal will flow when the power supply is turned on. Refer to the specification of the power supply module for inrush currents to each power supply module. Make sure that the supplied power and protection devices can withstand this inrush current.

TIP

The peak values and waveforms of the current are affected by the impedance of the input system. These change depending on the system structure (when comprised of multiple devices) and the power supply line condition. Generally, the inrush current when the system is comprised of multiple devices will be less than the total sum of the inrush current of each device.

Output Capacity

The output capacity of the power supply device is determined by calculating the maximum electric power of the system, but the peak value of the current will be 2 to 5 times more of the effective value. The effects and inrush current by this current waveform, as well as excess for future device expansion must be carefully considered.

Power Consumption Calculation

Refer to the power supply module specification for the maximum value of the power consumption. Take consideration of the expansion and changes of devices. In general, the maximum value should be used.

SEE ALSO

For the specification requirements for power supply modules, see General Specifications - FCN Autonomous Controller Hardware (FCN-500), GS 34P02Q14-01E.

TIP

The actual power consumption varies depending on what modules are installed and how many.

- The maximum current consumption of a unit, I_{MAX} , can be obtained by the following equation:

$$I_{MAX} = I_{BASE} + I_{CPU} + I_{I/O}$$

where

I_{BASE} = current consumption of the base module

I_{CPU} = current consumption of the CPU module (or of CPU modules if duplexed)

$I_{I/O}$ = current consumption of the input/output modules installed

- The power consumption of a unit, Q (VA), can then be obtained by the following equation:

$$Q = (5.1 \times I_{MAX}) / (E \times F)$$

where

E = efficiency of the power supply module

F = power factor of the power supply module

- Although the efficiency and power factor of the power supply module varies with the conditions, the following appropriate values can be used as guidelines:

$$E = 0.75$$

$$F = 0.5 \text{ (with no power-factor-correcting device)}$$



CAUTION

- When a power failure is detected, the control stops for a while even after recovery from the power failure before restarting.
- To avoid these problems, please use uninterruptible power supply(UPS) for power supply.

1.2.3 Field Power Supply

Field power supply is 24V DC power that is required for the interface circuit of field signals on I/O modules. It is necessary to supply field power separately from system power supply.

The following I/O modules require field power supply.

Analog I/O Module

- NFAI141 Current input, 16 points, non-isolated (*1)
- NFAI143 Current input, 16 points, isolated
- NFAI135 Current input, 8 points, individually isolated
- NFAI841 Current I/O, 8/8 points, non-isolated
- NFAB841 Voltage input/current output, 8/8 points, non-isolated
- NFAI543 Current output, 16 points, isolated
- NFAI835 Current input/current output, 4/4 points, individually isolated
- NFAP135 Pulse input, 8 points, individually isolated
- NFAF135 Frequency Input, 8 points, individually Isolated

*1: When this I/O module is used with 2-wire transmitter, the I/O module requires the field power supply.

Digital Output Module

- NFDV551 Digital output, 32 points
- NFDV561 Digital output, 64 points
- NFDV532 Pulse width output, 4-channel

IMPORTANT

Analog I/O modules and digital I/O modules require different field power supply systems.

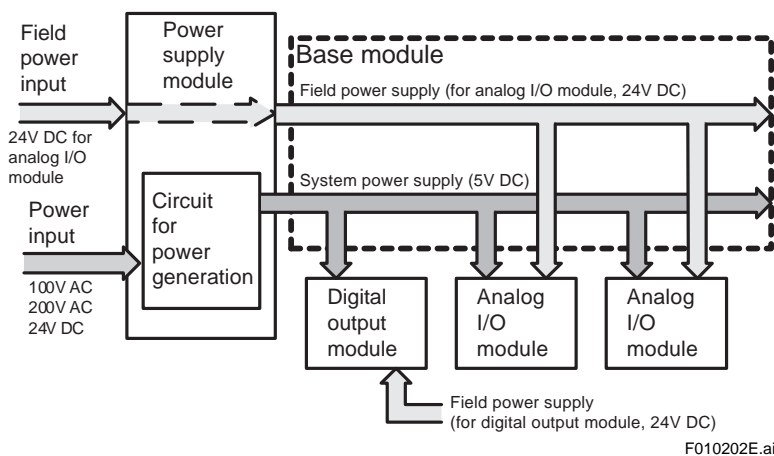


Figure Field Power Supply and System Power Supply

SEE
ALSO

For NFGS813 Servo module and NFGP813 High speed protection module, refer to GS 34P02Q33-01 "Turbomachinery I/O modules".

Field Power Supply for Analog I/O Modules

Field power supply for analog I/O modules is supplied to each analog I/O module via base modules.

IMPORTANT

- Supply the appropriate power by calculating the 24 V DC current consumption based on the specification of each I/O module. However, the power supply must be within the range of the power supply module specification (Max. 4A).
 - The I/O module terminal voltage is lower than the supplied voltage of the power supply module terminal. Adjust the supply voltage so as to match the specification of the field devices to be connected, taking the lowered voltage into consideration (see the specification of each module).
-

Field Power Supply for Digital Output Modules

Field power supply for digital output modules is supplied field power directly to each terminal of the module. Supply the appropriate power by calculating the 24 V DC current consumption based on the specification of each module.

TIP

Power is supplied by using different power supply systems between analog system and digital system to avoid interferences such as noises. When every 16 points are isolated among digital output signals, the power supply must also be isolated.

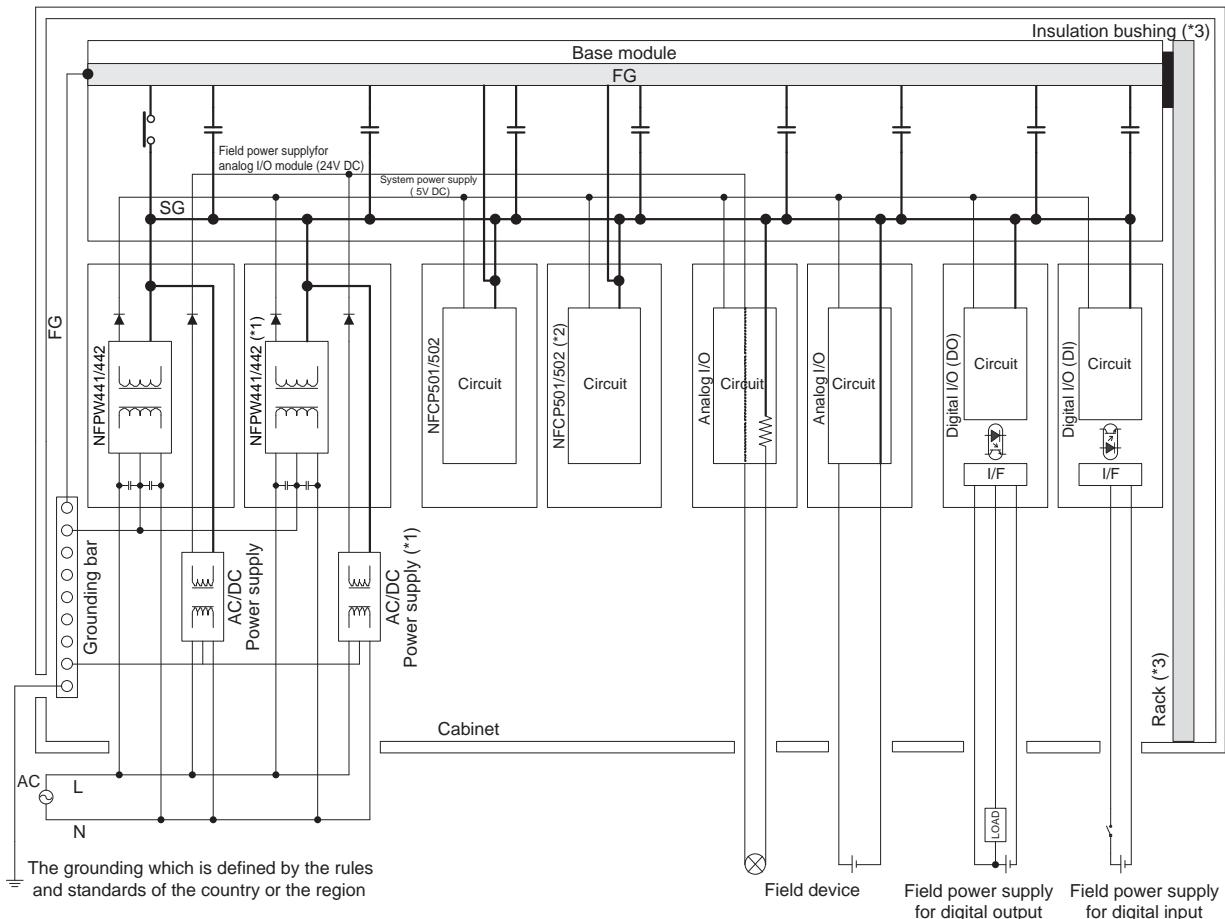
1.2.4 Grounding for FCN-500

When an FCN-500 is installed in a cabinet (with a 19-inch rack), instrument panel, or the like, it is insulated by the insulation bushings (accessories of only NFBU200) or a DIN rail attachment. To maintain this insulation, the following instructions must be followed.

- Ground the FCN separately from the grounding of other devices, motor control circuits, and electric control circuits.
- Perform the grounding which is defined by the rules and standards of the country or the region on the FG terminal of the base module.
- Perform the grounding system which is defined by the rules and standards of the country or the region on the protective grounding terminal.
- Perform the grounding which is defined by the rules and standards of the country or the region on the G terminal of the power supply module (line filter grounding).
- Perform the grounding of the base module and the power supply module at one point.

**SEE
ALSO**

For the specification of the grounding DC wire, see 1.3.2, "Wiring the Ground".



*1: N2BU051, NFBU050 and N2BU030 base modules have only one power supply module on it.

*2: N2BU051, NFBU050 and N2BU030 base modules have only one CPU module on it.

*3: Install N2BU051, NFBU050 and N2BU030 base modules in the cabinet insulating the panel or the DIN rail from the rack using insulation bushings.

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Figure Systematic Drawing of FCN-500 Power Supply/Grounding

1.3 Wiring (FCN-500)

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

1.3.1 Power Supply Wiring (FCN-500)

The following describes the power supply wiring for a power supply module that has finished being installed.

Wiring Specification and Terminal Preparation

For the wire terminals, use crimp-on terminal lugs with insulation sleeve. Be sure to use ring tongue terminal and crimping tools of the same brand.

Applicable Cables

Insulated cables for industrial equipment such as;

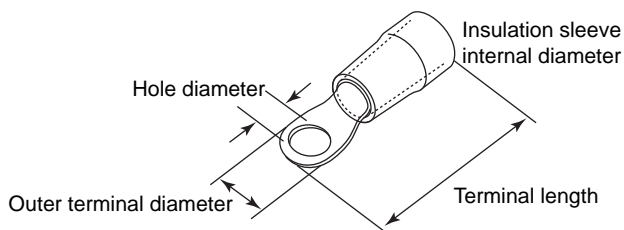
- 600 V polyvinyl chloride insulated wires (IV); JIS C3307
- Polyvinyl chloride insulated wires for electrical apparatus (KIV); JIS C3316
- 600 V grade heat-resistant polyvinyl chloride insulated wires (HIV); JIS C3317
- Heatproof vinyl insulated wires VW-1 (UL1015/UL1007)

Recommend Sizes

0.5 mm² to 2 mm² (AWG 20 to 14)

Terminal Preparation

Use ring tongue terminal for M4 terminals, with the outer diameter of the lug tip (outer terminal diameter) not exceeding 8.5 mm, and with an insulation sleeve.



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Figure Ring Tongue Terminal

Table Example of Ring Tongue Terminal Specification

Conductor nominal cross-sectional area (mm ²)	Screw used (mm)	Hole diameter (mm)	Outer terminal diameter (mm)	Terminal length (mm)	Insulation sleeve internal diameter (mm)
0.5 to 1.65 (AWG 20 to 16)	4	4.3 or more	8.0 or less	Approx. 20.0	3.6 or larger
1.04 to 2.63 (AWG 16 to 14)	4	4.3 or more	8.5 or less	Approx. 21.0	4.3 or larger

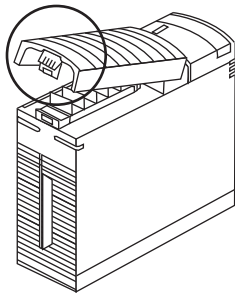
Connecting Power Supply

Follow the procedures below to connect the power supply cable.

1. Detach the protective cover for the terminals on the power supply module as follows:
 - You will find a locking tab at the bottom of the protective cover (circled area in figure). Push the lock up to unlock the tab.
 - Pull gently to remove the cover.
2. Connect the power cable to the terminals labeled L and N. Where necessary, connect a 24 V DC power supply cable to terminals under FLD 24 V DC=. Tighten the terminal screws (Phillips head M4) at a torque of 1.2 Nm.
3. Connect the grounding cable to the G terminal.
4. Replace the protective cover on the power supply connection terminal after wiring is complete.

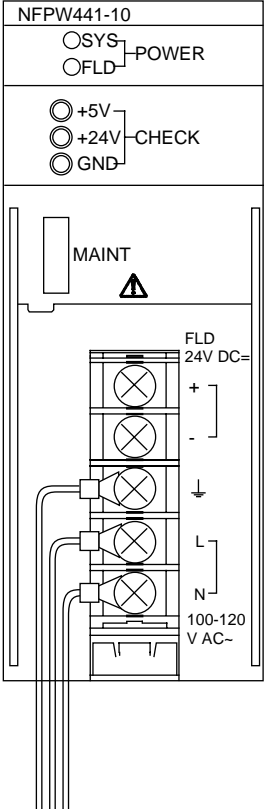
IMPORTANT

- It is recommended to install a switch or circuit breaker on the power wiring so that the power can be turned on and off individually during maintenance.
 - It is also recommended to install a noise filter to improve power supply quality.
-



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Figure Locking Tab of Protective Terminal Cover



F010303E.ai

Figure Example of Power Supply Cable Connection

1.3.2 Wiring the Ground (FCN-500)

Grounding must be applied to the grounding system which is defined by the rules and standards of the country or the region.

IMPORTANT

Connect the ground cable to the dedicated ground terminal specified by the equipment.

To avoid electric shocks and minimize the influences of external noise, FCN-500 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.

Applicable Cables

Insulated cables for industrial equipment such as;

- 600 V polyvinyl chloride insulated wires (IV); JIS C3307
- Polyvinyl chloride insulated wires for electrical apparatus (KIV); JIS C3316
- 600 V grade heat-resistant polyvinyl chloride insulated wires (HIV); JIS C3317
- Heatproof vinyl insulated wires VW-1 (UL1015/UL1007)

Recommend Sizes

2.0 mm² to 2.6 mm² (AWG 14 to 13)

Terminal Preparation

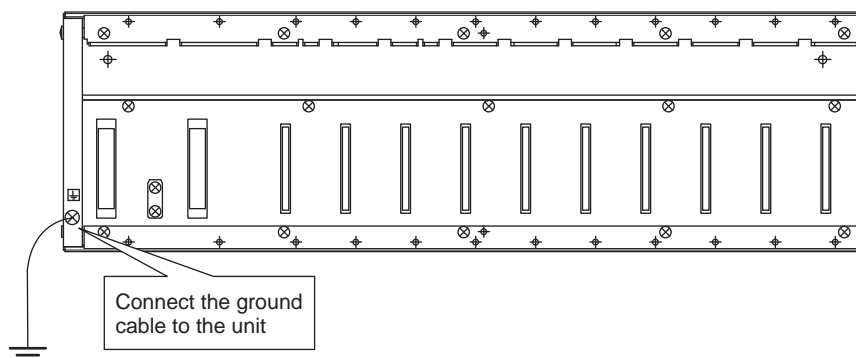
Round crimping terminal M4: External dimensions must be within 8.5 mm with insulation covers.

The material of the tongue terminal for protection grounding needs to be tin-plated.

Cable Connection

Connect the ground cable to the FG terminal (M4 screws) on the bottom left of the base module.

Secure the M4 screws at a tightening torque of 1.2 Nm.



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Figure Grounding the Base Module

1.3.3 Connecting the Signal Cable (FCN-500)

The signal cable can be connected in the following ways:

- Direct connection using pressure clamp terminals
- Connection using MIL connectors

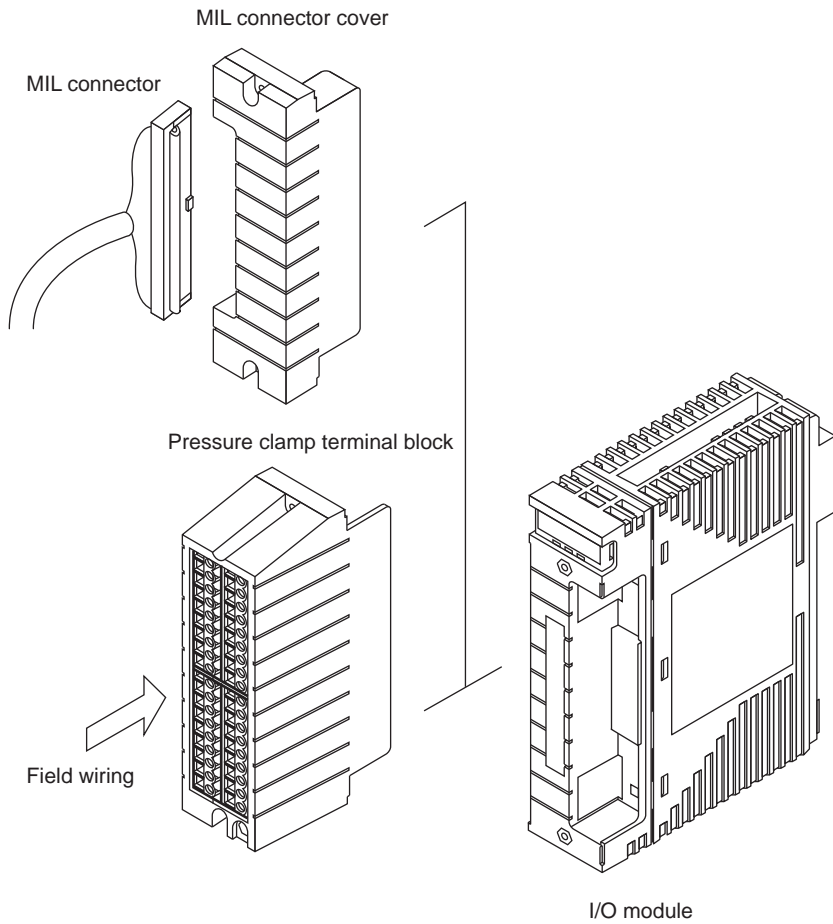


Figure Variations on Signal Cable Connections

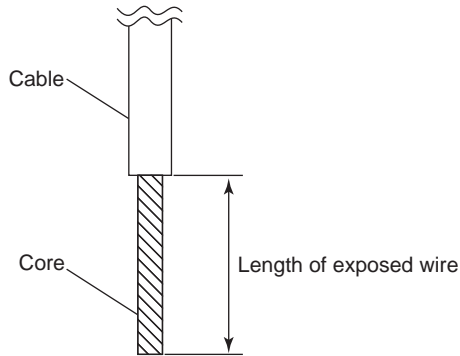
IMPORTANT

- Ensure that any signal wires that will have a high voltage applied are at least 1 cm away from other wires.
- It is recommended to use shielded twisted pair cables for analog I/O signals to prevent inductive noise. For effective noise prevention, use twisted pair cables with a twist pitch of 50 mm or less. The cable shield must be grounded. For digital I/O signals, shielded cables are recommended.
- For resistance temperature detector signals, use twisted triplet cables and ensure that the wiring resistances of the three wires for each detector are equal.
- Fix the cables to cable clamps or the like in order to prevent the weight of the cables being applied to the terminals.

Direct Wiring to Pressure Clamp Terminals

Each I/O module has a male connector on its front panel as the I/O interface. A pressure clamp terminal block is plugged into that connector for use.

Signal Wires for Pressure Clamp Terminals



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Figure Signal Cable

Applicable Cables

Insulated cables for industrial equipment such as;

- 600 V polyvinyl chloride insulated wires (IV); JIS C3307
- Polyvinyl chloride insulated wires for electrical apparatus (KIV); JIS C3316
- 600 V grade heat-resistant polyvinyl chloride insulated wires (HIV); JIS C3317
- Heatproof vinyl insulated wires VW-1 (UL1015/UL1007)
- Control cables (vinyl insulated vinyl sheath cable) (CVV); JIS C3401

Recommended Size

Without sleeve: 0.5 mm² to 2 mm² (AWG20 to 14)

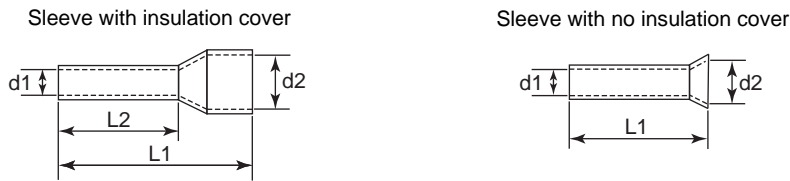
With sleeve: 0.5 mm² to 1.5 mm² (AWG20 to 16)

Wiring to Pressure Clamp Terminals (When Not Using Sleeves)

Table Wiring to Pressure Clamp Terminals without Sleeve

Cable Size	Insulation Stripping Length	Remarks
0.5 mm ² to 2 mm ² (AWG20 to 14)	11 mm	For terminals on NFTA4S, NFFT4S, NFTR8S, NFTB5S, NFTD5S, and NFTI3S modules
1.25 mm ² to 2 mm ² (AWG16 to 14)	13 mm	For terminals on NFTC4S and NFTC5S modules

Wiring to Pressure Clamp Terminals (When Using Sleeves)



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Figure Sleeve for Pressure Clamp Terminals and Applicable Cables

Table Sleeve for Pressure Clamp Terminals and Applicable Cables
(for NFTA4S, NFTB5S, NFTD5S, NFTI3S, NFTR8S and NFFT4S)

Cable Thickness	When using sleeves with insulation cover						When using sleeves with no insulation cover					
	Length of exposed wire	Sleeve dimensions				Widemuller Model Number	Length of exposed wire	Sleeve dimensions			Widemuller Model Number	
		L1	L2	d1	d2			L1	d1	d2		
0.5 mm ²	12 mm	16 mm	10 mm	1.0 mm	2.6 mm	H0.5/16	10 mm	10 mm	1.0 mm	2.1 mm	H0.5/10	
0.75 mm ²	12 mm	16 mm	10 mm	1.2 mm	2.8 mm	H0.75/16	10 mm	10 mm	1.2 mm	2.3 mm	H0.75/10	
1.0 mm ²	12 mm	16 mm	10 mm	1.4 mm	3.0 mm	H1.0/16	10 mm	10 mm	1.4 mm	2.5 mm	H1.0/10	
1.25 to 1.5 mm ²	12 mm	16 mm	10 mm	1.7 mm	3.5 mm	H1.5/16	10 mm	10 mm	1.7 mm	2.8 mm	H1.5/10	

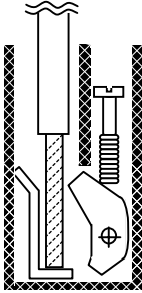
Table Sleeve for Pressure Clamp Terminals and Applicable Cables (for NFTC4S and NFTC5S)

Cable Thickness	When using sleeves with insulation cover						When using sleeves with no insulation cover					
	Length of exposed wire	Sleeve dimensions				Widemuller Model Number	Length of exposed wire	Sleeve dimensions			Widemuller Model Number	
		L1	L2	d1	d2			L1	d1	d2		
1.25 to 1.5 mm ²	15 mm	16 mm	12 mm	1.7 mm	3.5 mm	H1.5/18 D	12 mm	12 mm	1.7 mm	2.8 mm	H1.5/12	

IMPORTANT

- Use the same manufacturer for sleeves and tools.
- Use sleeve tools that match the wire thickness.
- Insert the wire to be connected completely into the pressure clamp terminal and attach it securely.
- It is recommended to use a driver (flat blade screwdriver with tip thickness 0.6 mm, axis radius 3.5 mm) that complies with the DIN 5264B standard when connecting cables.
- The tightening torque is 0.5 Nm.
- Secure the cable to cable clamps, etc. so that the weight of the cable applied to the terminal is minimized.
- Strip the cable for a length so that the core wire slightly extends from the metal tube of the sleeve. If this causes the length of the metal tube of the sleeve to be slightly shorter than the stripping length, this is no problem.

TIP The inside of pressure clamp terminals is designed as shown below:



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Figure Inside the Pressure Clamp Terminal

Installing the Pressure Clamp Terminal Block to the I/O Module

After the signal cable has been connected, a pressure clamp terminal block must be installed to the I/O module. The terminal block must be secured using M3 screws.

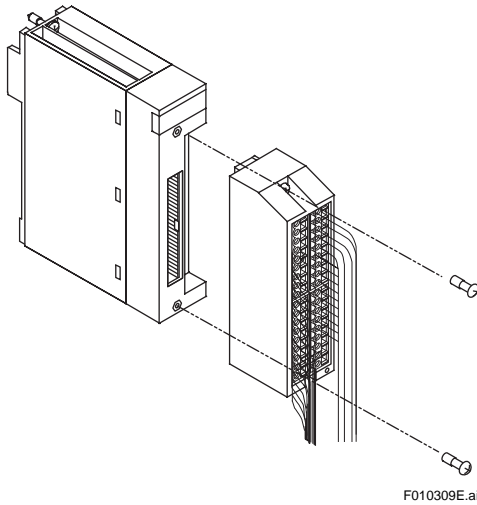


Figure Installing the Pressure Clamp Terminal Block to the I/O Module

Connecting the MIL Connector Cables

MIL connector cables can be connected directly without the installation of terminal blocks to the I/O module. MIL connector cables are sold separately.

To prevent MIL cables from disconnection, a cable connector cover (NFCCC01) is available.

Applicable Connectors and Cables/Wires

The cable used is a 40-pin or 50-pin female connector (see I/O Module Compatibility Table) that complies with the MIL-C-83503 standard. The cables and wires must also comply with the connector specification.

Table Applicable Connectors and Cables

Connector type	Applicable wire size
Press-fitting pin terminal type female connector (*1)	AWG 20 to AWG 28, or 0.5 mm ² to 0.08 mm ²
Pressure welding type female connector (*2)	AWG 28 or 0.08 mm ² , 1.27 pitch flat cable or equivalent, AWG 28 or 0.08 mm ² circular attachment cable

*1: Special solderless socket contact is used. Hoods cannot be used.

*2: Strain-relief is used (recommended).

For analog signals, use shielded twisted pair cables.

For resistance temperature detector signals, use twisted triplet cables.

For digital I/O signals, shielded cables are recommended.

IMPORTANT

- For a 50-pin MIL connector, use a model with two incorrect insertion prevention keys.
- For resistance temperature detector signals, ensure that the wiring resistances of the three wires for each detector are equal. A difference in resistance between the three wires directly results in a reading error.

Table Combinations of I/O Modules and Terminal Blocks

Model name	Module name	Terminal block	MIL connector
—	Analog I/O Modules		
NFAI141	Analog Input Module (4 to 20 mA, 16-Channel, Non-Isolated)	NFTA4S	MIL 40 pins
NFAV141	Analog Input Module (1 to 5 V, 16-Channel, Non-Isolated)	NFTA4S	MIL 40 pins
NFAI841	Analog I/O Module (4 to 20 mA Input, 4 to 20 mA Output, 8-Channel Input/8-Channel Output, Non-Isolated)	NFTA4S	MIL 40 pins
NFAB841	Analog I/O Module (1 to 5 V Input, 4 to 20 mA Output, 8-Channel Input/8-Channel Output, Non-Isolated)	NFTA4S	MIL 40 pins
NFAI143	Analog Input Module (4 to 20 mA, 16-Channel, Isolated)	NFTA4S	MIL 40 pins
NFAI543	Analog Output Module (4 to 20 mA, 16-Channel, Isolated)	NFTA4S	MIL 40 pins
NFAV144	Analog Input Module (-10 V to +10V, 16-Channel, Isolated)	NFTA4S	MIL 40 pins
NFAV544	Analog Output Module (-10 V to +10 V, 16-Channel, Isolated)	NFTA4S	MIL 40 pins
NFAT141	Thermocouple/mV Input Module (*1) (16-Channel, Isolated)	NFTT4S	MIL 40 pins (*1)
NFAR181	RTD Input Module (12-Channel, Isolated)	NFTR8S	MIL 40 pins
NFAI135	Analog Input Module (4 to 20 mA, 8-Channel, Isolated Channels)	NFTI3S	MIL 40 pins
NFAI835	Analog I/O Module (4 to 20 mA, 4-Channel Input/4-Channel Output, Isolated Channels)	NFTI3S	MIL 40 pins
NFAP135	Pulse Input Module (8-Channel, Pulse Count, 0 to 10 kHz, Isolated Channels)	NFTI3S	MIL 40 pins
NFAF135	Frequency Input Module (8-Channel, Pulse, 0.1 Hz to 10 kHz, Isolated Channels)	NFTI3S	MIL 40 pins
–	Digital I/O Modules		
NFDV151	Digital Input Module (32-Channel, 24 V DC)	NFTB5S	MIL 50 pins
NFDV161	Digital Input Module (64-Channel, 24 V DC)	-	MIL 50 pins x 2
NFDV532	Pulse Width Output Module (4-Channel : Up Pulse/Down Pulse, 24 V DC, Isolated)	NFTD5S	MIL 50 pins
NFDV551	Digital Output Module (32-Channel, 24 V DC)	NFTD5S	MIL 50 pins
NFDV561	Digital Output Module (64-Channel, 24 V DC)	-	MIL 50 pins x 2
NFDR541 -T□□	Relay Output Module (16-Channel, 24 to 125 V DC/100 to 240 V AC)	NFTC4S-7	-
–	Communication Modules		
NFLF111	FOUNDATION Fieldbus communication module (4-port)	NFTF9S	-
NFLR111	RS-232-C Communication Module (2-port, 300 bps to 115.2 kbps)	-	-
NFLR121	RS-422/RS-485 Communication Module (2-port, 300 bps to 115.2 kbps)	-	-
NFLC121	CANopen Communication Module (1-port, 10 kbps to 1 Mbps)	-	-
NFLP121	PROFIBUS-DP Communication Module (1-port, 9.6 kbps to 12 Mbps)	-	-

*1: Applied only when mV input is used.

Connection

Connection is made by aligning the MIL connector and incorrect insertion prevention key on the I/O module. Then install the MIL connector cover (NFCCC01) to secure the cable (excluding NFDV161 and 561).

For NFDV161 or 561, the cable is locked using the connector lock lever.

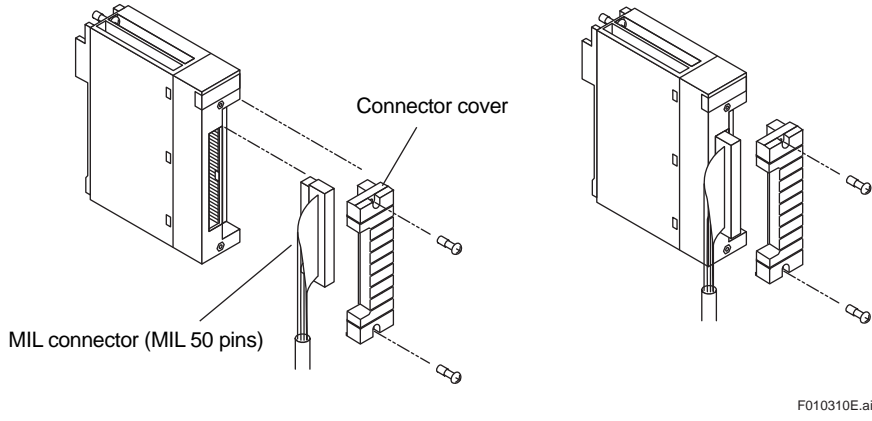


Figure Connecting the MIL Connector Cable (Securing the Cable Using MIL Connector Cover)

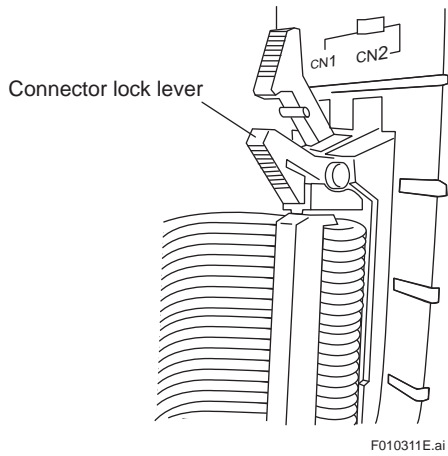
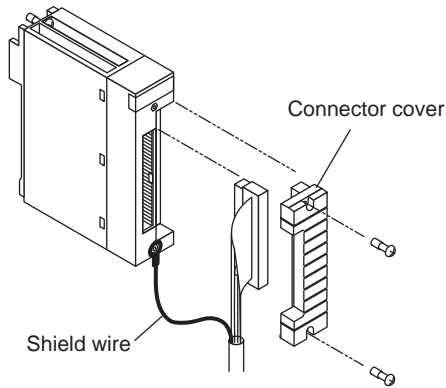


Figure Connecting the MIL Connector Cable (Securing the Cable Using Connector Lock Lever)

Grounding Signal Cable Shields

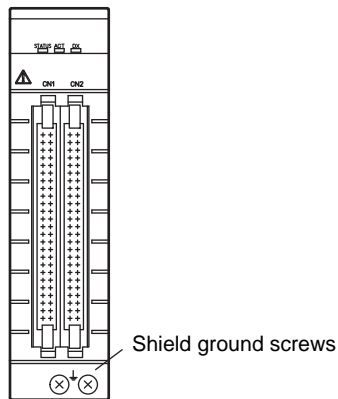
When using shielded cable for signal wiring, ground the cable shields as follows:

- Provide a grounding bar for shield ground (at the same electric potential with the system ground), and connect the cable shields to it.
- For each MIL connector cable except those for an NFDV161 or NFDV561, fix the terminal of the shield wire with the lower connector cover fixing screw together with the cover as shown below. For the NFDV161 or NFDV561, connect the cable shield to either of the shield ground screws.



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Figure Grounding Shield Wire of MIL Connector Cable



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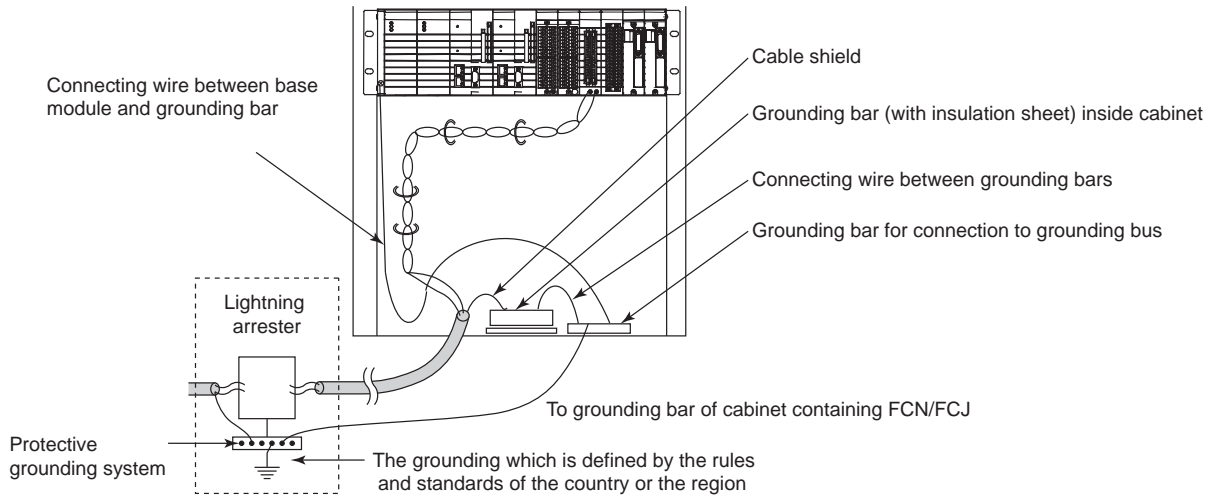
Figure Shield Ground Screws of NFDV161/561

Grounding Surge Absorbers and Lightning Arresters

When using a terminal block with optional surge absorbers or providing external lightning arresters, connect them as shown 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 equal potential including the floor and the case of other equipment.



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Figure Example of Grounding Arrester

1.3.4 Communication Cables (FCN-500)

Control Network

Connect the control network cable to the connector in the front of the CPU module. Use cables that comply with the 1000BASE-T, 100BASE-TX or 10BASE-T standard. When using the control network in single, connect the cable to the Network Interface 1.

IMPORTANT

When not using the Network Interface 2, leave the connector cover for dust protection on to prevent any damage to the connector.

E2 Bus Cable

The E2 bus interface modules for extension units are connected using E2 bus cables. Use cables that comply with the UTP straight cable (CAT 5e or higher).

SEE ALSO

When a E2 bus repeat module malfunctions, see C6.2.2, "Replacing FCN Modules" in "FCN/FCJ Guide (IM 34P02Q01-01E)" for on-line replacement procedures.

Extension of transmission distance by optical fiber cable

The E2 bus can be extended by optical fiber cable with a third party media converter.

- Up to three pairs of media converters can be used for each line.
- Only one pair of media converters can be used between units. For details, refer to TIP.
- The total transmission distance is up to 5 km for each line. If the total transmission distance exceeds 1 km, change the E2-bus setting of the CPU with Resource Configurator. For the setting method, refer to the online help.
- Generally it is up to 2 km when using multimode optical fiber. For the distance between media converters, refer to the specification of the media converter.

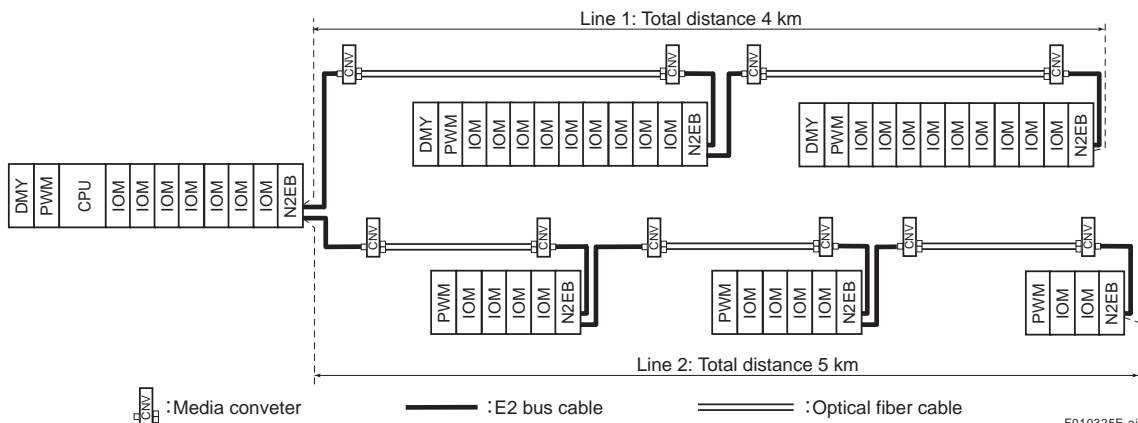
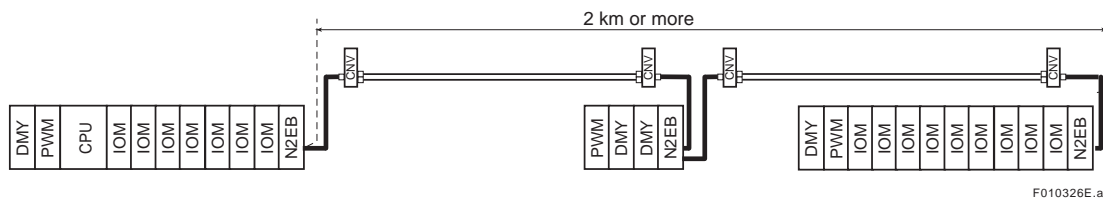


Figure Configuration example with optical fiber cable

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TIP

If media converter and optical fiber with a transmission distance of 2 km are used, install an extension unit for relay to connect units more than 2 km apart.

**SEE ALSO**

Only Layer 1 media converters which simply convert packets from electric signal to optical signal can be used for the E2 bus. Refer to the verified media converter information and precaution on Yokogawa Partner Portal STARDOM site (registration is required) when choosing the model.

“Verified Peripherals” Page in “YOKOGAWA Partner Portal STRADOM” site
<https://partner.yokogawa.com/global/member/rtu/os/index.htm#tab04>

SB Bus Cable

The SB bus repeat modules for extension units are connected using SB bus cables (model: NFCB301).

Connect the cables following the procedures below:

1. Connect the cable connector to the T-joint connector on the SB bus repeat module.
2. Secure the connector by turning the screws on the connector shell.
3. The tightening torque of the screws should be approximately 0.3 Nm.

**SEE
ALSO**

When a SB bus repeat module malfunctions, see C6.2.2, "Replacing FCN Modules" in "FCN/FCJ Guide (IM 34P02Q01-01E)" for on-line replacement procedures.

RS-232-C Communication Cable

Cable Connection

If RS-232-C communication cables are connected to CPU modules or RS-232-C communication modules, connect the cables that conform to the respective connector types. Then, fasten the cables using screws.

IMPORTANT

- The CPU module's serial ports are D-SUB 9 pins (male). Connectors are fastened using inch screw threads (No. 4-40 UNC).
 - RS-232-C communication module's serial ports are D-SUB 9 pins (female). Connectors are fastened using metric screw threads (M2.6).
-

Pin Assignments of CPU Module's Serial Port

Table Connector Pin Assignment (D-sub 9-pin, male)

Pin No	Signal name	Function
1	CD	Data channel receiving carrier detection
2	RD	Receiving data
3	SD	Transmission data
4	ER	Data terminal ready
5	SG	Signal ground
6	DR	Data set ready
7	RS	Transmission request
8	CS	Transmission enabled
9	–	Not Used

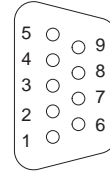


Figure Pin Position (Front View)

TIP

By default factory setting, flow controls are disabled.

Flow controls can be enabled by editing "COM Port Setting File" on "FCX Maintenance Menu."

For more information, refer to the Help of "FCX Maintenance Menu."

Pin Assignments of RS-232-C Communication Module's Serial Ports

Table Connector Pin Assignments (D-sub 9-pin, female)

Pin No	Signal name	Function
1	CD	Data channel receiving carrier detection
2	RD	Receiving data
3	SD	Transmission data
4	ER	Data terminal ready
5	SG	Signal ground
6	DR	Data set ready
7	RS	Transmission request
8	CS	Transmission enabled
9	–	Not used

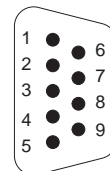


Figure Pin Position (Front View)

TIP

RS-232-C interface uses CS line (for input signal monitor) and CD line (for transmission of flow controls). Wirings of these signal lines are necessary.

RS-422/RS-485 Communication Cable

If users supply the communication cables for RS-422/RS-485, use cables that conform to the following standards:

Applicable Cables

Shielded twisted pair cables (cables for RS-422/RS-485 communication are recommended)

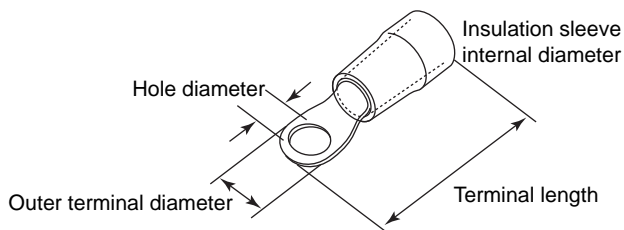
Recommend Size

0.5 mm² to 1.25 mm² (AWG 20 to 16)

(1.25 mm² is recommended)

Terminal Preparation

Use a ring tongue terminal for M4 terminals, with the outer diameter of the lug tip (outer terminal diameter) not exceeding 8.5 mm, and with an insulation sleeve.



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Figure Ring Tongue Terminal

Table Example of Ring Tongue Terminal Specification

Conductor nominal cross-sectional area (mm ²)	Screw used (mm)	Hole diameter (mm)	Outer terminal diameter (mm)	Terminal length (mm)	Insulation sleeve internal diameter (mm)
0.5 to 1.65 (AWG 20 to 16)	4	4.3 or more	8.0 or less	Approx. 20.0	3.6 or larger

Tightening Torque

Tightening torque: to be fixed at 1.2 Nm.

CANopen Communication Cable

Applicable Cables

Cables must be complied with the CiA 301 specification.

Applicable Terminator

Terminators must be complied with the CiA 301 specification.

The CANopen Communication Module (NFLC121) has no internal terminator so an external terminator is required.

Connectors

Table Connector Pin Assignments (D-sub 9 pin, Male)

Pin No	Signal name	Remarks
1	–	Not Used
2	CAN_L	CAN_L
3	CAN_GND	CAN ground
4	–	Not Used
5	–	Not Used
6	–	Not Used
7	CAN_H	CAN_H
8	–	Not Used
9	–	Not Used

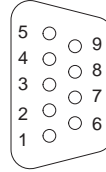


Figure Pin No. of D-sub 9-pin Connectors on the Module

Note: Connectors are fastened using inch screw threads (No. 4-40 UNC).

PROFIBUS-DP Communication Cable

Signal cables

Cables must be complied with the PROFIBUS-DP standards (PROFIBUS Specifications IEC 61158-2 type 3).

Terminators

Terminators must be complied with the PROFIBUS-DP standards (PROFIBUS Specifications IEC 61158-2 type 3).

Connectors

Table Connector Pin Assignments (D-sub 9-pin, female (*1))

Pin No	Signal name	Function
1	Shield	Shield
2	–	Not Used
3	RxD/TxD-P	Data reception/ transmission
4	–	Not Used
5	DGND	Signal grounding
6	VP	+5V
7	–	Not Used
8	RxD/TxD-N	Data reception/ transmission
9	–	Not used

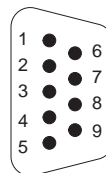


Figure Pin No. of D-sub 9-pin Connectors on the Module

*1: Connectors are fastened using inch screw threads (No.4-40UNC).

Ferrite Core

When the NFLP121 PROFIBUS-DP Communication Module is used, a ferrite core must be installed on the PROFIBUS cable to comply with the EMC standards.

Core (Part number: A1193MN)

Mount the supplied ferrite core on the covering of the PROFIBUS cable near the NFLP121.

Communication Cables (FCN-500)

The communication cable in the table below.

Table Adaptive Cable of Communication Interface (1/2)

Module	CPU module NFCP501/NFCP502		E2 bus interface module N2EB100	SB bus repeat module NFSB100
Port name/ Number of Ports	NFCP501: Control network Interface (10BASE-T, 100BASE-TX or 1000BASE-T) x 2 NFCP502: Control network Interface (10BASE-T, 100BASE-TX or 1000BASE-T) x 4	Serial port (RS-232-C) x 2	E2 bus port x 2	SB bus port x 2
Isolation	Isolated	Non-Isolated	Isolated	Non-Isolated
Connector	RJ-45	D-sub 9 pin, male Inch screw (No.4-40UNC)	RJ-45	Dedicated T-joint NFSBT01/NDSBT02
Cable	Network cable • 1000BASE-T: UTP (Category 5) • 100BASE-TX: UTP (Category 5) • 10BASE-T: UTP (Category 3)	RS-232-C Communication cable	UTP straight cable (Category 5e or higher)	Dedicated cable NFCB301
Commercial cable	Available			—
Notes of Wiring	—			
Wiring cable	—			
Recommended cable	Network cable (Category 5)	RS-232-C Communication cable	Network cable (Straight)	—

Table Adaptive Cable of Communication Interface (2/2)

Module	RS-232-C Communication module NFLR111	RS-422/RS-485 Communication module NFLR121	CANopen Communication Module NFLC121	PROFIBUS-DP Communication Module NFLP121
Port name/ Number of Ports	Serial port (RS-232-C) x 2	Serial port (RS422/RS-485) x 2	CANopen x 1	PROFIBUS-DP x 1
Isolation	Isolated			
Connector	D-sub 9 pin (female) metric screw (M2.6)	Terminal Block M4 screw (5 lines)	D-sub 9 pin, male Inch screw (No.4-40UNC)	D-sub 9 pin, female Inch screw (No.4-40UNC)
Cable	RS-232-C Communication cable	RS-422/RS-485 Communication cable	CANopen Communication Cable	PROFIBUS-DP Communication Cable
Commercial cable	Non (When it is connected to devices other than FA-M3 and YEWMAC, the cable must be made by the user.)		Available	Available
Notes of Wiring	Perform grounding on the FG line and shielding of cable in external equipment side.	Perform functional grounding on the FG line and shielding of cable in external equipment side.	An external terminator is required.	• An external terminator is required. • Attach a ferrite core complying with the EMC standard
Wiring cable	Twisted pair cable in which a signal wire and a ground wire are paired.	Shielded twisted pair cable (wire: AWG20 to 16)	—	—
Recommended cable	AKB131, AKB132, AKB133, AKB135, AKB136	AKB161, AKB162	CANopen Communication Cable	PROFIBUS-DP Communication Cable

Recommended cable (manufactured by Yokokawa Electric Corporation.)

- RS-232-C cable (For NFLR111)
 - AKB131 RS-232-C modem cable for connecting RS circuit isolation equipment 9 to 25 pins for startstop synchronization communication.
With a shield line of external equipment side.
 - AKB132 RS-232-C null modem cable for connecting RS circuit isolation equipment 9 to 25 pins for startstop synchronization communication.
With a shield line of external equipment side.
 - AKB133 RS-232-C null modem cable 9 to 9 pins (male) for start-stop synchronization communication.
With connector shell ground line of external equipment side. For FA-M3 and YEWMAC.
 - AKB135 RS-232-C modem cable 9 to 25 pins for startstop synchronization communication.
With connector shell ground line of external equipment side.
 - AKB136 RS-232-C null modem cable 9 to 25 pins for start-stop synchronization communication.
With connector shell ground line of external equipment side.
- Note: These cables cannot be connected to the serial port of the CPU module.
- RS-422/RS-485 cable (For NFLR121)
 - AKB161 Dedicated cable between NFLR121 and FA500, up to 100 m.

IMPORTANT

When connecting a Yokogawa-specific cable to CPU or Communication 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.

**SEE
ALSO**

For specifications of RS-232-C cable and RS-422/RS-485 cable, see GS 33J60J10-10EN.

Internal Connection

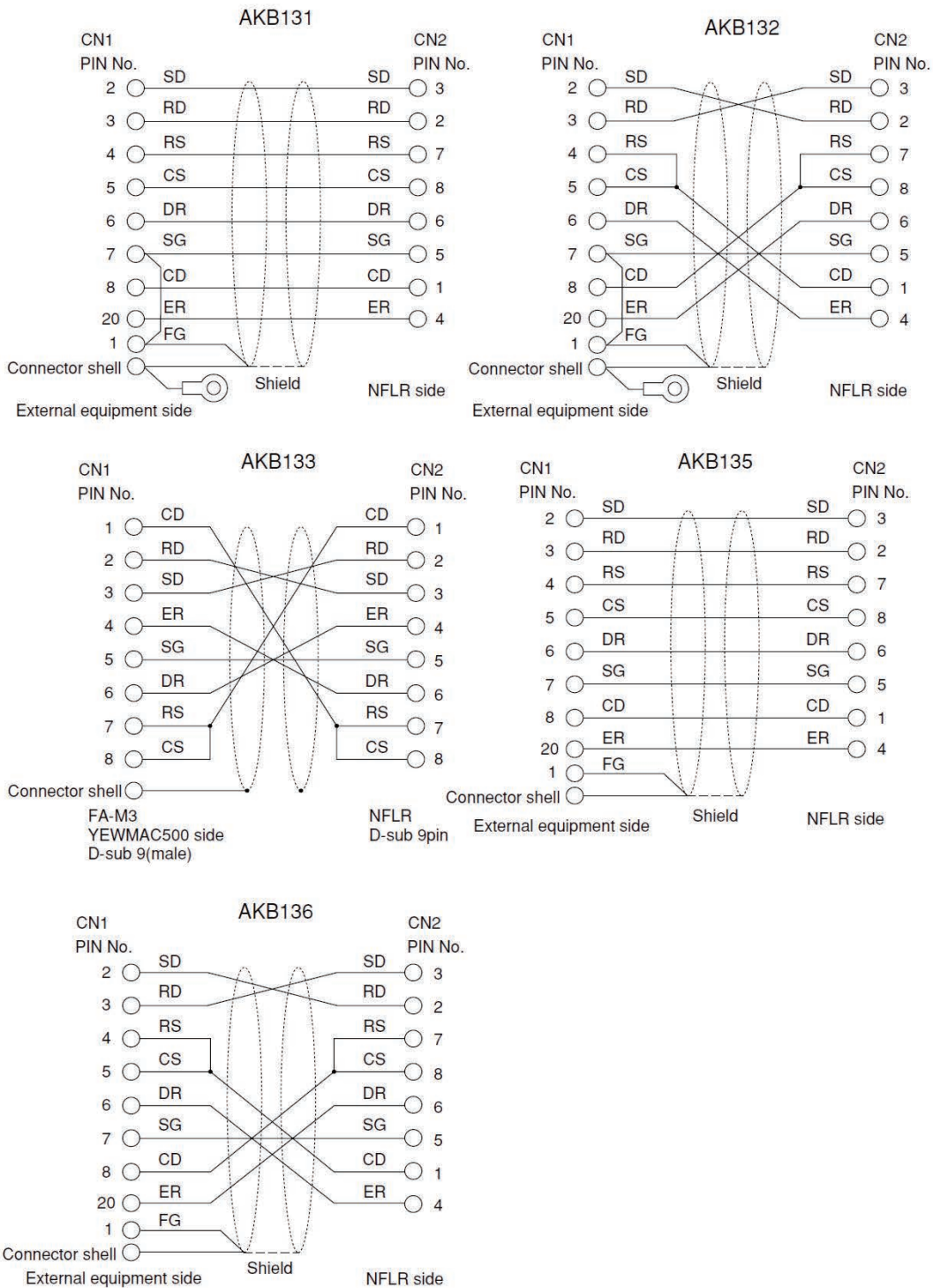


Figure Internal Connection of the Cables for NFLR111 RS 232 C Communication Module

IMPORTANT

- Since RS-232-C Communication module NFLR111 uses Carrier Detect (CD) signal to monitor the receiving signal and Clear To Send (CTS) signal to send flow control information, these signal lines need to be wired.
- The NFLR111 communication module isolates the RS 232 C interface circuit functionally. This prevents noise from entering the NFLR111 from the external equipment, thereby improving noise resistance. To use this function effectively, satisfy the following requirements:
 - Always ground the FG terminal at the partner terminal, with the grounding system defined by rules and standards of the country or the region.
 - Connect the FG and SG (pin No.7 on the D-sub25 pin, pin No.5 on the D-sub 9 pin RS 232 C circuit) together at the partner terminal.
 - Ground the cable shielding wires at the partner terminal. (When using AKB133 cable, connect the end of the cable with the red mark to the partner terminal.)
 - If the signal cable is prepared by users, make the sure the cable is the type of twisted pair cable in which a signal wire and a ground wire are paired.

NFLR121 FG Connection

Set up the RS 422/RS 485 shield as shown below.

- Grounding for the FG must be grounding on the connected side (external equipment side).
- The grounding method must comply with the grounding system defined by rules and standards of the country or the region.
- The cable shield between Model NFLR121 and the external equipment side must be connected to the FG on the external equipment side, not to the FG on Model NFLR121.

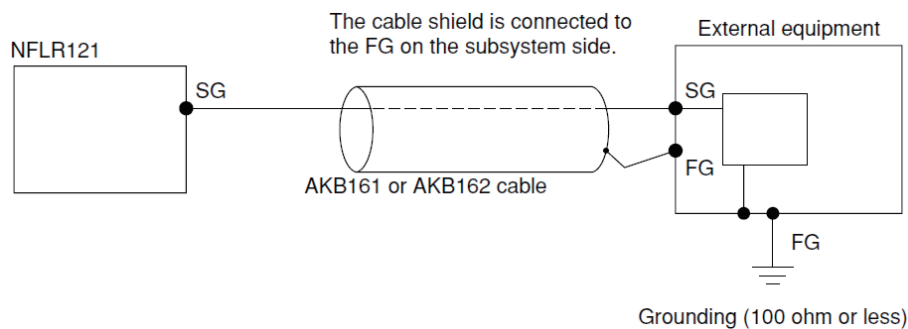


Figure NFLR121 FG Connection

Connection with External Equipment

Four-wire and two-wire types are provided for the connection of Model NFLR121 with external equipment.

Connection in 4-wire Type

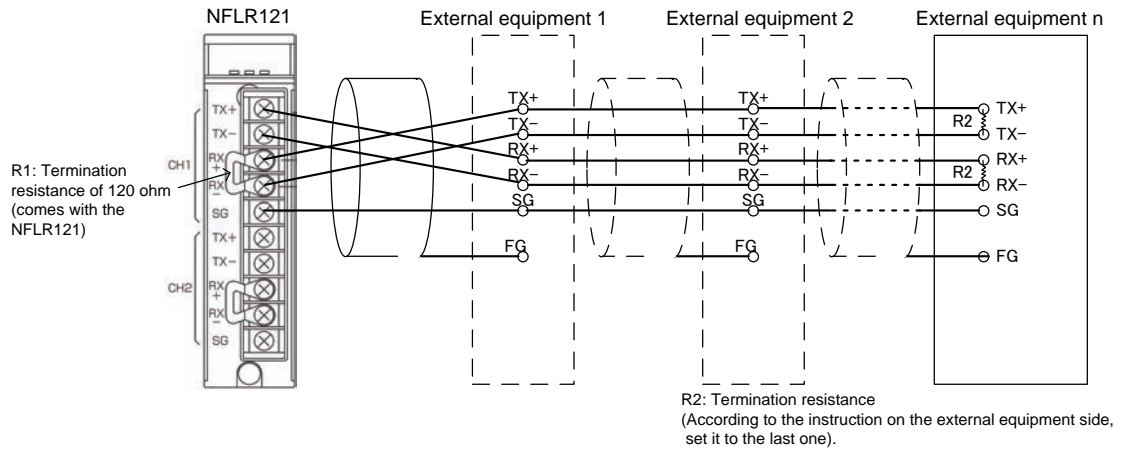


Figure Connection in 4-wire Type

Connection in 2-wire Type

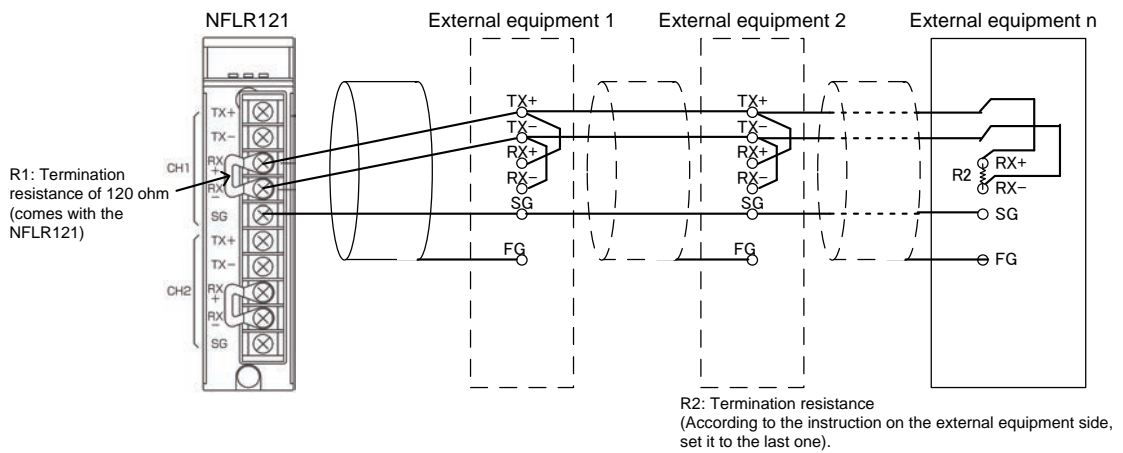


Figure Connection in 2-wire Type

1.4 Others

1.4.1 Connector Terminal Blocks/Cables

The following shows connector terminal blocks and connector cables those which can be used for I/O modules of FCN-500.

The terminal blocks and cables are used with I/O modules conforming to MIL connector connection.

Table Connector Terminal Blocks

Model	Suffix Codes	Description	Complied I/O Modules
TAS40	-0N	MIL Connector Terminal Block (40- pole plug type, M3.5, Gray)	Analog I/O modules (*1) (*2)
	-1N	MIL Connector Terminal Block (40- pole plug type, M3.0, Gray)	
	-2N	MIL Connector Terminal Block (40- pole plug type, M3.0, Black)	
TAS50	-0N	MIL Connector Terminal Block (50- pole plug type, M3.5, Gray)	NFDV151, NFDV161, NFDV532, NFDV551, NFDV561 (*3)
	-1N	MIL Connector Terminal Block (50- pole plug type, M3.0, Gray)	
	-2N	MIL Connector Terminal Block (50- pole plug type, M3.0, Black)	

Table Connector Cables

Model	Suffix Codes	Description	Complied I/O Modules
KMS40	-0□□ (according to length)	MIL Connector Cable (40-pole plug type) Cable length: 0.5 m, 1.0 m, 1.5 m, 2.0 m, 2.5 m, 3.0 m, 4.0 m, 5.0 m, 6.0 m, 7.0 m, 8.0 m, 9.0 m, 10.0 m, 15.0 m, 20.0 m, 25.0 m	Analog I/O modules (*1) (*2)
KMS50	-0□□ (according to length)	MIL Connector Cable (50-pole plug type) Cable length: 0.5 m, 1.0 m, 1.5 m, 2.0 m, 2.5 m, 3.0 m, 4.0 m, 5.0 m, 6.0 m, 7.0 m, 8.0 m, 9.0 m, 10.0 m, 15.0 m, 20.0 m, 25.0 m	NFDV151, NFDV161, NFDV532, NFDV551, NFDV561 (*3)

*1: NFAT141 can be used for a mV input only.

*2: NFAR181 cannot be used.

*3: NFDV161 or NFDV561 (64- pole plug type) can be connected to two sets of connector terminal blocks / cables.

IMPORTANT

When connecting a Yokogawa-specific cable to an IO 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.

**SEE
ALSO**

For specifications of connector terminal blocks or connector cables, see GS 34P02Q43-01E.

1.4.2 Terminal Boards/Cable

The following shows terminal boards and cable those which can be used for Turbomachinery I/O modules of FCN-500.

Table Terminal Board

Model	Suffix Codes	Description	Complied I/O Modules
AEGS1D	-0□	Terminal Board for Servo	NFGS813
AEGP1D	-0□	Terminal Board for High Speed Protection	NFGP813

Table Cable

Model	Suffix Code	Description	Complied I/O Modules
AKB337	-M0□□ (according to length)	Signal Cable (50-50 pins) Cable length:1.0 m, 2.0 m, 3.0 m, 5.0 m, 7.0 m, 10.0 m	NFGS813, NFGP813

IMPORTANT

When connecting a Yokogawa-specific cable to an IO 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.

SEE ALSO For specifications of terminal board and cable, see GS 34P02Q33-01E.

Installing Terminal board

Attach the terminal board to the 19 inch rack or general-purpose control panel using a M5 screw.

Grounding for Terminal board

When installing the terminal board to the 19 inch rack or general-purpose control panel, the following instructions must be followed.

- Perform the grounding which is defined by the rules and standards of the country or the region on the G terminal of the AEGS1D.
- Perform the grounding which is defined by the rules and standards of the country or the region on the protective grounding terminal of the AEGP1D. In addition, the material of the tongue terminal for protection grounding uses tin-plated parts.

SEE ALSO For specifications of wiring the ground, see 1.3.2, "Wiring the ground."

2. FCN-RTU

The following describes details and various operation procedures for FCN-RTU hardware system design and construction necessary for stable FCN-RTU operation.

- **Installation environment**
- **Power supply systems and equipment**
- **Wiring (Noise reduction grounding systems, wire routing)**

Perform FCN-RTU installation following the steps below.

1. Install base module
2. Install power supply module, CPU module, additional I/O module, and dummy cover
3. Install grounding cable, power supply cable, and signal cable

IMPORTANT

Do not use “power supply module for FCN (NFPW441, NFPW442 or NFPW444)” for FCN-RTU.

FCN-RTU Installation Specification

The conditions of the installation location must be appropriate for stable operation of the system. The table below shows the conditions required for installation location (and some conditions for transportation and storage) of an FCN-RTU.

Table FCN-RTU Installation Environment Specification

Item		Specification	Related standard
Ambient temperature	Operation	-40 to 70°C (*1)	
	Transportation	-40 to 85°C	
Ambient humidity	Operation	5 to 95% RH (No condensation)	
	Transportation	5 to 95% RH (No condensation)	
Ambient temperature fluctuation	Operation	Within $\pm 10^{\circ}\text{C}/\text{h}$	JEIDA29 Class B
	Transportation	Within $\pm 20^{\circ}\text{C}/\text{h}$	
Dust		0.3 mg/m ³ or less	
Protection class		IP20	IEC 529
Resistance to corrosive gas		ANSI/ISA S71.04 Class G2 (Standard) (ANSI/ISA S71.04 Class G3, option)	ANSI/ISA S71.04
Resistance to vibration		0.15 mm P-P (5 to 58 Hz)	IEC 68-2-6
		1 G (58 to 150 Hz)	
Resistance to shock		15 G 11 ms (during power-off, for sine half-waves in XYZ-directions)	IEC 68-2-27
Altitude		3000 m or less (*1)	
Noise	Electric field	3 V/m or less (26 MHz to 1 GHz)	
	Magnetic field	30 A/m or less (AC), 400 A/m or less (DC)	
	Electrostatic discharge	4 kV or less (contact discharge), 8 kV or less (air discharge)	
Grounding		Apply the grounding system which is defined by the rules and standards of the country or the region.	
Cooling		Natural air cooling	
Installation		DIN rail installation	

*1: It depends on additional I/O modules. Refer to General Specifications - FCN-RTU Low Power Autonomous Controller Hardware, GS 34P02Q13-01E.

IMPORTANT

- 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.
 - The temperature specification during operation indicates the criterion of the temperature at the air intake of the bottom portion of modules. Do not block ventilation holes, as it may hinder the air-cooling capabilities of the unit. When installing the FCN-RTU in a cabinet, note that the temperature specification is not in respect to the ambient temperature of the cabinet. Provide cooling fans in the cabinet if needed.
 - Avoid exposing the FCN-RTU to direct sunlight.
 - Prevent condensation under any circumstance.
 - The dust level of the room should not exceed 0.3 mg/m³. Under any circumstance, avoid iron flakes, carbon particles, or any other type of dust that are conductive.
 - Avoid existence of corrosive gases such as hydrogen sulfide, sulfurous acid gas, chlorine, and ammonia.
 - For vibration at the installation location, see also “FCN-RTU Vibration Criteria” within this Chapter.
 - For radio device noise to the FCN-RTU, see “Radio Device Noise to FCN-RTU” within this Chapter.
-

FCN-RTU Vibration Criteria

Ensure that if the frequency of vibration at the installation location is 58 Hz or less, the total amplitude is maintained less than 0.15 mm. If the vibration frequency is greater than 58 Hz, find a location that will meet the following condition:

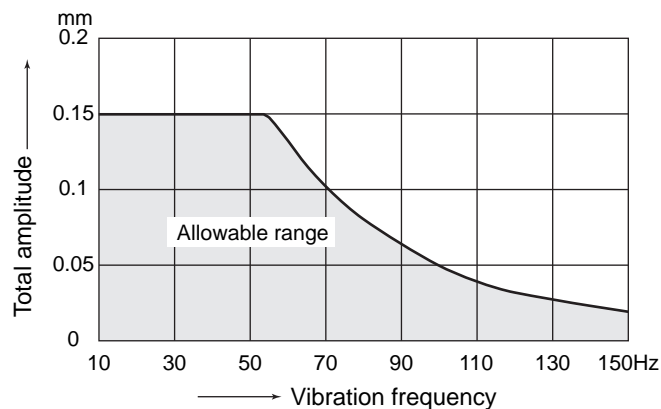
$$\text{Acceleration (m/s}^2\text{)} = 2\pi^2 \times A \times F^2 \times 10^{-3} < 9.8 (=1G)$$

where

A : Total amplitude (mm)

F : Frequency (Hz)

The range of allowable total amplitude is shown below.



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Figure Allowable Vibration Range

Radio Device Noise to FCN-RTU

The following shows general requirements when using a radio device such as transceivers; however, as a general rule, close the cabinet door when using a radio device:

- Transceivers that have 3 W of output power or less should be at least 1 m away.
Transceivers that have 10 W of output power or less should be at least 2 m away.
- Radio devices that have 1 W of output power or less including cellular phones and cordless phones should be at least 1 m away.

IMPORTANT

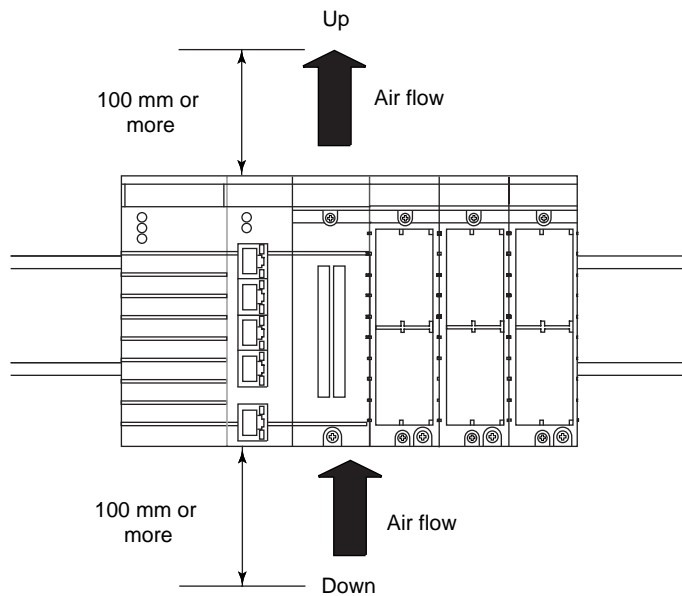
Mount two ferrite cores "A1193MN" to Ethernet cables to avoid conduction noise generated by wireless devices radiating the frequency of 40-50 MHz such as transceiver located closed to Ethernet port.

2.1 Installing the Base Module

FCN-RTU is designed to be attached to DIN rails, and general-purpose control panels. Note the following when installing FCN-RTU to cabinets, control panels, etc.

Installation Direction

FCN-RTU is designed to be cooled by natural air. Install an FCN-RTU so that the ventilation air flows upward from its bottom to its top as shown below.



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Figure Installing FCN-RTU Base Module

IMPORTANT

- Be sure to turn off the power before installing or removing FCN-RTU base module.
- Do not install the unit blocking the ventilation holes on the top and bottom.
- To prevent the cooling air current from being blocked, be sure to place the unit at least 100 mm away from other devices.
- Do not expose to direct sunlight.
- All access to FCN-RTU is performed from the front. Secure a space between 100 and 150 mm from the front panel of the unit to the cabinet door to provide enough space for the cables. (The bending radius will differ depending on the material of the cable. Verify the specification of the wire.)

Dimensions

Refer to the dimensions shown below and take sufficient allowances when installing an FCN-RTU.

DIN Rail Mounting

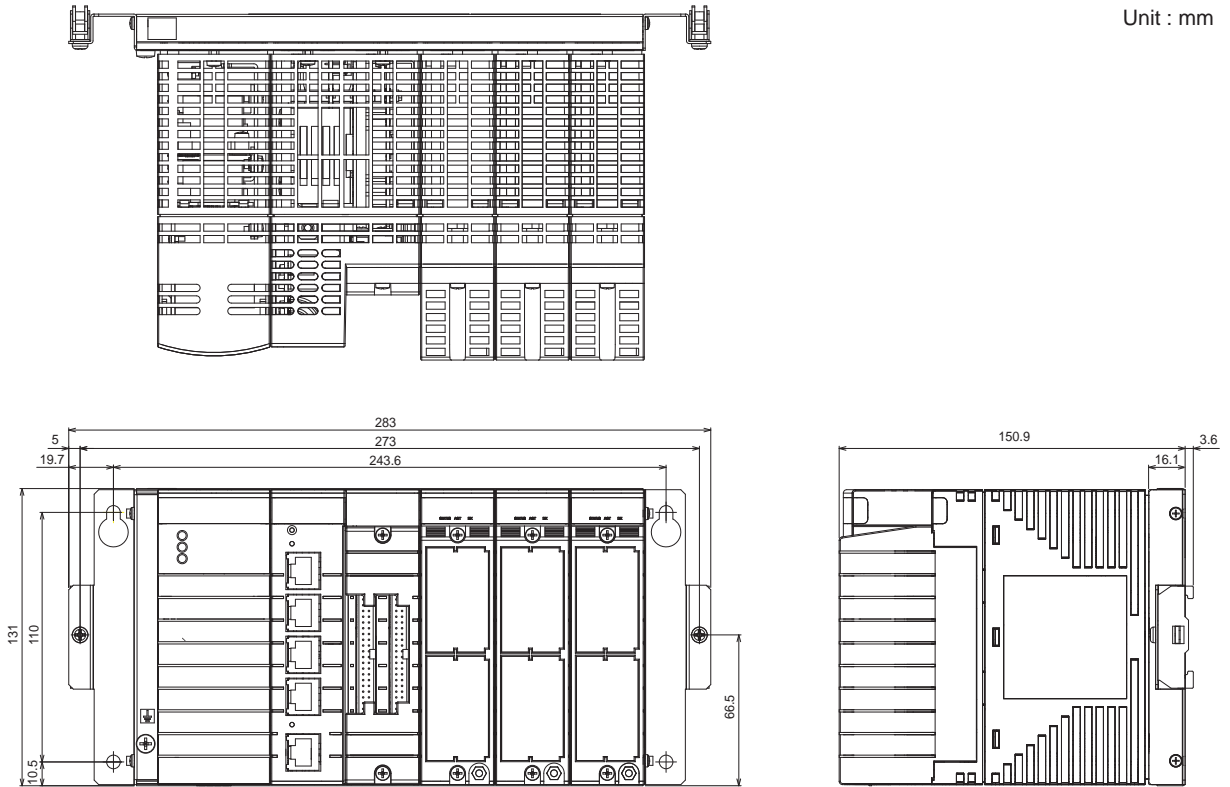


Figure Dimensions of DIN Rain-mounting FCN-RTU

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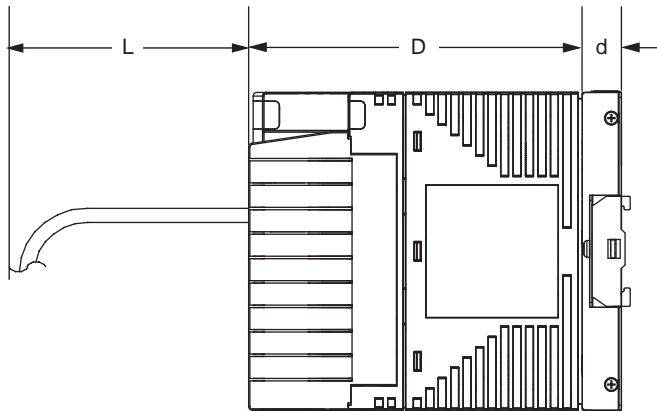
Depth Required for Installation Location

Installation of FCN-RTU requires enough cabinet depth for bends in cables to be connected in addition to the depth corresponding to the dimension from the rear of the base module to the other modules' front panels. $d+D+L$

The following table shows the data for estimating the required depth.

Table Module Depths

Module	Depth of Module	Depth Needed for Cable Bend (L)	Remarks
Base module	16.1 mm (d)	–	When mounted on a DIN rail
Power supply module	133.0 mm (D)	–	The power supply cable runs downward from the bottom.
CPU module	129.0 mm (D)	Add the larger radius of appropriate bends in Ethernet and RS cables where applicable.	Check the specifications of the cable(s) used.
Additional I/O module (with pressure clamp terminal block)	134.8 mm (D)	Add the radius of appropriate bends in signal cables.	Check the specifications of the cable(s) used.
Additional I/O module (with MIL connector cable)	94.0 mm (D)	Add the radius of appropriate bends in the MIL connector cable.	Check the specifications of the cable(s) used.
CANopen Communication Module	112.0 mm (D)	Add the radius of appropriate bends in signal cables.	Check the specifications of the cable(s) used.
PROFIBUS-DP Communication Module	112.0 mm (D)	Add the radius of appropriate bends in signal cables.	Check the specifications of the cable(s) used.



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Figure Estimating Depths Secured for Modules on DIN Rail-mounted Base Module

Precaution of Installing DIN Rails to Panel

DIN rail may be deformed due to the controller's weight and cable's tension.

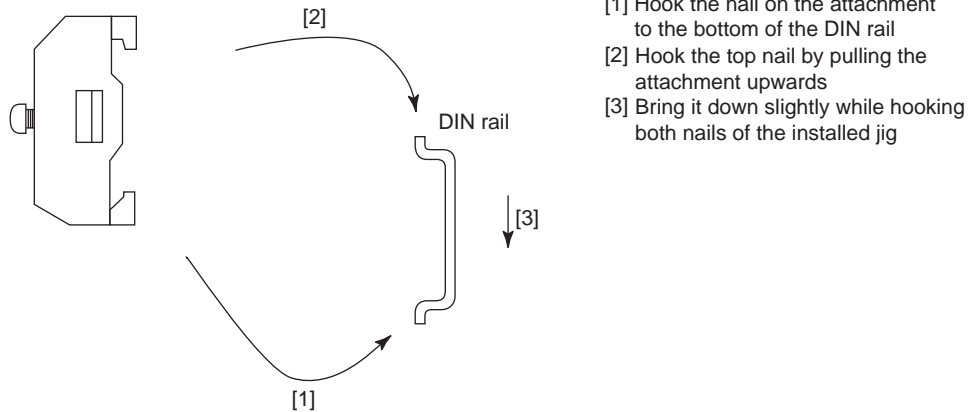
Please screw DIN rail to the panel in at least two positions where attachments on the back side (supplied DIN rail attachments) are placed.

Installing to DIN Rails

Follow the procedures below to install the base module to DIN rails.

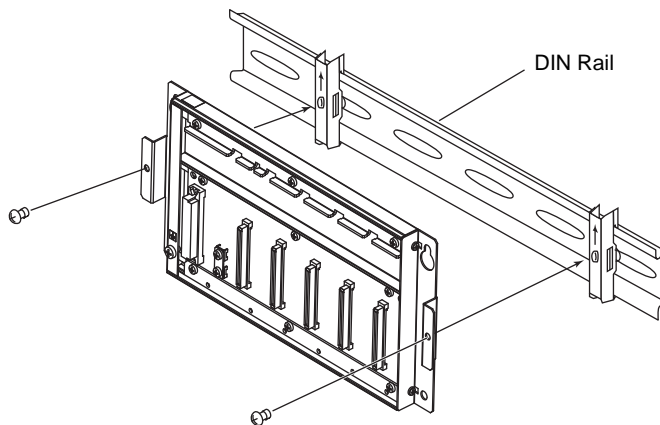
1. Snap the supplied DIN Rail Attachment to the DIN rail (See figure below)
Attach one on each side
2. Attach FCN-RTU by aligning the screws of the attachment to the installation holes on the left and right of FCN-RTU unit
3. Tighten the screws and secure FCN-RTU to the DIN rail

Supplied DIN rail attachment



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Figure Installing the Attachment to the DIN Rail



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Figure Installing the FCN-RTU Base Module on the DIN Rail

TIP

Use a DIN 60715, JIS C 2812, IEC 60715, and EN50022-compliant rail.

Confirm that the devices are firmly mounted after mounting when devices are mounted on the DIN rails.

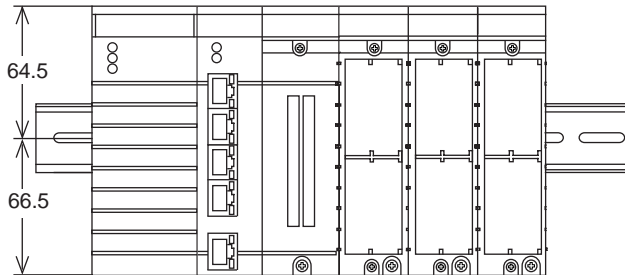
Install the modules to DIN rails while keeping the installation direction.



CAUTION

Pay attention not to drop nuts of the attachment to the DIN rail.

Reference



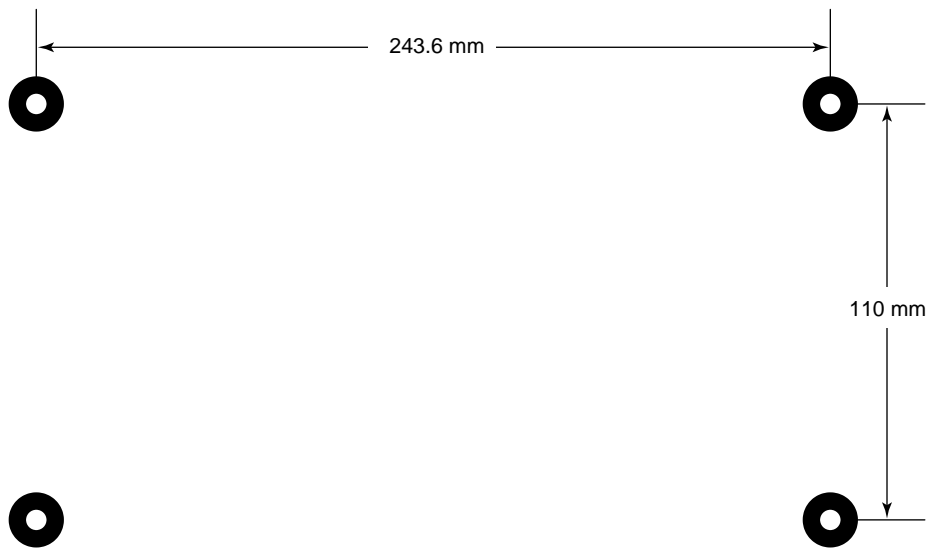
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Figure Dimensions of DIN Rail-mounted by NFBU050

Panel Installation Procedures

Follow the procedures below to install FCN-RTU to a panel.

1. Refer to the dimension diagram and create four holes to screw tapped M4 or M5 screws to a depth of 8 mm.
2. Secure the unit at four locations using the M4 or M5 screws.



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Figure FCN-RTU Installation Screw Hole Interval Dimension Diagram

Installing Modules

The following describes installation and removal procedures of modules to the base module.

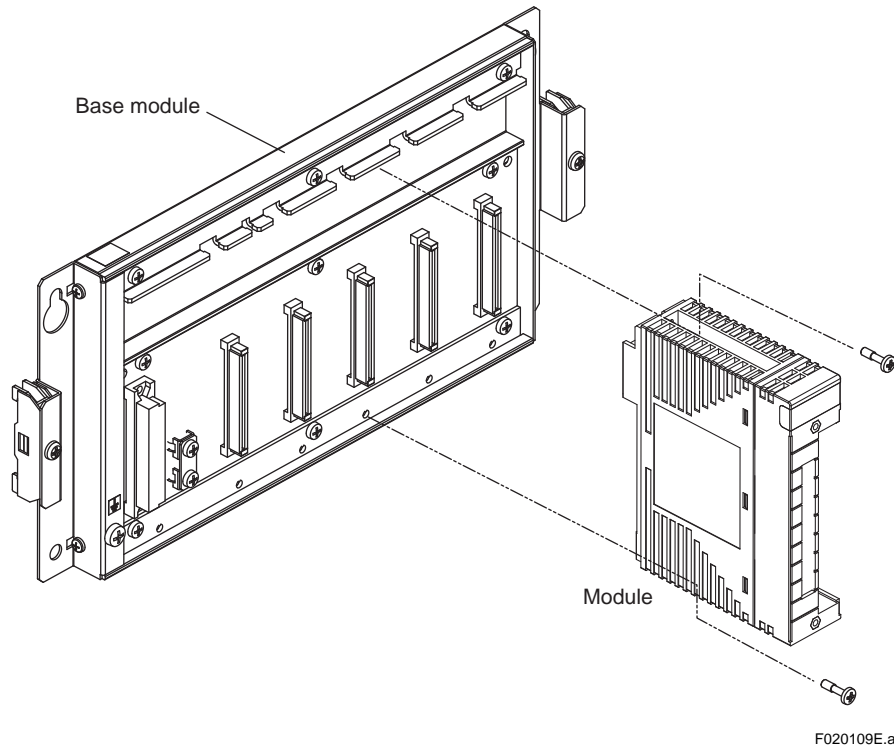


Figure Attaching Modules to the Base Module

Installation Procedures

1. Attach the module to the base module using screws.
2. Use a torque of approximately 0.5 Nm for the tightening torque of the screws.
3. Attach the external connection cables and terminal block.

Removal Procedures

1. Remove the external connection cables and terminal block.
2. Remove the screws that hold the module.
3. Pull out the module forward from the Base unit.

IMPORTANT

- Install I/O Module Dummy Covers (Model name: NFDCU01) on open I/O module slots.
 - Install Power Supply Module Dummy Covers (Model name: NFDCU02) on open power supply module slots.
-

Installing Other Modules on to the Base Module

This section describes the procedure for installing the power supply, CPU, and additional I/O modules onto a base module.

IMPORTANT

It is necessary to configure a base module before installing each module. For setting procedures of a base module, refer to A2.2, "Base Module (NFBU050)" in "FCN/FCJ Guide (IM 34P02Q01-01E)".

Installation Position of Each Module

This section describes the positioning of the modules during installation to the base module.

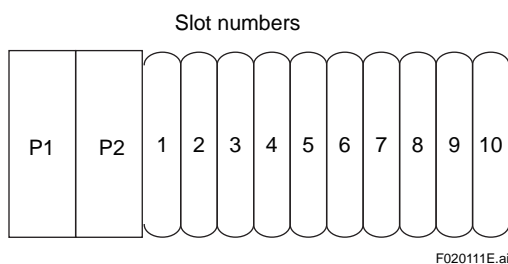


Figure Module Slot Numbers (NFBU200)

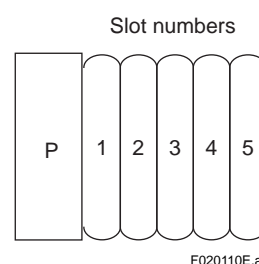


Figure Module Slot Numbers (NFBU050)

Table Installation Position Allowed for Each Module in FCN-RTU with Single Power Supply (NFBU200)

Module	Allowed position	Remarks
Power supply module	P1 or P2	Normally installed into P2.
CPU module	Slot 1 and 2	Occupies 2 slots per module.
Additional I/O module	Slot 3 to 10	(*1)

Table Installation Position Allowed for Each Module in FCN-RTU with Duplex Power Supply (NFBU200)

Module	Allowed position	Remarks
Power supply module	P1 and P2	
CPU module	Slot 1 and 2	Occupies 2 slots per module.
Additional I/O module	Slot 3 to 10	(*1)

Table Installation Position Allowed for Each Module in FCN-RTU (NFBU050)

Module	Allowed position	Remarks
Power supply module	P	
CPU module	Slot 1 and 2	Occupies 2 slots per module.
Additional I/O module	Slot 3 to 5	(*1)

*1: Some I/O modules have limits for the installation. For details, see the next page.

Restrictions and Precautions on Installation

Autonomous controller FCN-RTU supports the following I/O modules and communication module for up to three in the free slots.

Analog I/O Modules

- NFAI141
- NFAI841
- NFAT141
- NFAI835
- NFAV141
- NFAB841
- NFAR181
- NFAP135

Digital I/O Modules

- NFDV151
- NFDV551

Communication Modules

- NFLC121
- NFLF111
- NFLP121

Limitations of Installation for NFAT141

(the combination of Thermocouple input and Pressure clamp terminal)

To keep the cold junction compensation accuracy (GS 34P02Q31-01E), make sure to meet the following conditions. The pressure clamp terminal should not be affected by radiated heat.

- Do not install a heat-radiating unit beneath the NFAT141 installed unit.
- Do not install NFAT141 in a place where airflow impinges directly.
- Do not install NFAT141 next to the CPU modules (NFCP050), power supply modules (NFPW426).
- The installable modules next to the NFAT141 are as follows. When installing other than following I/O modules, make an empty slot (one or more) in each side.

Installable modules: NFAT141, NFAR181, NFAV141

Limitations of Installation for I/O Modules

When installing I/O modules, ensure that total power consumption does not exceed the rated power output of the power supply module. For each I/O module power consumption (5 V DC and 24 V DC), refer to the applicable general specifications.

Examples:

- The digital I/O module NFDV551 needs to be checked for current consumption of 5 V DC.
- Only one of the analog I/O modules NFAI141, NFAI841, NFAB841, NFAI835 and NFAP135 can be installed for current consumption both of 5 V DC and 24 V DC.

2.2 FCN-RTU Power Supply Equipment

Proper power equipment must be used for stable system operation. This section describes the following:

- Power supply system
- Supplied Power Source
- Field power supply specifications
- Grounding

2.2.1 Power Supply System

This section describes the power supply system for FCN-RTU.

System Separation

Power supply system for FCN-RTU should be separated from other systems. For example, the power supply system for the I/O signal circuit should be isolated by an insulation transformer.

Installation of Breakers, Switches, etc.

Power supply module for FCN-RTU has no switch. An external breaker or an external switch should be installed for maintenance and safety.

IMPORTANT

To conform the power supply system for FCN-RTU to the safety standards, use a safety standard compliant breaker or switch.

2.2.2 Supplied Power Source

The following items must be considered for stable FCN-RTU operation.

Inrush Current

An input current much larger than normal will flow when the power supply is turned on. Refer to the specification of the power supply module for inrush currents to each power supply module. Make sure that the supplied power and protection devices can withstand this inrush current.

TIP

The peak values and waveforms of the current are affected by the impedance of the input system. These change depending on the system structure (when comprised of multiple devices) and the power supply line condition. Generally, the inrush current when the system is comprised of multiple devices will be less than the total sum of the inrush current of each device.

Power Consumption Guidelines

Table Current Consumption of NFCP050 (without analog field power supply for built-in AO)

		NETWORK (Ethernet)	
		not used	used
SERIAL+ DI/O+AI/O (built-in I/Os: DI, DO, AI, AO, PI)	not used	0.26 A	0.39 A
	used	0.35 A	0.48 A

Output Capacity

The output capacity of the power supply device is determined by calculating the maximum electric power of the system, but the peak value of the current will be 2 to 5 times more of the effective value. The effects and inrush current by this current waveform, as well as excess for future device expansion must be carefully considered.

Power Consumption Calculation

Refer to the power supply module specification for the maximum value of the power consumption. Take consideration of the expansion and changes of devices. In general, the maximum value should be used.

SEE ALSO

For the specification requirements for power supply modules, see General Specifications - FCN-RTU Low Power Autonomous Controller Hardware, GS 34P02Q13-01E.

The actual power consumption varies depending on how many of which modules are installed.

Estimating modules that can be installed and operate

- The maximum current consumption of a unit at 5 V DC ($I_{MAX@5VDC}$) and at 24 V DC ($I_{MAX@24VDC}$) can be obtained by the following equations respectively:

$$I_{MAX@5VDC} = I_{BASE@5VDC} + I_{CPU@5VDC} + I_{I/O@5VDC}$$

$$I_{MAX@24VDC} = I_{I/O@24VDC}$$

(Base module and CPU module make no current consumption at 24 V DC)

where

I_{BASE} = current consumption of the base module (NFBU050)

$I_{CPU} (*1)$ = current consumption of the CPU module (NFPCP050)

I_{IO} = current consumption of the additional input/output modules installed

*1: Current consumption of NFPCP050 (without analog field power supply for built-in AO) in the table shown above

- Total power consumption must meet the specification of the power supply module.

Estimating power that is supplied to the unit

- The power consumption of a unit, Q (W), can then be obtained by the following equation:

$$Q = (5.1 \times I_{MAX@5VDC} + 24 \times I_{MAX@24VDC}) / 0.8$$

Example

Estimating power consumption for an unit consisting of NFPW426, NFBU050, NFPCP050 (using all serial ports, the active network interface and all built-in I/Os), NFAI841, NFDV151 and NFDV551.

- Power consumption at 5 V DC, $Q_{@5VDC}$ (W), can be obtained by the following equation:

$$Q_{@5VDC} = 5.1 \times (I_{NFBU050} + I_{NFPCP050} + I_{NFAI841@5VDC} + I_{NFDV151} + I_{NFDV551}) = 10.3$$

where

$$I_{NFBU050} = 0.025 \text{ (A)}$$

$$I_{NFPCP050} = 0.48 \text{ (A)}$$

$$I_{NFAI841@5VDC} = 0.31 \text{ (A)}$$

$$I_{NFDV151} = 0.5 \text{ (A)}$$

$$I_{NFDV551} = 0.7 \text{ (A)}$$

- Power consumption at 24 V DC, $Q_{@24VDC}$ (W), can be obtained by the following equation:

$$Q_{@24VDC} = 24 \times I_{NFAI841@24VDC} = 12$$

where

$$I_{NFAI841@24VDC} = 0.5 \text{ (A)}$$

- As the maximum allowable power of NFPW426 at 5 V DC is 12 W and the maximum power at 24 V DC is 13 W, the system of configuration shown above can be operated.

Estimating power that is supplied to unit

- The power that is to be supplied to power supply module, Q (W), can be obtained by the following equation:

$$Q = (10.3 + 12) / 0.8 = 27.9$$

thus

$$\text{Regular current consumption at 12 V DC input} = 2.4 \text{ (A)}$$

$$\text{Regular current consumption at 24 V DC input} = 1.2 \text{ (A)}$$



CAUTION

- When a power failure is detected, the control stops for a while even after recovery from the power failure before restarting.
- To avoid these problems, please use uninterruptible power supply(UPS) for power supply.

2.2.3 Field Power Supply

Some I/O modules require field power supply (24V DC). NFPW426 supports 24 V DC output for this requirement.

The following I/O modules require field power supply.

Analog I/O Module

- NFAI141 Current input, 16 points, non-isolated (*1)
- NFAI841 Current I/O, 8/8 points, non-isolated
- NFAB841 Voltage input/current output, 8/8 points, non-isolated
- NFAI835 Current input/current output, 4/4 points, individually isolated
- NFAP135 Pulse input, 8 points, individually isolated

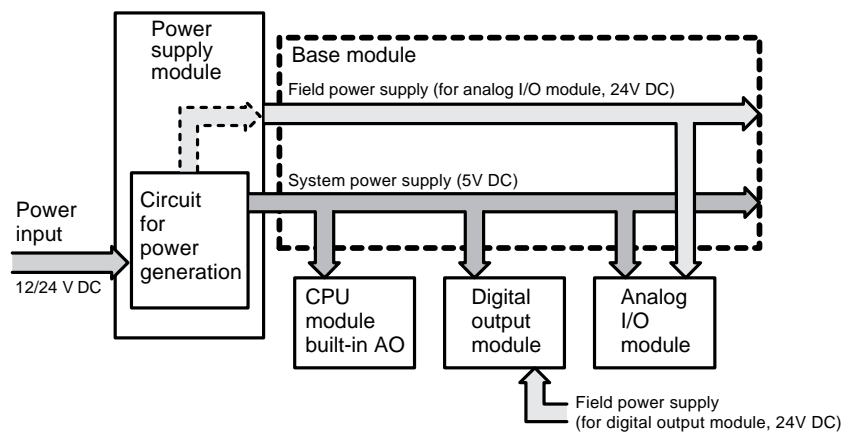
*1: When this I/O module is used with 2-wire transmitter, the I/O module requires the field power supply.

Digital Output Module

- NFDV551 Digital output, 32 points

IMPORTANT

Analog I/O modules and digital I/O modules require different field power supply systems.



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Figure Field Power Supply and System Power Supply

Field Power Supply for Analog I/O Modules

Field power supply for analog I/O modules is supplied to each analog I/O module via base modules.

IMPORTANT

- Supply the appropriate power by calculating the 24 V DC current consumption based on the specification of each I/O module. However, the power supply must be within the range of the power supply module specification.
 - The I/O module terminal voltage is lower than the supplied voltage of the power supply module terminal. Adjust the supply voltage so as to match the specification of the field devices to be connected, taking the lowered voltage into consideration (see the specification of each module).
-

Field Power Supply for Digital Output Modules

Field power supply for digital output modules is supplied field power directly to each terminal of the module. Supply the appropriate power by calculating the 24 V DC current consumption based on the specification of each module.

TIP

Power is supplied by using different power supply systems between analog system and digital system to avoid interferences such as noises. When every 16 points are isolated among digital output signals, the power supply must also be isolated.

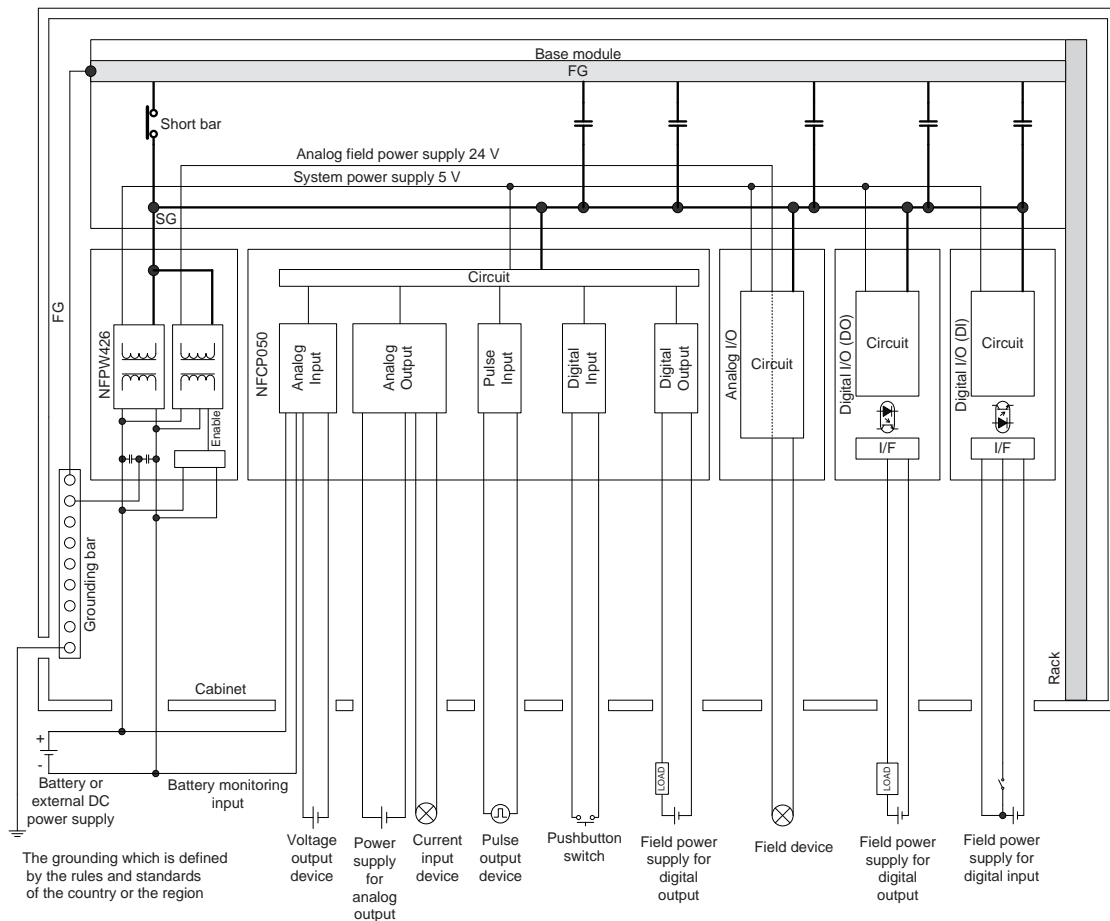
2.2.4 Grounding for FCN-RTU

When FCN-RTU is installed in a cabinet, instrument panel, or the like, it is insulated by a DIN rail attachment. To maintain this insulation, the following instructions must be followed.

- Ground FCN-RTU separately from the grounding of other devices, motor control circuits, and electric control circuits.
- Perform the grounding which is defined by the rules and standards of the country or the region on the FG terminal of the base module.
- Perform the grounding which is defined by the rules and standards of the country or the region on the G terminal of the power supply module (line filter grounding).
- Perform the grounding of the base module and the power supply module at one point.

**SEE
ALSO**

For the specification of the grounding wire, see 2.3.2, "Wiring the Ground".



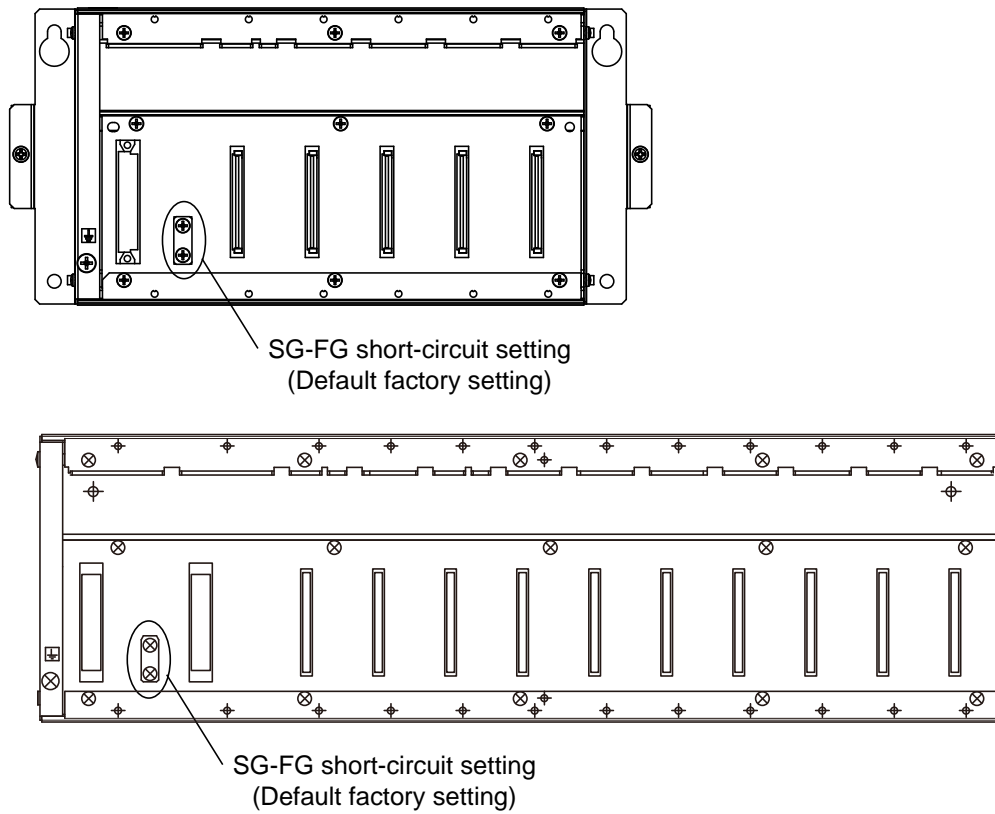
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Figure Systematic Drawing of FCN-RTU Power Supply/Grounding

SG-FG Short-Circuit Setting

SG (Signal Ground) and FG (Frame Ground) are connected by a short bar on two terminals (TM1 and TM2, from top) of base module (default factory setting).

According to system requirement, SG and FG could be separated removing the short bar (see the figure shown below).



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Figure SG-FG Short-circuit Setting

2.3 Wiring (FCN-RTU)

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



CAUTION

Do not bend or press the power cable or the signal cable if the ambient temperature is minus 20 degrees Celsius or below.

2.3.1 Power Supply Wiring (FCN-RTU)

The following describes the power supply wiring for a power supply module that has finished being installed.

Wiring Specification and Terminal Preparation

For the wire terminals, use crimp terminal lugs with insulation sleeve. Be sure to use ring tongue terminal and crimping tools of the same brand.

Applicable Cables

Insulated cables for industrial equipment such as;

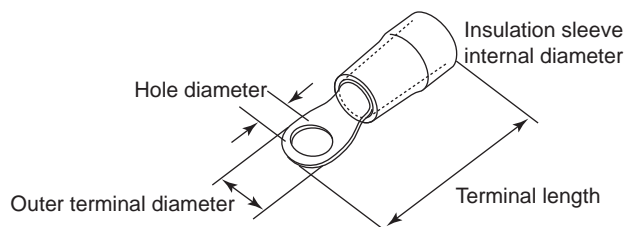
- 600 V polyvinyl chloride insulated wires (IV); JIS C3307
- Polyvinyl chloride insulated wires for electrical apparatus (KIV); JIS C3316
- 600 V grade heat-resistant polyvinyl chloride insulated wires (HIV); JIS C3317
- Heatproof vinyl insulated wires VW-1 (UL1015/UL1007)

Recommend Sizes

0.5 mm² to 2 mm² (AWG 20 to 14)

Terminal Preparation

Use ring tongue terminal for M4 terminals, with the outer diameter of the lug tip (outer terminal diameter) not exceeding 8.5 mm, and with an insulation sleeve.



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Figure Ring Tongue Terminal

Table Example of Ring Tongue Terminal Specification

Conductor nominal cross-sectional area (mm ²)	Screw used (mm)	Hole diameter (mm)	Outer terminal diameter (mm)	Terminal length (mm)	Insulation sleeve internal diameter (mm)
0.5 to 1.65 (AWG 20 to 16)	4	4.3 or more	8.0 or less	Approx. 20.0	3.6 or larger
1.04 to 2.63 (AWG 16 to 14)	4	4.3 or more	8.5 or less	Approx. 21.0	4.3 or larger

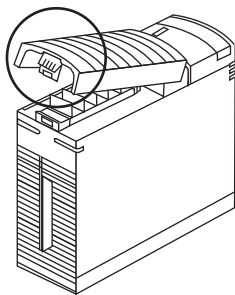
Connecting Power Supply

Follow the procedures below to connect the power supply cable.

- Detach the protective cover for the terminals on the power supply module as follows:
 - You will find a locking tab at the bottom of the protective cover (circled area in figure). Push the lock up to unlock the tab.
 - Pull gently to remove the cover.
- Connect the power cable to the terminals labeled 4 (+) and 5 (-). If field power supply is necessary, connect a cable to terminals according to the silk screen-printed diagram labeled FLD ENA. Tighten the terminal screws (Phillips head M4) at a torque of 1.2 Nm.
- Connect the grounding cable to the terminal labeled 3 (\perp).
- Replace the protective cover on the power supply connection terminal after wiring is completed.

IMPORTANT

- It is recommended to install a switch or circuit breaker on the power wiring so that the power can be turned on and off individually during maintenance.
- It is also recommended to install a noise filter to improve power supply quality.



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Figure Locking Tab of Protective Terminal Cover

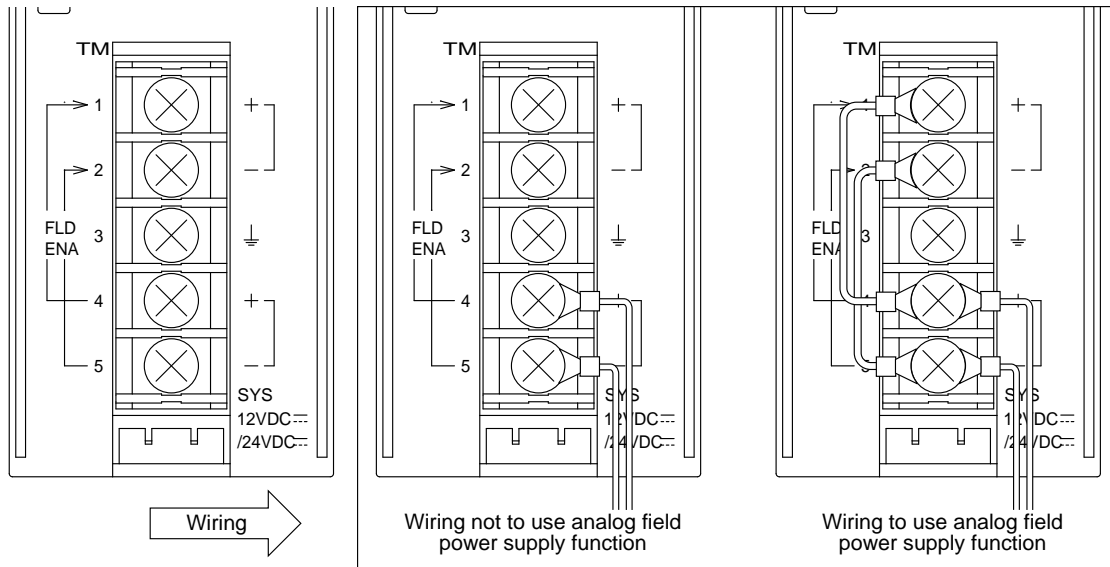


Figure Examples of Wiring

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2.3.2 Wiring the Ground (FCN-RTU)

Grounding must be applied to the grounding system which is defined by the rules and standards of the country or the region.

IMPORTANT

Connect the ground cable to the dedicated ground terminal specified by the equipment.

To avoid electric shocks and minimize the influences of external noise, FCN-RTU 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.

Applicable Cables

Insulated cables for industrial equipment such as;

- 600 V polyvinyl chloride insulated wires (IV); JIS C3307
- Polyvinyl chloride insulated wires for electrical apparatus (KIV); JIS C3316
- 600 V grade heat-resistant polyvinyl chloride insulated wires (HIV); JIS C3317
- Heatproof vinyl insulated wires VW-1 (UL1015/UL1007)

Recommend Sizes

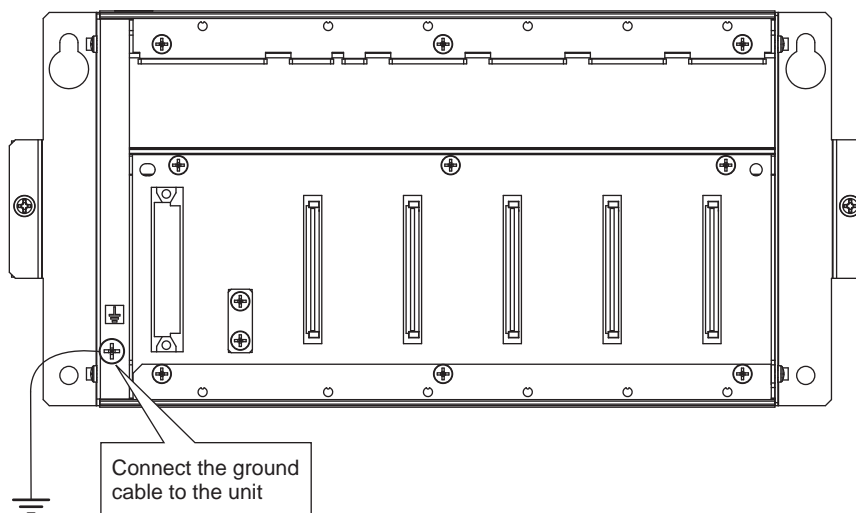
2.0 mm² to 2.6 mm² (AWG 14 to 13)

Terminal Preparation

Round crimping terminal M4: External dimensions must be within 8.5 mm with insulation covers. The material of the tongue terminal for protection grounding needs to be tin-plated.

Cable Connection

Connect the ground cable to the FG terminal (M4 screws) on the bottom left of the base module. Secure the M4 screws at a tightening torque of 1.2 Nm.



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Figure Grounding FCN-RTU Base Module

2.3.3 Connecting the Signal Cable (FCN-RTU)

The signal cable can be connected to CPU module built-in I/O interfaces using MIL connectors.

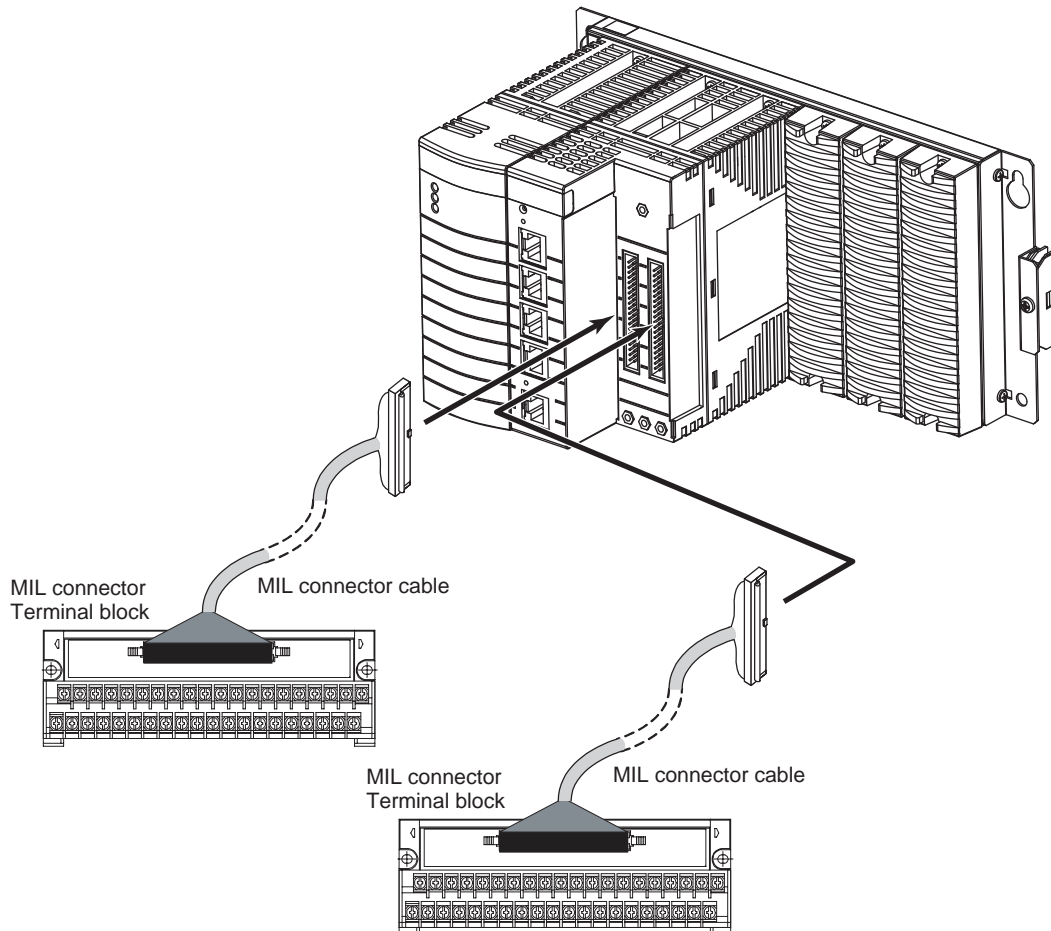
**SEE
ALSO**

For connection to additional I/O modules, see 1.3.3, "Connecting the Signal Cable (FCN)."

Connection

Using two sets of external MIL Connector Terminal Blocks (TAS40) and MIL Connector Cable (KMS40), field signals are connected to built-in I/Os of CPU module. (Refer to the following figures.)

1. Remove connector cover attached to main body.
2. Attach two MIL connector cables in the correct direction.
3. Connect shield line of MIL connector cable with FG terminal of under built-in I/O's connector. (See "Figure Connecting Shield Lines of MIL Connector Cables.")
4. Attach connector cover up on, so MIL Connector Cables are fixed.



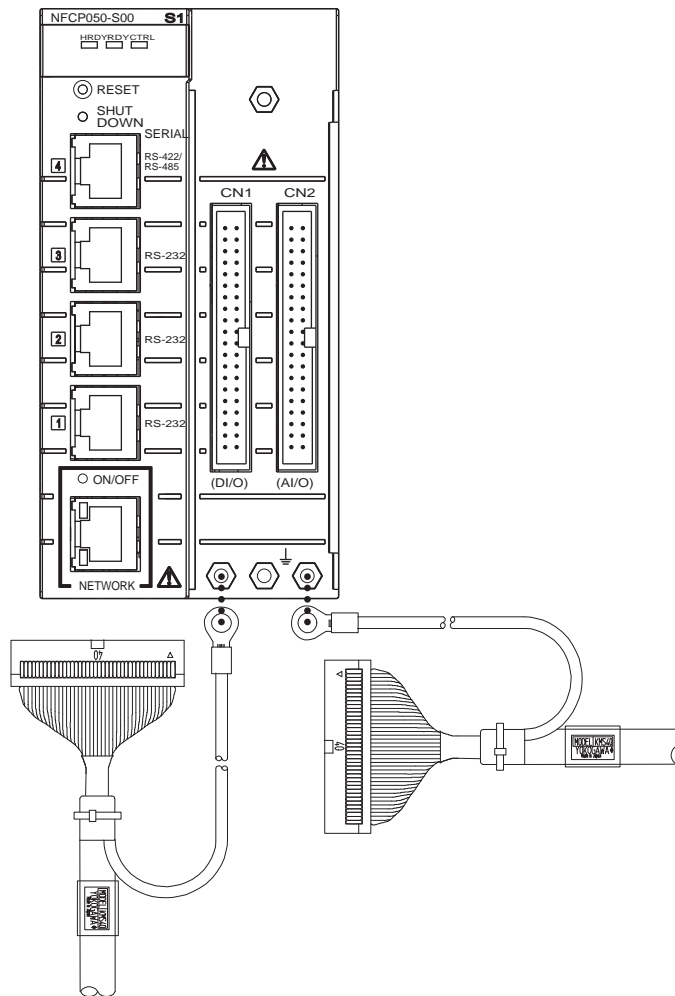
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Figure Attaching MIL Connector Cables

Grounding Signal Cable Shields

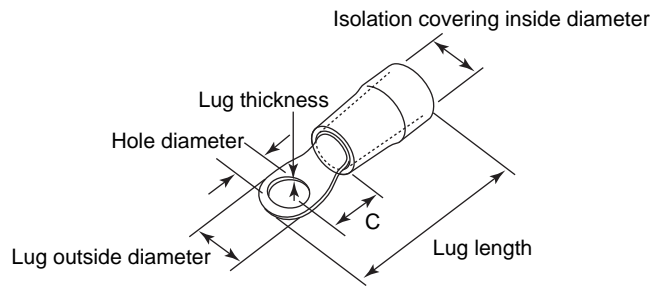
When using shielded cable for signal wiring, ground the cable shields as follows:

- Provide a grounding bar for shield ground (at the same electric potential with the system ground), and connect the cable shields to it.
- For each MIL connector cable, fix the terminal of the shield wire as shown below.



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Figure Grounding Shield Wire of MIL Connector Cable



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Figure Solderless Lug**Table Solderless Lug Dimensions**

Nominal cross sectional area	Screw used (mm)	Hole diameter (mm)	Lug outside diameter (mm)	Lug length (mm)	Isolation covering inside diameter (mm)	Dimension "C" (mm)	Lug thickness (mm)
1.25 mm ²	3	3.2 or more	8 or less	–	–	5.5 or more	1 or less

2.3.4 Communication Cables (FCN-RTU)

Control Network

Connect the control network cable to the connector in the front of the CPU module. Use cables that comply with the 100BASE-TX standard.

IMPORTANT

When not using the Network Interface, leave the connector cover for dust protection on to prevent any damage to the connector.

RS-232-C Communication Cable

Cable Connection

If the RS-232 communication ports of the CPU module are used, prepare the RJ45 connector cables.

Table Pin Assignment of RS-232 Serial Ports

RJ45 Pin No.	RS-232 Signal Name	Conversion to D-sub Connector	
		D-sub 9pin Male (Straight Cable)	D-sub 9pin Female (Crossover Cable)
1	DCD (Data Carrier Detect)	1	1
2	DSR (Data Set Ready)	6	4
3	RXD (Received Data)	2	3
4	RTS (Request To Send)	7	8
5	TXD (Transmitted Data)	3	2
6	CTS (Clear To Send)	8	7
7	DTR (Data Terminal Ready)	4	6
8	GND (Common Ground)	5	5

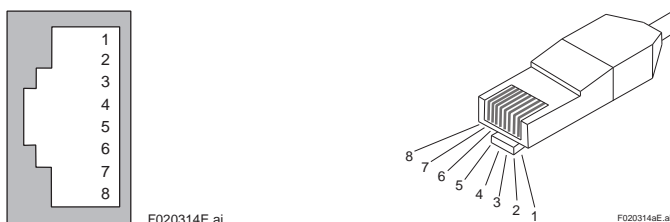
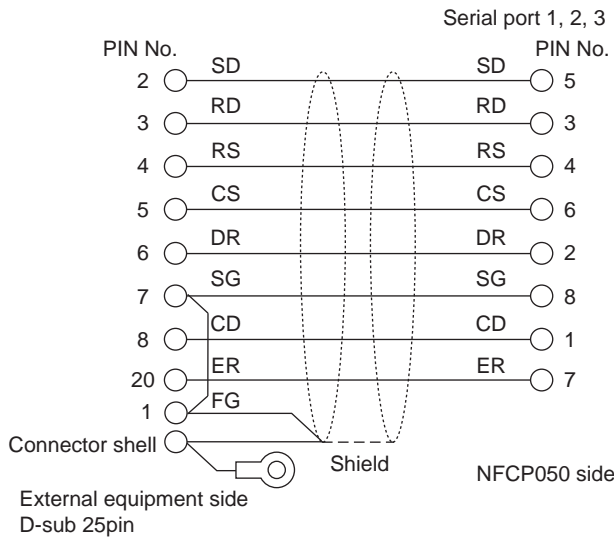


Figure Front View of RJ45 Jack / View of RJ45 Plug for RS-232 Serial Ports

TIP

By default factory setting, flow controls are disabled. Flow controls can be enabled by editing "COM Port Setting File" on "FCX Maintenance Menu."

For more information, refer to the Help of "FCX Maintenance Menu."



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Figure Internal Connection of the RS-232 Communication Cable

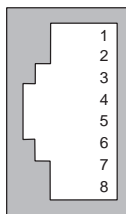
RS-422/RS-485 Communication Cable of CPU Module

Cable Connection

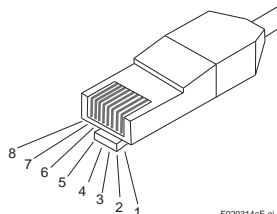
If the RS-422/RS-485 communication port of the CPU module is used, prepare the RJ45 connector cable.

Table Pin Assignment of RS-422/RS-485 Serial Port

RJ45 Pin No.	Half Duplex (2-wire)	Full Duplex (4-wire)
1	DATA+	TX+
2	DATA-	TX-
3		RX+
4		
5		
6		RX-
7		
8	GND	GND

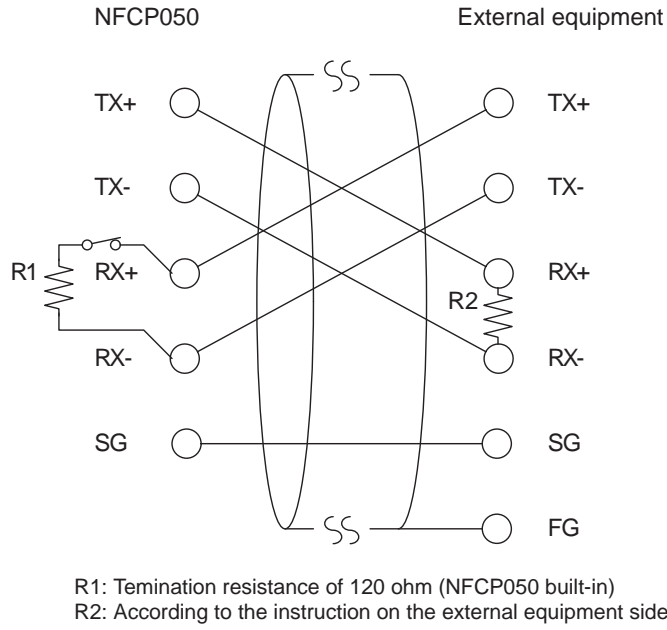


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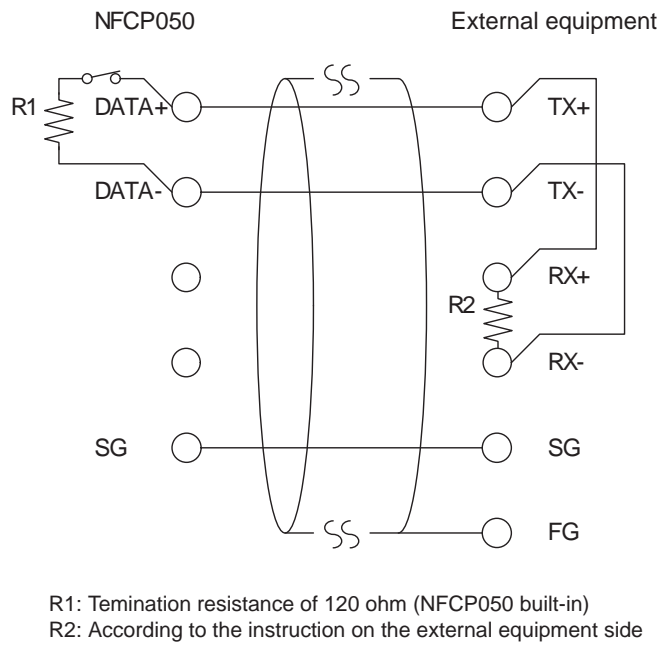
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Figure Front View of RJ45 Jack / View of RJ45 Plug for RS-422/RS-485 Serial Port



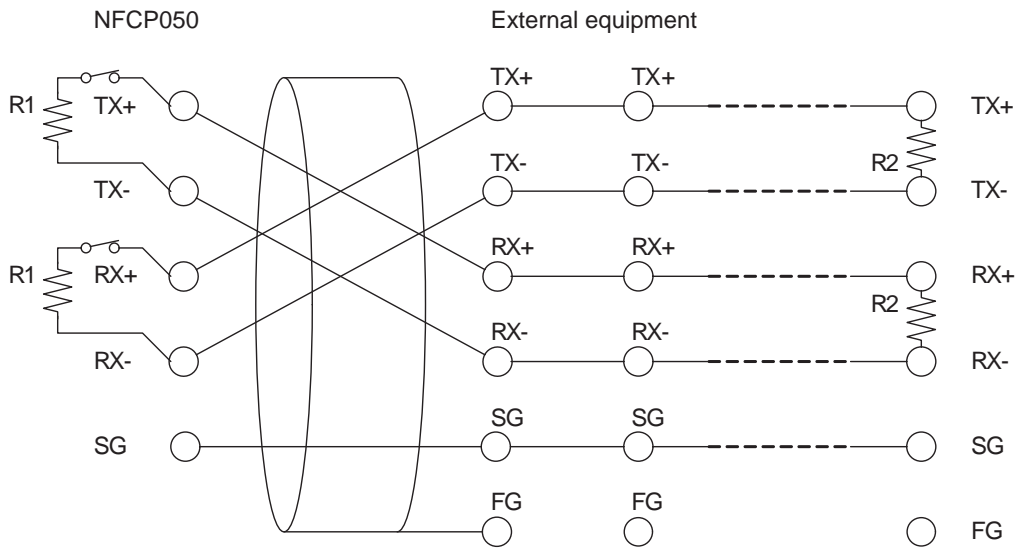
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Figure 1 to 1 Connection in 4-wire Type (RS-422/RS-485)



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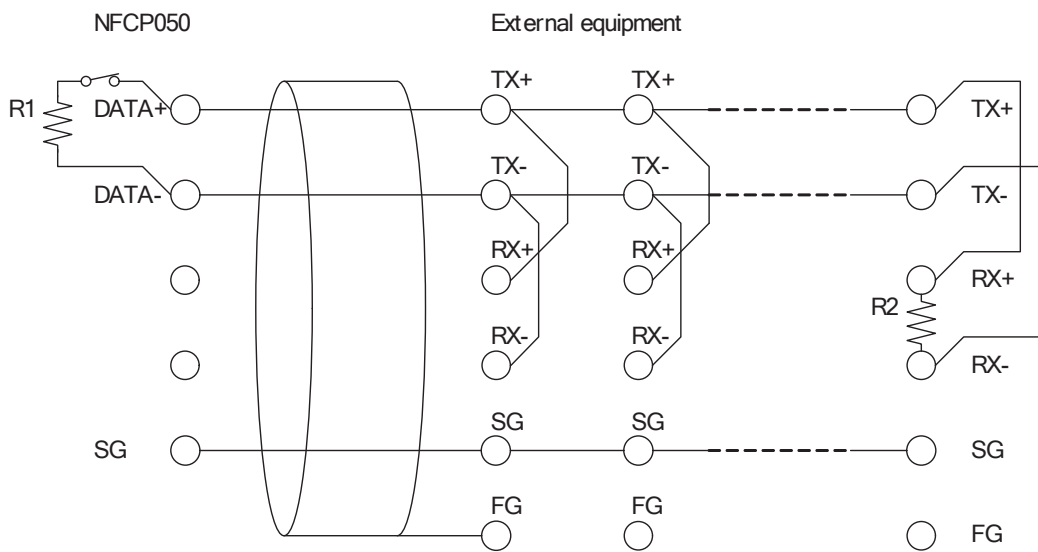
Figure 1 to 1 Connection in 2-wire Type (RS-422/RS-485)



R1: Termination resistance of 120 ohm (NFCP050 built-in)
 R2: According to the instruction on the external equipment side

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Figure 1 to n Connection in 4-wire Type (RS-485)



R1: Termination resistance of 120 ohm (NFCP050 built-in)
 R2: According to the instruction on the external equipment side

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Figure 1 to n Connection in 2-wire Type (RS-485)

Communication Cables (FCN-RTU)

The communication cable in the table below.

Table Adaptive Cable of Communication Interface

Module	CPU module NFCP050		
Port name/ Number of Ports	Control network Interface (10BASE-T or 100BASE- TX) x 1	Serial port (RS-232-C) x 3	Serial port (RS485) x 1
Isolation	Isolated	Non-Isolated	Isolated
Connector	RJ-45	RJ-45	RJ-45
Cable	Network cable • 100BASE-TX : UTP (Category 5) • 10BASE-T : UTP (Category 3)	RS-232-C Communication cable	RS-422/485 Communication cable
Commercial cable	Available	Non (The cable must be made by the user.)	Non (The cable must be made by the user.)
Notes of Wiring	—	—	Perform functional grounding on the FG line and shielding of cable in external equipment side.
Wiring cable	—	—	Shielded twisted pair cable
Recommended cable	Network cable (Category 5)	—	—

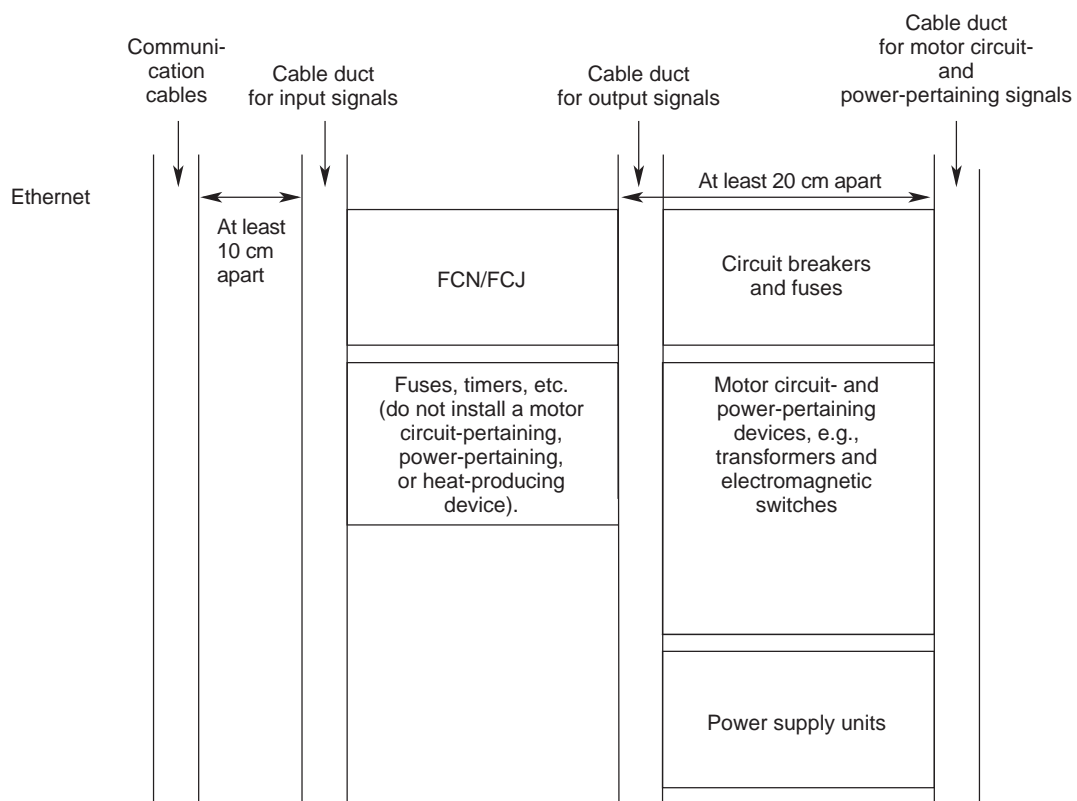
3. Common Guide

3.1 Considerations on Environment inside Cabinet or Panel

Arrangement

When determining the internal arrangement of the cabinet or panel in which the FCN(s) is to be installed, ensure that operability and maintainability will not be compromised and take the following environmental concerns into consideration.

Shown below is an example of recommended arrangements.

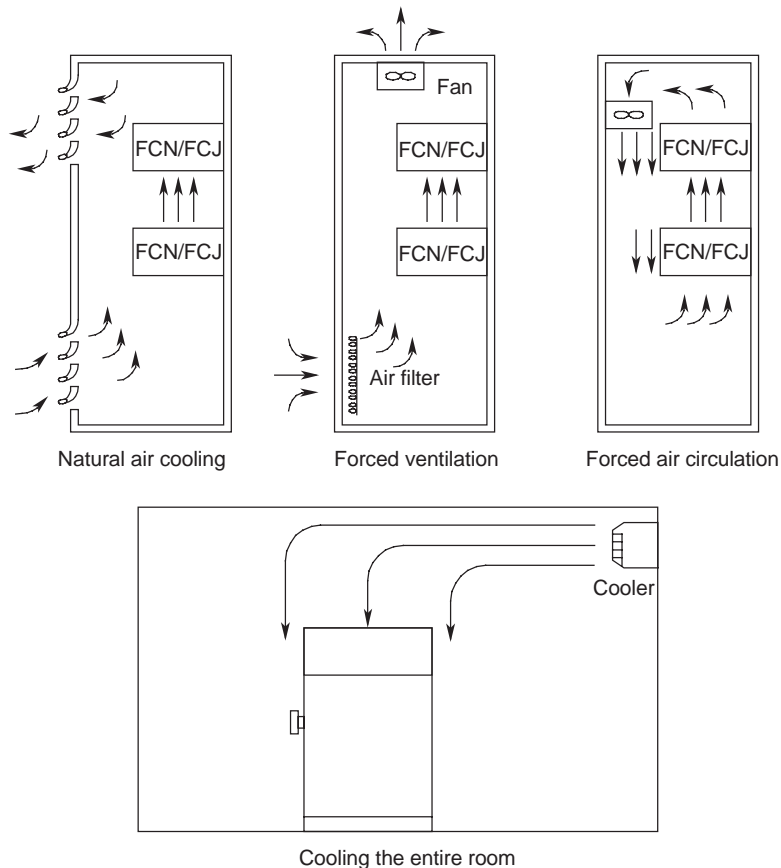


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Figure Example of Recommended Cabinet/Panel Internal Arrangement

Considerations on Temperature

- Provide adequate ventilation to release heat to the outside.
- Avoid installing a high heat-producing device right above an FCN.
- Cool down FCN with forced ventilation or cooler when temperature beneath modules is above 55°C, devise cooling by, for example, installing forced ventilation or circulation fans or a cooler. Since a failure of a fan or cooler will affect the system, consider a backup system such as a temperature sensor in the cabinet/panel that occur an alarm in case of failure. Conversely, if the temperature is lower than 0°C when starting the system such as in a cold climate, install a low-power space heater or lamp to provide preheating before a start. Examples of cooling methods are shown below.



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Figure Methods for Cooling Cabinet or Panel

Considerations on Humidity

Condensation may be caused by a rapid change in temperature after start or stop of heating or cooling. Condensation occurring on a circuit board may cause a short circuit, resulting in a malfunction. If condensation may occur, leave the power on at all times or continuously preheat inside the cabinet or panel with a space heater or the like.

Considerations on Vibrations and Shocks

- Restrain vibrations and shocks applied to an FCN from the outside within the specified limits by insulating the cabinet or panel from vibration and shock generating sources or fixing the cabinet or panel with rubber isolators.
- For shocks and vibrations generated by devices such as electromagnetic switches operating inside the cabinet or panel, restrain the shocks and vibrations applied to an FCN within the specified limits by taking measures such as fixing those devices with rubber isolators.

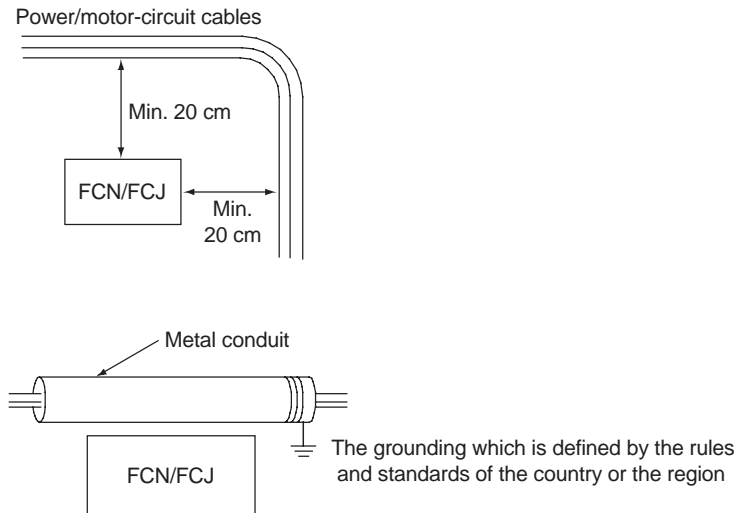
Considerations on Atmosphere

Where a large amount dust is suspended in the atmosphere, prevent the entry of suspended dust by, for example, using a cabinet or panel with an airtight structure, or purging clean air to the inside of the cabinet or panel to keep the internal pressure slightly higher than the atmosphere.

3.2 Considerations on Noise

Isolation from Power and Motor-circuit Cables

Lay any power or motor-circuit cable at least 20 cm away from all signal cables connected to any FCN. Should this be impossible, run the power or motor-circuit cables all the way through a metal conduit that is grounded protective grounding system.

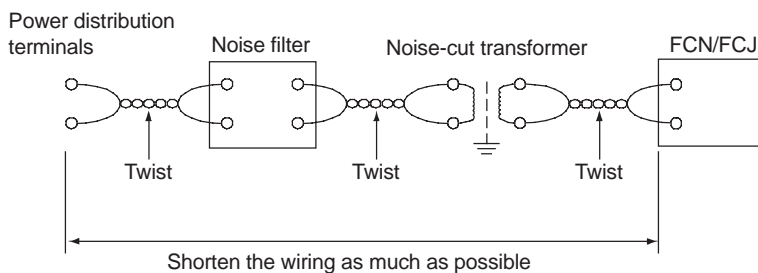


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Figure Isolation from Power and Motor-circuit Cables

Antinoise Measures for Power Supply Module/Circuit

- Twist the power supply wires and minimize the wiring length.
- Both the power supply modules in an FCN incorporate a noise filter and hence have ample immunity to the level of noise likely to occur in generic applications. However, for use in an environment under especially high noise levels, it is recommended to interpose a noise filter or noise-cut transformer in series with the power wiring.



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Figure Examples of Antinoise Measures for Power Supply Module/Circuit

Antinoise Measures for Analog Input/Output and Communication Signals

Signal wires connected to analog modules carry minute and/or fast signals and so do communication wires. Lay these wires in a separate duct at least 10 cm away from other input/output wires. Especially for an analog signal, it is difficult to distinguish noise from the signal in nature and noise interposed in the signal results in an error through analog-to-digital conversion. To avoid this, carefully lay analog signal and communication wires away from sources of noise to prevent noise from interposing and/or interpose a filter (such as an electric filter or software filter) to attenuate noise.

IMPORTANT

Be sure to use specified cables and take extra special care with grounding and cable/wire runs.

SEE ALSO For details about cables, see Section 1.3, "Wiring (FCN-500)" or Section 2.3, "Wiring (FCN-RTU)," as appropriate.

Antinoise Measures for Electric Control Input/Output Signals

- Lay AC control input/output wires separately from the DC control input/output wires. If this is impossible, use shielded cables individually.
- Lay output signal wires that carry large currents, separately from other input/output wires. If this is impossible, use shielded cables for those wires that carry large currents.
- Where an inductive load is connected to an input or output of an FCN, install a surge killer or a diode near the inductive load.

IMPORTANT

In an area where lightning often occurs, install protective devices such as surge arresters.

3.3 Requirements for External Cable Laying

For the laying of signal, power, and motor-circuit cables, it is recommended to lay them in such a way that the following requirements are met.

Cable Separation

When laying cables, keep cables that are likely to be a noise-generating source, such as motor-circuit and power cables, at least 15 cm away from any cable that is likely to be affected by noise, as shown in the figure below. If a distance of 15 cm or more cannot be secured, insert a separator to isolate them from each other.

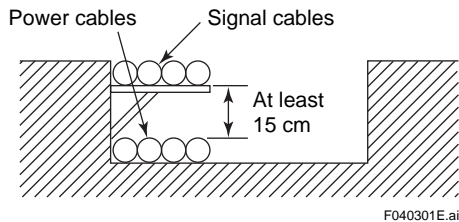


Figure Separation with Cable Rack

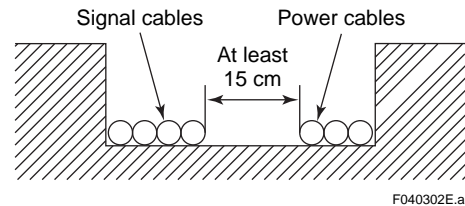


Figure Separation in Parallel Runs

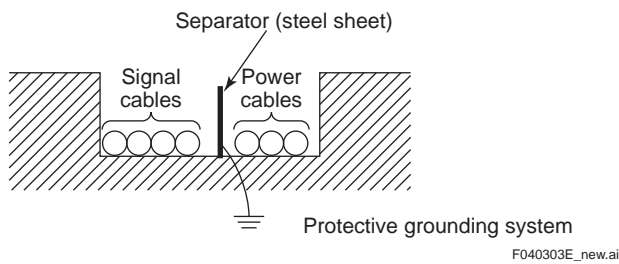


Figure Separation with Separator

Perpendicular Crossover of Cables

Where power cables and signal cables cross each other, make the cables cross over perpendicular to each other.

When shielded cables are not used, it is recommended to insert an iron plate with a thickness of 1.6 mm or larger to cover the crossover area as shown below.

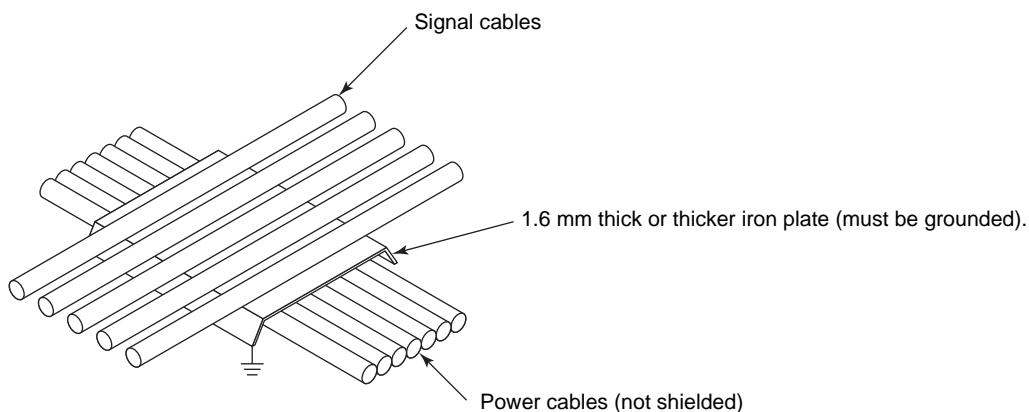


Figure Perpendicular Crossover of Cables

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3.4 FM Nonincendive

The FCN/FCJ have been approved that the products meet the Nonincendive (NI) (*1) requirements of the FM Standards.

By this approval, these devices can be installed in Class I Division 2 (*2) hazardous areas, but for compliance with the standard, the devices must be installed in a cabinet approved by local explosion-proof testing organization. In addition to that, the I/O modules of FCN can be directly connected to nonincendive local devices installed in hazardous areas, and the FCN/FCJ installed in non-hazardous areas can be connected to nonincendive local devices installed in hazardous areas.

Before connecting the nonincendive STARDOM devices to the nonincendive local devices, both parameters are compared and must satisfy the proper conditions.

*1: Nonincendive (NI):

NI is one of the explosion-proof systems of electrical products used in hazardous areas, particularly, in North America. NI devices can be used in Class I Division 2 areas.

*2: Class I Division 2:

This is an area where gaseous/ vaporous explosive atmospheres are not generated under normal conditions; if generated, they exist for a short period of time only.

IMPORTANT

- Control equipment connected to the FCN/FCJ must not use or generate more than 250 Vrms or Vdc.
 - Installation should be in accordance with the National Electrical Code (ANSI/NFPA 70).
 - The configuration of associated Apparatus must be FMRC Approval under Nonincendive Field Wiring Concept or be a simple apparatus (an electrical component or combination of components of simple construction with well-defined electrical parameters that does not generate more than 1.5 volts, 100 milliamps, and 25 milliwatts, or a passive component that does not dissipate more than 1.3 watts and is compatible with the intrinsic safety of the circuit in which it is used.).
 - Associated Apparatus manufacture's installation drawing must be followed when installing this equipment.
 - Associated Apparatus connection is representative of each input and output signal connection.
 - The nonincendive field wiring concept allows the interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus using any of the wiring methods permitted for unclassified locations.
 - No revision to drawing without prior FMRC Approval.
-

Compliance

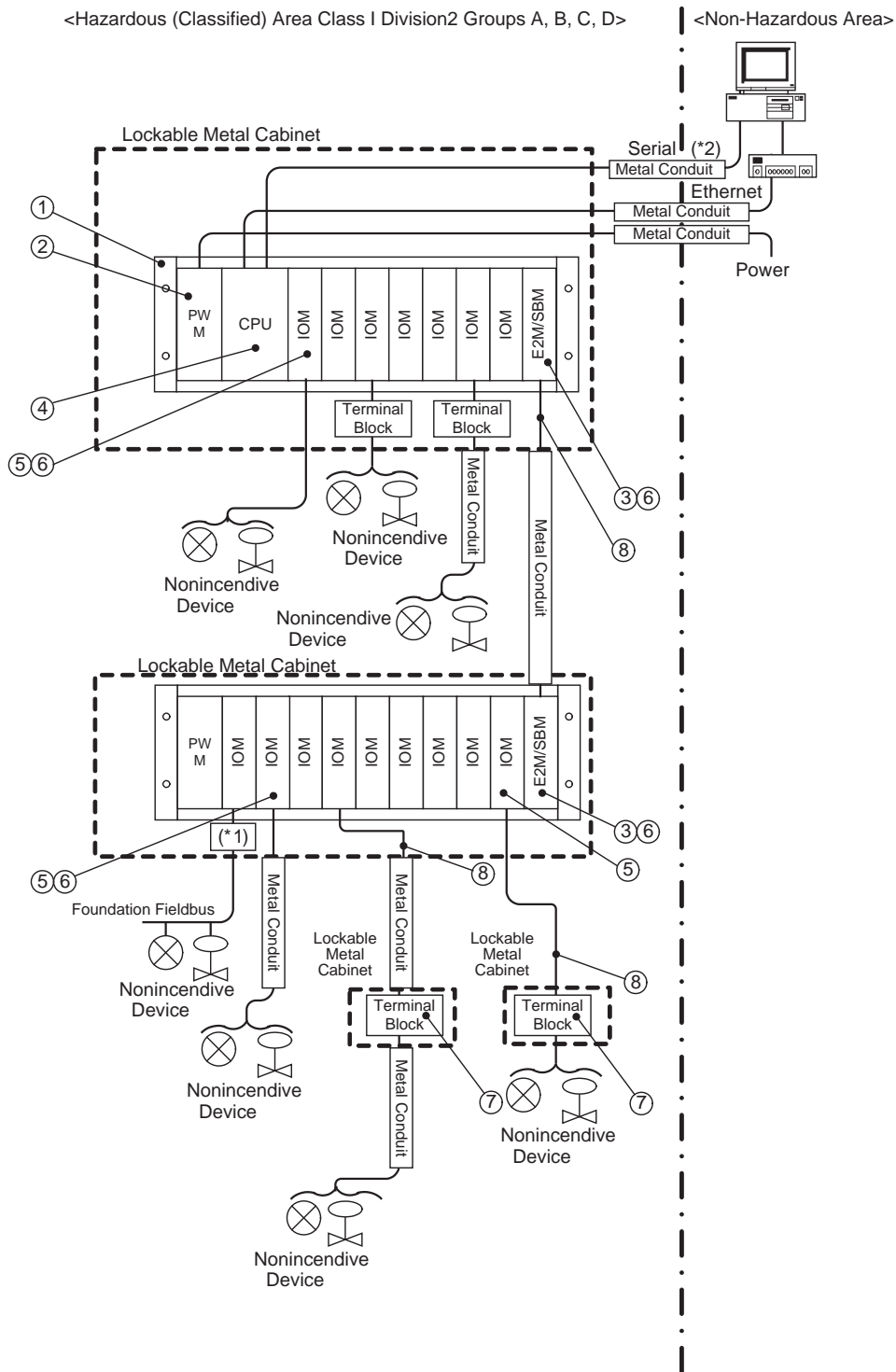
For Compliance, see "Appendix 1. FM NI Control Drawing for STARDOM FCN".

IMPORTANT

Note: For compliance with these standards, devices must be installed in a lockable metal cabinet with a key. Use a cabinet approved by local explosion-proof testing organization.

NI Products and Their Configuration

The figure below shows the example, how to configure NI products for FCN-500 installed in Class I Division 2 Hazardous Areas. For NI products for FCN-500, see next page.



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*1 Use the barrier for Fieldbus (for example MTL791)

*2 The cable for serial ports of NF501 and NF502 must be passed through a metal conduit.

Figure NI Products and Their Configuration

Table NI products (FCN-500) (1/2)

	Type	Model	Description
1	Base Module	NFBU200-□□E, -□□F	Base Module (long)
		N2BU051-□□E, -□□F	Base Module (short, for E2 bus)
		NFBU050-□□E, -□□F	Base Module (short)
		N2BU030-□□E, -□□F	Base Module (compact)
2	Power Supply Module	NFPW441-E□	Power Supply (100 to 120V AC input)
		NFPW444-E□	Power Supply (24V DC input)
3	E2 bus/SB bus Module	N2EB100-□E□	SB bus interface module
		NFSB100-□E□	SB bus repeat module
4	CPU Module	NFCP501-□□E, -□□F	CPU Module CPU module for FCN (with 2 Ethernet ports)
		NFCP502-□□E, -□□F	CPU Module CPU module for FCN (with 4 Ethernet ports)
5	I/O Module	NFAI141-□E□	Analog Input Module (4 to 20mA, 16-channel, non-isolated) (*1)
		NFAV141-□E□	Analog Input Module (1 to 5V, 16-channel, non-isolated)
		NFAI841-□E□	Analog I/O Module (4 to 20mA Input, 4 to 20mA Output, 8-channel Input/8-channel Output, non-isolated) (*1)
		NFAB841-□E□	Analog I/O Module (1 to 5V Input, 4 to 20mA Output, 8-channel Input/8-channel Output, non-isolated)
		NFAI143-□E□	Analog Input Module (4 to 20 mA, 16-channel, Isolated)
		NFAI543-□E□	Analog Output Module (4 to 20 mA, 16-channel, Isolated)
		NFAV144-□E□	Analog Input Module (-10 to +10V, 16-channel, Isolated)
		NFAV544-□E□	Analog Output Module (-10 to +10V, 16-channel, Isolated)
		NFAT141-□E□	Thermocouple/mV Input Module (16-channel, Isolated)
		NFAR181-□E□	RTD Input Module (12-channel, Isolated)
		NFAI135-□E□	Analog Input Module (4 to 20mA, 8-channel, Isolated Channels)
		NFAI835-□E□	Analog I/O Module (4 to 20mA, 4-channel Input/4-channel Output, Isolated channels)
		NFAP135-□E□	Pulse Input Module (0 to 10kHz, 8-channel, Isolated channels)
		NFAF135-□E□	Frequency Input Module (8-channel, Pulse, 0.1 Hz to 10 kHz, Isolated channels)
		NFDV151-□F□	Digital Input Module (32-channel, 24V DC, Isolated)
		NFDV551-□F□	Digital Output Module (32-channel, Isolated)
		NFDR541-□E□	Relay Output Module (16-channel, Isolated)
		NFLF111-□E□	FOUNDATION Fieldbus (FF-H1) Communication Module
NFLR111-□E□	RS-232-C Communication Module (2-port, 300 bps to 115.2 kbps)		
NFLR121-□E□	RS-422/RS-485 Communication Module (2-port, 300 bps to 115.2 kbps)		

*1: I/O modules with suffix code "with HART communication" do not conform to the explosion-proof standards.

Table NI products (FCN-500) (2/2)

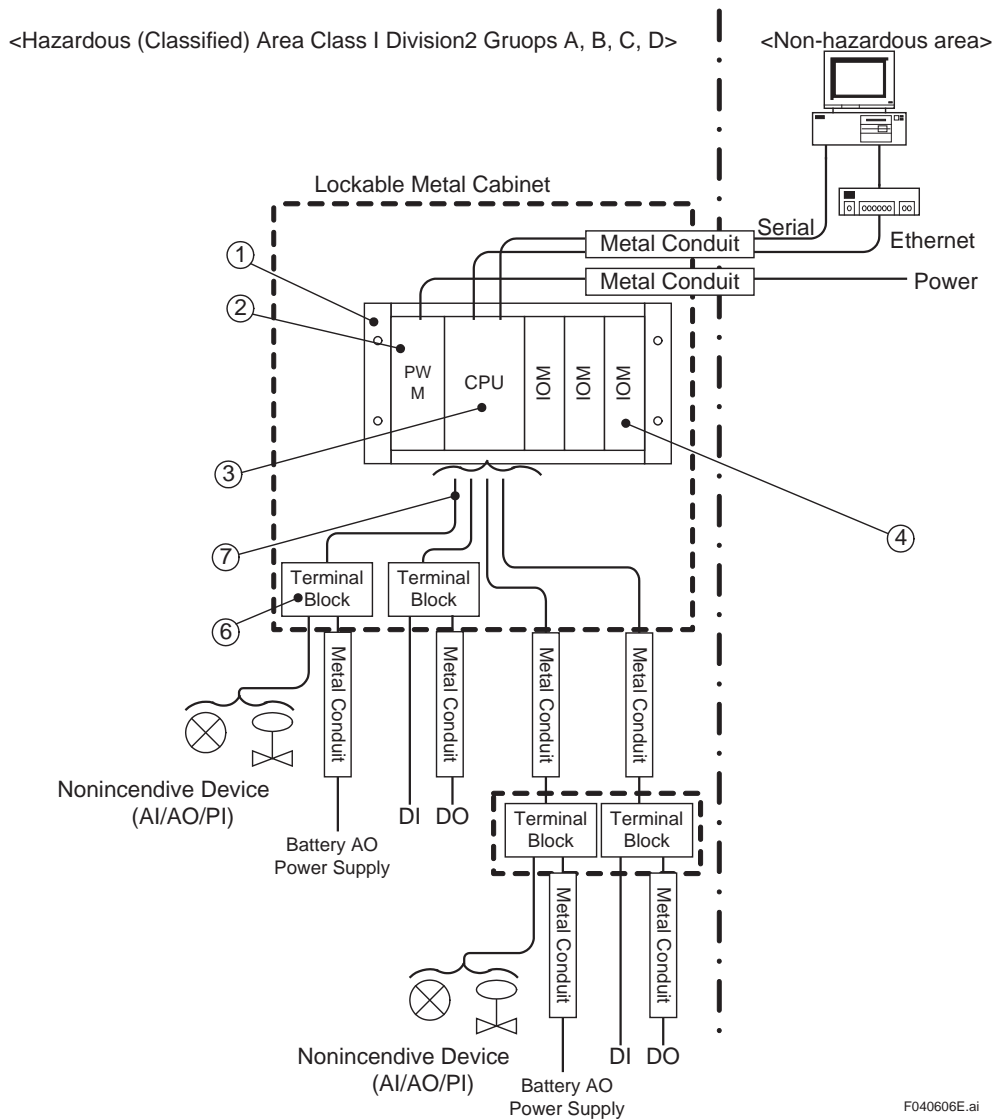
	Type	Model	Description
6	Terminal Block etc.	NFTA4S	Pressure Clamp Terminal Block for Analog (16-channel)
		NFTT4S	Pressure Clamp Terminal Block for Thermocouple/mV (16-channel)
		NFTR8S	Pressure Clamp Terminal Block for RTD (16-channel)
		NFTB5S	Pressure Clamp Terminal Block for Digital Input (32-channel)
		NFTD5S	Pressure Clamp Terminal Block for Digital Output (32-channel)
		NFTI3S	Pressure Clamp Terminal Block for Isolated Analog Module and Pulse Module (for NFAI135, NFAP135: 8-channel, NFAI835: 4-channel Input, 4-channel Output)
		NFTC4S-7□	Pressure Clamp Terminal Block for Digital (for NFDR541)
		NFTF9S	Pressure Clamp Terminal Block for FOUNDATION Fieldbus (for NFLF111)
		NFSBT0□	SB bus T-joint
		NFDCV0□	Dummy cover
7	Terminal Block	TAS40	MIL Connector Terminal Block (40 Pole Plug Types)
		TAS50	MIL Connector Terminal Block (50 Pole Plug Types)
8	Cable	NFCB301	SB Bus Cable
		KMS40	MIL Connector Cable (40 Pole Plug Types)
		KMS50	MIL Connector Cable (50 Pole Plug Types)

IMPORTANT

Some indications of suffix code are omitted, but all existing suffix codes of the models in Table NI products are NI products.

The figure below shows the example, how to configure NI products for FCN-RTU installed in Class I Division 2 Hazardous Areas.

SEE ALSO For NI products for FCN-RTU, see next page.



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Table NI products (FCN-RTU)

	Type	Model	Description
1	Base Module	NFBU050-□□E, -□□F	Base Module (short)
		NFBU200-□□E, -□□F	Base Module (long)
2	Power Supply Module	NFPW426-E□	Power Supply Module 12 VDC input, 24 VDC input)
		NFPW444-E□	Power Supply Module (24 V DC input)
3	CPU Module	NFCP050-□□E, -□□F	CPU module for FCN-RTU
4	I/O Module	NFAI141-□E□	Analog Input Module (4 to 20mA, 16-channel, non-isolated) (*1)
		NFAV141-□E□	Analog Input Module (1 to 5 V, 16-channel, Non-Isolated)
		NFAI841-□E□	Analog I/O Module (4 to 20 mA input, 4 to 20 mA output, 8-channel input/ 8-channel output, Non-Isolated)
		NFAB841-□E□	Analog I/O Module (1 to 5 V input, 4 to 20 mA output, 8-channel input/ 8-channel output, Non-Isolated)
		NFAI143-□E□	Analog Input Module (4 to 20 mA, 16-channel, Isolated)
		NFAI543-□E□	Analog Output Module (4 to 20 mA, 16-channel, Isolated)
		NFAV144-□E□	Analog Input Module (-10 to +10V, 16-channel, Isolated)
		NFAT141-□E□	Thermocouple/mV Input Module (16-channel, Isolated)
		NFAR181-□E□	RTD Input Module (12-channel, Isolated)
		NFAI135-□E□	Analog Input Module (4 to 20mA, 8-channel, Isolated Channels)
		NFAI835-□E□	Analog I/O Module (4 to 20mA, 4-channel Input/4-channel Output, Isolated channels)
		NFAP135-□E□	Pulse Input Module (0 to 10kHz, 8-channel, Isolated channels)
		NFDV151-□F□	Digital Input Module (32-channel, 24 V DC, Isolated)
		NFDV551-□F□	Digital Output Module (32-channel, 24 V DC, Isolated)
		NFDR541-□E□	Relay Output Module (16-channel, Isolated)
		NFLF111-□E□	FOUNDATION Fieldbus (FF-H1) Communication Module
5	Pressure Clamp Terminal Block etc.	NFTA4S	Pressure Clamp Terminal Block for Analog (16-channel)
		NFTT4S	Pressure Clamp Terminal Block for Thermocouple/mV (16-channel)
		NFTR8S	Pressure Clamp Terminal Block for RTD (16-channel)
		NFTB5S	Pressure Clamp Terminal Block for Digital Input (32-channel)
		NFTD5S	Pressure Clamp Terminal Block for Digital Output (32-channel)
		NFTI3S	Pressure Clamp Terminal Block for Isolated Analog Module and Pulse Module (for NFAI135, NFAP135: 8-channel, NFAI835: 4-channel Input, 4-channel Output)
		NFTC4S-7□	Pressure Clamp Terminal Block for Digital (for NFDR541)
		NFTF9S	Pressure Clamp Terminal Block for FOUNDATION Fieldbus (for NFLF111)
		NFDCV0	Dummy cover
6	Terminal Block	TAS40	MIL Connector Terminal Block (40 Pole Plug Types)
		TAS50	MIL Connector Terminal Block (50 Pole Plug Types)
7	Cable	KMS40	MIL Connector Cable (40 Pole Plug Types)
		KMS50	MIL Connector Cable (50 Pole Plug Types)

IMPORTANT

Some indications of suffix code are omitted, but all existing suffix codes of the models in Table NI products are NI products.

Power Cable

The power cables of FCN/FCJ must be passed through a metal conduit, and wired from a non-hazardous area without applying stress to the end of the cables. In addition, connect cables according to the National Electrical Code (NEC) or local electrical codes.

Ethernet Cable

The Ethernet cable of FCN/FCJ must be passed through a metal conduit, without applying stress to the end of the cables. In addition, connect cables according to the National Electrical Code (NEC) or local electrical codes.

E2 Bus Cable/SB Bus Cable

The E2 bus cable/the SB bus cable of FCN-500 must be wired within a lockable metal cabinet with a key. Or the E2 bus /the SB bus cable which is wired between cabinets must be passed through a metal conduit without supplying stress to the end of the cables.

Serial Port of NFPC501, NFPC502, NFPC050

The cable for serial ports of NFPC501, NFPC502 and NFPC050 must be passed through a metal conduit, without applying stress to the end of the cables. In addition, connect cables according to the Canadian Electrical Code (CEC) or local electrical codes.

Other Cables

Connect cables according to the National Electrical Code (NEC) or local electrical codes.

- The MIL connector cable (KMS40) to be connected to NFPC050 must be connected to MIL connector terminal block (TAS40). In this case; the cable must be wired within a lockable metal cabinet with a key, or must be passed through a metal conduit without supplying stress to the end of the cable between cabinets in which NFPC050 and TAS40 are installed separately.
- When NFPC050 and TAS40 are connected, the conduit wiring on TAS40's side is required for the field cable of external power supply for DO and AO, and AI for battery monitoring.
- The conduit wiring is required for the cable to be connected to NFDV151, NFDV551, NFLR111, NFLR121 and NFLF111.
- The conduit wiring is required for the cable to be connected to NFAP135 in power supply mode.

IMPORTANT

- During Operation
While the system is on, never connect or disconnect cables, or attach or remove fuses, or insert or remove cards in explosive atmospheres.
 - During Maintenance
When doing maintenance on a system in operation, never connect or disconnect products in explosive atmospheres.
 - Warning – Explosion Hazard
DO NOT DISCONNECT CABLES, FUSES AND CARDS WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.
-

Cabinet for FCN/FCJ

The FCN/FCJ must be installed in a lockable metal cabinet with a key. Use a cabinet approved by local explosion-proof testing organization.

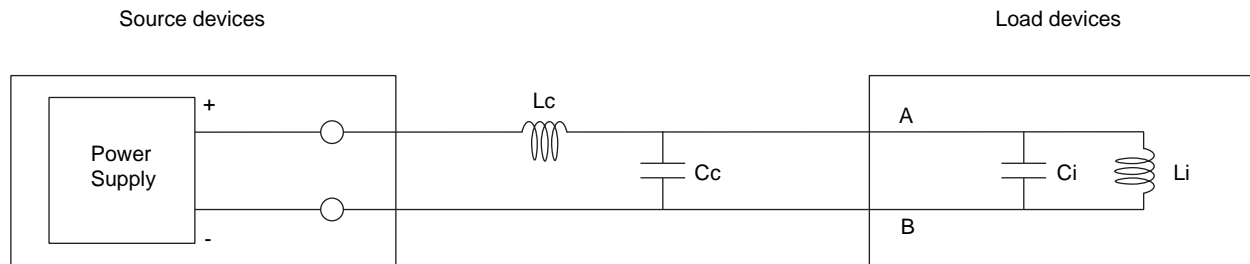
Use the FCN/FCJ accommodated in the cabinet on condition that the ambient temperature of the FCN/FCJ meets its specifications, considering temperature rise in the cabinet.

3.4.1 Parameters for Connecting NI Products

Supplying or receiving energy to/from circuits affects NI characteristics. Parameters must be displayed for circuit protection when connecting NI products. NI products are classified into source devices and load devices.

NI Product Connection and Parameters

Parameters in Connecting NI-compliant Devices



Parameters

Voc: Maximum open circuit output voltage

Isc: Maximum short circuit output current

Ca: Maximum allowable capacitance

La: Maximum allowable connected inductance

Cn: Maximum allowable connected capacitance based upon the normal circuit voltage V_n

V_n : Normal circuit voltage

L_n : Maximum allowable inductance based upon the normal circuit current I_n

I_n : Normal circuit current

C_c : External wiring (circuit) cable capacitance

L_c : External wiring (circuit) cable inductance

Parameters

V_{max} : Maximum input voltage

I_{max} : Maximum input current

C_i : Maximum internal capacitance

L_i : Maximum internal inductance

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Figure Parameters in Connecting NI-compliant Devices

IMPORTANT

For current controlled circuits the parameter I_{max} is not required and need not be aligned with parameter I_{sc} or I_t of the barrier or associated nonincendive field wiring apparatus.

Source Device Parameters

- Voc: Maximum open circuit output voltage
Maximum voltage generated at the open terminal (part) when an NI-circuit is an open circuit
- Isc: Maximum short circuit output current
Maximum current running when making a short NI-circuit or grounding an NI circuit
- Ca: Maximum allowable capacitance
Maximum capacitance connectable to an NI circuit
- La: Maximum allowable inductance
Maximum inductance connectable to an NI circuit
- Cn: Maximum allowable capacitance (at normal circuit voltage V_n)
Maximum capacitance connectable when normal circuit voltage V_n is applied to an NI circuit (circuit current running where a circuit is not open, shorted, or grounded)
- Vn: Normal circuit voltage
Circuit voltage generated where a circuit is not open, shorted, or grounded
- Ln: Maximum allowable inductance (at normal circuit current I_n)
Maximum inductance connectable when normal circuit current I_n is applied to an NI circuit (circuit current running where a circuit is not open, shorted, or grounded)
- In: Normal circuit current
Circuit current running where a circuit is not open, shorted, or grounded
- Cc: Capacitance of external wiring (circuit) cable
- Lc: Inductance of external wiring (circuit) cable

Load Device Parameters

- Vmax: Maximum input voltage
Maximum input voltage to maintain NI characteristics of the relevant device
- Imax: Maximum input current
Maximum input current to maintain NI characteristics of the relevant device
- Ci: Maximum internal capacitance
Maximum internal capacitance of a device which can be connected to an NI circuit (external wiring) when the device is connected to the NI circuit
- Li: Maximum internal inductance
Maximum internal inductance of a device which can be connected to an NI circuit (external wiring) when the device is connected to the NI circuit

3.4.2 NI Products and Parameters

For applicable I/O modules and their parameters, see “Appendix 1. FM NI Control Drawing for STARDOM FCN”.

3.4.3 How to Compare Parameters

Before connecting the STRADOM I/O modules of FCN to NI products, both source and load parameters must satisfy the following conditions:

Div2 wiring based on NEC or local electrical code

Source devices		Load devices
V_n	\leq	V_{max}
I_n	\leq	I_{max}
C_n	\geq	Total C_i of source devices + total capacitance C_c (*1) of external wiring
L_n	\geq	Total L_i of source devices + total inductance L_c (*2) of external wiring

General wiring based on NEC or local electrical code

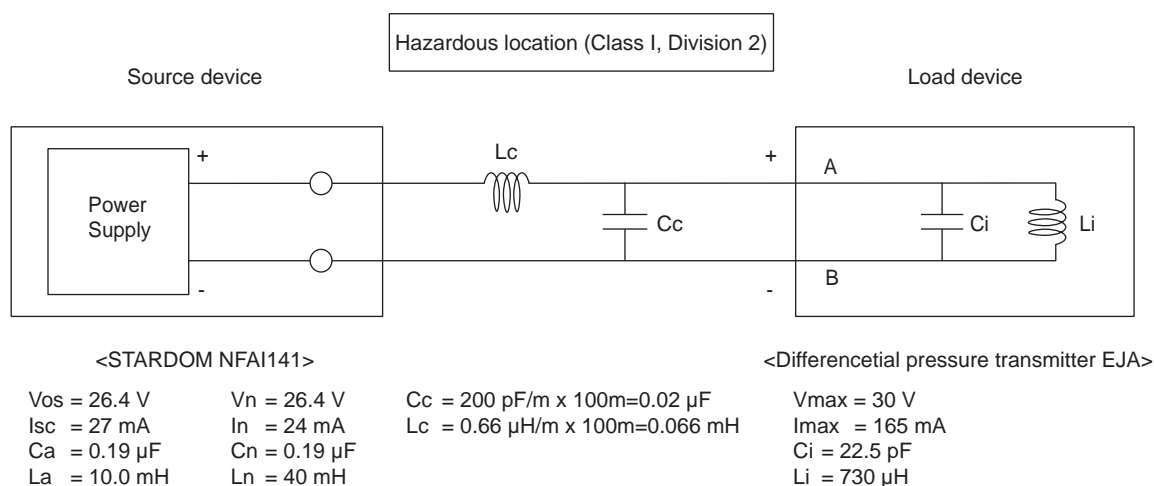
Source devices		Load devices
V_{oc}	\leq	V_{max}
I_{sc}	\leq	I_{max}
C_a	\geq	Total C_i of source devices + total capacitance C_c (*1) of external wiring
L_a	\geq	Total L_i of source devices + total inductance L_c (*2) of external wiring

*1: If the value is unknown, calculate using 200 pF/m.

*2: If the value is unknown, calculate using 0.66 μ H/m.

Example

Consider how to connect the NFAI141 Current Input Module, one of the STRADOM I/O modules of FCN, to Yokogawa's EJA Differential Pressure Transmitter. One EJA is connected to one circuit of the NFAI141 module via 100 m cable, which is located in a Class I Division 2 Hazardous Area.



Therefore,

$$\begin{aligned}
 V_{os} = 26.4 \text{ V} &< V_{max} = 30 \text{ V} \\
 I_{sc} = 27 \text{ mA} &< I_{max} = 165 \text{ mA} \\
 C_a = 0.19 \text{ }\mu\text{F} &> C_i + C_c = 0.0425 \text{ }\mu\text{F} \\
 L_a = 10 \text{ mH} &> L_i + L_c = 0.796 \text{ mH}
 \end{aligned}$$

Since the conditions for Nonincendive wiring are satisfied, NFAI141 can be connected with EJA.

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Figure Connecting NFAI141 with EJA

3.5 ATEX Ex “ec”/UKEX Ex “ec”

ATEX Ex “ec”/UKEX Ex “ec” are a construction that enhances safety not to cause a spark, an arc or high surface temperatures in a normal operation in CENELEC standard and IEC standard and also to avoid causing a spark, an arc or high surface temperatures under defined conditions such as an overload.

Complied Standards

ATEX Ex “ec”/UKEX Ex “ec” standards complied by the FCN/FCJ are the following.

Regarding the latest conformity standard for each model, refer to GS 34P02Q13-01E for FCN-RTU and GS 34P02Q14-01E for FCN-500.

[Explosion-proof specifications]

⊕II 3 G Ex ec nC II C T4 Gc X

⊕II 3 G Ex ec II C T4 Gc X

[Complied standard]

EN IEC 60079-0:2018

EN IEC 60079-7:2015 + A1:2018

EN 60079-15:2010

EN IEC 60079-15:2019

The FCN/FCJ can be installed in a hazardous area of Zone 2 after accommodating them in a keyed cabinet (*1) of protection rating IP54 or higher. They can be connected to a Ex “ec”/Type “n” approved field device installed in a hazardous area of Zone 2. (*2)

In addition, it is possible to connect them installed in a non-hazardous area and a Ex “ec”/Type “n” approved field device installed in a hazardous area of Zone 2. (*2)

They can be connected to the intrinsic safety device installed in Zone 0, Zone 1 and Zone 2 using a barrier. (*3)

Refer to IM 34P02Q11-02E for the installation and the precaution for ATEX Ex “ec”/UKEX Ex “ec”compliant equipment.

- *1: Use the FCN/FCJ accommodated in the cabinet on condition that the ambient temperature of the FCN/FCJ meets its specifications, considering temperature rise in the cabinet.
- *2: Explosion-proof wiring for Ex“ec”/Type “n” device that is defined in EN 60079-14 and the rules/standards of each country or region is needed.
- *3: Explosion-proof wiring for intrinsically safe circuits that is defined in EN 60079-14 and EN 60079-25 and the rules/standards of each country or region is needed.

Ex “ec” Approved Products

Table Ex “ec” Products (FCN-500) (1/2)

	Type	Model	Description
1	Base Module	NFBU200-□□E, -□□F	Base Module (long)
		N2BU051-□□E, -□□F	Base module (short, for E2 bus)
		NFBU050-□□E, -□□F	Base module (short)
		N2BU030-□□E, -□□F	Base module (compact)
2	Power Supply Module	NFPW444-E□	Power supply module for FCN (24 V DC input)
3	E2 bus/SB bus Module	N2EB100-□E□	E2 bus interface module
		NFSB100-□E□	SB bus repeat module for FCN
4	CPU Module	NFCP501-□□E, -□□F	CPU ModuleCPU module for FCN (with 2 Ethernet ports)
		NFCP502-□□E, -□□F	CPU ModuleCPU module for FCN (with 4 Ethernet ports)
5	I/O Module	NFAI141-□E□	Analog Input Module (4 to 20 mA, 16-channel, Non-Isolated)
		NFAV141-□E□	Analog Input Module (1 to 5 V, 16-channel, Non-Isolated)
		NFAI841-□E□	Analog I/O Module (4 to 20 mA input, 4 to 20 mA output, 8-channel input/ 8-channel output, Non-Isolated)
		NFAB841-□E□	Analog I/O Module (1 to 5 V input, 4 to 20 mA output, 8-channel input/ 8-channel output, Non-Isolated)
		NFAI143-□E□	Analog Input Module (4 to 20 mA, 16-channel, Isolated)
		NFAI543-□E□	Analog Output Module (4 to 20 mA, 16-channel, Isolated)
		NFAV144-□E□	Analog Input Module (-10 to +10V, 16-channel, Isolated)
		NFAV544-□E□	Analog Output Module (-10 to +10V, 16-channel, Isolated)
		NFAT141-□E□	TC/mV Input Module (16-channel, Isolated)
		NFAR181-□E□	RTD Input Module (12-channel, Isolated)
		NFAI135-□E□	Analog Input Module (4 to 20 mA, 8-channel, Isolated channels)
		NFAI835-□E□	Analog I/O Module (4 to 20 mA, 4-channel input/4-channel output, Isolated channels)
		NFAP135-□E□	Pulse Input Module (8-channel, Pulse count, 0 to 10 kHz, Isolated channels)
		NFAF135-□E□	Frequency Input Module (8-channel, Pulse, 0.1 Hz to 10 kHz, Isolated channels)
		NFDV151-□F□	Digital Input Module (32-channel, 24 V DC, Isolated)
		NFDV551-□F□	Digital Output Module (32-channel, 24 V DC, Isolated)
		NFDR541-□E□	Relay Output Module (16-channel, Isolated)
		NFLF111-□E□	FOUNDATION Fieldbus communication module (4-port)
		NFLR111-□E□	RS-232-C Communication Module (2-port, 300 bps to 115.2 kbps)
NFLR121-□E□	RS-422/RS-485 Communication Module (2-port, 300 bps to 115.2 kbps)		

Table Ex "ec" Products (FCN-500) (2/2)

	Type	Model	Description
6	Pressure clamp Terminal Block etc.	NFTA4S	Pressure Clamp Terminal Block for Analog (16-channel)
		NFTT4S	Pressure Clamp Terminal Block for Thermocouple/mV (16-channel)
		NFTR8S	Pressure Clamp Terminal Block for RTD (16-channel)
		NFTB5S	Pressure Clamp Terminal Block for Digital Input (32-channel)
		NFTD5S	Pressure Clamp Terminal Block for Digital Output (32-channel)
		NFTI3S	Pressure Clamp Terminal Block for Isolated Analog Module and Pulse Module (for NFAI135, NFAP135: 8-channel, NFAI835: 4-channel Input, 4-channel Output)
		NFTC4S-7□	Pressure Clamp Terminal Block for Digital (for NFDR541)
		NFTF9S	Pressure Clamp Terminal Block for FOUNDATION Fieldbus (for NFLF111)
		NFDCV0□	Dummy cover
		NFSBT0□	SB bus T-joint
7	Terminal Block	TAS40	MIL Connector Terminal Block (40 Pole Plug Types)
		TAS50	MIL Connector Terminal Block (50 Pole Plug Types)
8	Cable (*2)	NFCB301	SB Bus Cable
		KMS40	MIL Connector Cable (40 Pole Plug Types)
		KMS50	MIL Connector Cable (50 Pole Plug Types)

*2: The self-declaration of EX "ec" is not applicable for cables.

Table Ex “ec” Products (FCN-RTU)

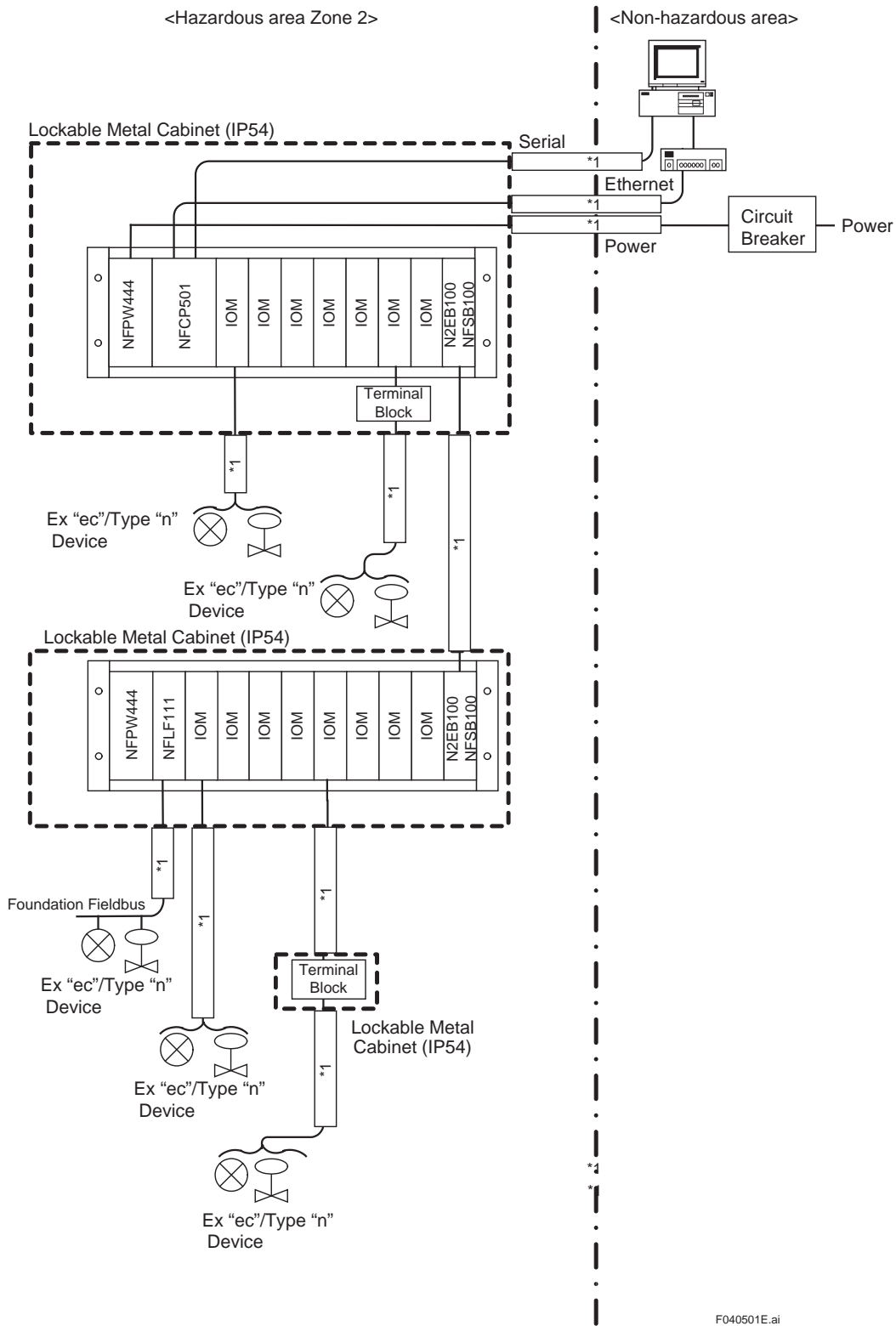
	Type	Model	Description
1	Base Module	NFBU050-□□E, -□□F	Base Module (short)
		NFBU200-□□E, -□□F	Base Module (long)
2	Power Supply Module	NFPW426-E□	Power Supply Module 12 VDC input, 24 VDC input)
		NFPW444-E□	Power Supply Module (24 V DC input)
3	CPU Module	NFCP050-□□E, -□□F	CPU module for FCN-RTU
4	I/O Module	NFAI141-□E□	Analog Input Module (4 to 20 mA, 16-channel, Non-Isolated)
		NFAV141-□E□	Analog Input Module (1 to 5 V, 16-channel, Non-Isolated)
		NFAI841-□E□	Analog I/O Module (4 to 20 mA input, 4 to 20 mA output, 8-channel input/ 8-channel output, Non-Isolated)
		NFAB841-□E□	Analog I/O Module (1 to 5 V input, 4 to 20 mA output, 8-channel input/ 8-channel output, Non-Isolated)
		NFAI143-□E□	Analog Input Module (4 to 20 mA, 16-channel, Isolated)
		NFAI543-□E□	Analog Output Module (4 to 20 mA, 16-channel, Isolated)
		NFAV144-□E□	Analog Input Module (-10 to +10V, 16-channel, Isolated)
		NFAT141-□E□	TC/mV Input Module (16-channel, Isolated)
		NFAR181-□E□	RTD Input Module (12-channel, Isolated)
		NFAI135-□E□	Analog Input Module (4 to 20 mA, 8-channel, Isolated channels)
		NFAI835-□E□	Analog I/O Module (4 to 20 mA, 4-channel input/4-channel output, Isolated channels)
		NFAP135-□E□	Pulse Input Module (8-channel, Pulse count, 0 to 10 kHz, Isolated channels)
		NFDV151-□F□	Digital Input Module (32-channel, 24 V DC, Isolated)
		NFDV551-□F□	Digital Output Module (32-channel, 24 V DC, Isolated)
		5	Pressure Clamp Terminal Block etc.
NFTT4S	Pressure Clamp Terminal Block for Thermocouple/mV (16-channel)		
NFTR8S	Pressure Clamp Terminal Block for RTD (16-channel)		
NFTB5S	Pressure Clamp Terminal Block for Digital Input (32-channel)		
NFTD5S	Pressure Clamp Terminal Block for Digital Output (32-channel)		
NFTI3S	Pressure Clamp Terminal Block for Isolated Analog Module and Pulse Module (for NFAI135, NFAP135: 8-channel, NFAI835: 4-channel Input, 4-channel Output)		
NFTC4S-7□	Pressure Clamp Terminal Block for Digital (for NFDR541)		
NFTF9S	Pressure Clamp Terminal Block for FOUNDATION Fieldbus (for NFLF111)		
NFDCV0	Dummy cover		
6	Terminal Block		
		TAS50	MIL Connector Terminal Block (50 Pole Plug Types)
7	Cable (*1)	KMS40	MIL Connector Cable (40 Pole Plug Types)
		KMS50	MIL Connector Cable (50 Pole Plug Types)

*1: The self-declaration of Ex “ec” is not applicable for cables.

IMPORTANT

- In a hazardous area of Zone 2, install FCN/FCJ and MIL Connector Terminal Block in a lockable metal cabinet which has IP54 or higher protection rating provided in IEC 60529.
 - In hazardous areas, all the cables such as FCN/FCJ power cable, Ethernet cable, serial port cable, and SB bus cable used outside of the above described cabinet must be wired in accordance with the EN 60079-14 and the relevant local electrical codes for explosion-proof.
 - The power cables of FCN/FCJ must be wired from a non-hazardous area without applying stress to the end of the cables.
For emergency purpose, convenient means of switching-off the electrical supplies to FCN/FCJ shall be provided in accordance with EN 60079-14.
-

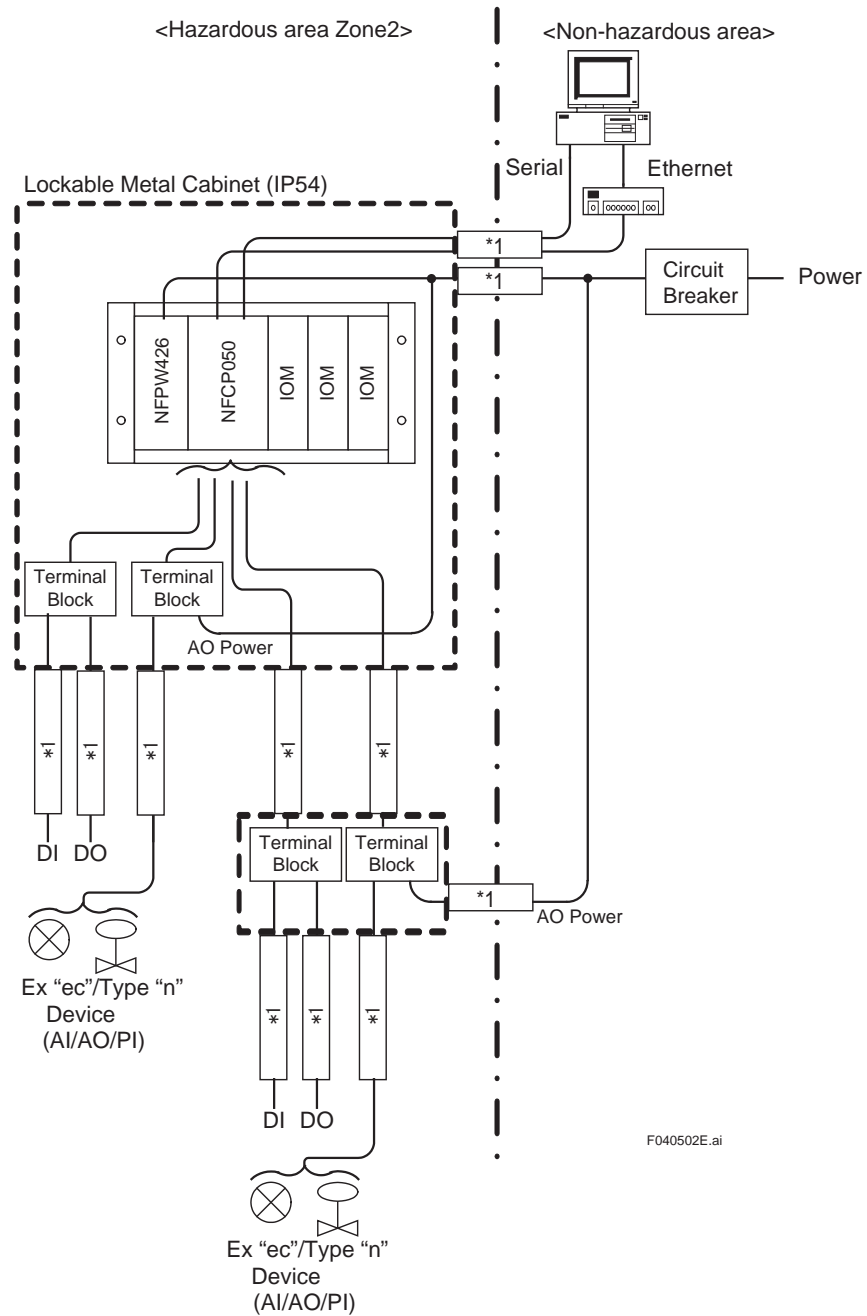
The figure below is an example of the configuration of Ex “ec”/Type “n” products of FCN-500.



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*1: Explosion-proof wiring for Ex“ec”/Type “n” device that is defined in EN 60079-14 and the rules/standards of each country or region

The figure below is an example of the configuration of Ex “ec”/Type “n” products of FCN-RTU.



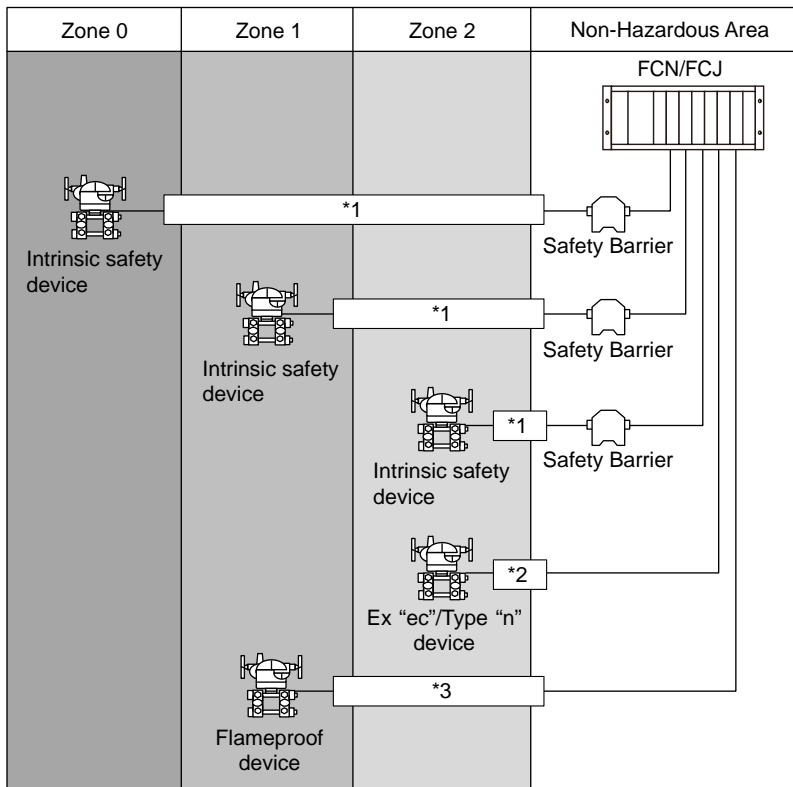
*1: Explosion-proof wiring for Ex “ec”/type“n” deice that is defined in EN 60079-14 and the rules/standards of each country or region

Connecting with Field Devices

The FCN/FCJ ATEX Ex “ec”/UKEX Ex “ec” equipment can be connected to the intrinsic safety device installed in Zone 0, Zone 1 and Zone 2 using a barrier and explosion-proof wiring as shown in the following figures.

They can be connected to Ex “ec”/Type “n” device installed in Zone 2 using explosion-proof wiring for Ex “ec”/Type “n” device that is defined in EN 60079-14 and the rules/standards of each country or region.

And they can be connected to flameproof device using explosion-proof wiring for flameproof device that is defined in EN 60079-14 and the rules/standards of each country or region.



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Figure Installation in Non-Hazardous Area

- *1: Explosion-proof wiring for intrinsically safe circuits that is defined in EN 60079-14 and EN 60079-25 and the rules/standards of each country or region
- *2: Explosion-proof wiring for Ex “ec”/Type “n” device that is defined in EN 60079-14 and the rules/standards of each country or region
- *3: Explosion-proof wiring for flameproof device that is defined in EN 60079-14 and the rules/standards of each country or region

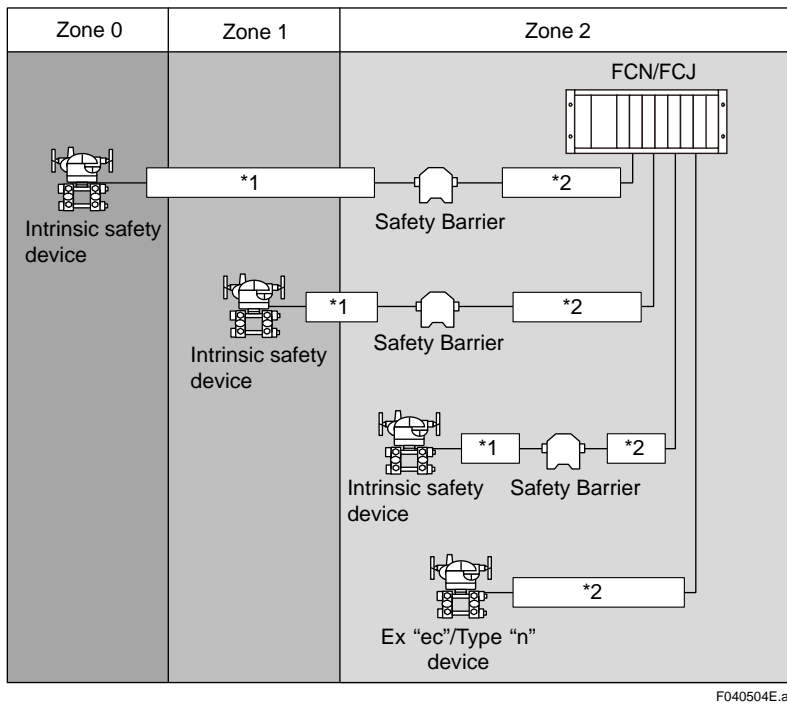


Figure Installation in Zone2

- *1: Explosion-proof wiring for intrinsically safe circuits that is defined in EN 60079-14 and EN 60079-25, and the rules/standards of each country or region
- *2: Explosion-proof wiring for Ex "ec"/Type "n" device that is defined in EN 60079-14 and the rules/standards of each country or region

Precautions

Refer to IM 34P02Q11-02E for the installation and the precaution for ATEX Ex “ec”/UKEX Ex “ec” compliant equipment.

Specific conditions of use

- The equipment shall only be used in an area of not more than pollution degree 2, as defined in EN 60664-1.
- The equipment shall be installed in an enclosure that provides a degree of protection not less than IP54 in accordance with EN IEC 60079-0.

Installation

- The equipment shall be installed and used within their ratings.
- All equipment wiring in hazardous areas shall be installed in accordance with EN 60079-14 and related local electrical codes and the installation shall also comply with the appropriate requirements for non-hazardous areas.
- Instructions provided in GS (General specifications), TI (Technical Information of Installation Guidance) and/or IM (User’s Manuals) shall be observed.
- The installation shall be carried out only by qualified personnel whose training has included instruction on the type of protection and installation practices, relevant rules and regulations and general principles of area classification.
- The degree of protection not less than IP54 shall be maintained at cable entries into the cabinet.
- It must be observed during the installation that the venting slots of the equipment are not blocked off by cable parts, fixing accessories etc.
- Screws of terminals for field wiring connections shall be tightened with specified torque values.
- On completion of the installation and prior to first use, initial inspection of the equipment and installation shall be carried out in accordance with EN 60079-17.
- Abide by the following guidance so as to ensure the safety and performance.
 - Make sure that all the empty slots in the cabinet should be properly covered with attached caps.
 - Make sure that all the cables are rigidly fixed in the cabinet.
- The models which were included in the in the previous EU Declaration of Conformity of FCN with marking “nA” can be installed into the system.

Maintenance and Repair

- Inspections and maintenance of the equipment and installations shall be carried out only by qualified personnel and in accordance with EN 60079-17.
- Repair, overhaul, reclamation of the equipment shall be carried out only by qualified personnel and in accordance with EN 60079-19.
- Repairs of the equipment shall be carried out only by trained, experienced, skilled, knowledgeable and/or supervised personnel, or by the service engineers recognized by Yokogawa. Otherwise, the type of protection may be invalidated.
- Modifications shall not be made to the equipment which is operated in hazardous areas.
- Use only the following batteries specified by YOKOGAWA for CPU modules:
 - S9883FA for NFPC050
 - S9049FE for NFPC501 and NFPC502



WARNING

WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT,

- DO NOT OPEN THE CABINET WHILE THE EQUIPMENTS ARE ENERGIZED
 - DO NOT SEPARATE THE CONNECTIONS WHEN ENERGIZED
-

3.6 CSA Non-Incendive

The FCN/FCJ have been approved that the products meet the Non-Incendive (NI) (*1) requirements of the CSA Standards.

By this approval, these devices can be installed in Class I Division 2 (*2) hazardous areas, but for compliance with the standard, the devices must be installed in a cabinet approved by local explosion-proof testing organization. In addition to that, the I/O modules of FCN can be directly connected to non-incendive local devices installed in hazardous areas, and the FCN/FCJ installed in non-hazardous areas can be connected to non-incendive local devices installed in hazardous areas.

Before connecting the non-incendive STARDOM devices to the non-incendive local devices, both parameters are compared and must satisfy the proper conditions.

*1: Non-Incendive (NI):

NI is one of the explosion-proof systems of electrical products used in hazardous areas, particularly, in North America. NI devices can be used in Class I Division 2 areas.

*2: Class I Division 2:

This is an area where gaseous/ vaporous explosive atmospheres are not generated under normal conditions; if generated, they exist for a short period of time only.

IMPORTANT

Installation should be in accordance with the Canadian Electrical Code (C22.1-06).

Compliance

For Compliance, see “Appendix 2. CSA NI Control Drawing for STARDOM FCN”.

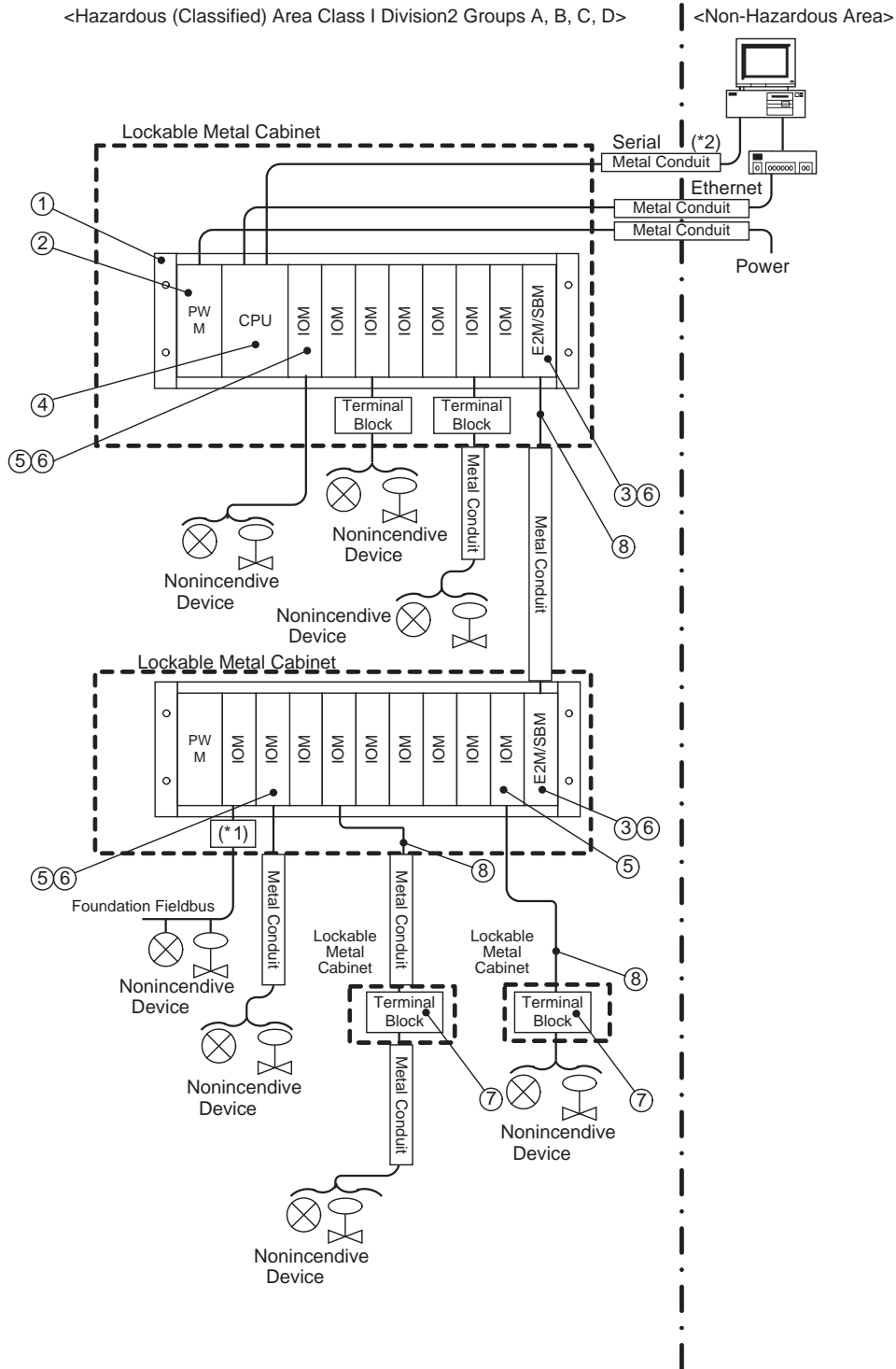
IMPORTANT

Note: For compliance with these standards, devices must be installed in a lockable metal cabinet with a key. Use a cabinet approved by local explosion-proof testing organization.

NI Products and Their Configuration

The figure below shows the example, how to configure NI products for FCN-500 installed in Class I Division 2 Hazardous Areas.

SEE ALSO For NI products for FCN-500, see next page.



*1 Use the barrier for Fieldbus (for example MTL791)
 *2 The cable for serial ports of NF501 and NF502 must be passed through a metal conduit.

Figure NI Products and Their Configuration

Table NI products (FCN-500) (1/2)

	Type	Model	Description
1	Base Module	NFBU200-□□E, -□□F	Base Module (long)
		N2BU051-□□E, -□□F	Base Module (short, for E2 bus)
		NFBU050-□□E, -□□F	Base Module (short)
		N2BU030-□□E, -□□F	Base Module (compact)
2	Power Supply Module	NFPW441-E□	Power Supply (100 to 120V AC input)
		NFPW444-E□	Power Supply (24V DC input)
3	E2 bus/SB bus Module	N2EB100-□E□	E2 bus interface module
		NFSB100-□E□	SB bus repeat module
4	CPU Module	NFCP501-□□E, -□□F	CPU Module CPU module for FCN (with 2 Ethernet ports)
		NFCP502-□□E, -□□F	CPU Module CPU module for FCN (with 4 Ethernet ports)
5	I/O Module	NFAI141-□E□	Analog Input Module (4 to 20mA, 16-channel, non-isolated) (*1)
		NFAV141-□E□	Analog Input Module (1 to 5V, 16-channel, non-isolated)
		NFAI841-□E□	Analog I/O Module (4 to 20mA Input, 4 to 20mA Output, 8-channel Input/8-channel Output, non-isolated) (*1)
		NFAB841-□E□	Analog I/O Module (1 to 5V Input, 4 to 20mA Output, 8-channel Input/8-channel Output, non-isolated)
		NFAI143-□E□	Analog Input Module (4 to 20 mA, 16-channel, Isolated)
		NFAI543-□E□	Analog Output Module (4 to 20 mA, 16-channel, Isolated)
		NFAV144-□E□	Analog Input Module (-10 to +10V, 16-channel, Isolated)
		NFAV544-□E□	Analog Output Module (-10 to +10V, 16-channel, Isolated)
		NFAT141-□E□	Thermocouple/mV Input Module (16-channel, Isolated)
		NFAR181-□E□	RTD Input Module (12-channel, Isolated)
		NFAI135-□E□	Analog Input Module (4 to 20mA, 8-channel, Isolated Channels)
		NFAI835-□E□	Analog I/O Module (4 to 20mA, 4-channel Input/4-channel Output, Isolated channels)
		NFAP135-□E□	Pulse Input Module (0 to 10kHz, 8-channel, Isolated channels)
		NFAF135-□E□	Frequency Input Module (8-channel, Pulse, 0.1 Hz to 10 kHz, Isolated channels)
		NFDV151-□F□	Digital Input Module (32-channel, 24V DC, Isolated)
		NFDV551-□F□	Digital Output Module (32-channel, Isolated)
		NFDR541-□E□	Relay Output Module (16-channel, Isolated)
		NFLF111-□E□	FOUNDATION Fieldbus (FF-H1) Communication Module
NFLR111-□E□	RS-232-C Communication Module (2-port, 300 bps to 115.2 kbps)		
NFLR121-□E□	RS-422/RS-485 Communication Module (2-port, 300 bps to 115.2 kbps)		

*1: I/O modules with suffix code "with HART communication" do not conform to the explosion-proof standards.

Table NI products (FCN-500) (2/2)

	Type	Model	Description
6	Pressure Clamp Terminal Block etc.	NFTA4S	Pressure Clamp Terminal Block for Analog (16-channel)
		NFTT4S	Pressure Clamp Terminal Block for Thermocouple/mV (16-channel)
		NFTR8S	Pressure Clamp Terminal Block for RTD (16-channel)
		NFTB5S	Pressure Clamp Terminal Block for Digital Input (32-channel)
		NFTD5S	Pressure Clamp Terminal Block for Digital Output (32-channel)
		NFTI3S	Pressure Clamp Terminal Block for Isolated Analog Module and Pulse Module (for NFAI135, NFAP135: 8-channel, NFAI835: 4-channel Input, 4-channel Output)
		NFTC4S-7□	Pressure Clamp Terminal Block for Digital (for NFDR541)
		NFTF9S	Pressure Clamp Terminal Block for FOUNDATION Fieldbus (for NFLF111)
		NFSBT0□	SB bus T-joint
		NFDCV0□	Dummy cover
7	Terminal Block	TAS40	MIL Connector Terminal Block (40 Pole Plug Types)
		TAS50	MIL Connector Terminal Block (50 Pole Plug Types)
8	Cable	NFCB301	SB Bus Cable
		KMS40	MIL Connector Cable (40 Pole Plug Types)
		KMS50	MIL Connector Cable (50 Pole Plug Types)

The figure below shows the example, how to configure NI products for FCN-RTU installed in Class I Division 2 Hazardous Areas.

SEE ALSO For NI products for FCN-RTU, see next page.

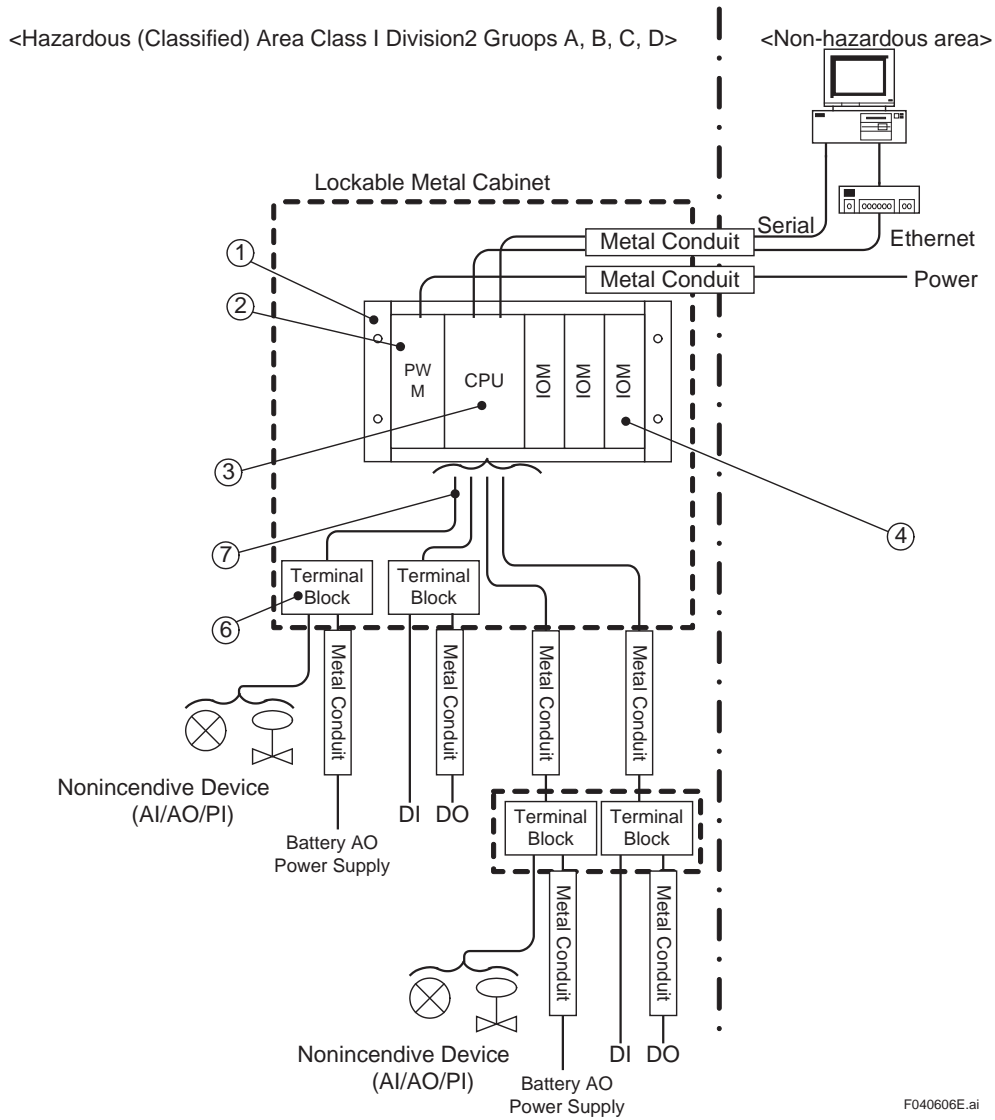


Table NI products (FCN-RTU)

	Type	Model	Description
1	Base Module	NFBU050-□□E, -□□F	Base Module (short)
		NFBU200-□□E, -□□F	Base Module (long)
2	Power Supply Module	NFPW426-E□	Power Supply Module 12 VDC input, 24 VDC input)
		NFPW444-E□	Power Supply Module (24 V DC input)
3	CPU Module	NFCP050-□□E, -□□F	CPU module for FCN-RTU
4	I/O Module	NFAI141-□E□	Analog Input Module (4 to 20mA, 16-channel, non-isolated) (*1)
		NFAV141-□E□	Analog Input Module (1 to 5 V, 16-channel, Non-Isolated)
		NFAI841-□E□	Analog I/O Module (4 to 20 mA input, 4 to 20 mA output, 8-channel input/ 8-channel output, Non-Isolated)
		NFAB841-□E□	Analog I/O Module (1 to 5 V input, 4 to 20 mA output, 8-channel input/ 8-channel output, Non-Isolated)
		NFAI143-□E□	Analog Input Module (4 to 20 mA, 16-channel, Isolated)
		NFAI543-□E□	Analog Output Module (4 to 20 mA, 16-channel, Isolated)
		NFAV144-□E□	Analog Input Module (-10 to +10V, 16-channel, Isolated)
		NFAT141-□E□	Thermocouple/mV Input Module (16-channel, Isolated)
		NFAR181-□E□	RTD Input Module (12-channel, Isolated)
		NFAI135-□E□	Analog Input Module (4 to 20mA, 8-channel, Isolated Channels)
		NFAI835-□E□	Analog I/O Module (4 to 20mA, 4-channel Input/4-channel Output, Isolated channels)
		NFAP135-□E□	Pulse Input Module (0 to 10kHz, 8-channel, Isolated channels)
		NFDV151-□F□	Digital Input Module (32-channel, 24 V DC, Isolated)
		NFDV551-□F□	Digital Output Module (32-channel, 24 V DC, Isolated)
		NFDR541-□E□	Relay Output Module (16-channel, Isolated)
NFLF111-□E□	FOUNDATION Fieldbus (FF-H1) Communication Module		
5	Pressure Clamp Terminal Block etc.	NFTA4S	Pressure Clamp Terminal Block for Analog (16-channel)
		NFTT4S	Pressure Clamp Terminal Block for Thermocouple/mV (16-channel)
		NFTR8S	Pressure Clamp Terminal Block for RTD (16-channel)
		NFTB5S	Pressure Clamp Terminal Block for Digital Input (32-channel)
		NFTD5S	Pressure Clamp Terminal Block for Digital Output (32-channel)
		NFTF9S	Pressure Clamp Terminal Block for FOUNDATION Fieldbus (for NFLF111)
		NFTI3S	Pressure Clamp Terminal Block for Isolated Analog Module and Pulse Module (for NFAI135, NFAP135: 8-channel, NFAI835: 4-channel Input, 4-channel Output)
		NFTC4S-7□	Pressure Clamp Terminal Block for Digital (for NFDR541)
		NFDCV0	Dummy cover
6	Terminal Block	TAS40	MIL Connector Terminal Block (40 Pole Plug Types)
		TAS50	MIL Connector Terminal Block (50 Pole Plug Types)
7	Cable	KMS40	MIL Connector Cable (40 Pole Plug Types)
		KMS50	MIL Connector Cable (50 Pole Plug Types)

IMPORTANT

Some indications of suffix code are omitted, but all existing suffix codes of the models in Table NI products are NI products.

Power Cable

The power cables of FCN/FCJ must be passed through a metal conduit, and wired from a non-hazardous area without applying stress to the end of the cables. In addition, connect cables according to the Canadian Electrical Code (CEC) or local electrical codes.

Ethernet Cable

The Ethernet cable of FCN/FCJ must be passed through a metal conduit, without applying stress to the end of the cables. In addition, connect cables according to the Canadian Electrical Code (CEC) or local electrical codes.

E2 Bus Cable/SB Bus Cable

The E2 bus cable/the SB bus cable of FCN-500 must be wired within a lockable metal cabinet with a key. Or the E2 bus cable/the SB bus cable which is wired between cabinets must be passed through a metal conduit without supplying stress to the end of the cables.

Serial Port of NFCP501, NFCP502, NFCP050

The cable for serial ports of NFCP501, NFCP502 and NFCP050 must be passed through a metal conduit, without applying stress to the end of the cables. In addition, connect cables according to the Canadian Electrical Code (CEC) or local electrical codes.

Other Cables

Connect cables according to the Canadian Electrical Code (CEC) or local electrical codes.

- The MIL connector cable (KMS40) to be connected to NFCP050 must be connected to MIL connector terminal block (TAS40). In this case; the cable must be wired within a lockable metal cabinet with a key, or must be passed through a metal conduit without supplying stress to the end of the cable between cabinets in which NFCP050 and TAS40 are installed separately.
- When NFCP050 and TAS40 are connected, the conduit wiring on TAS40's side is required for the field cable of external power supply for DO and AO, and AI for battery monitoring.
- The conduit wiring is required for the cable to be connected to NFDV151, NFDV551, NFLR111, NFLR121 and NFLF111.
- The conduit wiring is required for the cable to be connected to NFAP135 in power supply mode.

IMPORTANT

- **During Operation**
While the system is on, never connect or disconnect cables, or attach or remove fuses, or insert or remove cards in explosive atmospheres.
- **During Maintenance**
When doing maintenance on a system in operation, never connect or disconnect products in explosive atmospheres.

<English>

Warning – Explosion Hazard

DO NOT DISCONNECT CABLES, FUSES AND CARDS WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.

<French>

AVERTISSEMENT-RISQUE D'EXPLOSION. NE PAS DÉBRANCHER TANT QUE LE CIRCUIT EST SOUS TENSION, À MOINS QU'IL NE S'AGISSE D'UN EMPLACEMENT NON DANGEREUX.

Cabinet for FCN/FCJ

The FCN/FCJ must be installed in a lockable metal cabinet with a key. Use a cabinet approved by local explosion-proof testing organization.

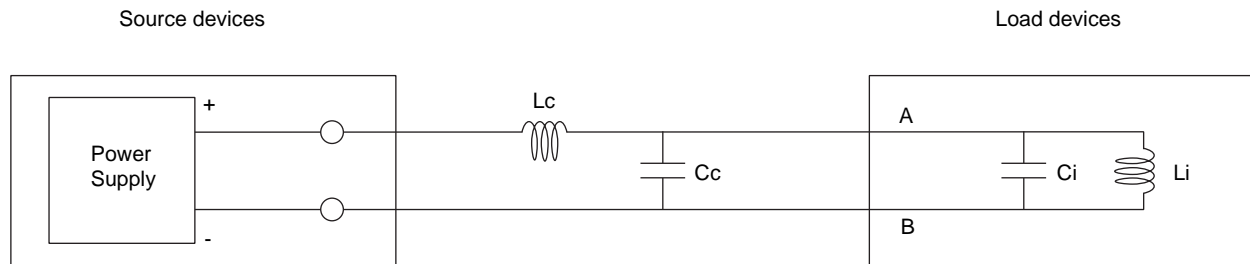
Use the FCN/FCJ accommodated in the cabinet on condition that the ambient temperature of the FCN/FCJ meets its specifications, considering temperature rise in the cabinet.

3.6.1 Parameters for Connecting NI Products

Supplying or receiving energy to/from circuits affects NI characteristics. Parameters must be displayed for circuit protection when connecting NI products. NI products are classified into source devices and load devices.

NI Product Connection and Parameters

Parameters in Connecting NI-compliant Devices



Parameters

Voc: Maximum open circuit output voltage

Isc: Maximum short circuit output current

Ca: Maximum allowable capacitance

La: Maximum allowable connected inductance

Cn: Maximum allowable connected capacitance based upon the normal circuit voltage V_n

V_n : Normal circuit voltage

L_n : Maximum allowable inductance based upon the normal circuit current I_n

I_n : Normal circuit current

C_c : External wiring (circuit) cable capacitance

L_c : External wiring (circuit) cable inductance

Parameters

V_{max} : Maximum input voltage

I_{max} : Maximum input current

C_i : Maximum internal capacitance

L_i : Maximum internal inductance

Figure Parameters in Connecting NI-compliant Devices

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IMPORTANT

For current controlled circuits the parameter I_{max} is not required and need not be aligned with parameter I_{sc} or I_t of the barrier or associated nonincendive field wiring apparatus.

Source Device Parameters

- Voc: Maximum open circuit output voltage
Maximum voltage generated at the open terminal (part) when an NI-circuit is an open circuit
- Isc: Maximum short circuit output current
Maximum current running when making a short NI-circuit or grounding an NI circuit
- Ca: Maximum allowable capacitance
Maximum capacitance connectable to an NI circuit
- La: Maximum allowable inductance
Maximum inductance connectable to an NI circuit
- Cn: Maximum allowable capacitance (at normal circuit voltage V_n)
Maximum capacitance connectable when normal circuit voltage V_n is applied to an NI circuit (circuit current running where a circuit is not open, shorted, or grounded)
- Vn: Normal circuit voltage
Circuit voltage generated where a circuit is not open, shorted, or grounded
- Ln: Maximum allowable inductance (at normal circuit current I_n)
Maximum inductance connectable when normal circuit current I_n is applied to an NI circuit (circuit current running where a circuit is not open, shorted, or grounded)
- In: Normal circuit current
Circuit current running where a circuit is not open, shorted, or grounded
- Cc: Capacitance of external wiring (circuit) cable
- Lc: Inductance of external wiring (circuit) cable

Load Device Parameters

- Vmax: Maximum input voltage
Maximum input voltage to maintain NI characteristics of the relevant device
- Imax: Maximum input current
Maximum input current to maintain NI characteristics of the relevant device
- Ci: Maximum internal capacitance
Maximum internal capacitance of a device which can be connected to an NI circuit (external wiring) when the device is connected to the NI circuit
- Li: Maximum internal inductance
Maximum internal inductance of a device which can be connected to an NI circuit (external wiring) when the device is connected to the NI circuit

3.6.2 NI Products and Parameters

For the applicable I/O modules and their parameters, see “Appendix 2. CSA NI Control Drawing for STARDOM FCN”.

3.6.3 How to Compare Parameters

Before connecting the STRADOM I/O modules of FCN to NI products, both source and load parameters must satisfy the following conditions:

Div2 wiring based on CEC or local electrical code

Source devices		Load devices
V_n	\leq	V_{max}
I_n	\leq	I_{max}
C_n	\geq	Total C_i of source devices + total capacitance C_c (*1) of external wiring
L_n	\geq	Total L_i of source devices + total inductance L_c (*2) of external wiring

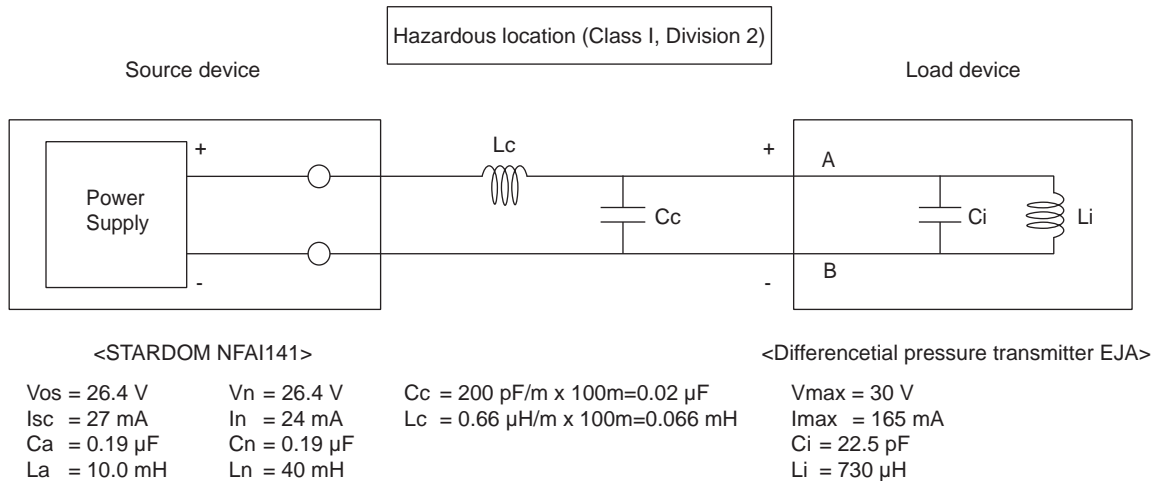
General wiring based on CEC or local electrical code

Source devices		Load devices
V_{oc}	\leq	V_{max}
I_{sc}	\leq	I_{max}
C_a	\geq	Total C_i of source devices + total capacitance C_c (*1) of external wiring
L_a	\geq	Total L_i of source devices + total inductance L_c (*2) of external wiring

*1: If the value is unknown, calculate using 200 pF/m.
 *2: If the value is unknown, calculate using 0.66 μ H/m.

Example

Consider how to connect the NFAI141 Current Input Module, one of the STRADOM I/O modules of FCN, to Yokogawa's EJA Differential Pressure Transmitter. One EJA is connected to one circuit of the NFAI141 module via 100 m cable, which is located in a Class I Division 2 Hazardous Area.



Therefore,
 $V_{os} = 26.4\text{ V} < V_{max} = 30\text{ V}$
 $I_{sc} = 27\text{ mA} < I_{max} = 165\text{ mA}$
 $C_a = 0.19\ \mu\text{F} > C_i + C_c = 0.0425\ \mu\text{F}$
 $L_a = 10\ \text{mH} > L_i + L_c = 0.796\ \text{mH}$

Since the conditions for Non-incendive wiring are satisfied, NFAI141 can be connected with EJA.

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Figure Connecting NFAI141 with EJA

3.7 IECEx Ex “ec”

IECEx Ex “ec” is a construction that enhances safety not to cause a spark, an arc or high surface temperatures in a normal operation in IEC standard and also to avoid causing a spark, an arc or high surface temperatures under defined conditions such as an overload.

Complied Standards

IECEx Ex “ec” standards complied by the FCN-500 and FCN-RTU are the following.

[Marking]

Ex ec IIC T4 Gc

[Applicable Standards]

IEC 60079-0 Ed. 7.0 (2017)

IEC 60079-7 Ed. 5.1 (2017)

The FCN-500 and FCN-RTU can be installed in a hazardous area of Zone 2 after accommodating them in a keyed cabinet (*1) of protection rating IP54 or higher. They can be connected to a Ex “ec”/Type “n” approved field device installed in a hazardous area of Zone 2. (*2)

In addition, it is possible to connect them installed in a non-hazardous area and a Ex “ec”/Type “n” approved field device installed in a hazardous area of Zone 2. (*2)

They can be connected to the intrinsic safety device installed in Zone 0, Zone 1 and Zone 2 using a barrier. (*3)

- *1: Use the FCN-500 and FCN-RTU accommodated in the cabinet on condition that the ambient temperature of the FCN-500 and FCN-RTU meets its specifications, considering temperature rise in the cabinet.
- *2: Explosion-proof wiring for Ex “ec”/Type “n” device that is defined in IEC 60079-14 and the rules/standards of each country or region is needed.
- *3: Explosion-proof wiring for intrinsically safe circuits that is defined in IEC 60079-14 and IEC 60079-25 and the rules/standards of each country or region is needed.

Ex “ec” Approved Products

Table Ex “ec” Products (FCN-500)

	Type	Model	Description
1	Base Module	NFBU050-S1E, -S1F	Base Module (short)
		NFBU200-S□E, -S□F	Base Module (long)
2	Power Supply Module	NFPW444-E□	Power Supply Module (24 V DC input)
3	CPU Module	NFCP501-□□E, -□□F	CPU ModuleCPU module for FCN (with 2 Ethernet ports)
		NFCP502-□□E, -□□F	CPU ModuleCPU module for FCN (with 4 Ethernet ports)
4	I/O Module	NFAI141-SE□	Analog Input Module (4 to 20 mA, 16-channel, Non-Isolated)
		NFAI143-□E□	Analog Input Module (4 to 20 mA, 16-channel, Isolated)
		NFAI543-□E□	Analog Output Module (4 to 20 mA, 16channel, Isolated)
		NFAI841-SE□	Analog I/O Module (4 to 20 mA input, 4 to 20 mA output, 8-channel input/ 8-channel output, Non-Isolated)
		NFAI835-□E□	Analog I/O Module (4 to 20 mA, 4-channel input/4-channel output, Isolated channels)
		NFAR181-SE□	RTD Input Module (12-channel, Isolated)
		NFDV151-PF□	Digital Input Module (32-channel, 24 V DC, Isolated)
		NFDV551-PF□	Digital Output Module (32-channel, 24 V DC, Isolated)
5	Pressure Clamp Terminal Block etc.	NFTA4S	Pressure Clamp Terminal Block for Analog (16-channel)
		NFTR8S	Pressure Clamp Terminal Block for RTD (16-channel)
		NFTB5S	Pressure Clamp Terminal Block for Digital Input (32-channel)
		NFTD5S	Pressure Clamp Terminal Block for Digital Output (32-channel)
		NFTI3S	Pressure Clamp Terminal Block for Isolated Analog Module (for NFAI135, NFAP135, NFAF135)
		NFDCV0□	Dummy cover
		NFCCC01	MIL Cable Connector Cover
6	Terminal Block	TAS40	MIL Connector Terminal Block (40 Pole Plug Types)
		TAS50	MIL Connector Terminal Block (50 Pole Plug Types)
7	Cable	KMS40	MIL Connector Cable (40 Pole Plug Types)
		KMS50	MIL Connector Cable (50 Pole Plug Types)

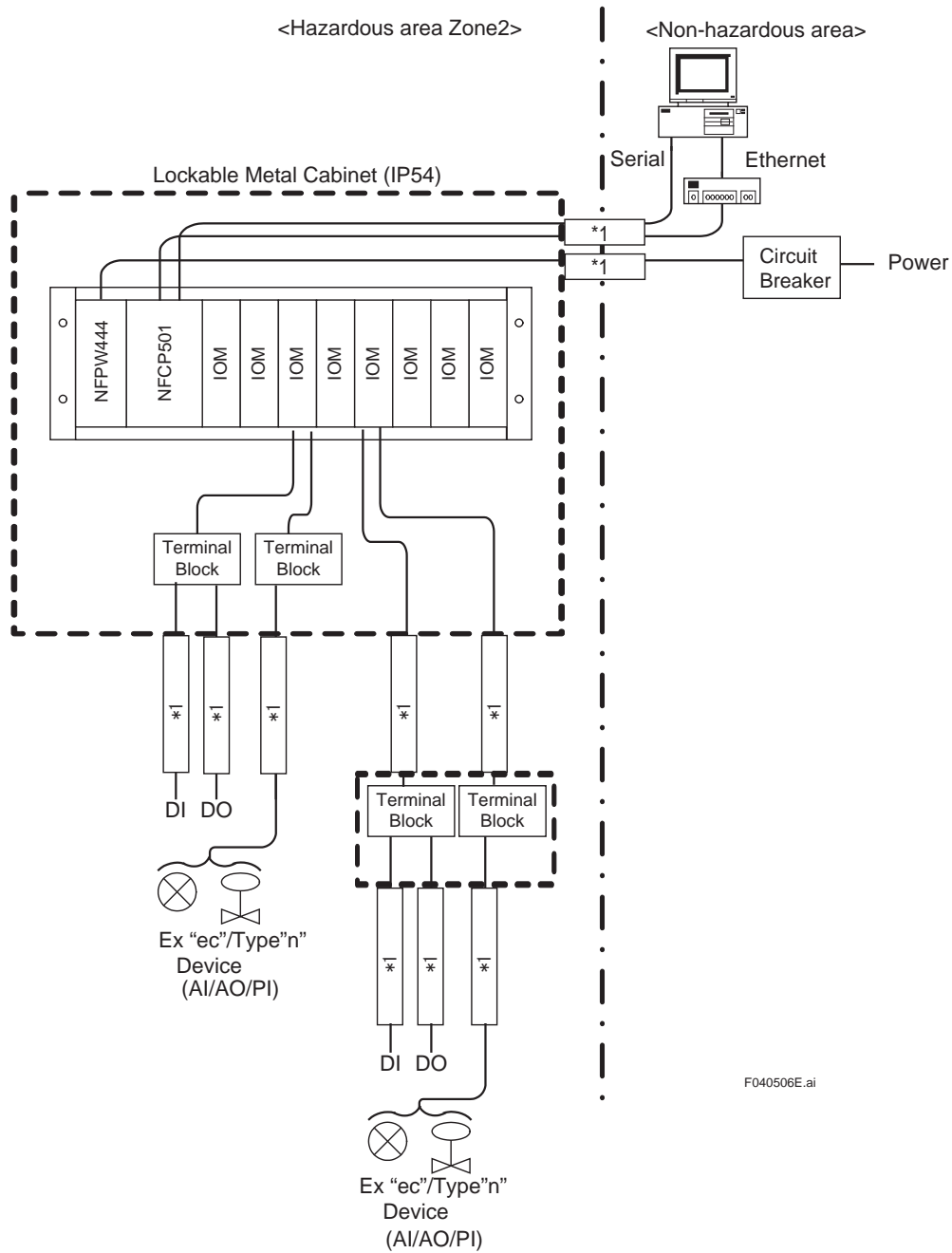
Table Ex “ec” Products (FCN-RTU)

	Type	Model	Description
1	Base Module	NFBU050-S1E, -S1F	Base Module (short)
		NFBU200-S□E, -S□F	Base Module (long)
2	Power Supply Module	NFPW426-E□	Power Supply Module 12 VDC input, 24 VDC input)
		NFPW444-E□	Power Supply Module (24 V DC input)
3	CPU Module	NFCP050-S□E, -S□F	CPU module for FCN-RTU
4	I/O Module	NFAI141-SE□	Analog Input Module (4 to 20 mA, 16-channel, Non-Isolated)
		NFAI143-□E□	Analog Input Module (4 to 20 mA, 16-channel, Isolated)
		NFAI543-□E□	Analog Output Module (4 to 20 mA, 16channel, Isolated)
		NFAI841-SE□	Analog I/O Module (4 to 20 mA input, 4 to 20 mA output, 8-channel input/ 8-channel output, Non-Isolated)
		NFAI835-□E□	Analog I/O Module (4 to 20 mA, 4-channel input/4-channel output, Isolated channels)
		NFAR181-SE□	RTD Input Module (12-channel, Isolated)
		NFDV151-PF□	Digital Input Module (32-channel, 24 V DC, Isolated)
		NFDV551-PF□	Digital Output Module (32-channel, 24 V DC, Isolated)
5	Pressure Clamp Terminal Block etc.	NFTA4S	Pressure Clamp Terminal Block for Analog (16-channel)
		NFTR8S	Pressure Clamp Terminal Block for RTD (16-channel)
		NFTB5S	Pressure Clamp Terminal Block for Digital Input (32-channel)
		NFTD5S	Pressure Clamp Terminal Block for Digital Output (32-channel)
		NFTI3S	Pressure Clamp Terminal Block for Isolated Analog Module (for NFAI135, NFAP135, NFAF135)
		NFDCV0□	Dummy cover
		NFCCC01	MIL Cable Connector Cover
6	Terminal Block	TAS40	MIL Connector Terminal Block (40 Pole Plug Types)
		TAS50	MIL Connector Terminal Block (50 Pole Plug Types)
7	Cable	KMS40	MIL Connector Cable (40 Pole Plug Types)
		KMS50	MIL Connector Cable (50 Pole Plug Types)

IMPORTANT

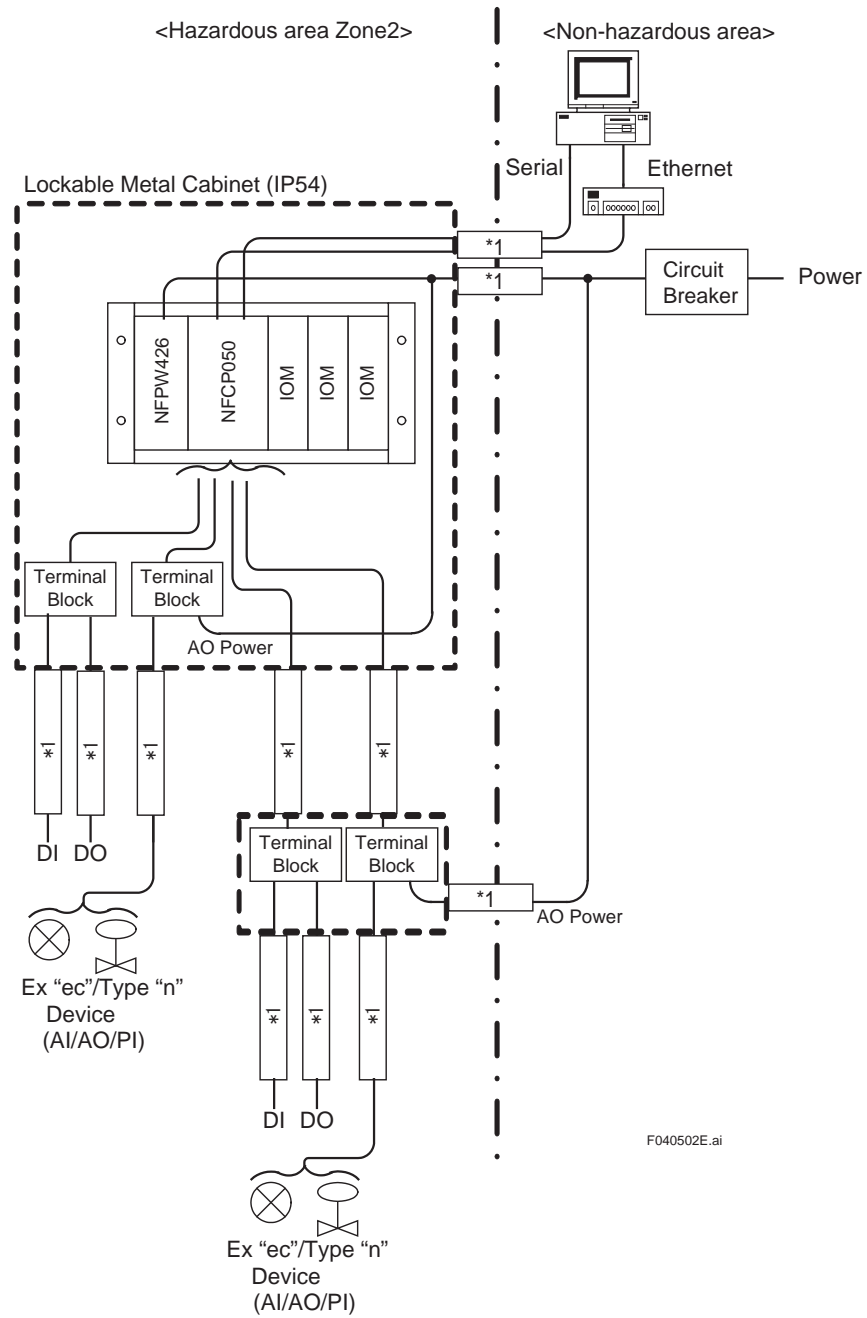
- In hazardous areas where the use of EPL Gc device is required, the FCN-500 and FCN-RTU needs to be installed in a lockable metal cabinet that provides a degree of protection not less than IP54 in accordance with IEC 60079-15.
- In hazardous areas, all the cables such as FCN-500 and FCN-RTU power cable, Ethernet cable, serial port cable, and SB bus cable used outside of the above described cabinet must be wired in accordance with the IEC 60079-14 and the relevant local electrical codes for explosionproof.
- The power cables of FCN-500 and FCN-RTU must be wired from a non-hazardous area without applying stress to the end of the cables.
For emergency purpose, convenient means of switching-off the electrical supplies to FCN-500 and FCN-RTU shall be provided in accordance with IEC 60079-14.

The figure below is an example of the configuration of Ex “ec”/Type “n” products of FCN-500 and FCN-RTU.



*1: Explosion-proof wiring for Ex "ec"/Type "n" device that is defined in IEC 60079-14 and the rules/standards of each country or region

Figure Ex “ec”/Type “n” Products and Their Configuration



*1: Explosion-proof wiring for Ex "ec"/Type "n" device that is defined in IEC 60079-14 and the rules/standards of each country or region

Figure Ex "ec"/Type "n" Products and Their Configuration

Connecting with Field Devices

The FCN-500 and FCN-RTU Ex “ec” equipment can be connected to the intrinsic safety device installed in Zone 0, Zone 1 and Zone 2 using a barrier and explosion-proof wiring as shown in the following figures.

They can be connected to Ex “ec”/Type “n” device installed in Zone 2 using explosion-proof wiring for type “n” device that is defined in IEC 60079-14 and the rules/standards of each country or region.

And they can be connected to flameproof device using explosion-proof wiring for flameproof device that is defined in IEC 60079-14 and the rules/standards of each country or region.

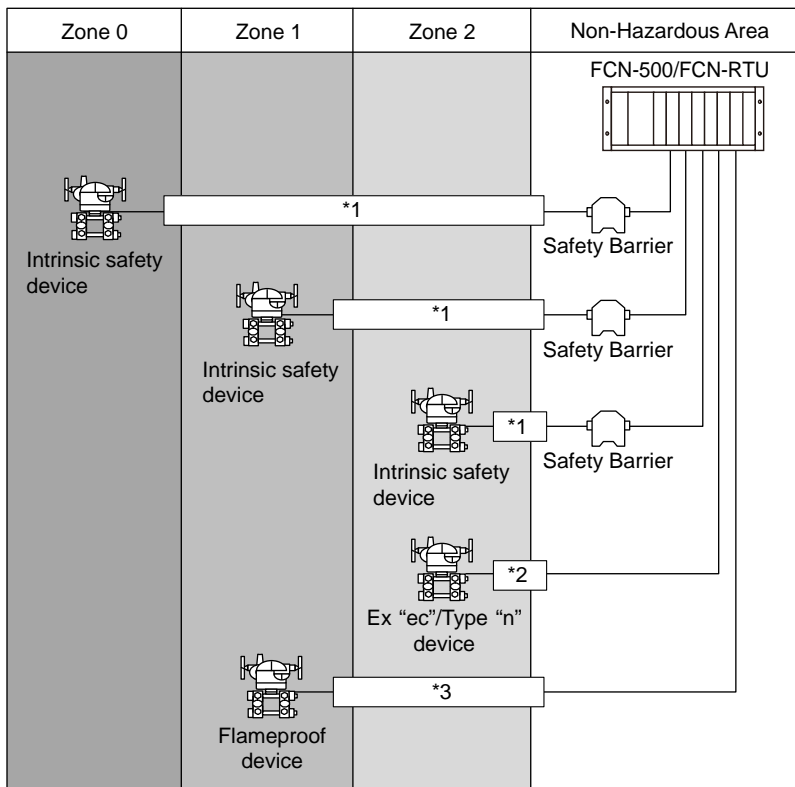
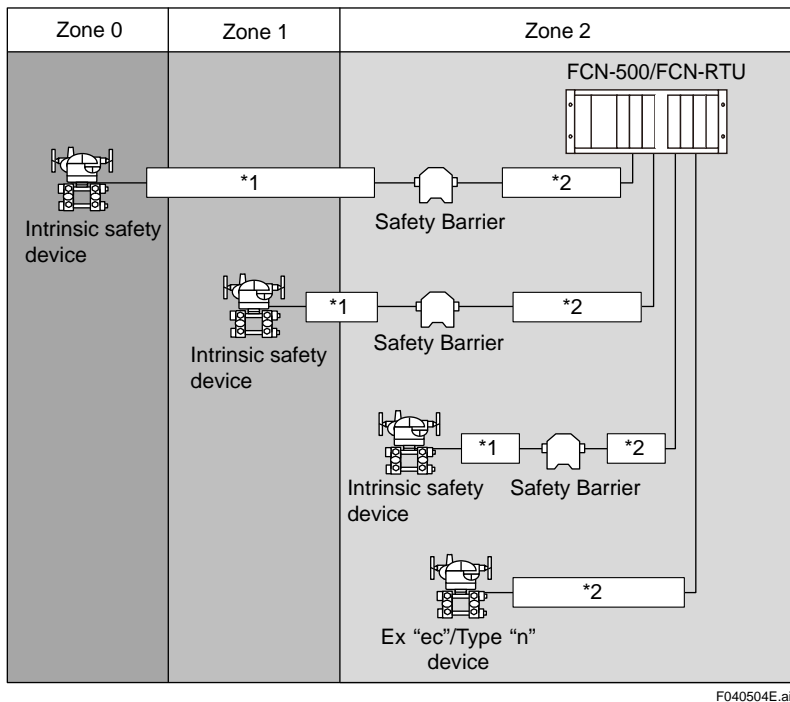


Figure Installation in Non-Hazardous Area

- *1: Explosion-proof wiring for intrinsically safe circuits that is defined in IEC 60079-14 and IEC 60079-25 and the rules/standards of each country or region
- *2: Explosion-proof wiring for Ex “ec”/Type “n” device that is defined in IEC 60079-14 and the rules/standards of each country or region
- *3: Explosion-proof wiring for flameproof device that is defined in IEC 60079-14 and the rules/standards of each country or region



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Figure Installation in Zone2

- *1: Explosion-proof wiring for intrinsically safe circuits that is defined in IEC 60079-14 and IEC 60079-25, and the rules/standards of each country or region
- *2: Explosion-proof wiring for Ex "ec"/Type "n" device that is defined in IEC 60079-14 and the rules/standards of each country or region

Specific Conditions of Use

- The equipment shall only be used in an area of not more than pollution degree 2, as defined in IEC 60664-1.
- The equipment shall be installed in an enclosure that provides a degree of protection not less than IP54 in accordance with IEC 60079-15.

Installation

- Installations must be in accordance with IEC 60079-14 and related standards and codes.
- Instructions provided in GS (General specifications), TI (Technical Information of Installation Guidance) and/or IM (User's Manuals) must be observed.
- The degree of protection not less than IP54 must be maintained at cable entries into the cabinet.
- Venting slots of the equipment must not be blocked off by cable parts, fixing accessories etc. during installation.
- Screws of terminals for field wiring connections must be tightened with specified torque values.
- All empty slots in the cabinet must be properly covered with attached caps.
- All cables must be rigidly fixed in the cabinet.
- Modifications must not be made to the equipment.



WARNING

WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT,

- DO NOT OPEN THE CABINET WHILE THE EQUIPMENT **S** ARE ENERGIZED
 - DO NOT SEPARATE THE CONNECTIONS WHEN ENERGIZED
-

3.8 ECAS-Ex Ex “ec”

Emirates Conformity Assessment Scheme (ECAS-Ex) Ex “ec” is a construction that enhances safety not to cause a spark, an arc or high surface temperatures in a normal operation in IEC standard and also to avoid causing a spark, an arc or high surface temperatures under defined conditions such as an overload.

Complied Standards

ECAS-Ex Ex “ec” standards complied by the FCN-500 and FCN-RTU are the following.

[Marking]

Ex ec IIC T4 Gc

[Applicable Standards]

IEC 60079-0 Ed. 7.0 (2017)

IEC 60079-7 Ed. 5.1 (2017)

UAE.S IEC 60079-0

UAE.S IEC 60079-7

The FCN-500 and FCN-RTU can be installed in a hazardous area of Zone 2 after accommodating them in a keyed cabinet (*1) of protection rating IP54 or higher. They can be connected to a Ex “ec”/Type “n” approved field device installed in a hazardous area of Zone 2. (*2)

In addition, it is possible to connect them installed in a non-hazardous area and a Ex “ec”/Type “n” approved field device installed in a hazardous area of Zone 2. (*2)

They can be connected to the intrinsic safety device installed in Zone 0, Zone 1 and Zone 2 using a barrier. (*3)

- *1: Use the FCN-500 and FCN-RTU accommodated in the cabinet on condition that the ambient temperature of the FCN-500 and FCN-RTU meets its specifications, considering temperature rise in the cabinet.
- *2: Explosion-proof wiring for Ex “ec”/Type “n” device that is defined in IEC 60079-14 and the rules/standards of each country or region is needed.
- *3: Explosion-proof wiring for intrinsically safe circuits that is defined in IEC 60079-14 and IEC 60079-25 and the rules/standards of each country or region is needed.

Ex “ec” Approved Products

Table Ex “ec” Products (FCN-500)

	Type	Model	Description
1	Base Module	NFBU050-S1E, -S1F	Base Module (short)
		NFBU200-S□E, -S□F	Base Module (long)
2	Power Supply Module	NFPW444-E□	Power Supply Module (24 V DC input)
3	CPU Module	NFCP501-□□E, -□□F	CPU ModuleCPU module for FCN (with 2 Ethernet ports)
		NFCP502-□□E, -□□F	CPU ModuleCPU module for FCN (with 4 Ethernet ports)
4	I/O Module	NFAI141-SE□	Analog Input Module (4 to 20 mA, 16-channel, Non-Isolated)
		NFAI143-□E□	Analog Input Module (4 to 20 mA, 16-channel, Isolated)
		NFAI543-□E□	Analog Output Module (4 to 20 mA, 16channel, Isolated)
		NFAI841-SE□	Analog I/O Module (4 to 20 mA input, 4 to 20 mA output, 8-channel input/ 8-channel output, Non-Isolated)
		NFAI835-□E□	Analog I/O Module (4 to 20 mA, 4-channel input/4-channel output, Isolated channels)
		NFAR181-SE□	RTD Input Module (12-channel, Isolated)
		NFDV151-PF□	Digital Input Module (32-channel, 24 V DC, Isolated)
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5	Pressure Clamp Terminal Block etc.	NFTA4S	Pressure Clamp Terminal Block for Analog (16-channel)
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		NFTI3S	Pressure Clamp Terminal Block for Isolated Analog Module (for NFAI135, NFAP135, NFAF135)
		NFDCV0□	Dummy cover
		NFCCC01	MIL Cable Connector Cover
6	Terminal Block	TAS40	MIL Connector Terminal Block (40 Pole Plug Types)
		TAS50	MIL Connector Terminal Block (50 Pole Plug Types)
7	Cable	KMS40	MIL Connector Cable (40 Pole Plug Types)
		KMS50	MIL Connector Cable (50 Pole Plug Types)

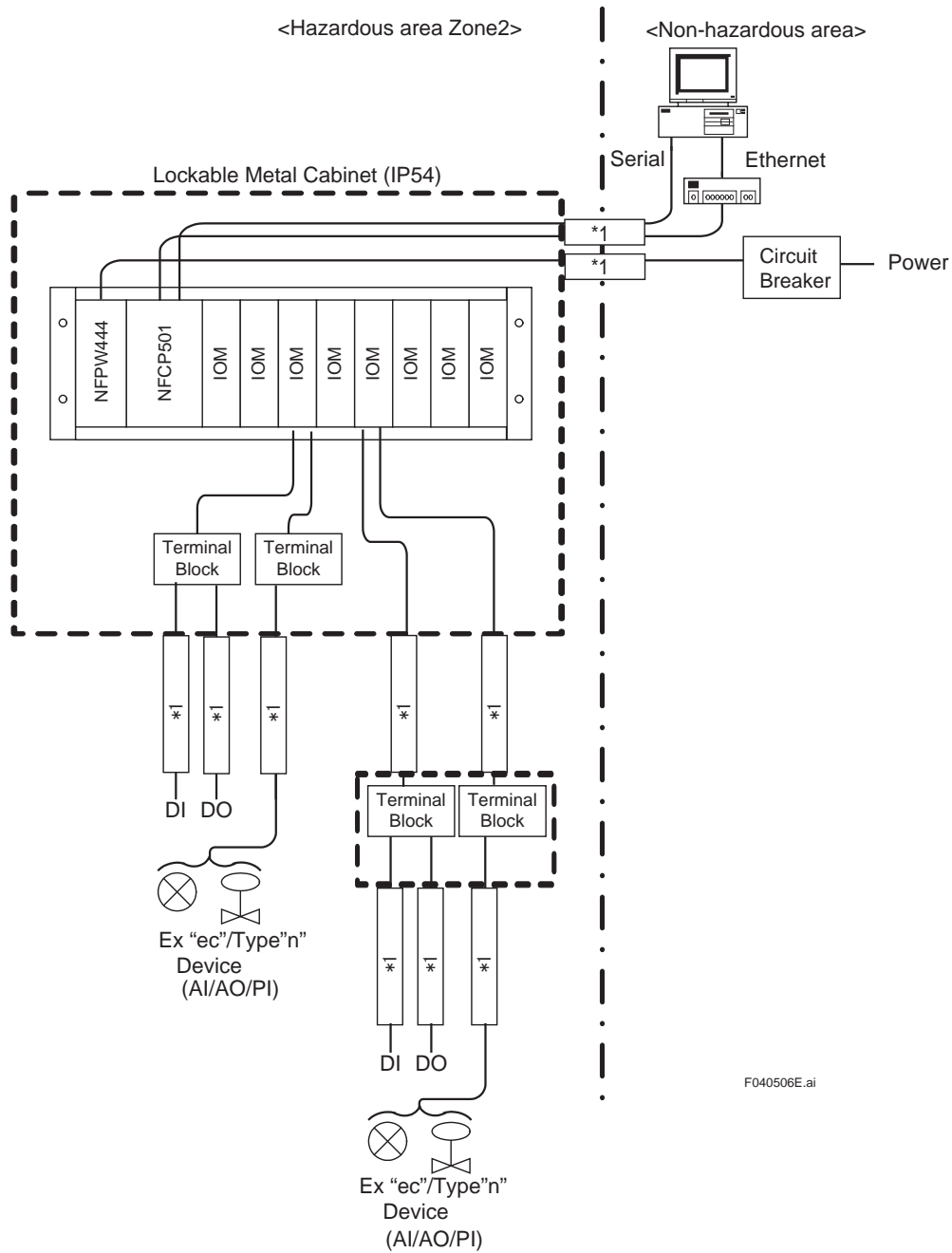
Table Ex “ec” Products (FCN-RTU)

	Type	Model	Description
1	Base Module	NFBU050-S1E, -S1F	Base Module (short)
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2	Power Supply Module	NFPW426-E□	Power Supply Module 12 VDC input, 24 VDC input)
		NFPW444-E□	Power Supply Module (24 V DC input)
3	CPU Module	NFCP050-S□E, -S□F	CPU module for FCN-RTU
4	I/O Module	NFAI141-SE□	Analog Input Module (4 to 20 mA, 16-channel, Non-Isolated)
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		NFAI543-□E□	Analog Output Module (4 to 20 mA, 16channel, Isolated)
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		NFAI835-□E□	Analog I/O Module (4 to 20 mA, 4-channel input/4-channel output, Isolated channels)
		NFAR181-SE□	RTD Input Module (12-channel, Isolated)
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6	Terminal Block	TAS40	MIL Connector Terminal Block (40 Pole Plug Types)
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7	Cable	KMS40	MIL Connector Cable (40 Pole Plug Types)
		KMS50	MIL Connector Cable (50 Pole Plug Types)

IMPORTANT

- In hazardous areas where the use of EPL Gc device is required, the FCN-500 and FCN-RTU needs to be installed in a lockable metal cabinet that provides a degree of protection not less than IP54 in accordance with IEC 60079-15.
- In hazardous areas, all the cables such as FCN-500 and FCN-RTU power cable, Ethernet cable, serial port cable, and SB bus cable used outside of the above described cabinet must be wired in accordance with the IEC 60079-14 and the relevant local electrical codes for explosionproof.
- The power cables of FCN-500 and FCN-RTU must be wired from a non-hazardous area without applying stress to the end of the cables.
For emergency purpose, convenient means of switching-off the electrical supplies to FCN-500 and FCN-RTU shall be provided in accordance with IEC 60079-14.

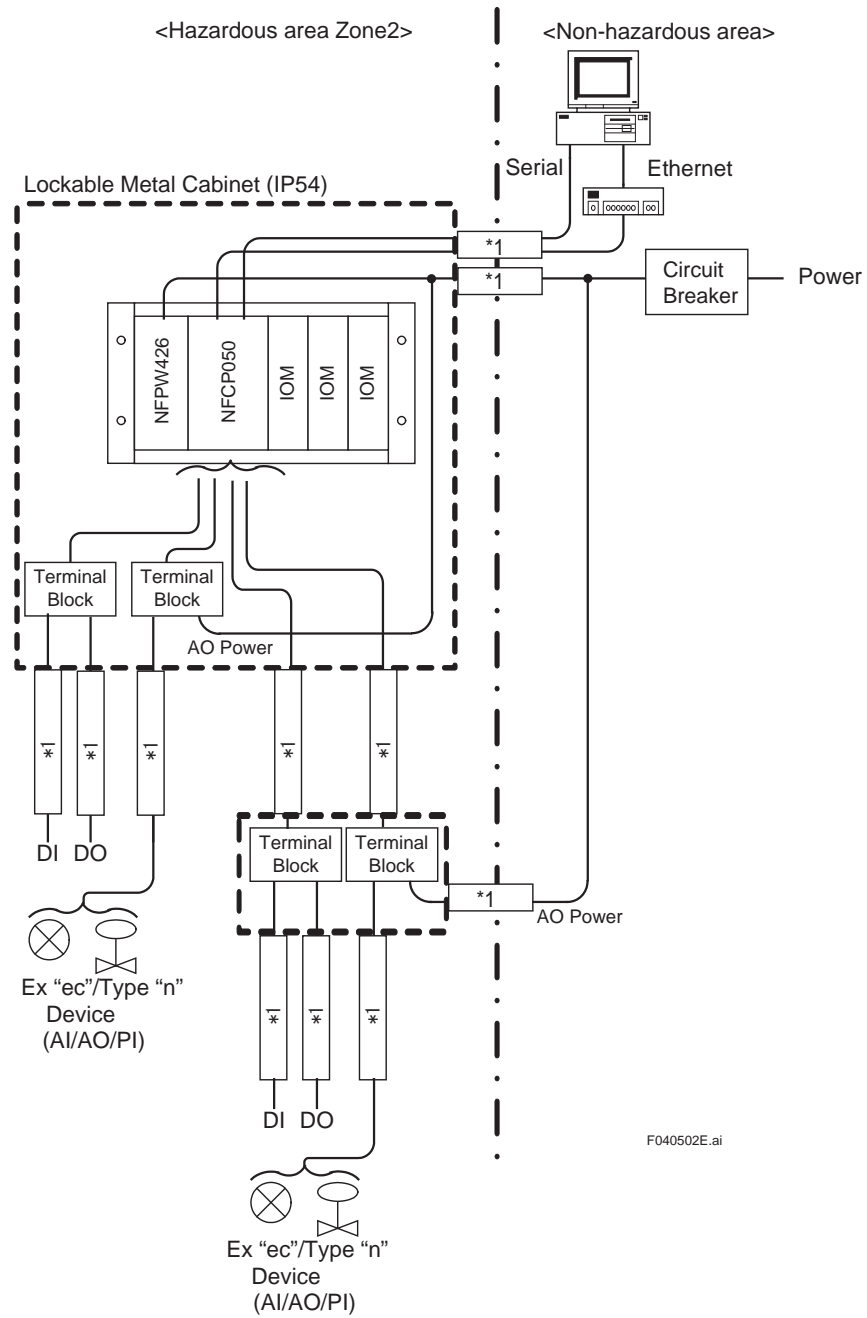
The figure below is an example of the configuration of Ex “ec”/Type “n” products of FCN-500 and FCN-RTU.



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*1: Explosion-proof wiring for Ex "ec"/Type "n" device that is defined in IEC 60079-14 and the rules/standards of each country or region

Figure Ex “ec”/Type “n” Products and Their Configuration



*1: Explosion-proof wiring for Ex "ec" device that is defined in IEC 60079-14 and the rules/standards of each country or region

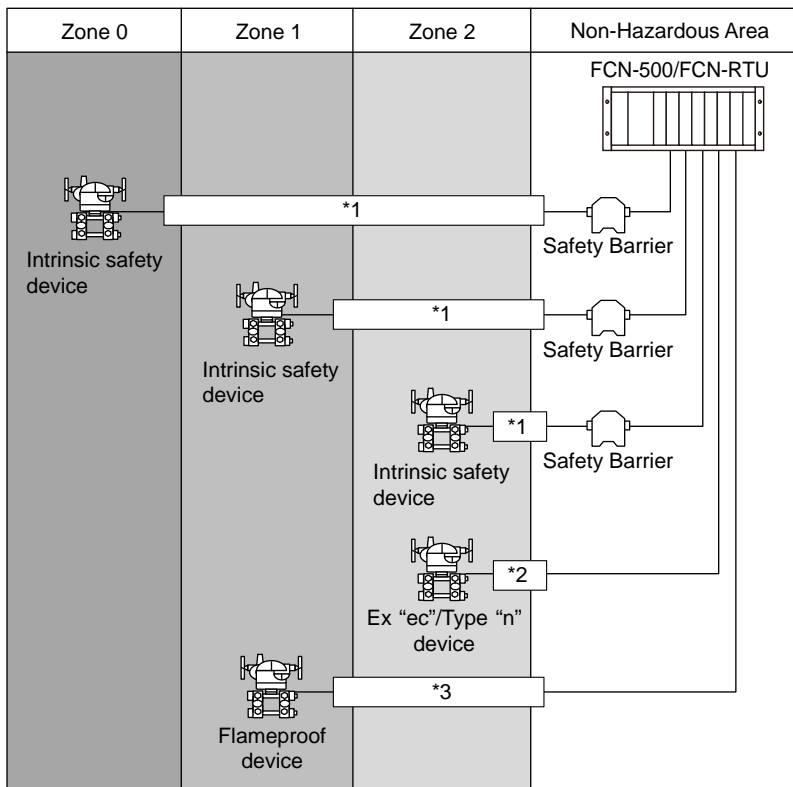
Figure Ex "ec"/Type "n" Products and Their Configuration

Connecting with Field Devices

The FCN-500 and FCN-RTU Ex “ec” equipment can be connected to the intrinsic safety device installed in Zone 0, Zone 1 and Zone 2 using a barrier and explosion-proof wiring as shown in the following figures.

They can be connected to Ex “ec”/Type “n” device installed in Zone 2 using explosion-proof wiring for type “n” device that is defined in IEC 60079-14 and the rules/standards of each country or region.

And they can be connected to flameproof device using explosion-proof wiring for flameproof device that is defined in IEC 60079-14 and the rules/standards of each country or region.



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Figure Installation in Non-Hazardous Area

- *1: Explosion-proof wiring for intrinsically safe circuits that is defined in IEC 60079-14 and IEC 60079-25 and the rules/standards of each country or region
- *2: Explosion-proof wiring for Ex “ec”/Type “n” device that is defined in IEC 60079-14 and the rules/standards of each country or region
- *3: Explosion-proof wiring for flameproof device that is defined in IEC 60079-14 and the rules/standards of each country or region

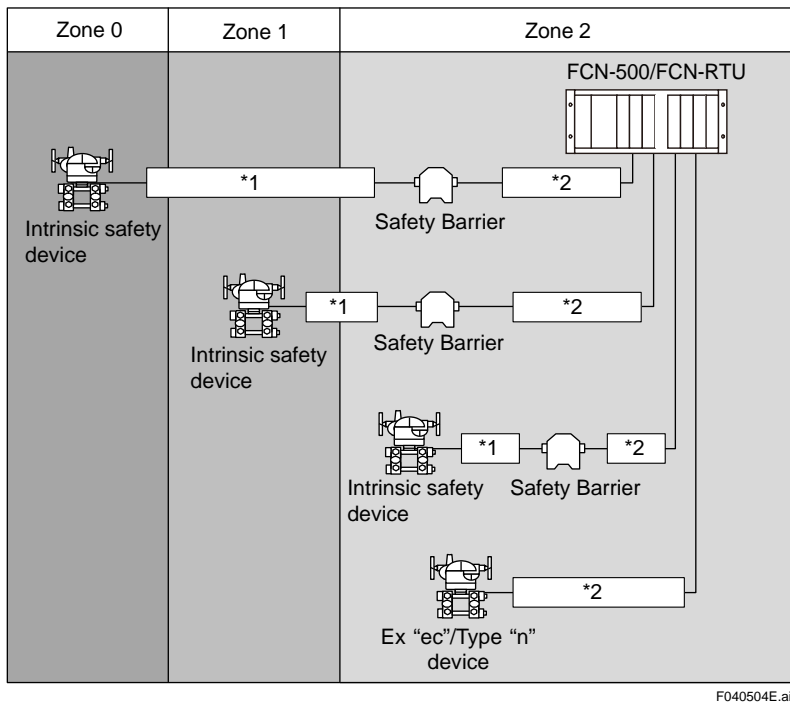


Figure Installation in Zone2

- *1: Explosion-proof wiring for intrinsically safe circuits that is defined in IEC 60079-14 and IEC 60079-25, and the rules/standards of each country or region
- *2: Explosion-proof wiring for Ex "ec"/Type "n" device that is defined in IEC 60079-14 and the rules/standards of each country or region

Specific Conditions of Use

- The equipment shall only be used in an area of not more than pollution degree 2, as defined in IEC 60664-1.
- The equipment shall be installed in an enclosure that provides a degree of protection not less than IP54 in accordance with IEC 60079-15.

Installation

- Installations must be in accordance with IEC 60079-14 and related standards and codes.
- Instructions provided in GS (General specifications), TI (Technical Information of Installation Guidance) and/or IM (User's Manuals) must be observed.
- The degree of protection not less than IP54 must be maintained at cable entries into the cabinet.
- Venting slots of the equipment must not be blocked off by cable parts, fixing accessories etc. during installation.
- Screws of terminals for field wiring connections must be tightened with specified torque values.
- All empty slots in the cabinet must be properly covered with attached caps.
- All cables must be rigidly fixed in the cabinet.
- Modifications must not be made to the equipment.



WARNING

WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT,

- DO NOT OPEN THE CABINET WHILE THE EQUIPMENT **S** ARE ENERGIZED
 - DO NOT SEPARATE THE CONNECTIONS WHEN ENERGIZED
-

3.9 Intrinsic Safety Explosion Protection Instrumentation Using Barriers

Intrinsic safety explosion protection is an electric circuit and a construction, which made so as not to ignite to gas by controlling the energy of electric circuit, if sparks, arc, and heat occur at the time of normal operating and an accident (short-circuit, earth fault, burnout). Intrinsic safety explosion protection equipments include intrinsic safety equipments and equipments related with intrinsic safety. Intrinsic safety equipments are able to be used in hazardous area. Equipments related with intrinsic safety are set up in non-hazardous area, and is connected with intrinsic safety equipment.

Intrinsic safety explosion protection instrumentation for FCN/FCJ shall be materialized by combining with equipment related with intrinsic safety such as Zener barrier and isolated barrier, sold by barrier manufacturers, and by connecting to intrinsic safety equipment.

3.9.1 Category of Barriers

There are two major barriers: Zener barrier and isolated barrier; and the latter is recommended for FCN/FCJ. Zener barrier can be used for a certain module, but basically select isolated barrier.

1. Feature of Zener barriers
Zener barrier has a simple construction which consists of just Zener Diode and resistance. Due to the simple construction, it is limited in use.
As the circuit of hazardous area and non-hazardous area are not insulated, they request the single point ground by the bus bar of Zener barriers, so as not to be created the functionally unfavorable ground loop by double point ground. Moreover, in most countries, it is impossible to ground circuits in hazardous area.
A power supply for barrier is not required, because Zener barriers carry out the function for security just with Zener Diode and resistance.
2. Feature of isolated barriers
On the other hand, isolated barriers does not request intrinsic safety ground because the place between input and output of them is insulated. It is possible to ground circuits in hazardous area and use them (single point ground). However, a power supply for barrier is additionally required.

Considerations for Selection of Barrier

Here is a general explanation about the selection of barrier. Also, instrumentation on site is case by case, and the matters to notice are wide-ranging. The following 11 items are not all of the matters to consider. On the occasion of implementing intrinsic safety instrumentation, select a barrier according to the manufacture's specifications with the equipment.

Before connecting FCN/FCJ and barrier, make sure of the latest specification of the barrier and that there is no problem with connection.

1. Approved standard
Make sure the barrier has the approved standard which is required for the installation site.
2. Cost
Compared Zener barriers to isolated barriers about the general cost of the main unit only per a channel, the approximate proportion are 1 to 2. Also, isolated barriers request a power supply.

3. Volume (dimensions)
Dimensions may influence the number of cabinet in which the barrier is set. Compared Zener barriers to isolated barriers about the size per a general channel, the approximate proportion are 1 to 2.
4. Difficulty of wiring, necessity of isolated hazardous area circuit
Zener barriers always need intrinsic safety ground, and most model of them have the construction grounded through the bus bar. All the circuit on the same bus bar in hazardous area and non-hazardous area are grounded to the same electric potential. Moreover, in most countries, circuits in hazardous area need withstand voltage of 500 Vrms. Therefore, it is impossible to ground circuits in hazardous area and use them.
Isolated barriers impose no restrictions like this, so it is possible to ground circuits in hazardous area and use them (single point ground). However, a power supply for barrier is additionally required.
5. Failure rate
The construction of Zener barriers is simple, because they carry out the function for security just with Zener Diode and resistance. On the other hand, isolated barriers consist of various parts, because they have the function of insulation and energy restriction. Therefore, the failure rate of isolated barriers is generally higher than that of Zener barriers. In Zener barriers, problems are usually solved by replacement and, in isolated barriers by modification.
6. Accuracy, response
In general, Zener barriers have advantages about accuracy and response, because isolated barriers usually have more complex signal path than Zener barriers.
7. Withstand voltage
Withstand voltage is a rating which only isolated barriers have. Most of the models have 250 V or more AC/DC, so there's almost no problem at the time of instrumentation.
8. Security rating
Security rating indicates the scale of energy that can be occurred in hazardous area of barrier in the case of the accident.
It is usually described by the signage, such as $U_0 = n \text{ V}$, $I_0 = n \text{ mA}$, $P_0 = n \text{ W}$, $C_0 = n \text{ }\mu\text{F}$, $L_0 = n \text{ mH}$ ($U_m = n \text{ Vrms}$ or DC: only isolated barriers).
(In FM standard, it is called entity parameter, including the parameter of (10), and is described such as $V_{oc} = n \text{ V}$, $I_{sc} = n \text{ mA}$, $C_a = n \text{ }\mu\text{F}$, $L_a = n \text{ mH}$).
9. Permissible cable parameter
Permissible cable parameter indicates the scale (capacity, inductance) of hazardous area circuit (including cables) which can be connected to barriers. It is regulated by a barrier and a kind of gases. It is usually described by group (ex. IIC etc.=a kind of gases), $n \text{ }\mu\text{F}$ (capacity), $n \text{ mH}$ or $n \text{ }\mu\text{H}/\Omega$ (inductance or L/R ratio).
10. Voltage in non-hazardous area
In regards to Zener barriers, V_{wkg} (maximum working voltage) and V_{max} (maximum permissible voltage) are regulated. In regards to isolated barriers, regulation of voltage is for power supply rating only, but the use conditions of circuit in non-hazardous area are different by models.
11. Influence by resistance value between input and output
This is a matter of only Zener barriers. As resistance and fuse exist between terminals of input and output in a barrier, in regards to an application that pass an electric current, it is necessary to take account of voltage drop inside the barrier. Moreover, in some application, it is necessary to take account of Diode current leakage (usually several μA).

3.9.2 Wiring of Intrinsic Safety Explosion Protection

An intrinsic safety circuit must be isolated from non-intrinsic safety circuit. Keep creepage distance of at least 50 mm between intrinsic safety circuit and non-intrinsic safety circuit. Wiring should be prepared in accordance with IEC 60079-14, NEC (National Electrical code : NFPA-70), and the standard of the country and the area in which it is set. The wiring in cabinet should keep the distance to non-intrinsic safety circuit.

After setting, check the wiring according to the checklist described in IEC 60079-17.

An intrinsic safety circuit of barrier is indicated by the following ratings.

Maximum voltage of intrinsic safety circuit	U_0
Maximum current of intrinsic safety circuit	I_0
Maximum electricity of intrinsic safety circuit	P_0
Permissible inductance of intrinsic safety circuit	L_0
Permissible capacitance of intrinsic safety circuit	C_0

As a connection of intrinsic safety circuits connected with barriers and wiring, it is necessary to meet the following conditions to keep the intrinsic safety performance.

$$U_0 \leq U_i$$

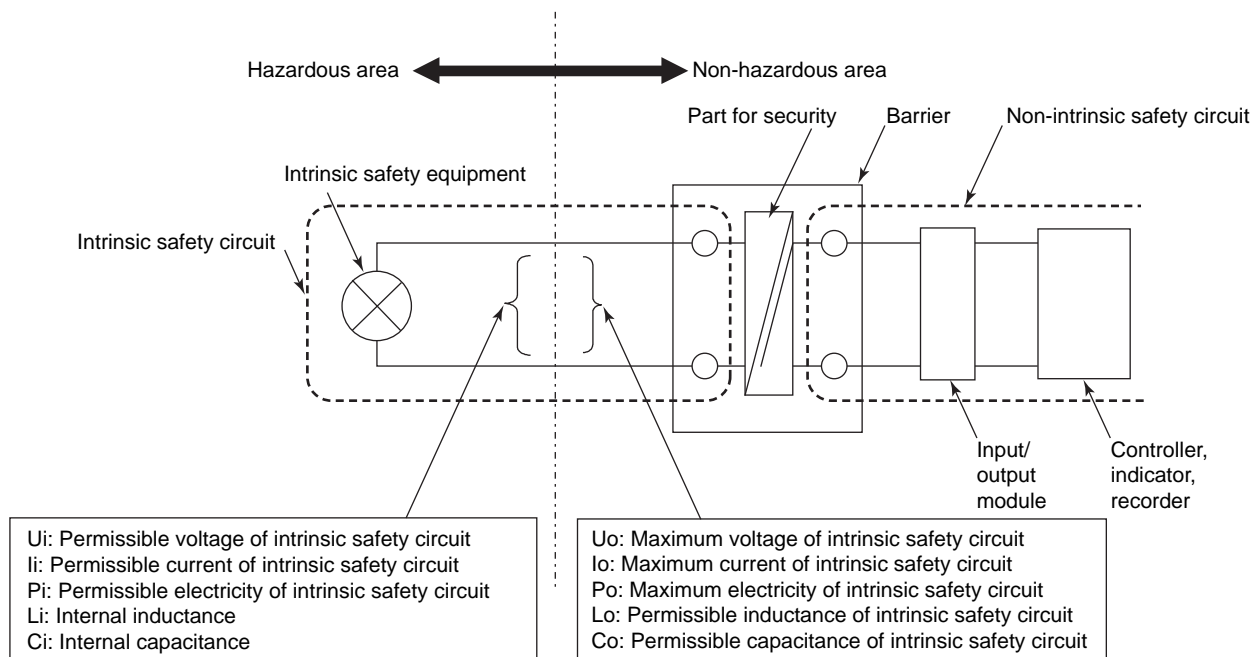
$$I_0 \leq I_i$$

$$P_0 \leq P_i$$

$$L_0 \geq L_i + L_w$$

$$C_0 \geq C_i + C_w$$

Intrinsic safety circuit should consist of barriers to meet these conditions of permissible voltage, current, and electricity, and should be wired so that inductance and capacitance of its wiring doesn't exceed its permissible value.



F040701E.ai

Figure Composition Used in a Barrier

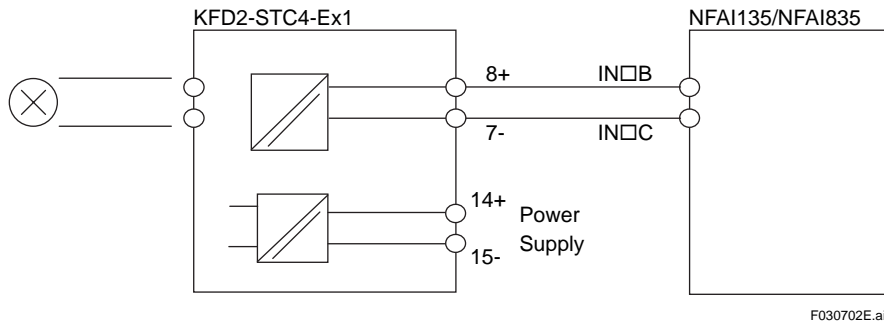
3.9.3 Concrete Examples of Connections between FCN/FCJ System and Barriers

The followings are the examples of connections between a barrier of various manufacturers and I/O module of FCN/FCJ, and their considerations.

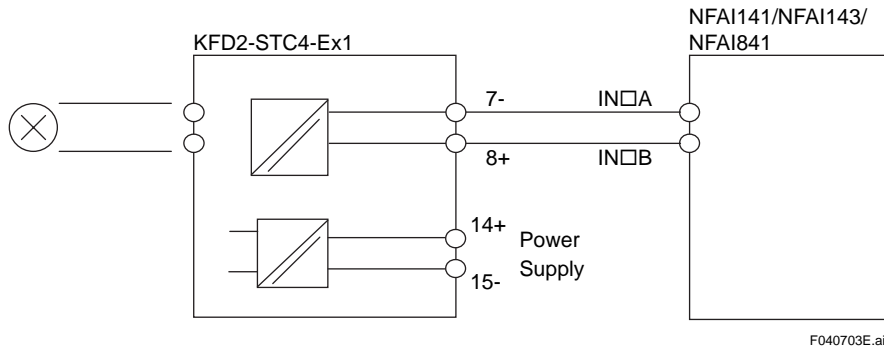
Before using barriers, make sure of barrier specification, conduct connection test and make sure that there is no problem.

Transmitter Input and Barrier

- Connection of NFAI135/NFAI835(Input) and KFD2-STC4-Ex1 from P+F



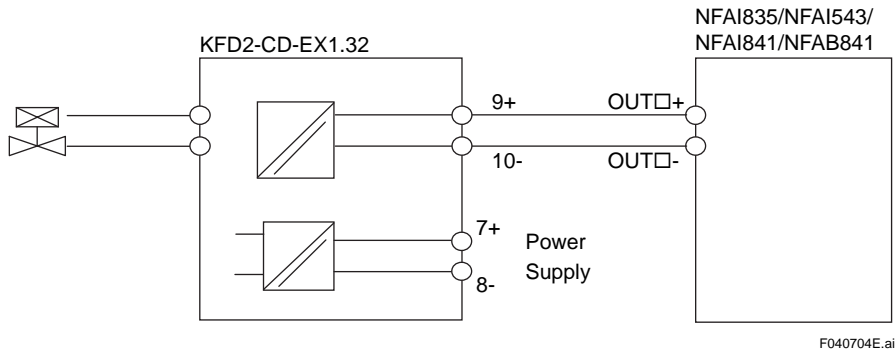
- Connection of NFAI141/NFAI143/NFAI841(Input) and KFD2-STC4-Ex1 from P+F



Note: Use NFAI141/NFAI143/NFAI841(Input) in four-wire input mode.

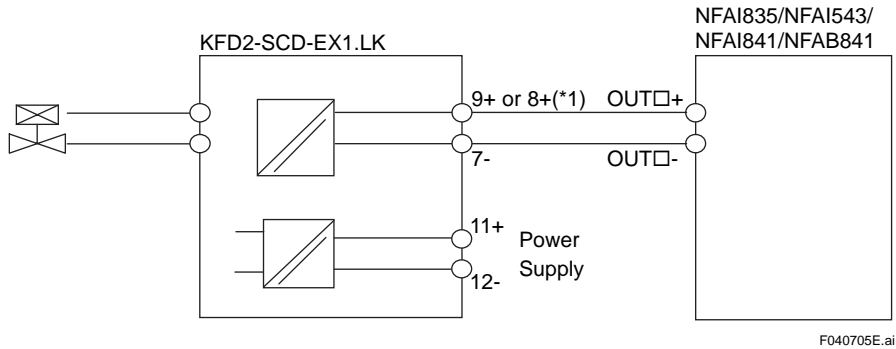
Operating Equipment and Barrier

- Connection of NFAI835(Output)/NFAI543/NFAI841(Output)/NFAB841(Output) and KFD2-CD-EX1.32 from P+F



Note: The barrier cannot detect burnout because of no function for it.

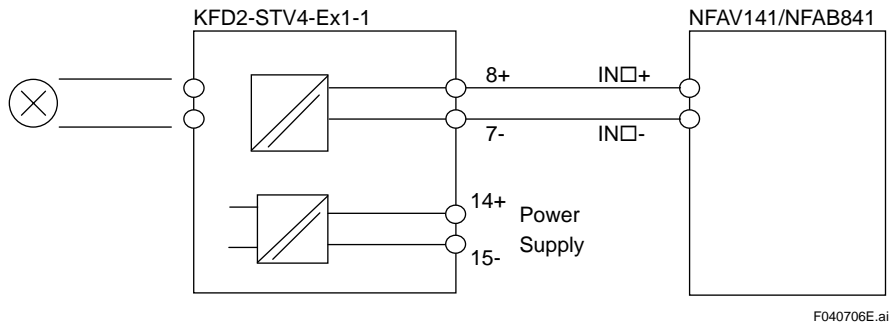
- Connection of NFAI835(Output)/NFAI543/NFAI841(Output)/NFAB841(Output) and KFD2-SCD-EX1.LK from P+F



*1: It is recommended that the connection with equipment with HART in the target I/O module be to 8+, the rest of the connections to 9+.

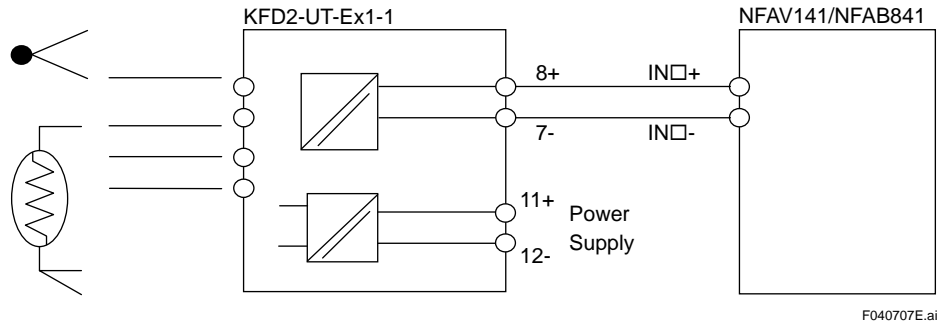
Transmitter Input and Barrier

- Connection of NFAV141/NFAB841(Input) and KFD2-STV4-Ex1-1



TC or RTD Input and Barrier

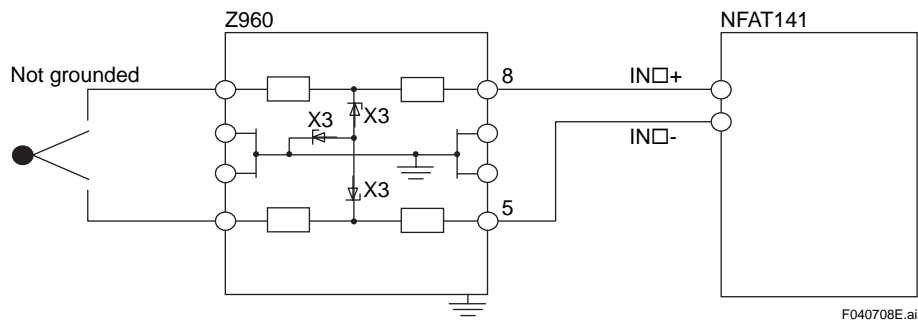
- Connection of NFAV141/NFAB841(Input) and KFD2-UT-Ex1-1



Note: In FCN/FCJ default detection level IOP, IOP can't be detected.

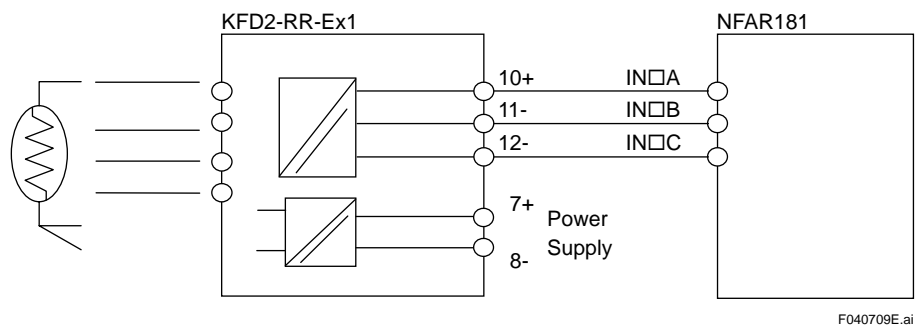
TC Input and Barrier

- Connection of NFAT141 and Z960



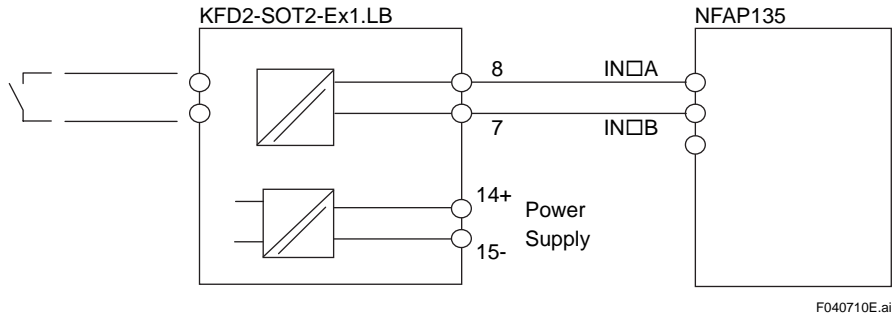
RTD Input and Barrier

- Connection of NFAR181 and KFD2-RR-Ex1



Contact Input and Barrier

- Connection of NFAP135 and KFD2-SOT2-Ex1.LB



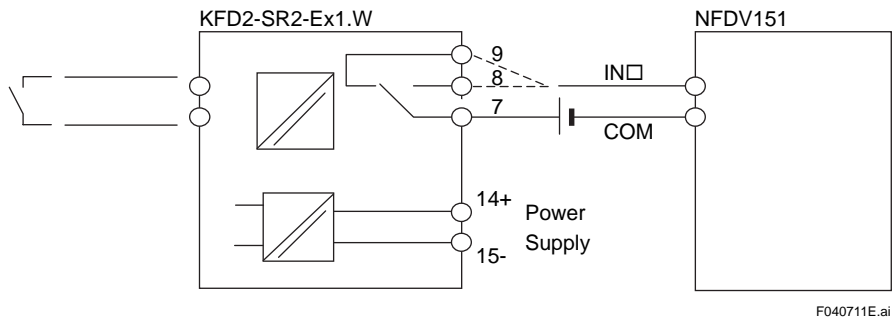
F040710E.ai

NFAP135 should be connected so as to receive current pulse.

In regards to the setting of the power supply of I/O module transmitter and the reception resistance, choose either of the following two.

- V_{tt} = 12 V, R_L = 500 Ω
- V_{tt} = 24 V, R_L = 1 kΩ

- Connection of NFDV151 and KFD2-SR2-Ex1.W / KFD2-SR2-Ex2.W



F040711E.ai

NFDV151 needs an external power supply so as to receive input (meet the input conditions of NFDV151).

As the barrier output has contact a/contact b, choose one of them.

If Switch S1 is the side of I, under the situation that the input to the barrier is ON, output pin8 is ON, and pin9 OFF.

If Switch S1 is the side of II, the polarity inverts.

Switch S3 is for breaking detection.

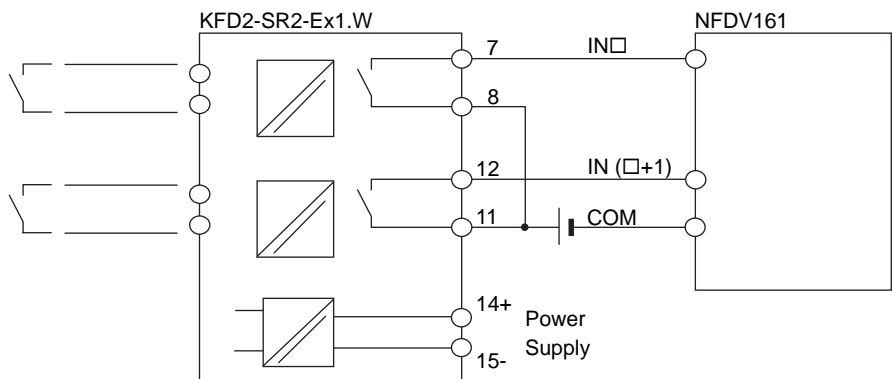
However, if the Switch S3 is I side, opening of contact is considered as breaking, and the output becomes off.

Therefore, Switch S3 should be usually used on the side of I.

Note that the switching of output relay in this barrier is available up to 10⁷ times.

Moreover, KFD2-SR2-Ex2.W has 2 circuits of the barrier for contact.

- Connection of NFDV161 and KFD2-SR2-Ex2.2S



F040712.ai

NFDV161 needs an external power supply so as to receive input (meet the input conditions of NFDV161).

If Switch S1 is the side of I, under the situation that the input to the barrier is ON, output pin7 is ON.

If Switch S1 is the side of I, the polarity inverts.

If Switch S2 is the side of I side, under the situation that the input to the barrier is ON, output pin12 is ON.

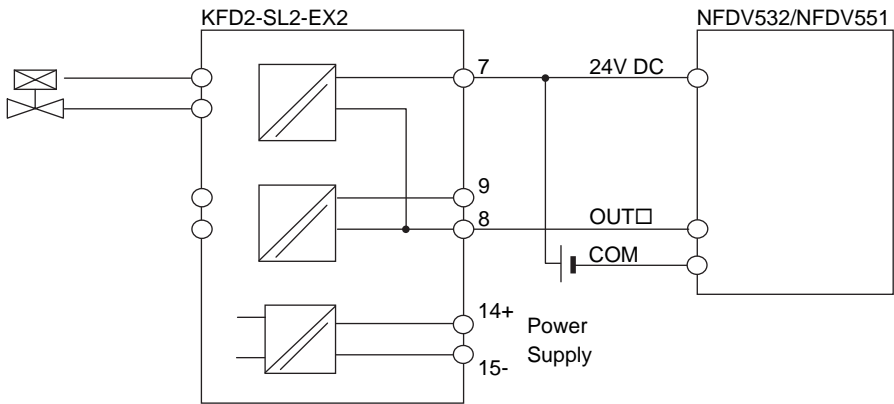
If Switch S2 is the side of I, the polarity inverts.

Note that the switching of output relay in this barrier is available up to 10⁸ times.

Contact Output and Barrier

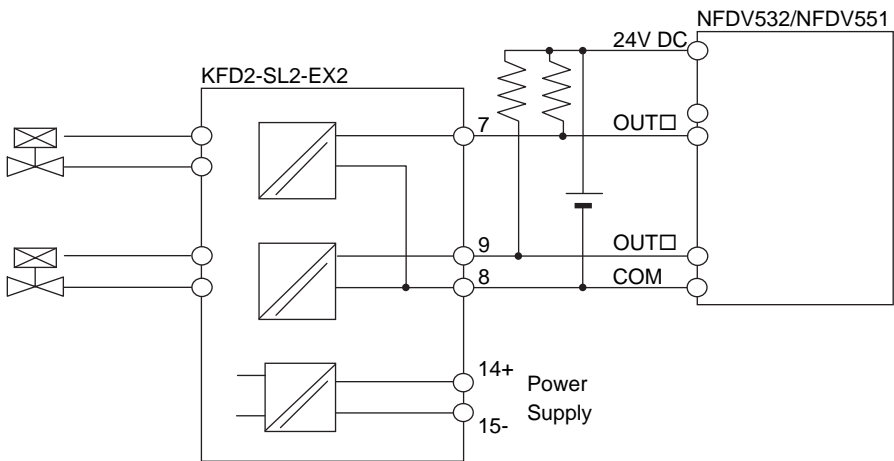
- Connection of NFDV532/NFDV551 and KFD2-SL2-Ex2

1. Case 1 (The barrier supports 2 channels, but this is the method of connecting 1 channel.)



F040713E.ai

2. Case 2 (This is a method of connecting 2 channels.)



F040714E.ai

3.10 Corrosive-gas Environment Compatibility

The STARDOM system employs modules which meet the ANSI/ISA G3 environment requirements by the option and are compatible with the corrosive gas-susceptible environment.

**SEE
ALSO**

Please refer to the general specifications (GS) for each module to check whether each module meets the G3 environment requirements.

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 cm² in area, 0.635 mm in thickness, 1/2 to 3/4H in hardness. The test piece is placed in the plant site for one month and checked for any change before and after the test to determine the degree of corrosion (see table below). If the test period is shorter than one month, the result is calculated to obtain equivalent data using an 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 ₂ S	< 3	< 10	< 50	≥ 50	[mm ³ /m ³]
	SO ₂ , SO ₃	< 10	< 100	< 300	≥ 300	
	Cl ₂	< 1	< 2	< 10	≥ 10	
	NO _x	< 50	< 125	< 1250	≥ 1250	
Group B	HF	< 1	< 2	< 10	≥ 10	
	NH ₃	< 500	< 10000	< 25000	≥ 25000	
	O ₃	< 2	< 25	< 100	≥ 100	

- Note:
- The gas density data indicated in the table are for reference only, with the relative humidity of 50% RH or less. The category goes up one rank higher every time the humidity increases 10% exceeding the 50% RH or over 6% per hour.
 - The Group-A gases shown in the table may coexist and cause inter-reaction.
 - Inter-reaction factors are not known for the Group-B gases.

3.11 Marking

Following marks are affixed to each module.

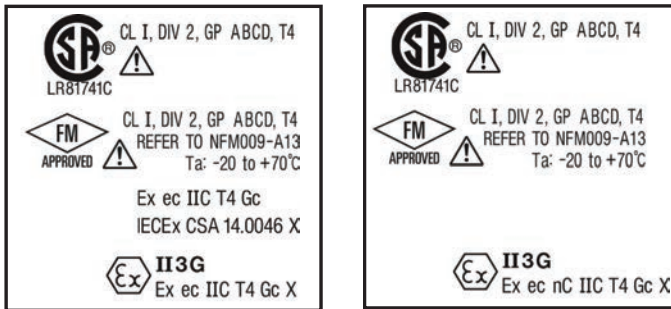


Figure Example of Marking

WARNING mark is affixed to the base board.



Figure WARNING mark

FCN

- N2BU030, N2BU051, NFBU050, NFBU200

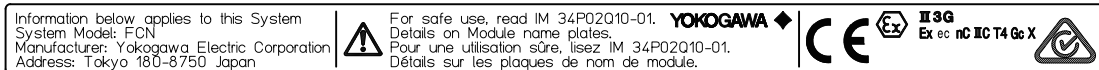


Figure System Name Plate



Figure Example of Marking

- NFPW426, NFPW444



Figure Example of Marking

- NFCP050, NFDV551



Figure Example of Marking

- NFCP501, NFCP502, Communication Module and other I/O Modules



Figure Example of Marking

Note: *1 shows "The country of origin".

*2 shows "Model code".

*3 Serial number, production year and month.

Marking Details

MODEL	: Specified model code
STYLE	: Style code
SUFFIX	: Specified suffix code
SUPPLY	: Supply voltage and current
No.	: Serial number, production year and month
YOKOGAWA◆	: The manufacturer name and corporated ID
TOKYO 180-8750 JAPAN	: Address of manufacturer "180-8750" is a zip code which represents 2-9-32 Nakacho, Musashino-shi, Tokyo Japan

4. Connections between I/O Modules and External Devices

Reconfirmation of Specifications



WARNING

- Reconfirm the input/output specifications of I/O modules. Take extra special care because if an excess voltage is applied to an input circuit, or if a voltage or current applied to an output circuit exceeds the maximum switching capacity, a failure, breakdown, or fire may result.
 - Ensure to turn off the power before detaching a cover for wiring or maintenance, to prevent an electric shock.
 - Ensure correct polarity for a power supply connection with the polarity designated.
-

IMPORTANT

I/O module and inner circuit of terminal block are subject to change without notice.

4.1 Connections to Analog I/O Modules

Refer to the following diagrams for connections to analog I/O modules.

NFAI141 Module (4 to 20 mA inputs, non-isolated)

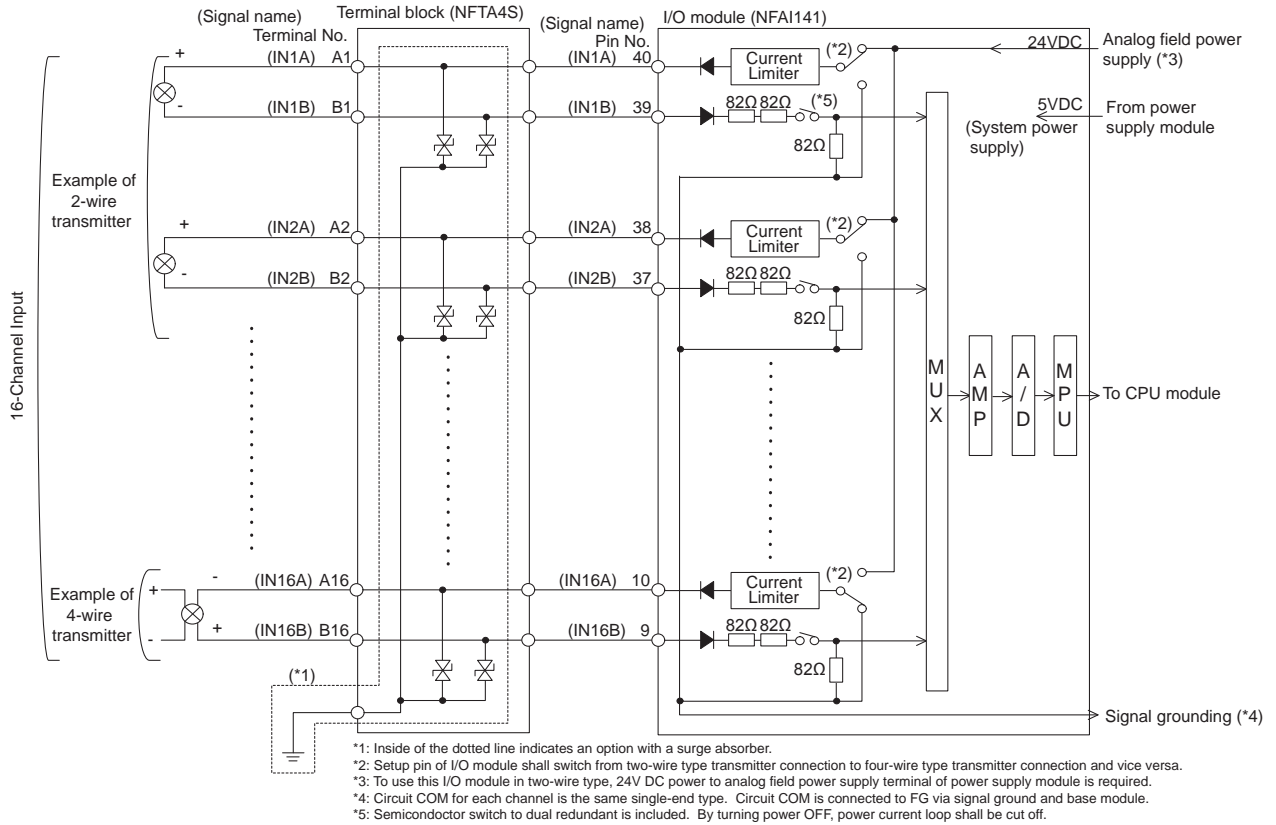
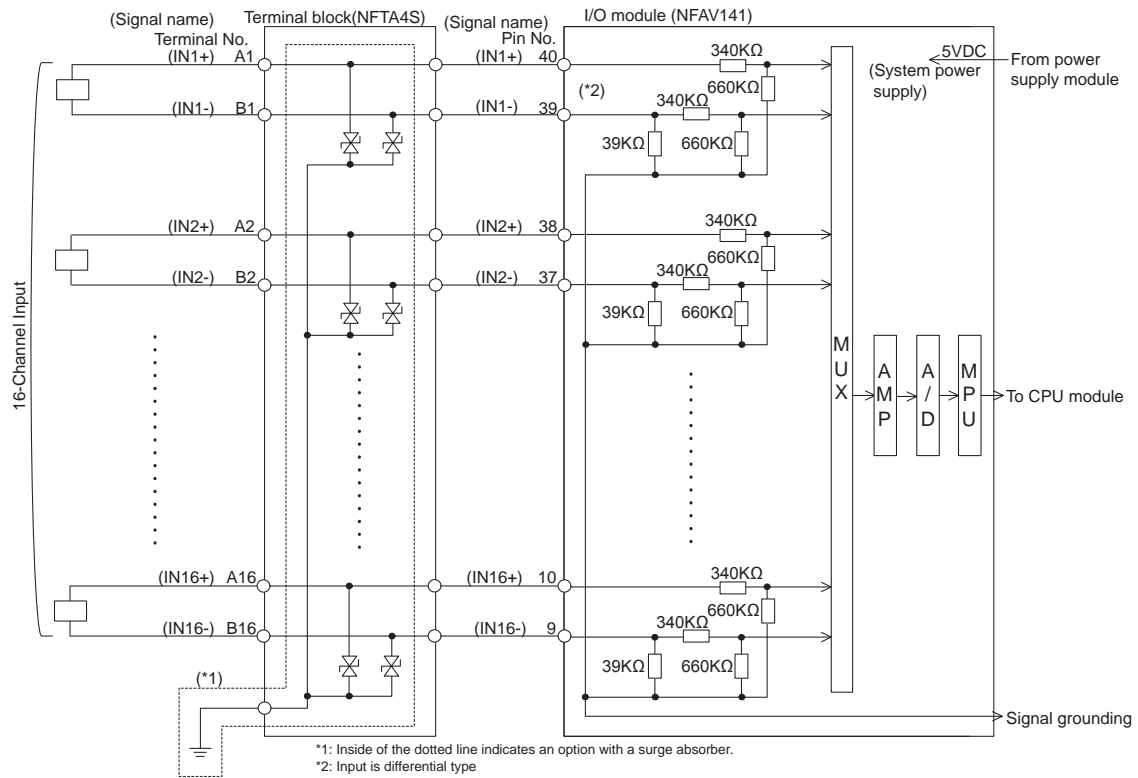


Figure Wiring Diagram for NFAI141 Current Input Module

F050101E.ai

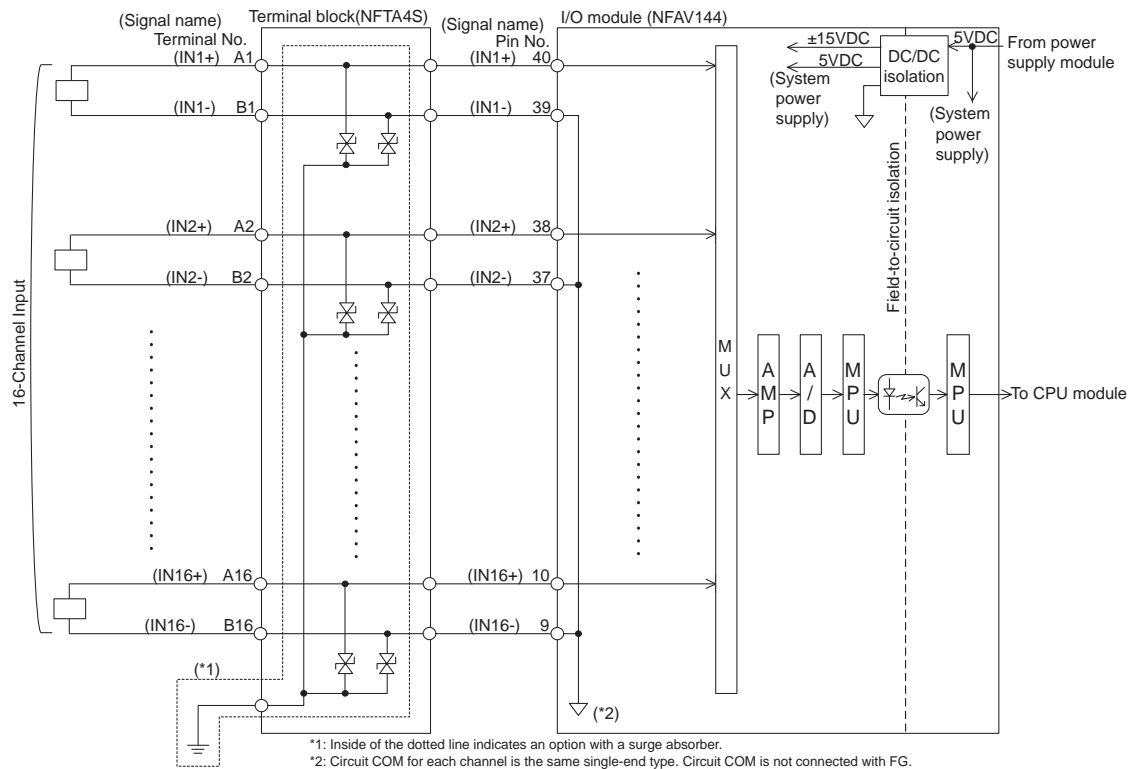
NFAV141 Module (1 to 5 V DC inputs, non-isolated)



F050102.ai

Figure Wiring Diagram for NFAV141 Voltage Input Module

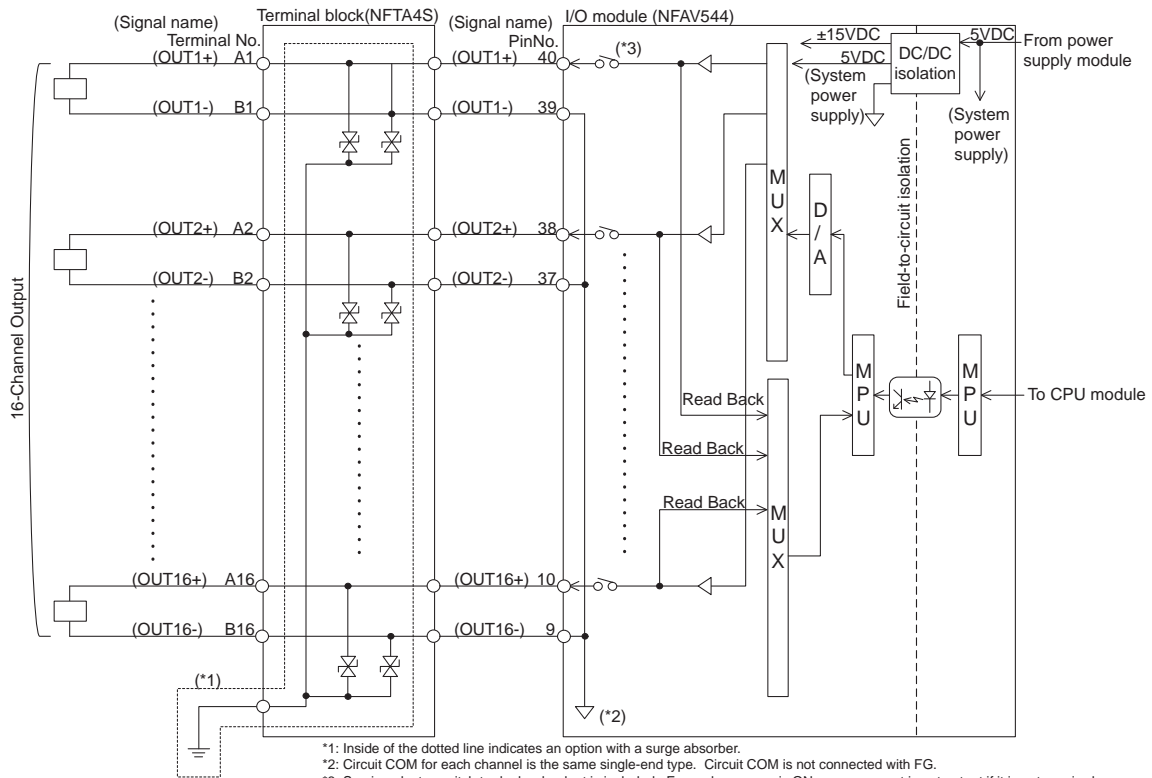
NFAV144 Module (-10 to +10 V DC inputs, isolated)



F050104E.ai

Figure Wiring Diagram for NFAV144 Voltage Input Module

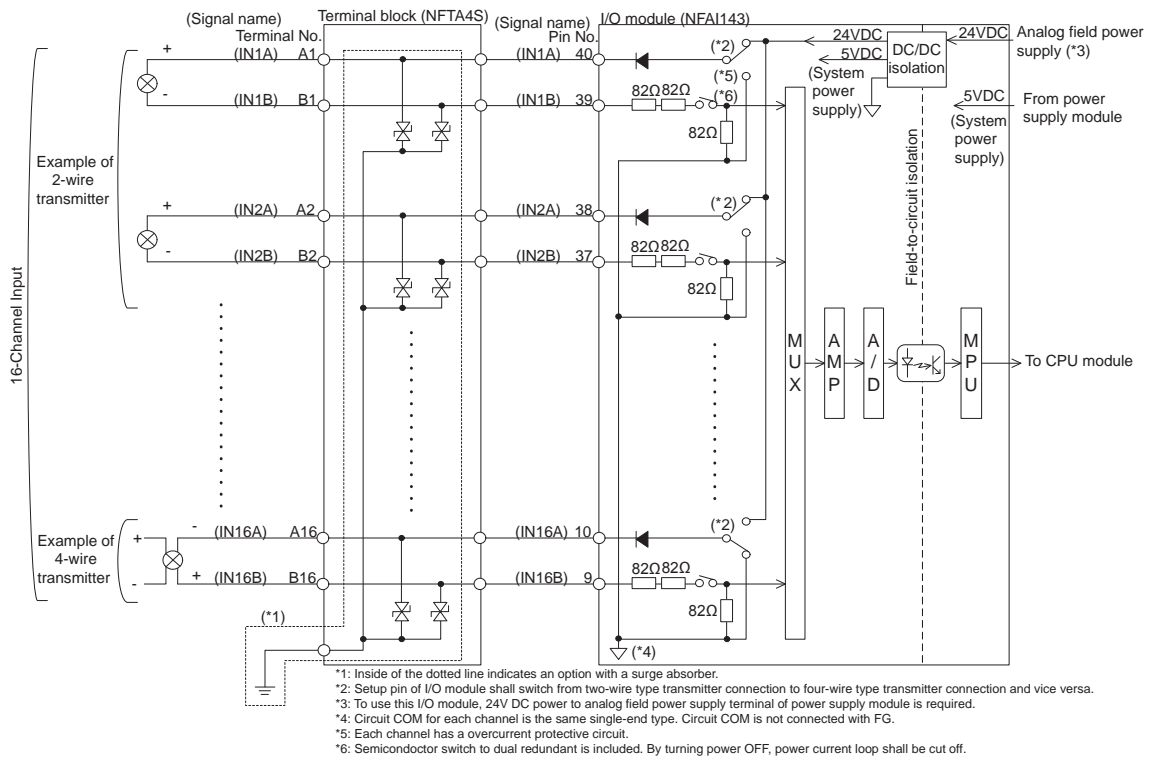
NFAV544 Module (-10 to +10 V DC outputs, isolated)



F050106E.ai

Figure Wiring Diagram for NFAV544 Voltage Output Module

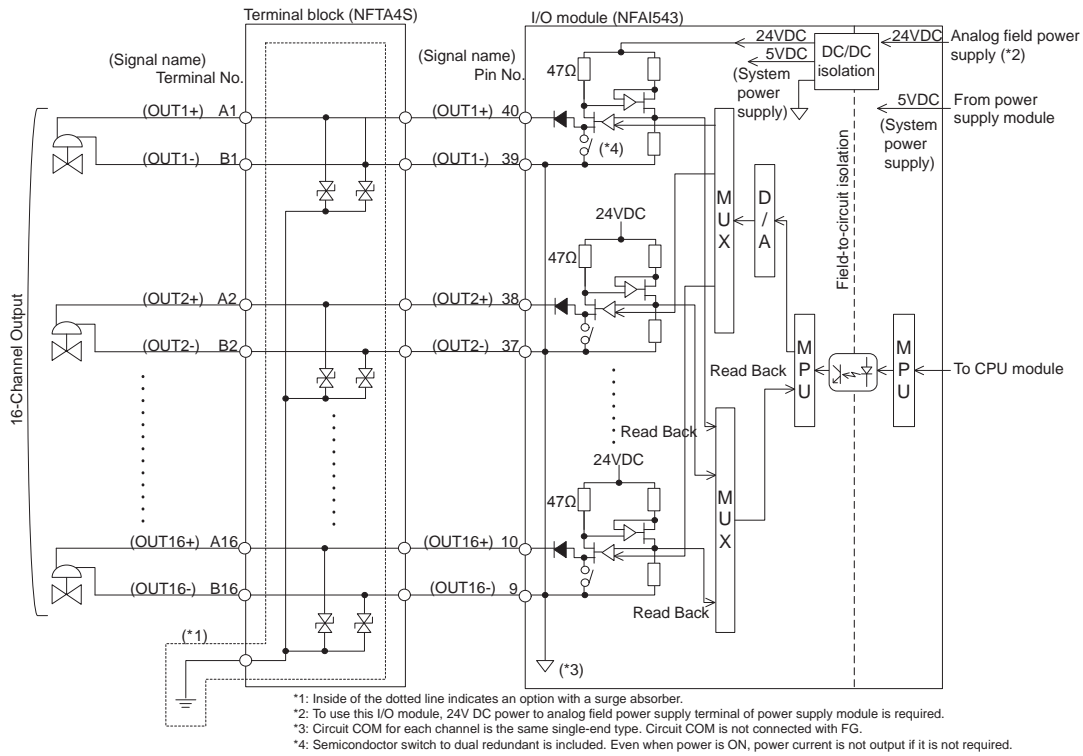
NFAI143 Module (4 to 20 mA inputs, isolated)



F050107E.ai

Figure Wiring Diagram for NFAI143 Current Input Module

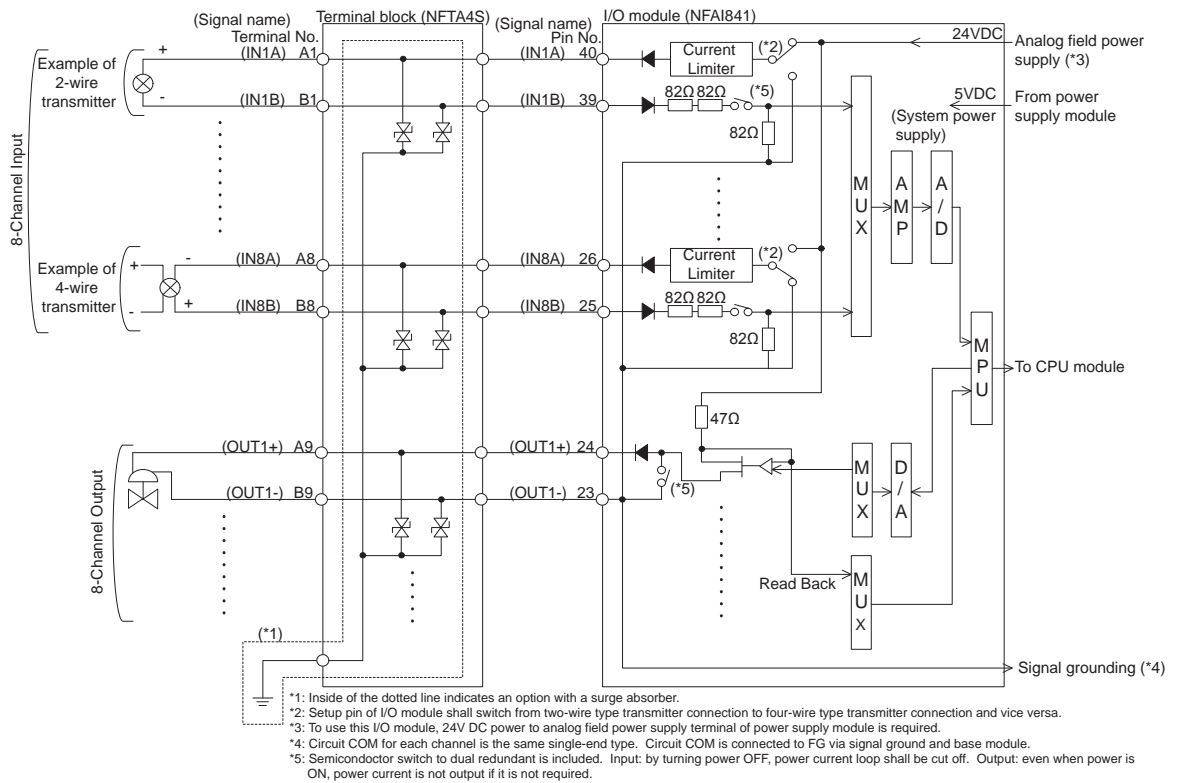
NFAI543 Module (4 to 20 mA outputs, isolated)



F050108E.ai

Figure Wiring Diagram for NFAI543 Current Output Module

NFAI841 Module (4 to 20 mA inputs/outputs, non-isolated)



F050109E.ai

Figure Wiring Diagram for NFAI841 Current Input/Output Module

NFAB841 Module (1 to 5 V DC inputs, 4 to 20 mA outputs, non-isolated)

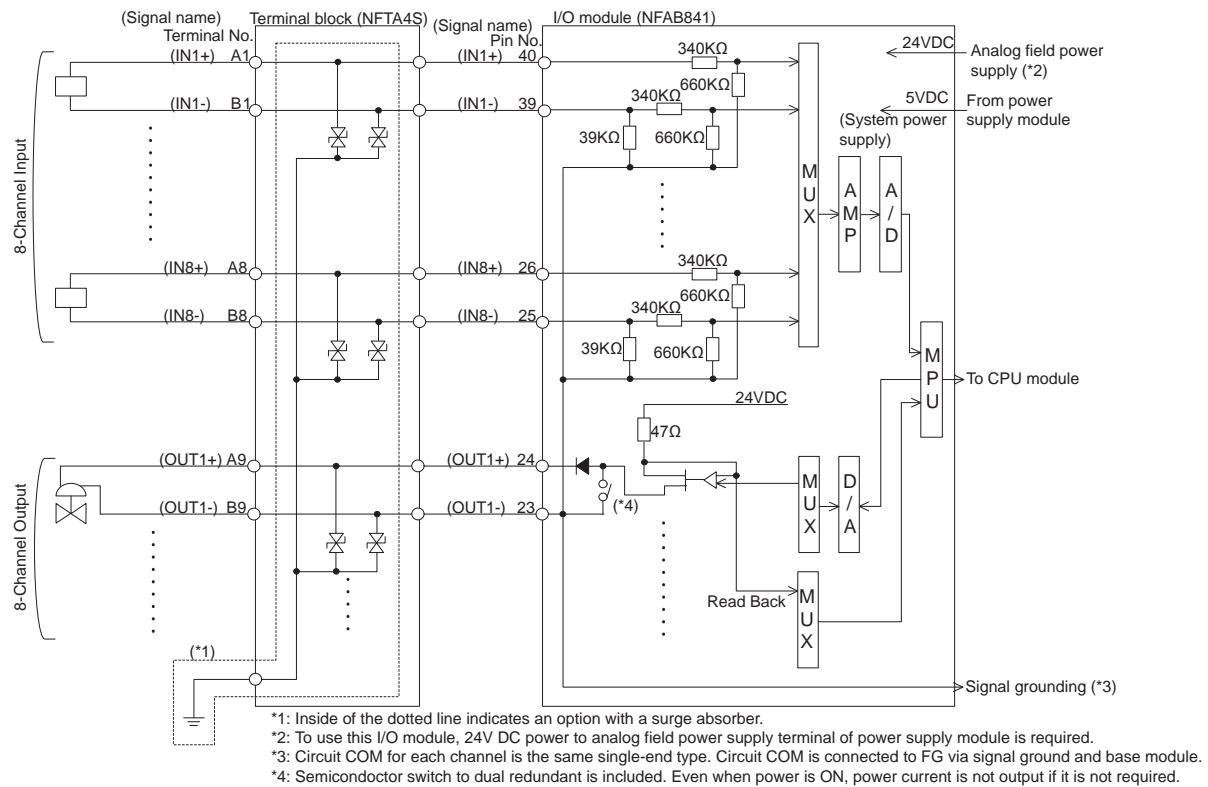


Figure Wiring Diagram for NFAB841 Voltage Input and Current Output Module

F050110E.ai

NFAR181 Module (RTD inputs, isolated)

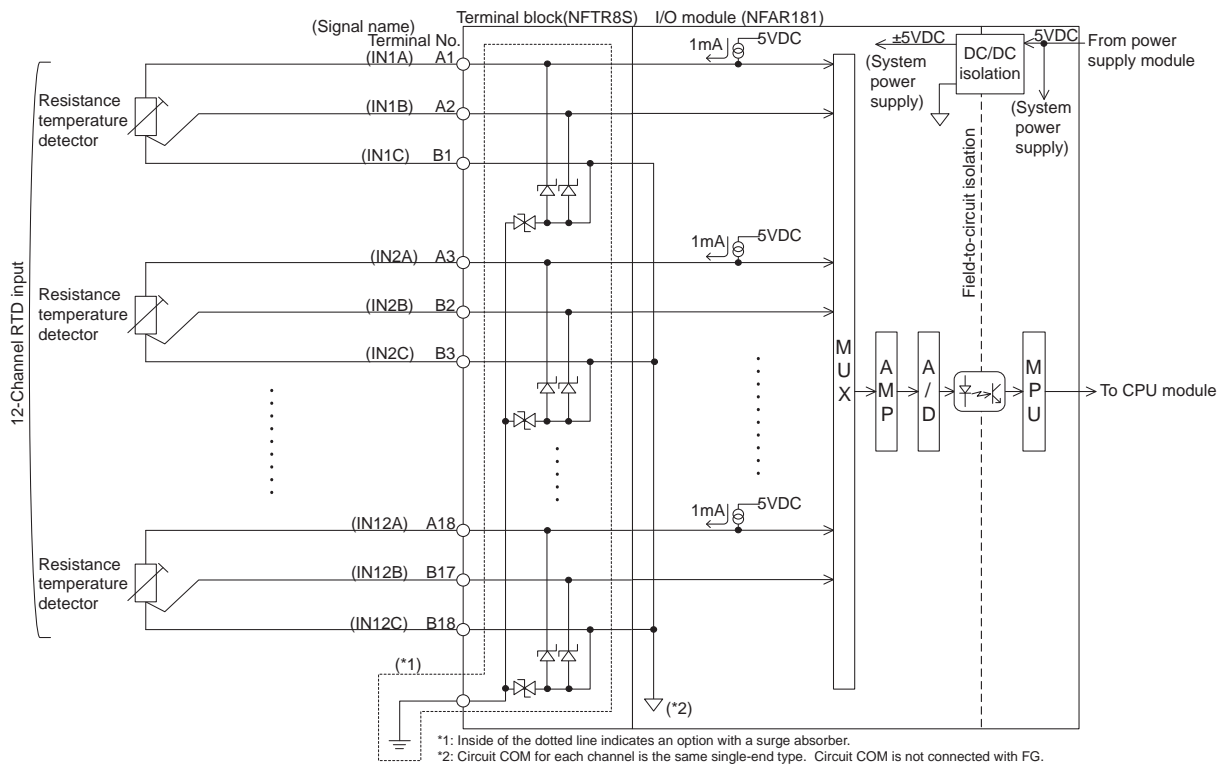


Figure Wiring Diagram for NFAR181 RTD Input Module

F050111E.ai

NFAT141 Module (thermocouple/mV inputs, isolated)

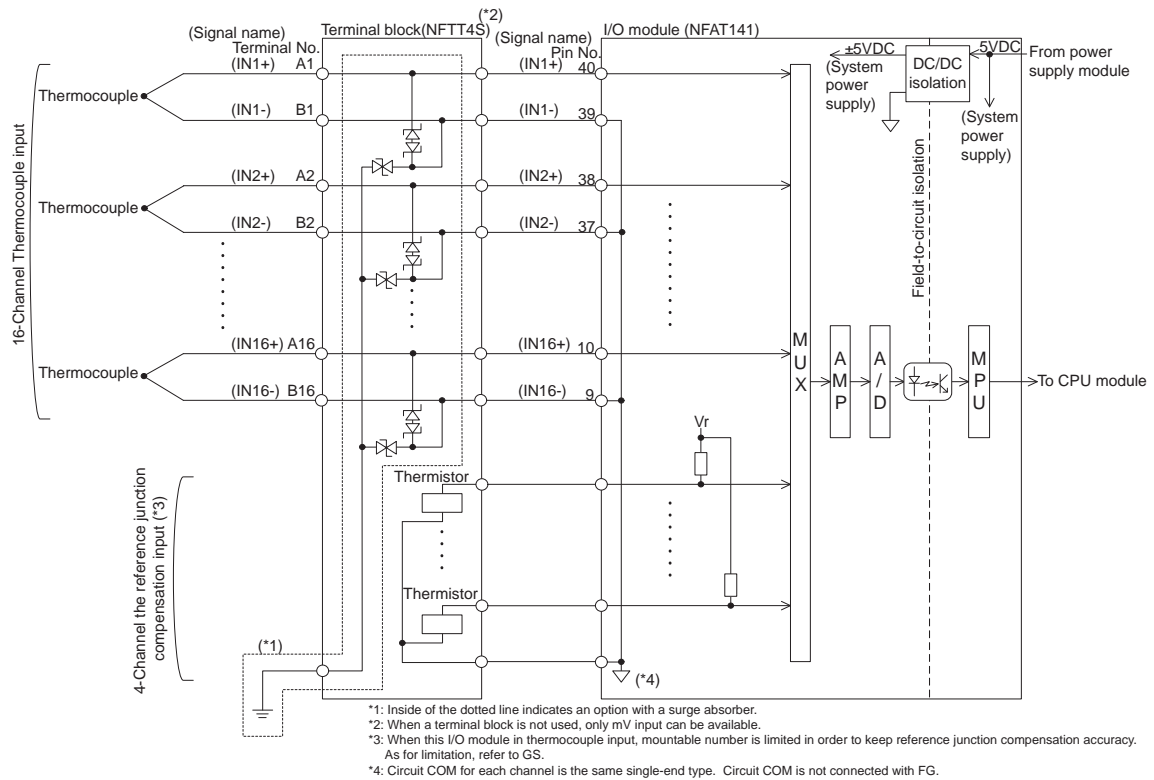


Figure Wiring Diagram for NFAT141 Thermocouple Input Module

F050112E.ai

NFAI135 Module (4 to 20 mA inputs, isolated channels)

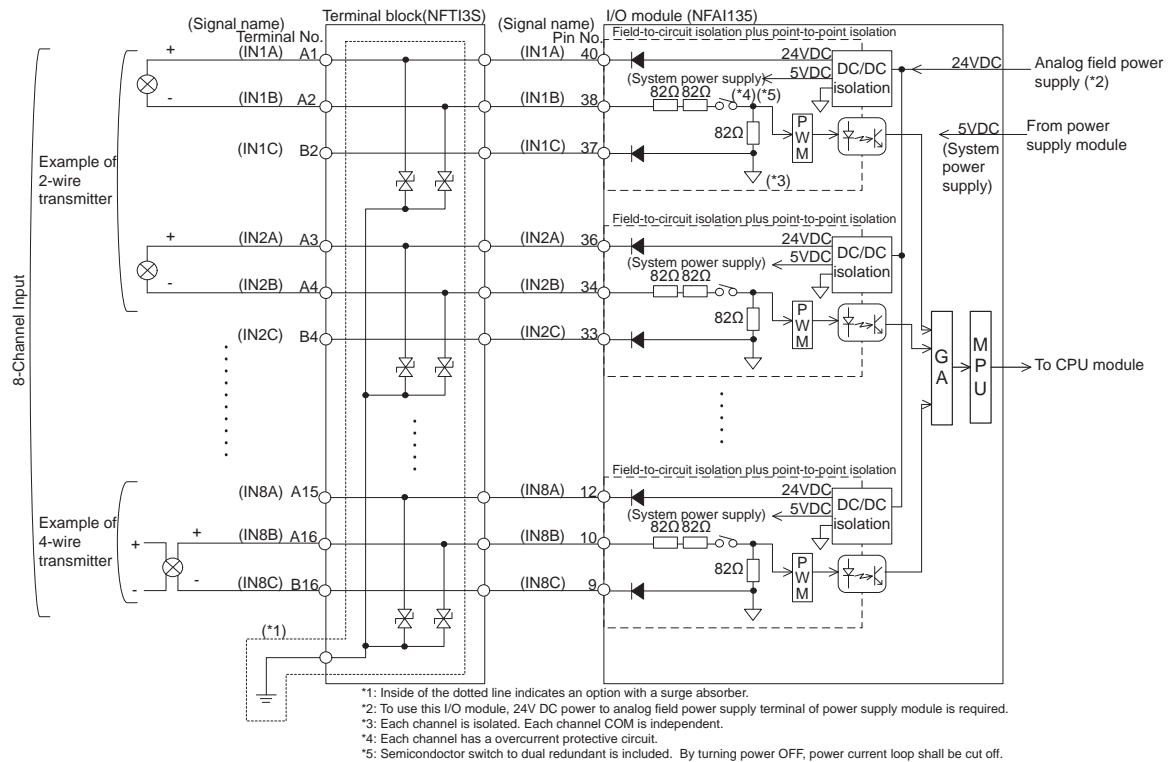


Figure Wiring Diagram for NFAI135 Current Input Module

F050113E.ai

NFAP135 Module (pulse inputs, isolated channels)

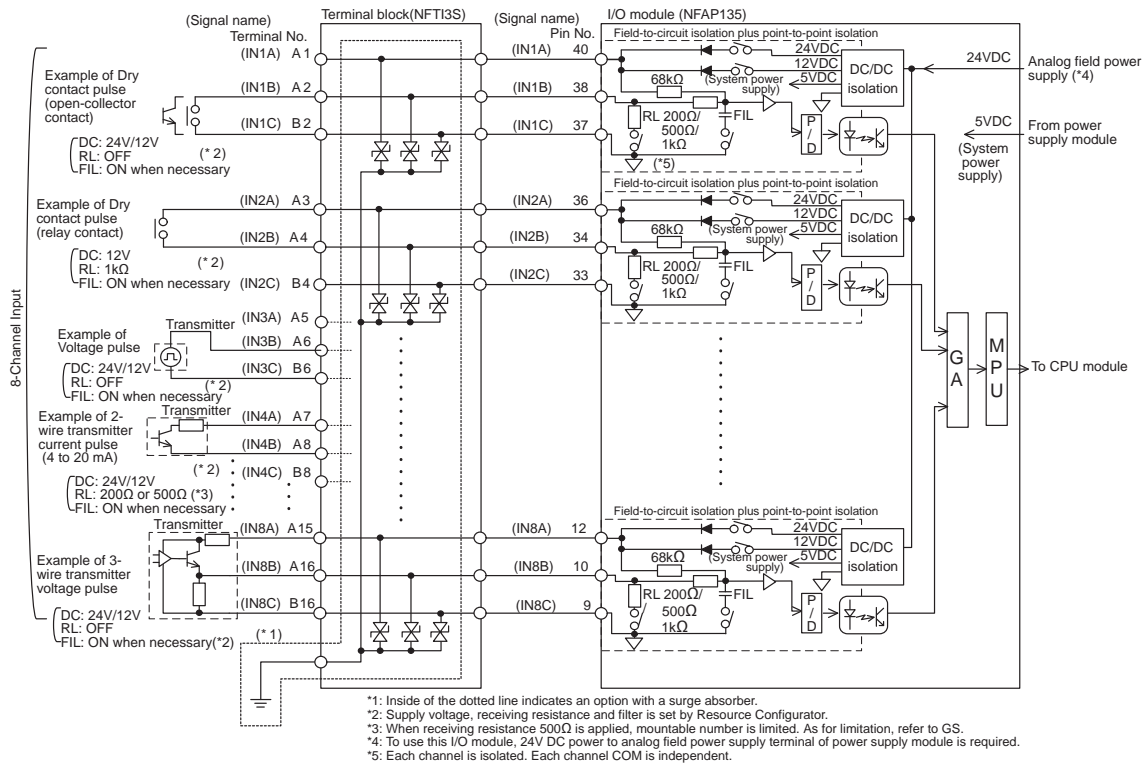


Figure Wiring Diagram for NFAP135 Pulse Input Module

F050114E.ai

NFAF135 Module (Frequency inputs, isolated channels)

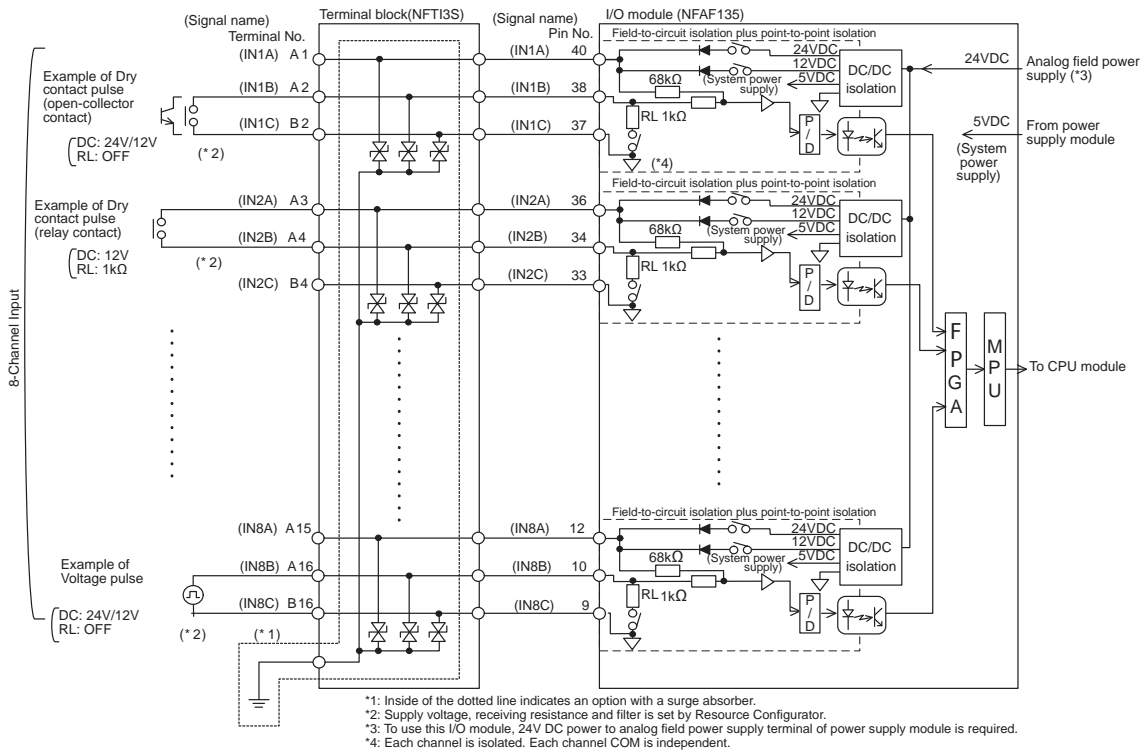


Figure Wiring Diagram for NFAF135 Frequency Input Module

F050119E.ai

NFAI835 Module (4 to 20 mA inputs/outputs, isolated channels)

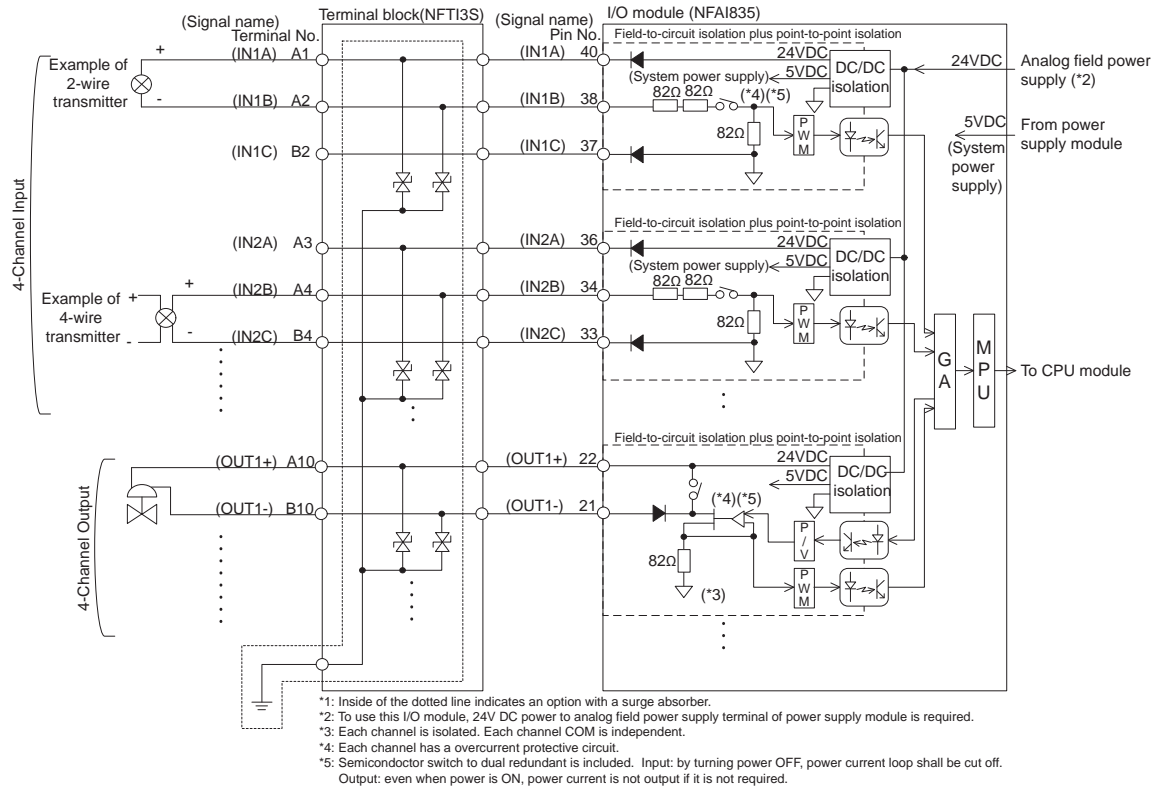


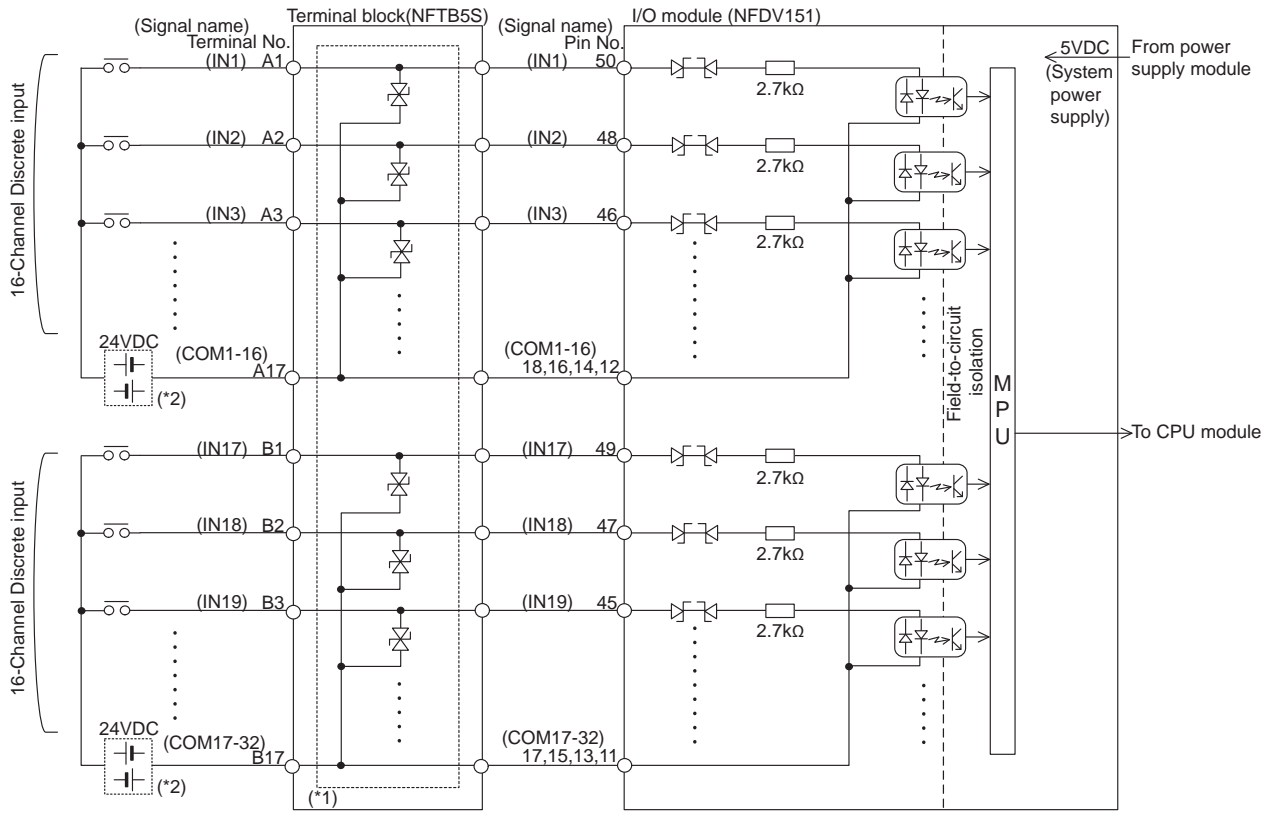
Figure Wiring Diagram for NFAI835 Current Input/Output Module

F050115E.ai

4.2 Connections to Digital I/O Modules

Refer to the following diagrams for connections to digital I/O modules.

NFDV151 Module (24 V DC inputs, Isolated)

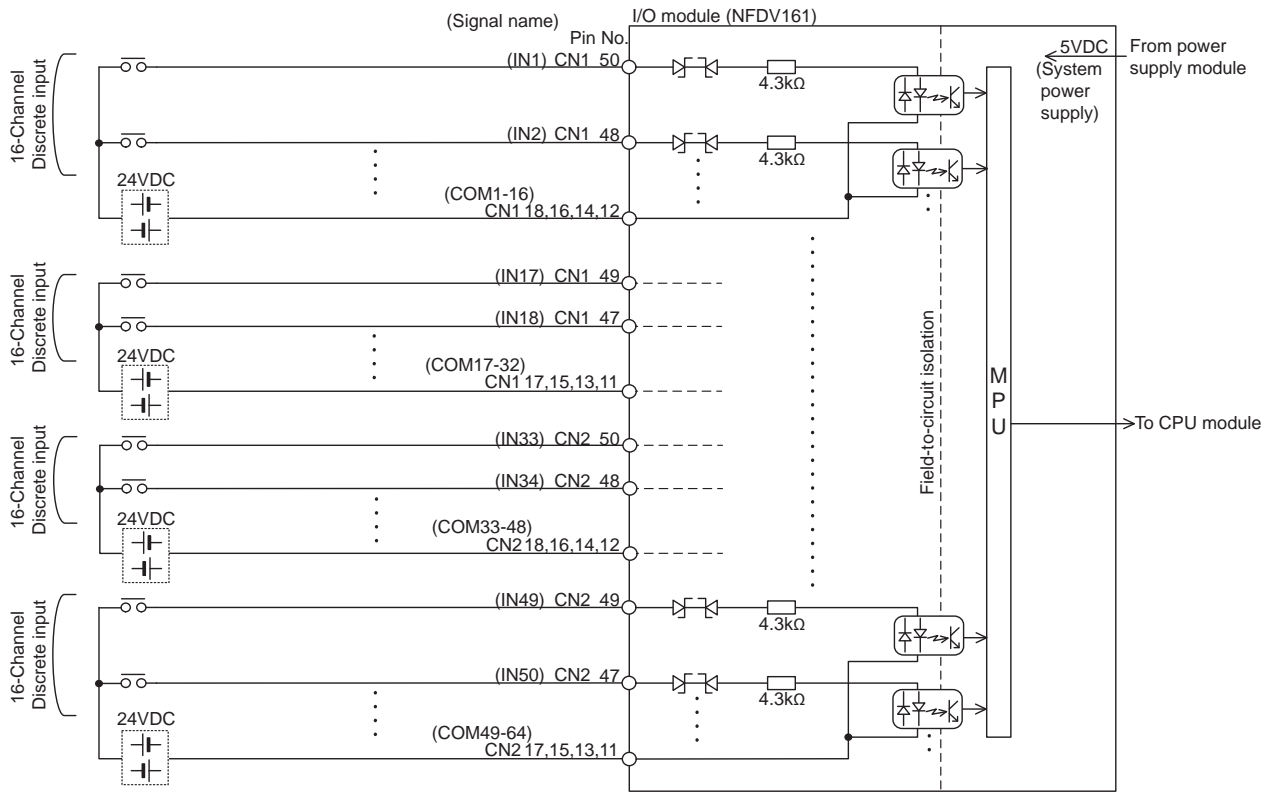


*1: Inside of the dotted line indicates an option with a surge absorber.
 *2: When a terminal block with surge absorber is used, have identical polar character for COM1-16 and COM17-32.

F050201E.ai

Figure Wiring Diagram for NFDV151 24 V DC Input Module

NFDV161 Module (24 V DC inputs, Isolated)



F050203E.ai

Figure Wiring Diagram for NFDV161 24 V DC Input Modules

NFDV532 Module (24 V DC Pulse Width Output, Isolated)

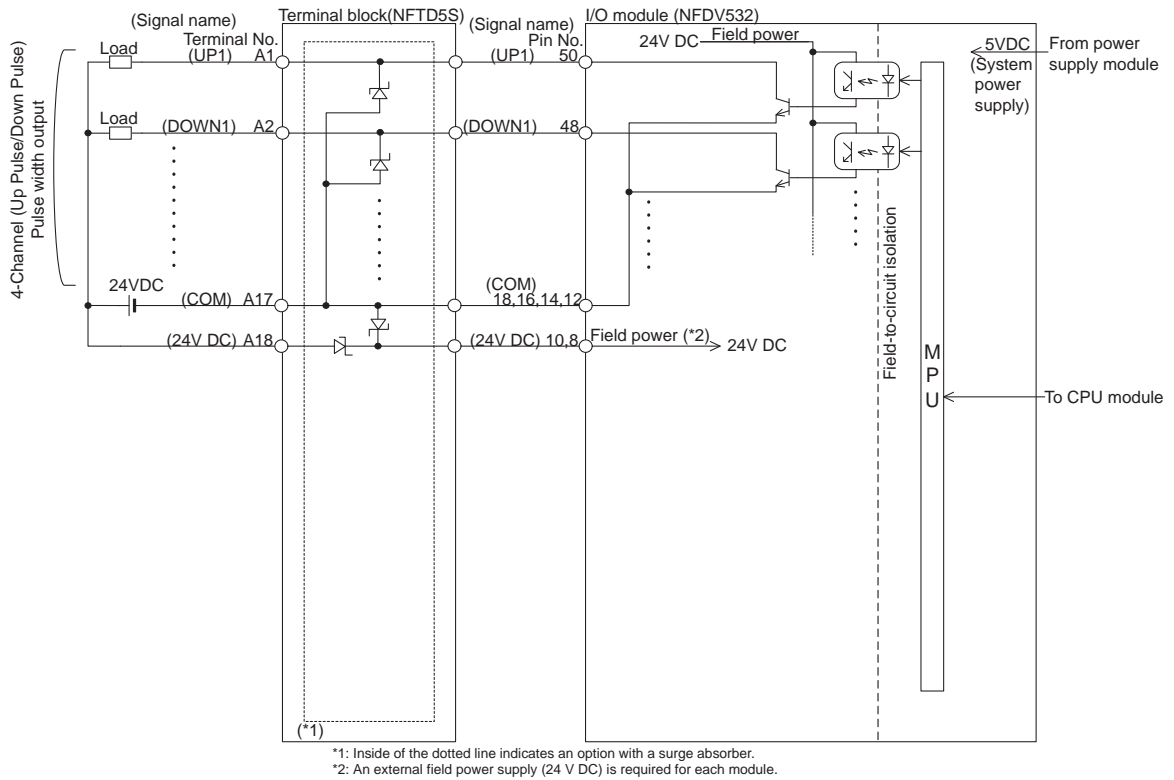


Figure Wiring Diagram for NFDV532 Pulse Width Output Module

F050204E.ai

NFDV551 Module (24 V DC outputs, Isolated)

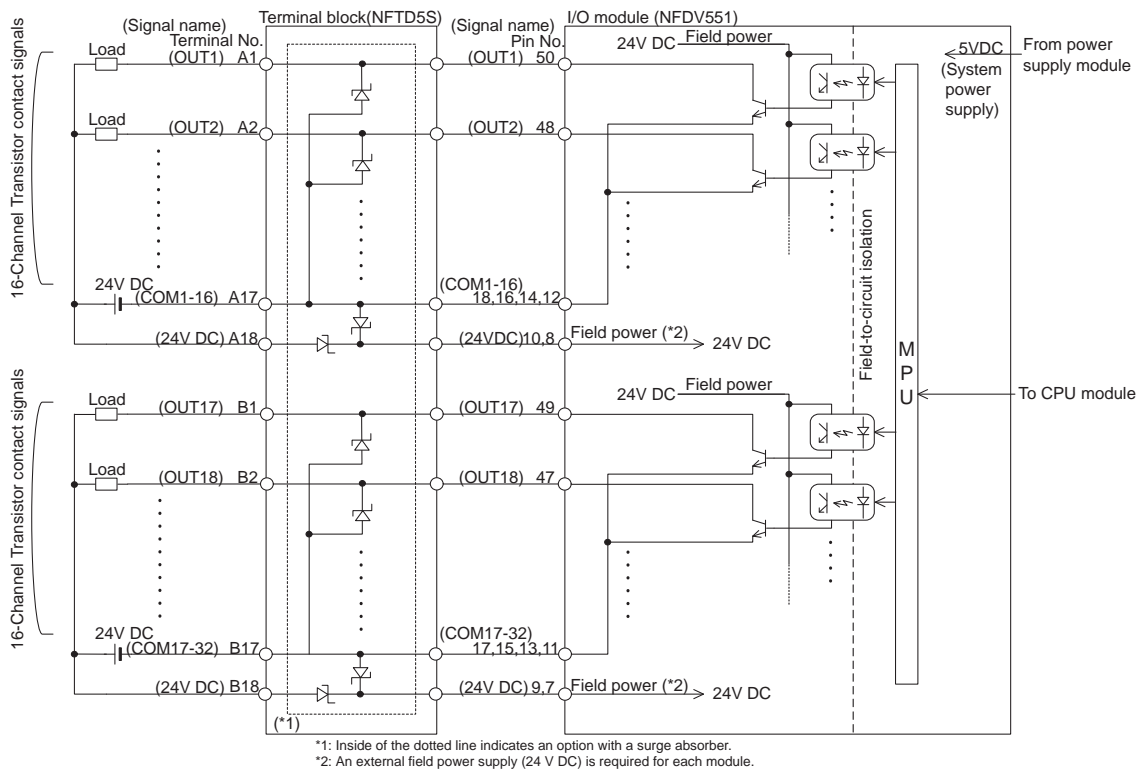


Figure Wiring Diagram for NFDV551 24 V DC Output Module

F050205E.ai

NFDV561 Modules (24 V DC outputs, Isolated)

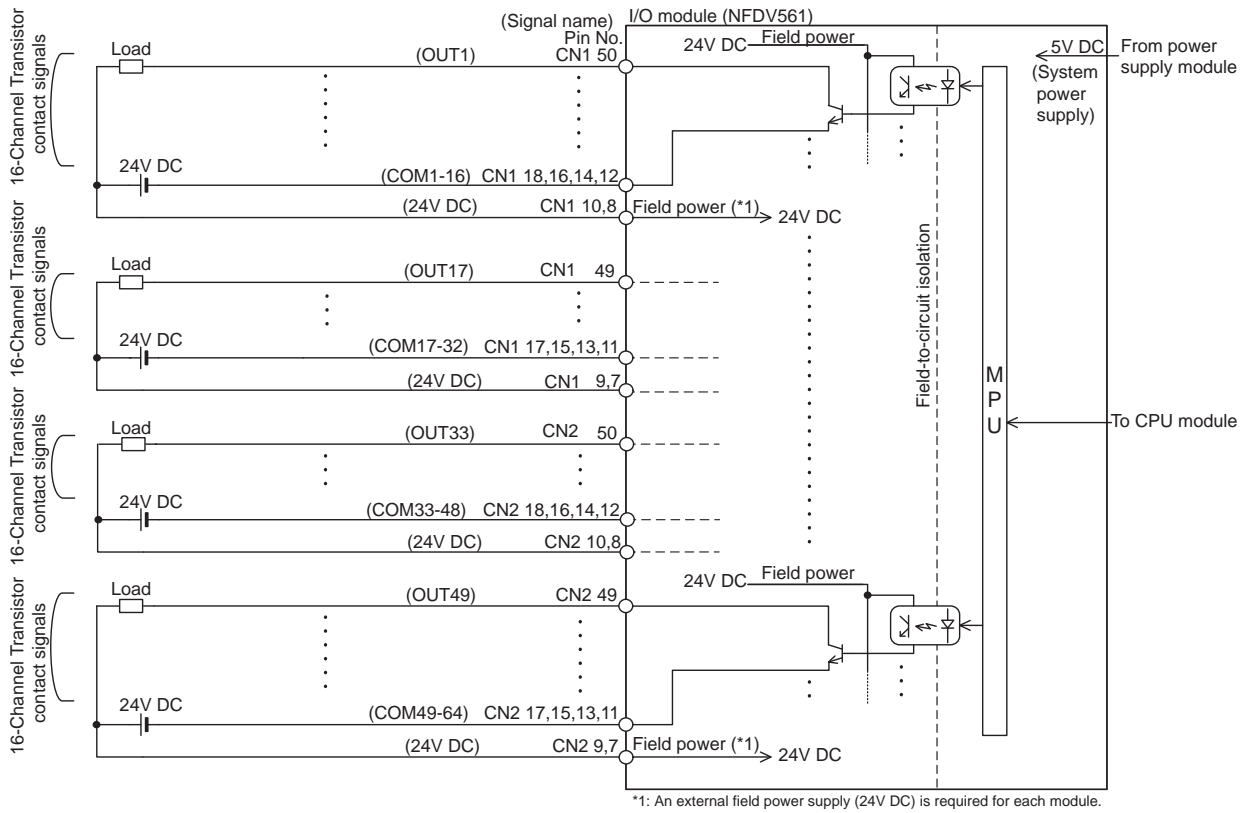


Figure Wiring Diagram for NFDV561 24 V DC Output Module

NFDR541 Module (relay outputs, Isolated)

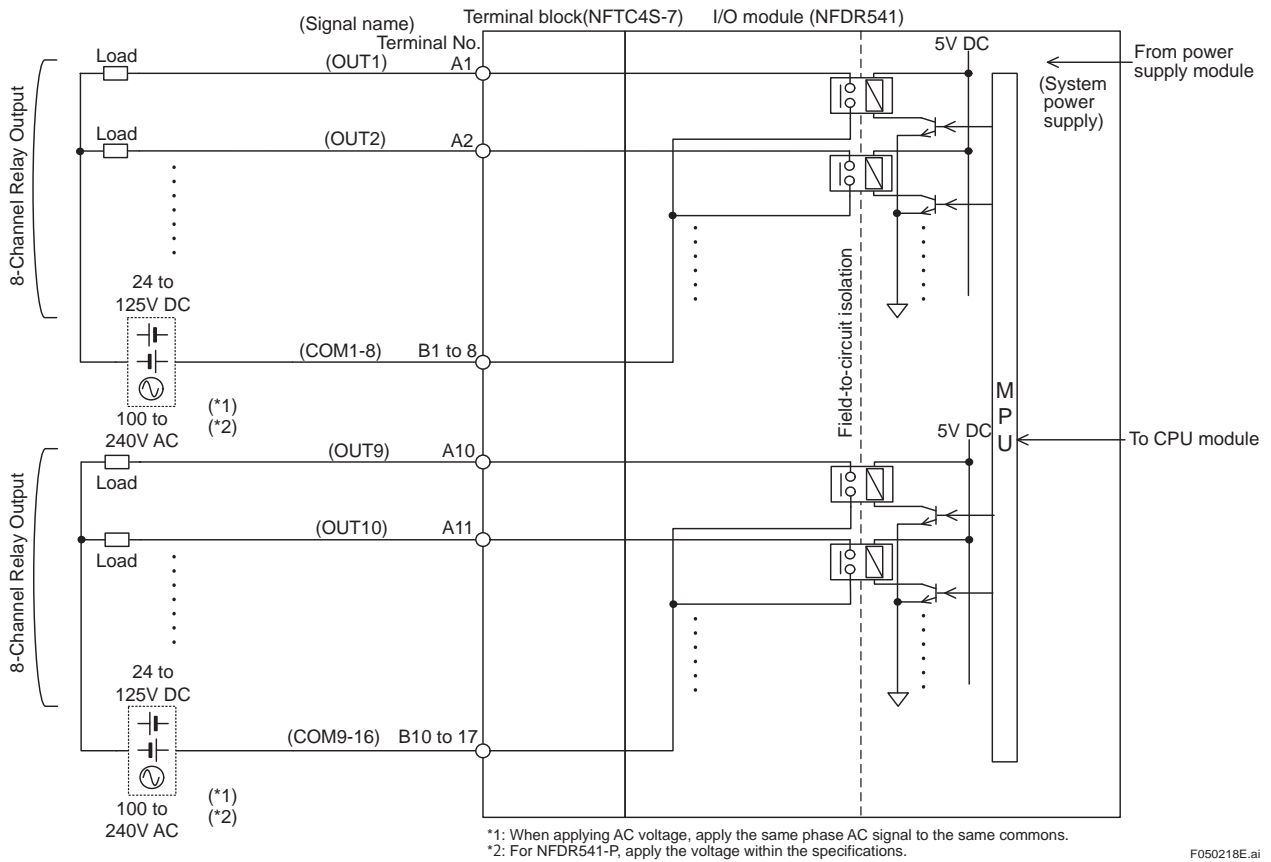
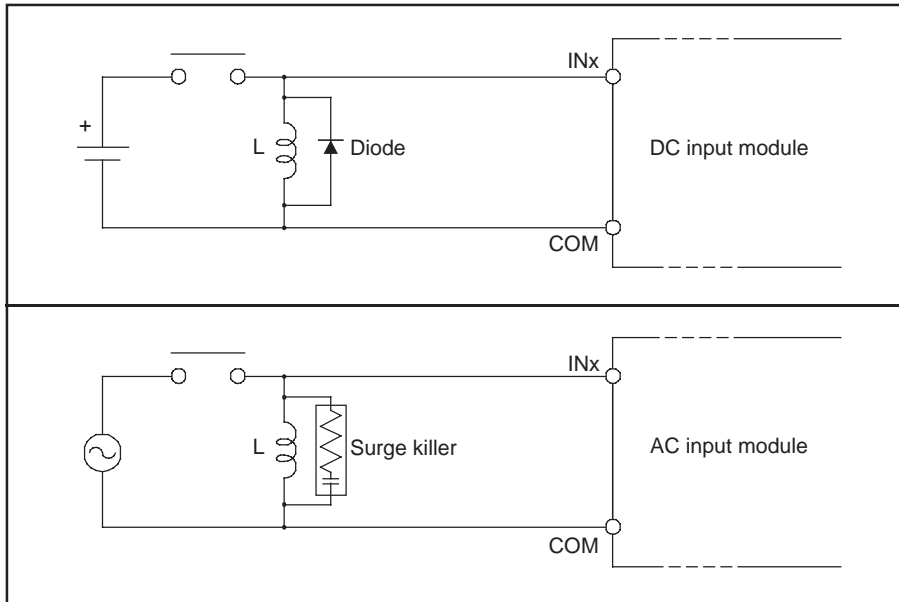


Figure Wiring Diagram for NFDR541 Relay Output Module

Precaution on Connections to Digital Input Module

Measures for Inductive Load

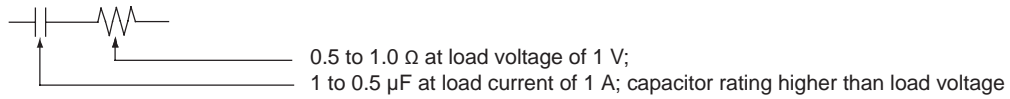
Where an inductive load is connected to a digital input, install a surge killer or a diode near the inductive load as shown below.



F050209E.ai

Figure Measures for Inductive Load

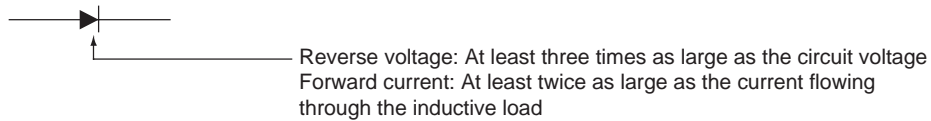
Surge Killer



F050210E.ai

Figure Surge Killer

Diode



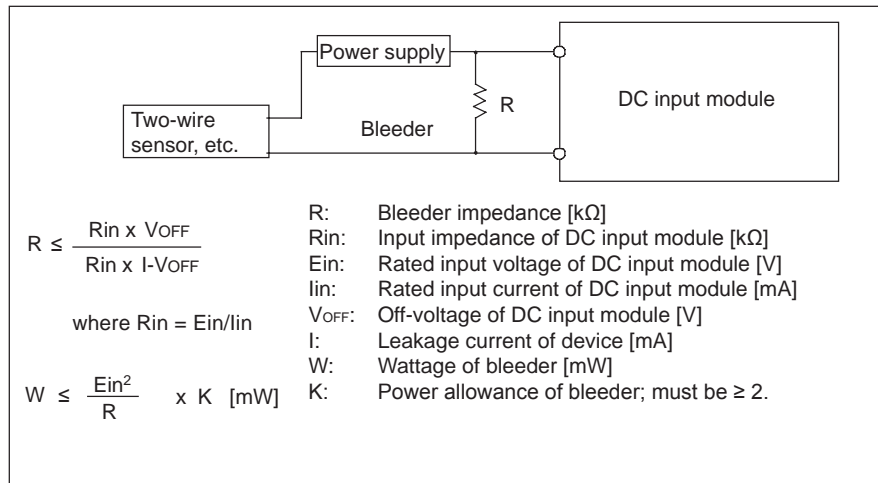
F050211E.ai

Figure Diode

Consideration on Leakage Current

Where a two-wire sensor (such as a proximity switch or optoelectronic switch) or a limit switch with an LED is used, a leakage current may cause an erroneous input or cause a lamp to light at an undesired time. The leakage current will not be problematic as far as its intensity is less than the off-current rated in the specifications of the module used. If it exceeds the off-current, install a bleeder resistor as shown in the figure below to decrease the input impedance.

Forward voltage: At least twice as large as current flowing through inductive load

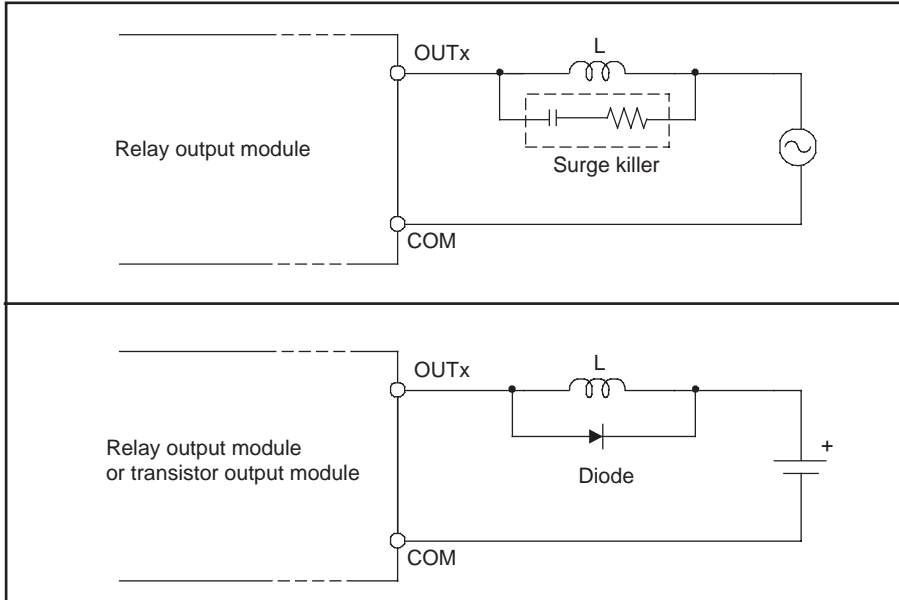


F050212E.ai

Figure Consideration on Leakage Current

Precaution on Connections to Digital Output Module

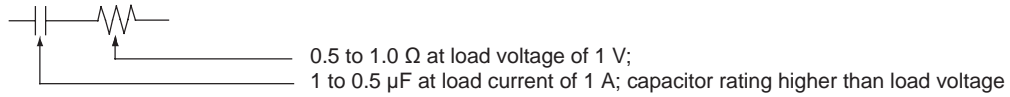
Where an inductive load is connected to a digital output, install a surge killer or a diode near the inductive load as shown below. When installing a diode, connect its cathode to the positive side of the power supply.



F050213E.ai

Figure Measures for Inductive Load

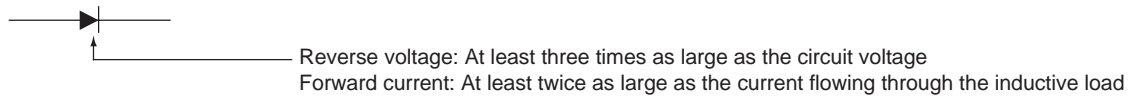
Surge Killer



F050214E.ai

Figure Surge Killer

Diode



F050215E.ai

Figure Diode

IMPORTANT

Exercise caution as the internal circuitry (such as output transistors) may be destroyed if the input signal of a digital output module (NFDV551 or NFDV561) and pulse width output module (NFDV532) exceeds the given range of specifications (maximum load: 100 mA/point, 26.4 V). Major points in which care must be taken include:

- Mistakenly connecting a 24 V source at no (or light) load and turning on the contact output
- Failing to take anti-surge measures for an inductive load

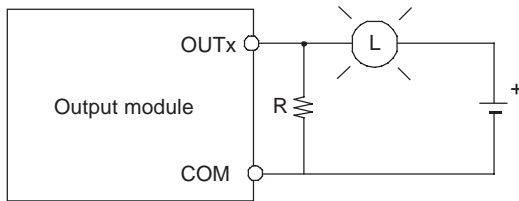
TIP

For details on the specifications of digital output modules, see the STARDOM FCN/FCJ Guide (IM 34P02Q01-01E). Use each module within the given range of specifications.

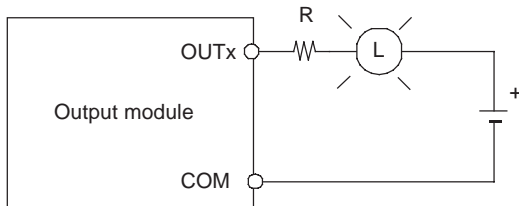
Consideration on Inrush Current

Where a device with a large inrush current such as an incandescent lamp is connected, consideration must be given to prevent the output device from being broken down. A few examples of measures for suppressing the inrush current are shown below.

Feeding idling current at about one third of the rating



Installing a current-limiting resistor



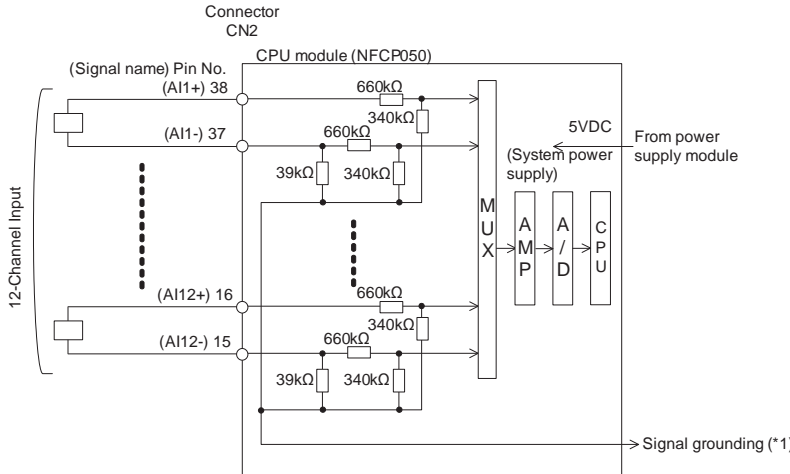
F050216E.ai

Figure Measures for Suppressing Inrush Current

4.3 Connections to FCN-RTU CPU Modules

Refer to the following diagrams for connections to FCN-RTU CPU module (NFCP050) built-in I/O interfaces.

NFCP050 Built-in AI (1 to 5 V DC)

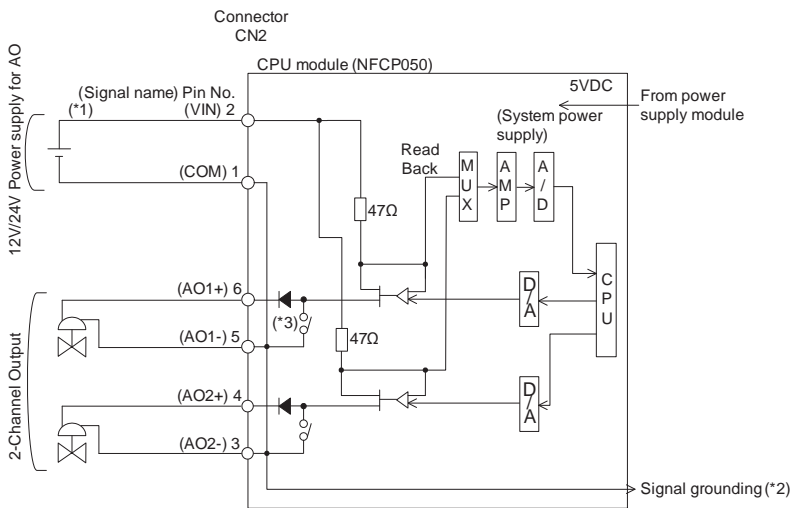


F050303E.ai

*1: Circuit COM for each channel is the same single-end type. Circuit COM can be either connected to FG via signal ground and base module or disconnected from FG.

Figure Wiring Diagram for NFCP050 Built-in Analog Inputs (1 to 5 V DC)

NFCP050 Built-in AO

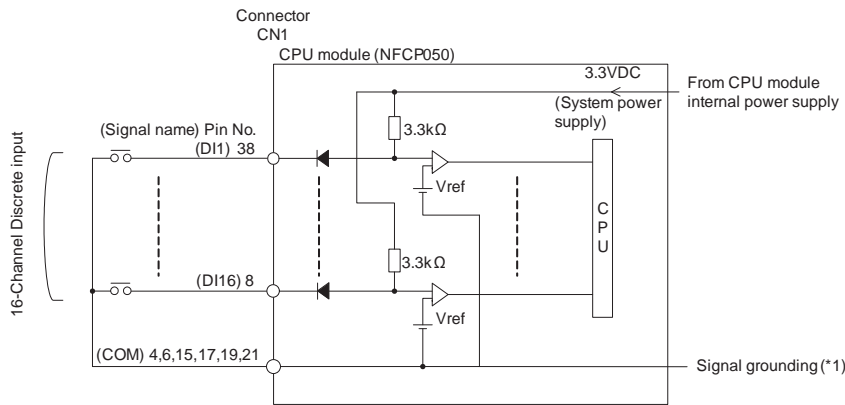


F050304E.ai

*1: To use AO function, 12 V or 24 V DC power to field power supply terminal of CN2 is required.
 *2: Circuit COM for each channel is the same single-end type. Circuit COM can be either connected to FG via signal ground and base module or disconnected from FG.
 *3: Semiconductor switch of output ON/OFF is included. Right after power gets turned ON, power current is not output.

Figure Wiring Diagram for NFCP050 Built-in Analog Outputs

NFCP050 Built-in DI

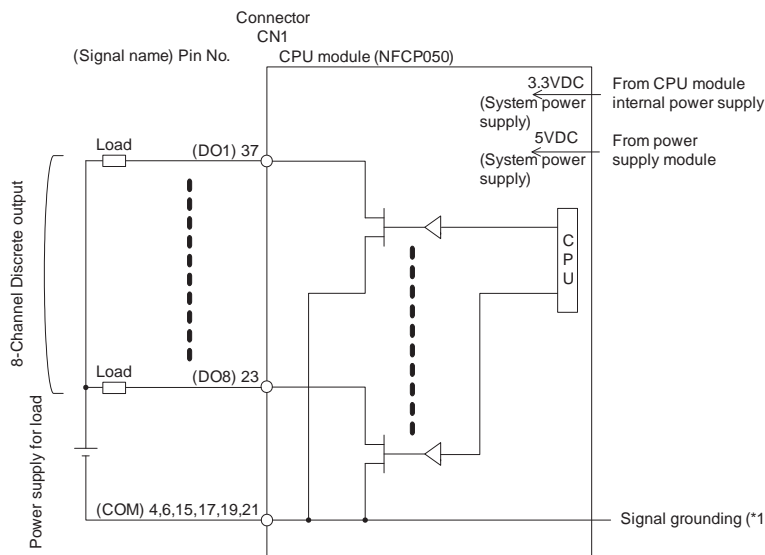


F050305E.ai

*1: Circuit COM for each channel is the same single-end type. Circuit COM can be either connected to FG via signal ground and base module or disconnected from FG.

Figure Wiring Diagram for NFCP050 Built-in Digital Inputs

NFCP050 Built-in DO

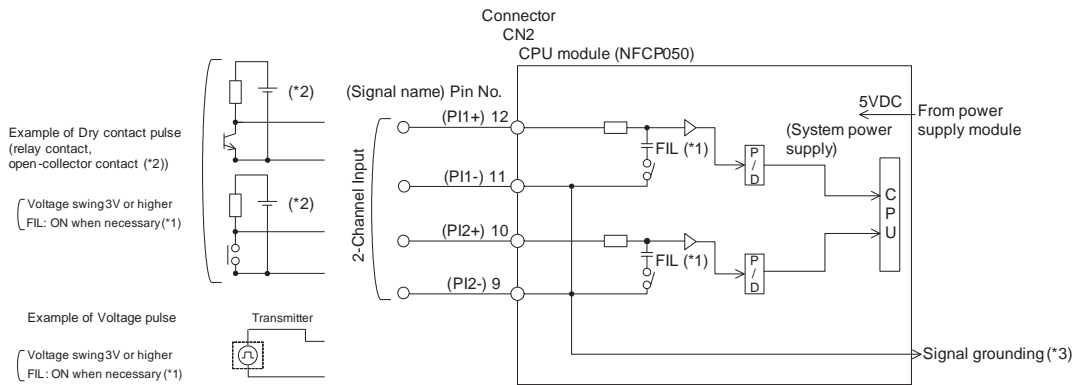


F050306E.ai

*1: Circuit COM for each channel is the same single-end type. Circuit COM can be either connected to FG via signal ground and base module or disconnected from FG.

Figure Wiring Diagram for NFCP050 Built-in Digital Outputs

NFCP050 Built-in PI

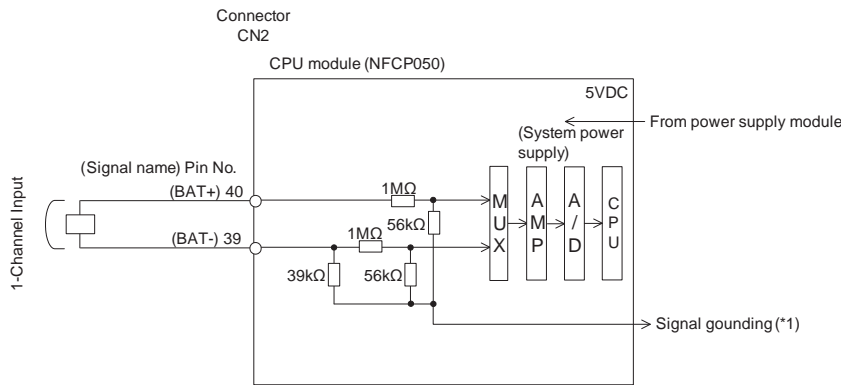


F050307E.ai

- *1: Filter is set by Resource Configurator.
- *2: For dry contact pulse input, pull-up of signal must be performed on field device side.
- *3: Circuit COM for each channel is the same single-end type. Circuit COM can be either connected to FG via signal ground and base module or disconnected from FG.

Figure Wiring Diagram for NFCP050 Built-in Pulse Inputs

NFCP050 Built-in AI (0 to 32 V DC)



F050308E.ai

- *1: Circuit COM is the same single-end type as each channel of AI. Circuit COM can be either connected to FG via signal ground and base module or disconnected from FG.

Figure Wiring Diagram for NFCP050 Built-in Analog Input (0 to 32 V DC)

5. Dimensional Drawings

Contents of Dimensional Drawings

Model NFBU200	Base Module (long)	SD 34P02Q12-01E
Models NFPW441, NFPW442, and NFPW444	Power Supply Modules for FCN	SD 34P02Q12-02E
Model NFSB100	SB Bus Repeat Module for FCN	SD 34P02Q12-04E
Model NFSBT01	SB Bus T-joint	
Model NFSBT02	SB Bus T-joint with Built-in Terminator.....	SD 34P02Q12-05E
Model NFCB301	SB Bus Cable	SD 34P02Q12-06E
Models NFDCV01, NFDCV02	Dummy Cover.....	SD 34P02Q12-07E
Model N2BU051, NFBU050	Base Module (Short).....	SD 34P02Q13-01E
Model NFPW426	Power Supply Modules for FCN-RTU	SD 34P02Q13-02E
Model NFPC050	CPU Module for FCN-RTU	SD 34P02Q13-03E
Model NFPC501, NFPC502	CPU Module for FCN.....	SD 34P02Q14-01E
Model N2BU030	Base Module (compact)	SD 34P02Q14-02E
Model N2EB100	E2 Bus Interface Module	SD 34P02Q14-03E
Models NFAI141, NFAV141, NFAV144, NFAI841, NFAB841, NFAV544, NFAI143, NFAI543, NFAT141, NFAR181, NFAI135, NFAI835, NFAP135, and NFAF135	Analog Input/Output Modules.....	SD34P02Q31-01E
Models NFDV151 and NFDV551	Digital Input/Output Modules	
Model NFDV532	Pulse Width Output Module.....	SD 34P02Q35-01E
Models NFDV161 and NFDV561	Digital Input/Output Modules	SD 34P02Q35-02E
Models NFDR541	Digital Input/Output Modules	SD 34P02Q35-03E
Models NFGS813, NFGP813	Turbomachinery I/O modules	SD 34P02Q33-01E
Model NFLR111	RS-232-C Communication Module	SD 34P02Q36-01E
Model NFLR121	RS-422/RS-485 Communication Module.....	SD 34P02Q36-02E
Models NFLC121 NFLP121	CANopen Communication module PROFIBUS-DP Communication module	SD 34P02Q57-01E
Models NFTA4S, NFTT4S, NFTR8S, NFTD5S, NFTI3S, NFTC4S and NFTB5S	Pressure Clamp Terminal Blocks	SD 34P02Q41-01E

Models	
TAS40-□N	MIL Connector Terminal Block
KMS40-□□□	MIL Connector Cable.....SD 34P02Q41-91E
Models	
TAS50-□N	MIL Connector Terminal Block
KMS50-□□□	MIL Connector Cable.....SD 34P02Q41-92E
Model NFLF111	Foundation Fieldbus Communication Module.....SD 34P02Q55-01E

SEE
ALSO For the size of AEGS1D, AEGP1D and AKB337, refer to GS 34P02Q33-01E "Turbomachinery I/O modules".

Drawings

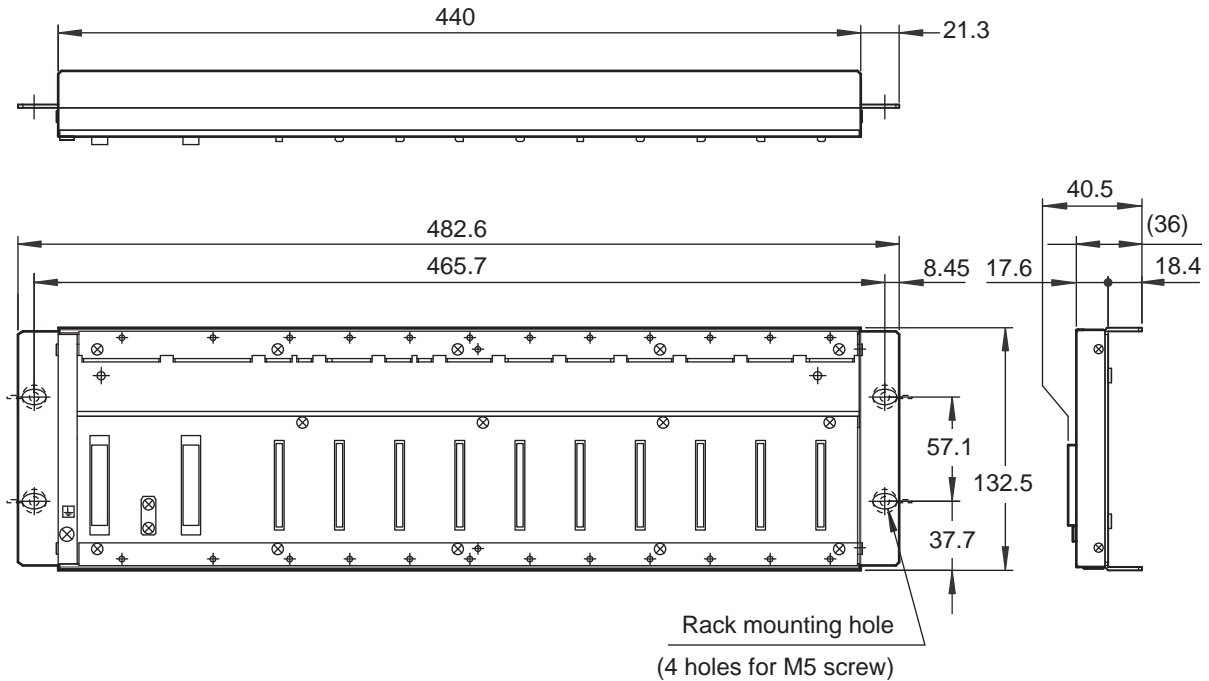
Model NFBU200 Base Module (long)



SD 34P02Q12-01E

Unit : mm
(approx. inch)

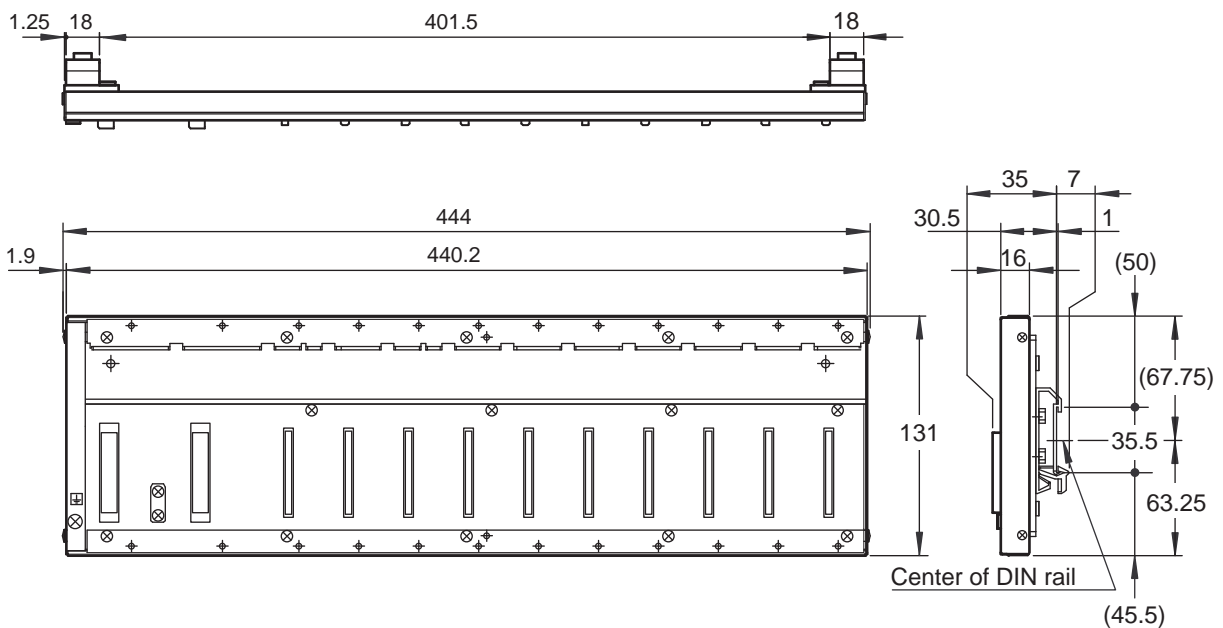
● NFBU200-S00 (19-inch rack-mounting model)



Weight: Approx. 2 kg

Normal allowable deviation: As per JEM1459

● NFBU200-S10 (DIN rail rack-mounting model)



Weight: Approx. 0.9kg

Normal allowable deviation: As per JEM1459

Drawings

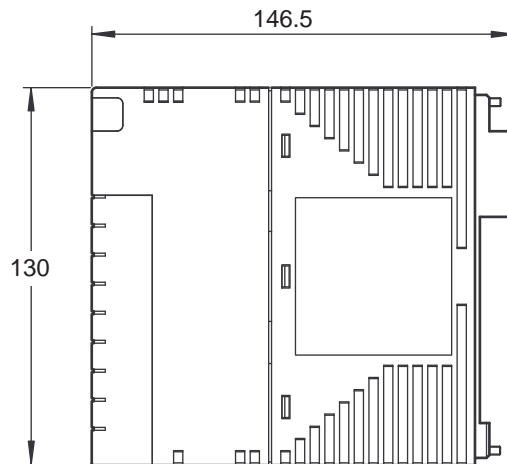
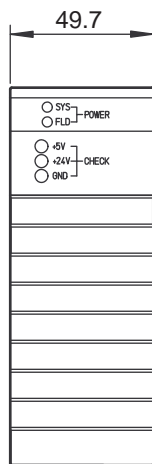
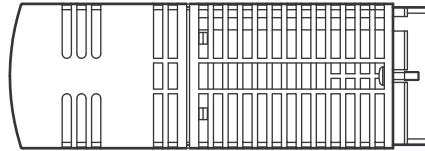
Models NFPW441, NFPW442,
and NFPW444
Power Supply Modules for FCN



SD 34P02Q12-02E

Unit : mm
(approx. inch)

- NFPW441, NFPW442, and NFPW444



Weight: Approx. 0.8 kg

Normal allowable deviation: As per JEM1459

Drawings

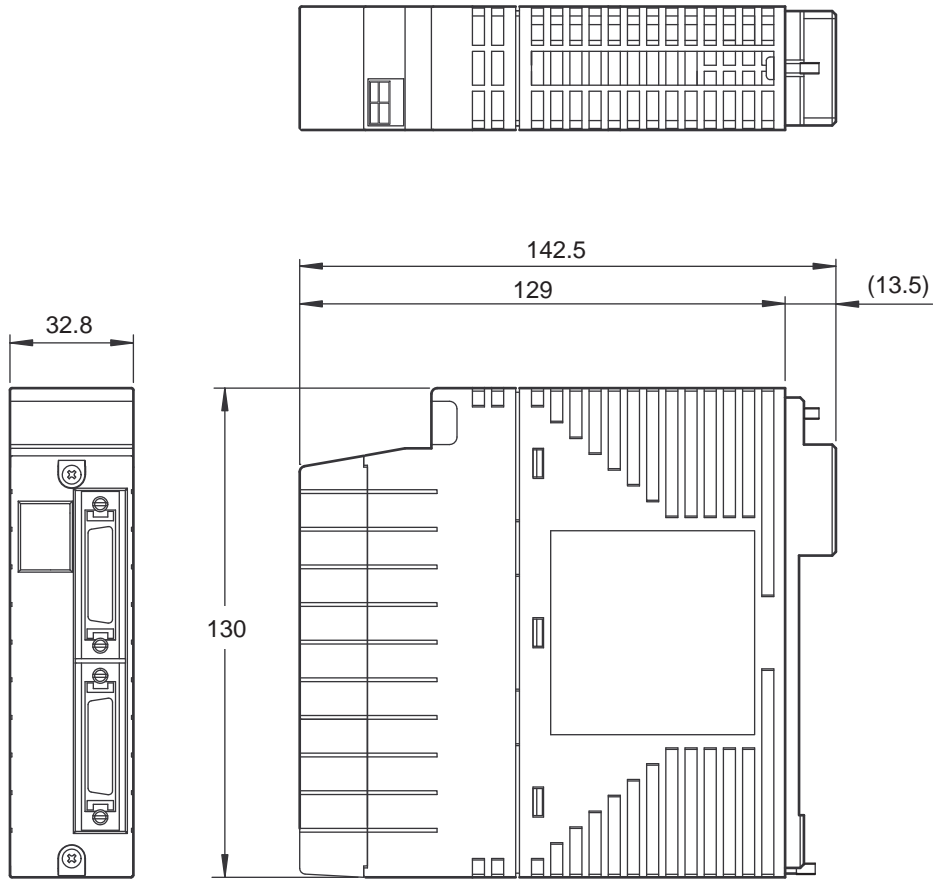
Model NFSB100 SB Bus Repeat Module for FCN



SD 34P02Q12-04E

Unit : mm
(approx. inch)

● NFSB100



Weight: Approx. 0.3 kg

Normal allowable deviation: As per JEM1459

Drawings

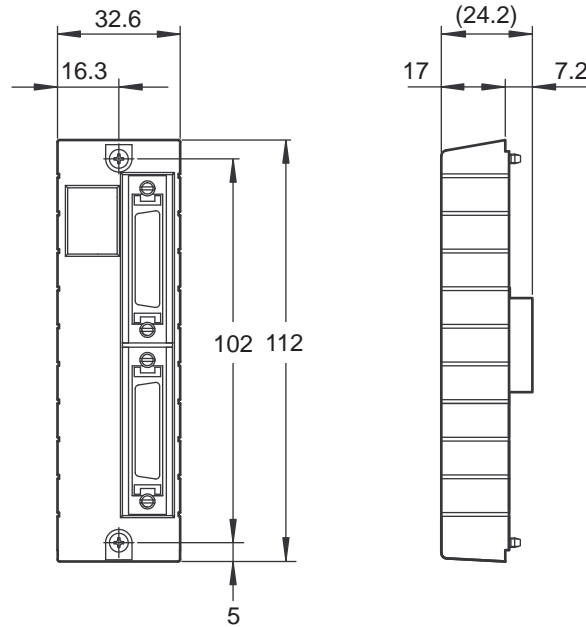
Model NFSBT01
SB Bus T-joint
Model NFSBT02
SB Bus T-joint with Built-in Terminator



SD 34P02Q12-05E

Unit : mm
(approx. inch)

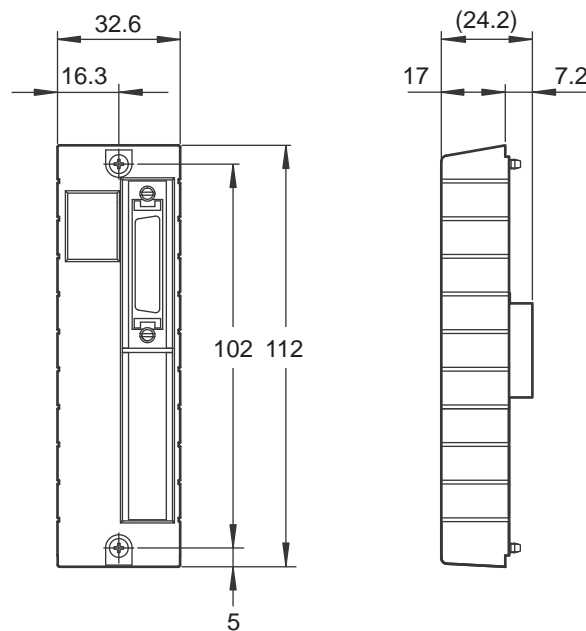
● Model NFSBT01



Weight: Approx. 0.1 kg

Normal allowable deviation: As per JEM1459

● Model NFSBT02

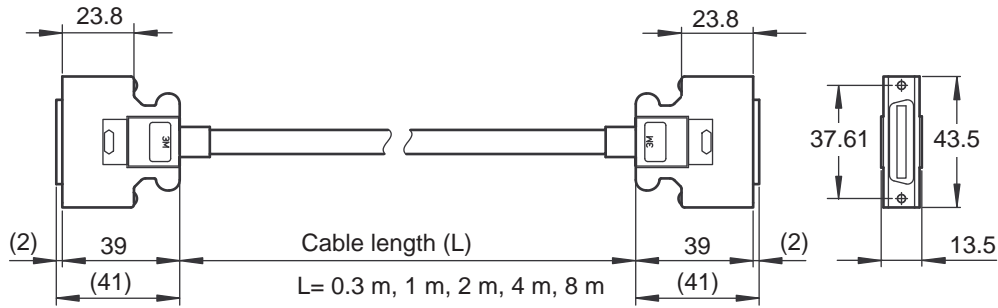


Weight: Approx. 0.1 kg

Normal allowable deviation: As per JEM1459

Unit : mm
(approx. inch)

● NFCB301



Normal allowable deviation: As per JEM1459

Drawings

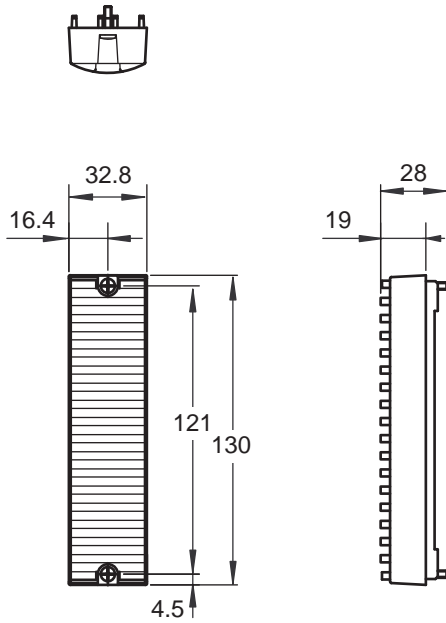
Models NFDCV01 and NFDCV02 Dummy Cover



SD 34P02Q12-07E

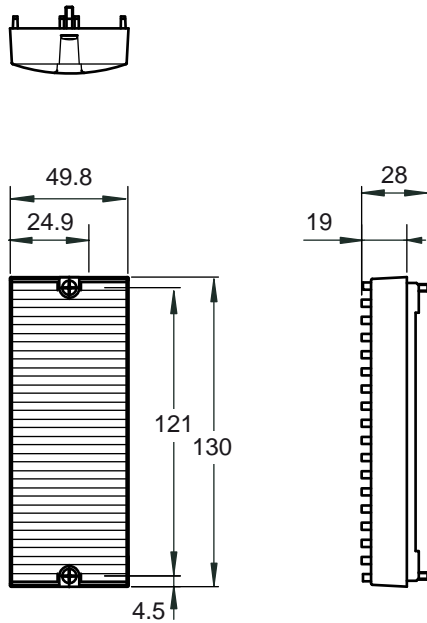
Unit : mm

● NFDCV01



Weight: Approx 0.04kg
Normal allowable deviation: As per JEM1459

● NFDCV02



Weight: Approx 0.06kg
Normal allowable deviation: As per JEM1459

Drawings

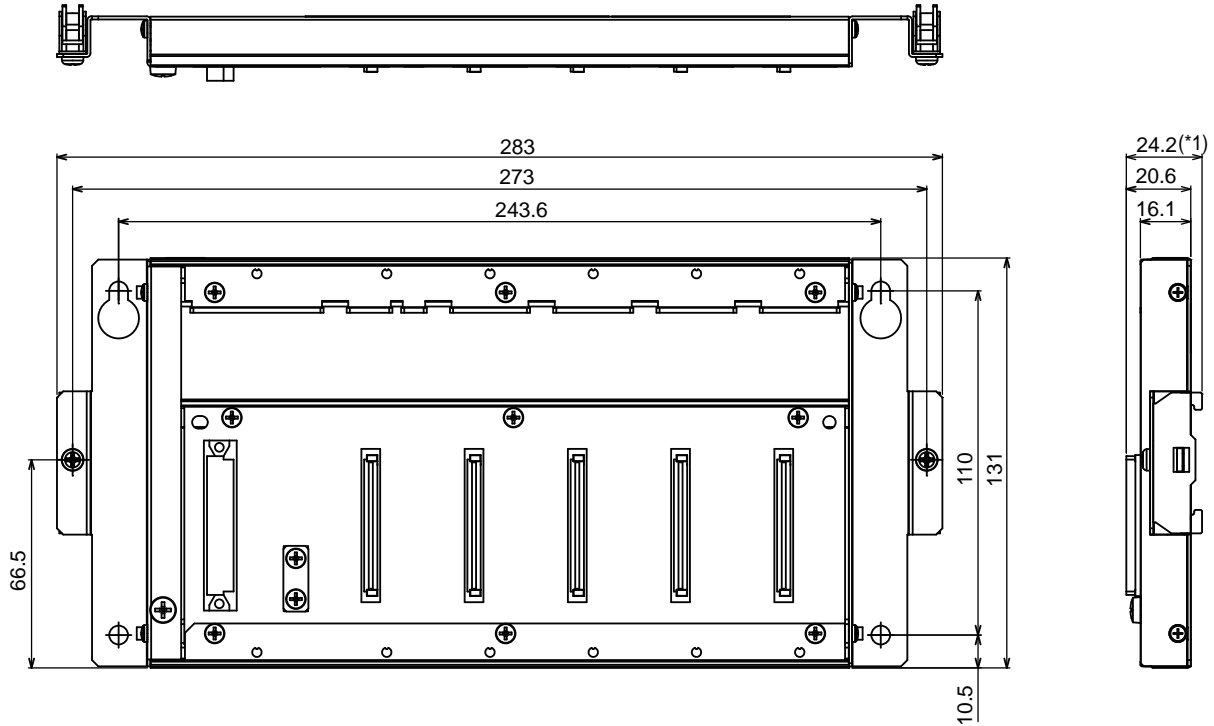
Model N2BU051, NFBU050
Base Module (short)



SD 34P02Q13-01E

Unit : mm
(approx. inch)

- N2BU051-S10 (DIN rail rack-mounting model), NFBU050-S10 (DIN rail rack-mounting model)



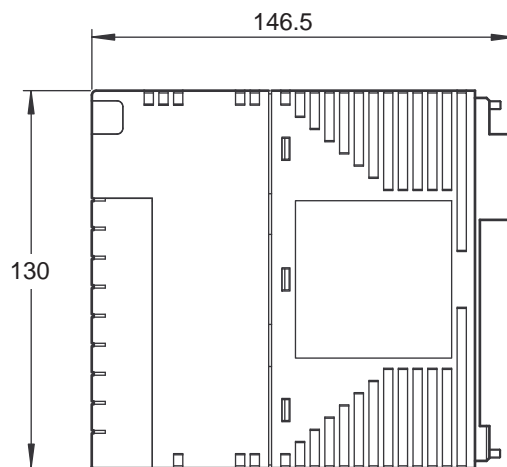
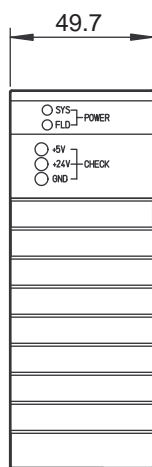
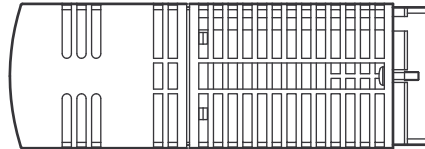
*1: Including mounting parts for DIN rail

Weight: Approx. 0.6 kg

Normal allowable deviation: As per JEM1459

Unit : mm
(approx. inch)

● NFPW426

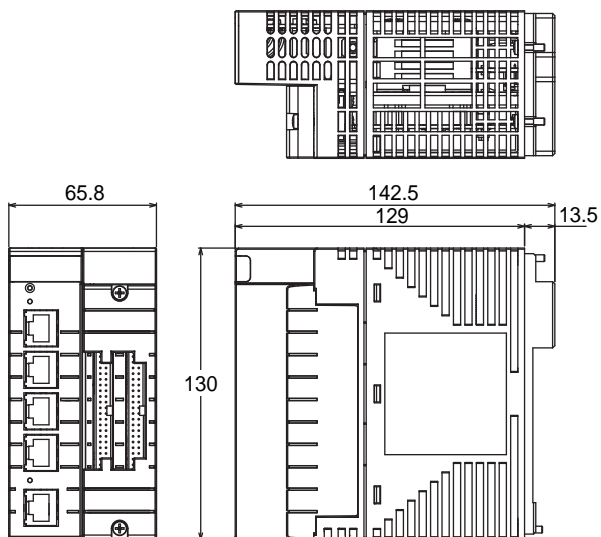


Weight: Approx. 0.61 kg

Normal allowable deviation: As per JEM1459

Unit : mm
(approx. inch)

● NF050



Weight: Approx. 0.57 kg

Normal allowable deviation: As per JEM1459

Drawings

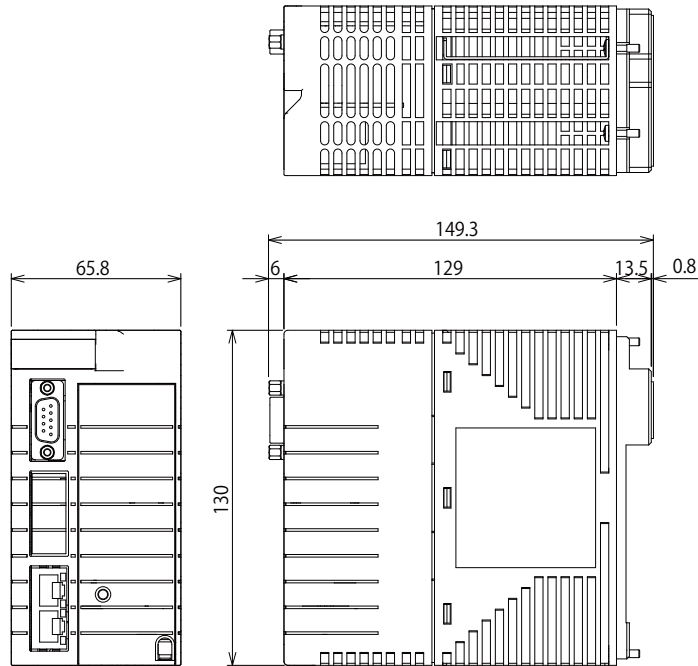
Model NF501, NF502 CPU Module for FCN



SD 34P02Q14-01E

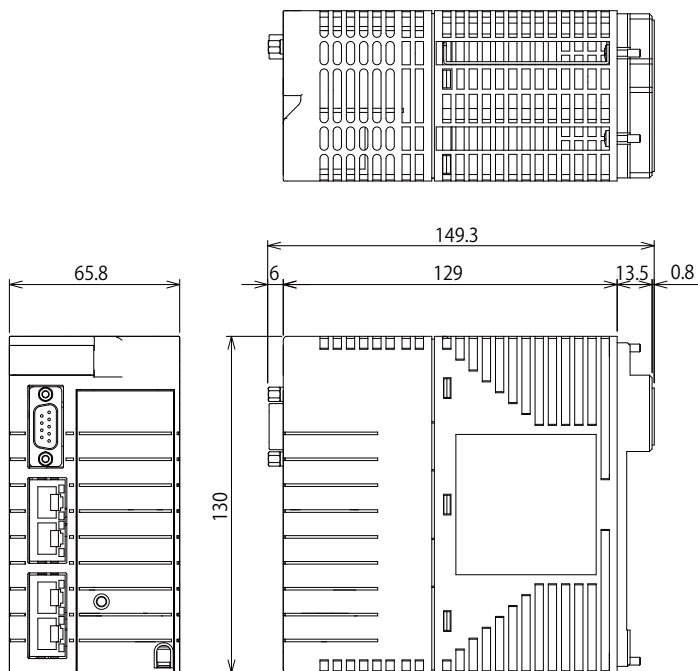
Unit : mm
(approx. inch)

● NF501



Weight: Approx. 0.9 kg
Normal allowable deviation: As per JEM1459

● NF502



Weight: Approx. 0.9 kg
Normal allowable deviation: As per JEM1459

Drawings

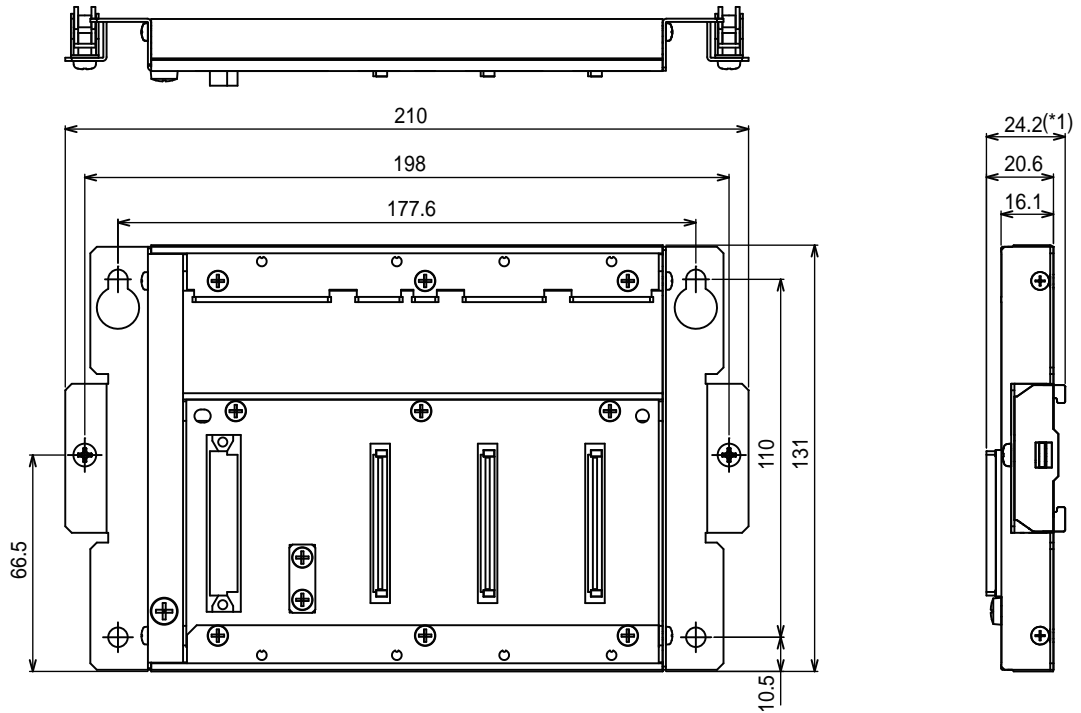
Model N2BU030
Base Module (compact)



SD 34P02Q14-02E

Unit : mm
(approx. inch)

● N2BU030-S10 (DIN rail rack-mounting model)



*1: Including mounting parts for DIN rail

Weight: Approx. 0.5 kg

Normal allowable deviation: As per JEM1459

Drawings

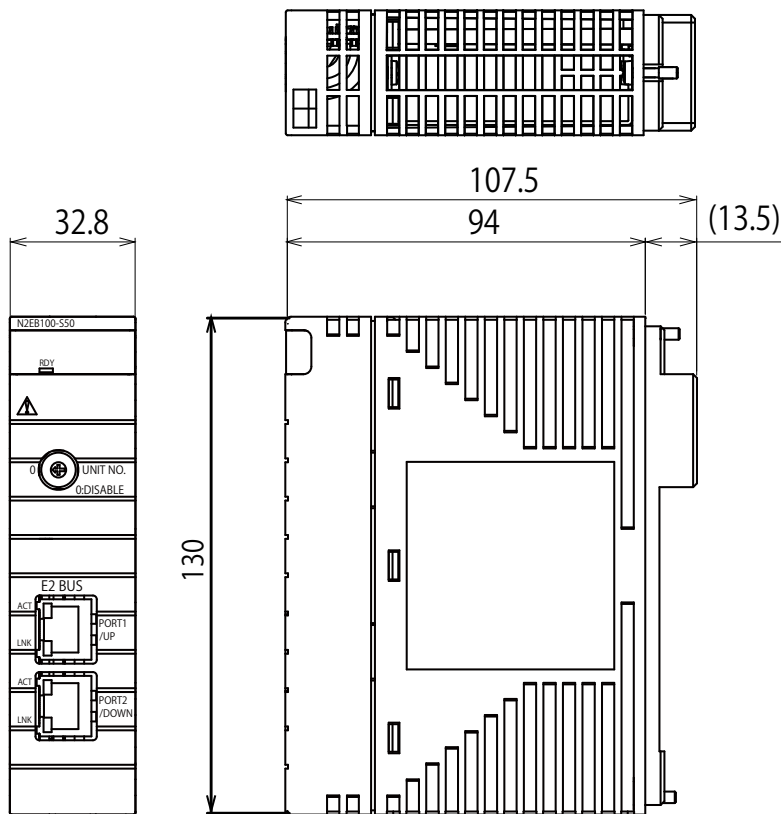
Model N2EB100
E2 Bus Interface Module



SD 34P02Q14-03E

Unit : mm
(approx. inch)

● NFSB100



Weight: Approx. 0.2 kg

Normal allowable deviation: As per JEM1459

Drawings

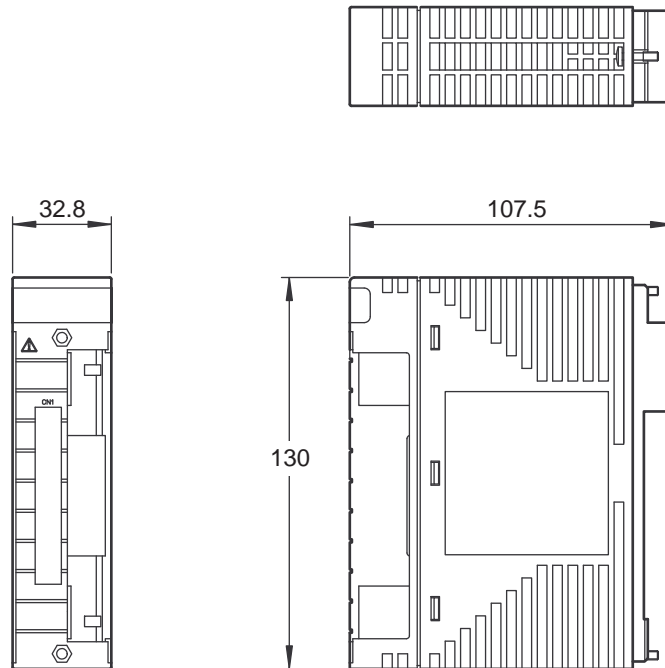
Models NFAI141, NFAV141, NFAV144, NFAI841, NFAB841, NFAV544, NFAI143, NFAI543, NFAT141, NFAR181, NFAI135, NFAI835, NFAP135, and NFAF135



SD 34P02Q31-01E Analog Input/Output Modules

Unit : mm

- NFAI141, NFAV141, NFAI841, NFAB841, NFAI143, NFAI543, NFAT141, NFAR181, NFAI135, NFAI835, NFAP135, and NFAF135



Weight: Approx. 0.3 kg

Normal allowable deviation: As per JEM1459

Drawings

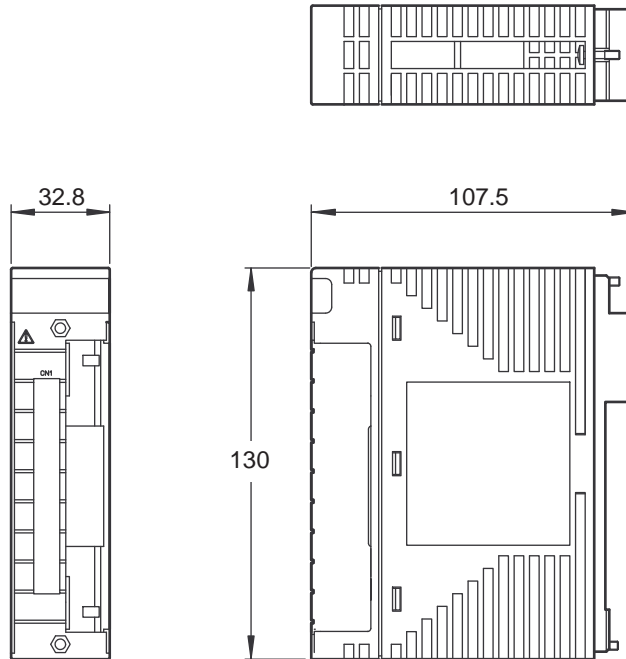
Models NFDV151 and NFDV551
Digital Input/Output Modules
Model NFDV532
Pulse Width Output Module



SD 34P02Q35-01E

Unit : mm
(approx. inch)

- NFDV151, NFDV551,
and NFDV532



Weight: Approx. 0.3 kg

Normal allowable deviation: As per JEM1459

Drawings

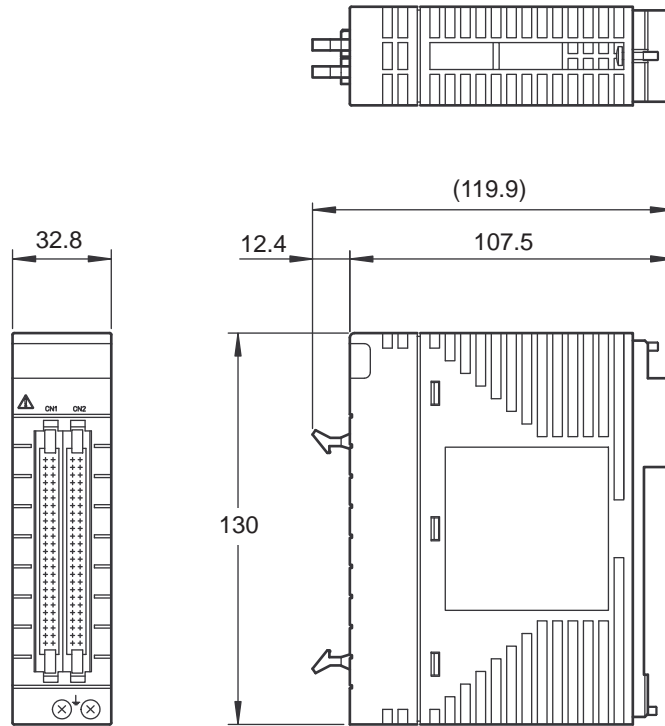
Models NFDV161 and NFDV561 Digital Input/Output Modules



SD 34P02Q35-02E

Unit : mm
(approx. inch)

● NFDV161 and NFDV561



Weight: Approx. 0.3 kg

Normal allowable deviation: As per JEM1459

Drawings

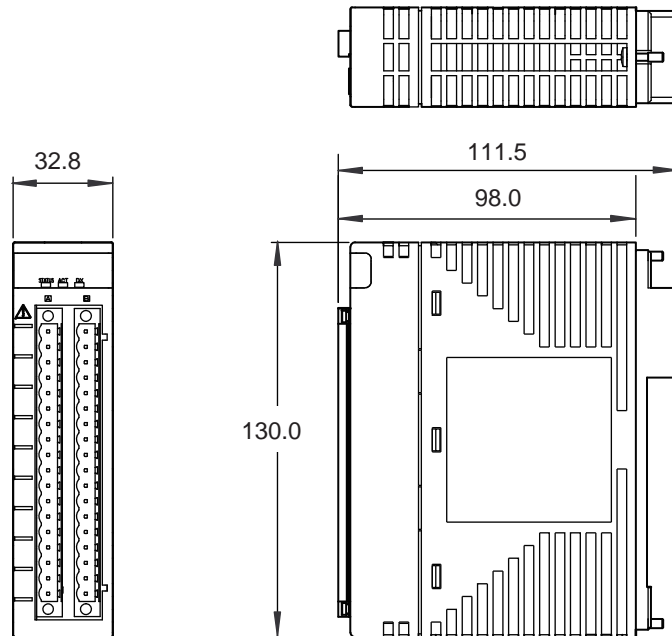
Models NFDR541 Digital Input/Output Modules



SD 34P02Q35-03E

Unit : mm
(approx. inch)

- NFDR541-T□□



Weight: Approx. 0.3 kg

Normal allowable deviation: As per JEM1459

Drawings

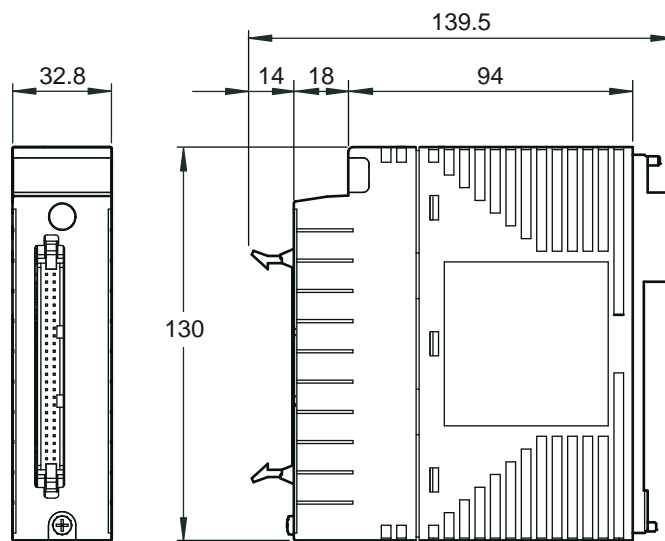
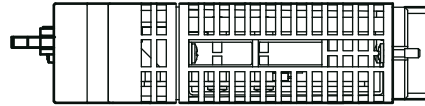
Models NFGS813 and NFGP813 Turbomachinery I/O Modules



SD 34P02Q33-01E

Unit : mm

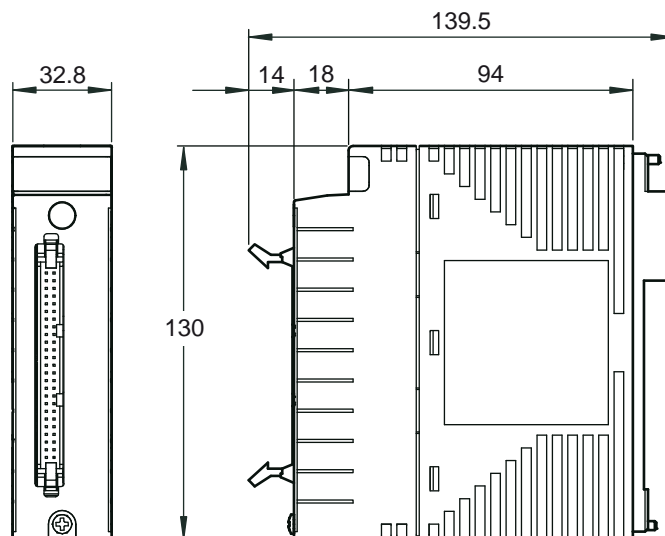
● NFGS813



Weight: Approx. 0.4 kg

Normal allowable deviation: As per JEM1459

● NFGP813



Weight: Approx. 0.3 kg

Normal allowable deviation: As per JEM1459

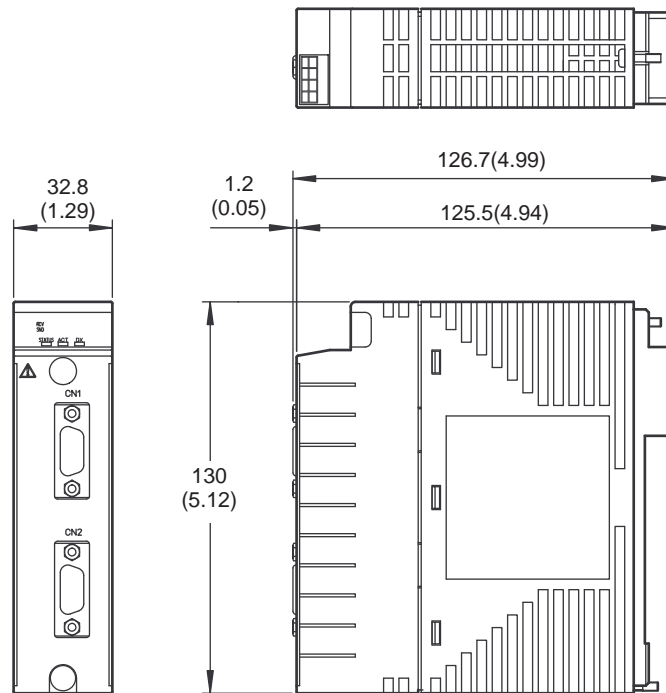
Drawings

Model NFLR111
RS-232-C Communication Module



SD 34P02Q36-01E

Unit : mm
(approx. inch)



Weight : approx. 0.3 kg (0.7 lb)

Normal tolerance is based on JEM1459.

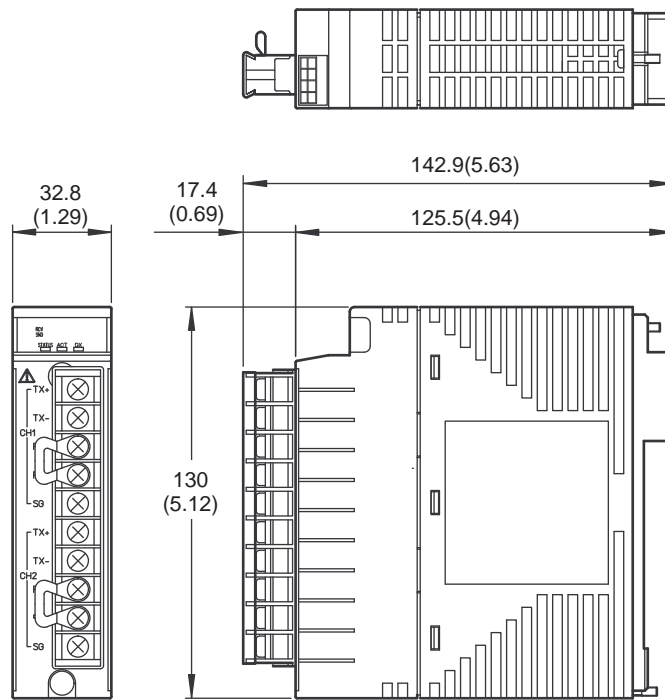
Drawings

Model NFLR121
RS-422 / RS-485 Communication Module



SD 34P02Q36-02E

Unit : mm
(approx. inch)



Weight : approx. 0.3 kg (0.7 lb)

Normal tolerance is based on JEM1459.

Drawings

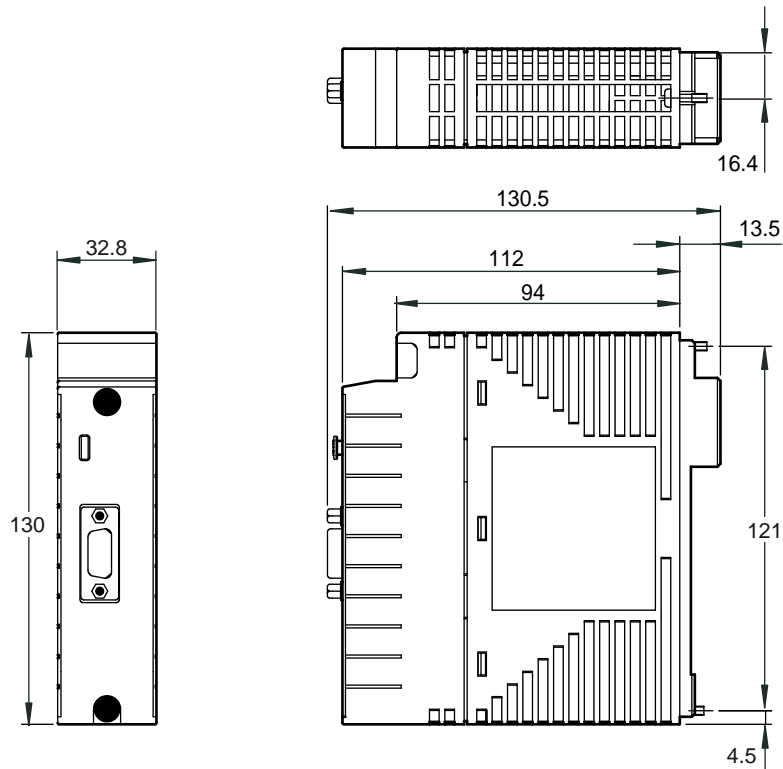
Model NFLC121
CANopen Communication Module
Model NFLP121
PROFIBUS-DP Communication Module



SD 34P02Q57-01E

Unit : mm

- NFLC121, NFLP121



Weight: Approx. 0.3 kg

Normal allowable deviation: As per JEM1459

Drawings

Models NFTA4S, NFTT4S, NFTR8S,
NFTD5S, NFTI3S, NFTC4S
and NFTB5S

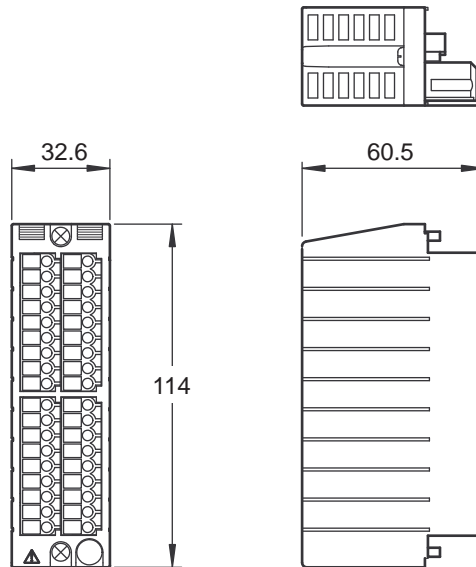


Pressure Clamp Terminal Blocks

SD 34P02Q41-01E

Unit : mm
(approx. inch)

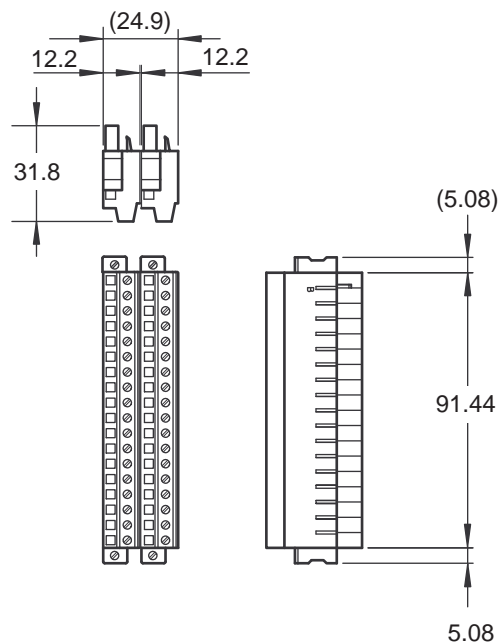
● NFTA4S, NFTT4S, NFTR8S, NFTD5S, NFTI3S, and NFTB5S



Weight: Approx. 0.2 kg

Normal allowable deviation: As per JEM1459

● NFTC4S



Weight: Approx. 0.1 kg

Normal allowable deviation: As per JEM1459

Drawings

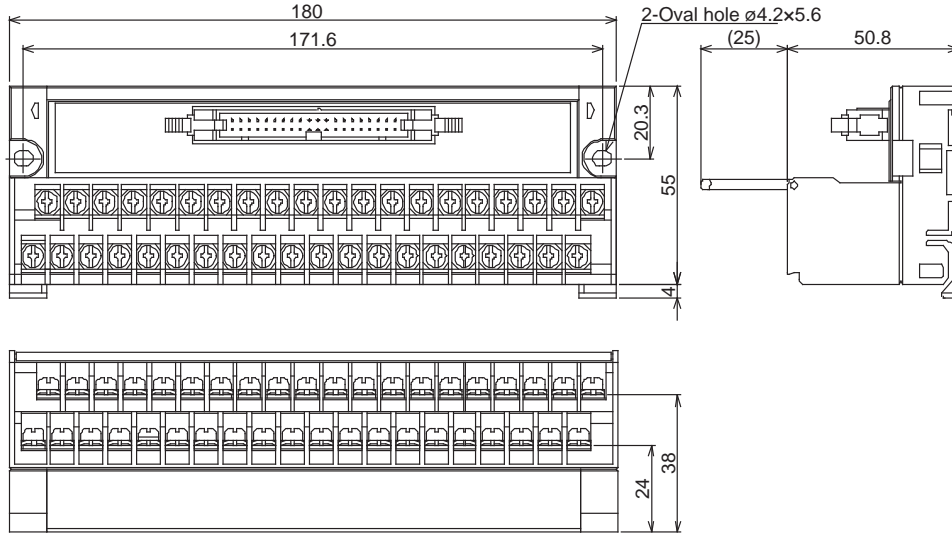
Model TAS40-□□
 MIL Connector Terminal Block
 Model KMS40-□□□
 MIL Connector Cable



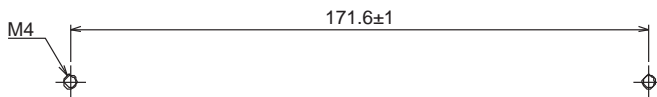
SD 34P02Q41-91E

Unit : mm
 (approx. inch)

● TAS40-0N

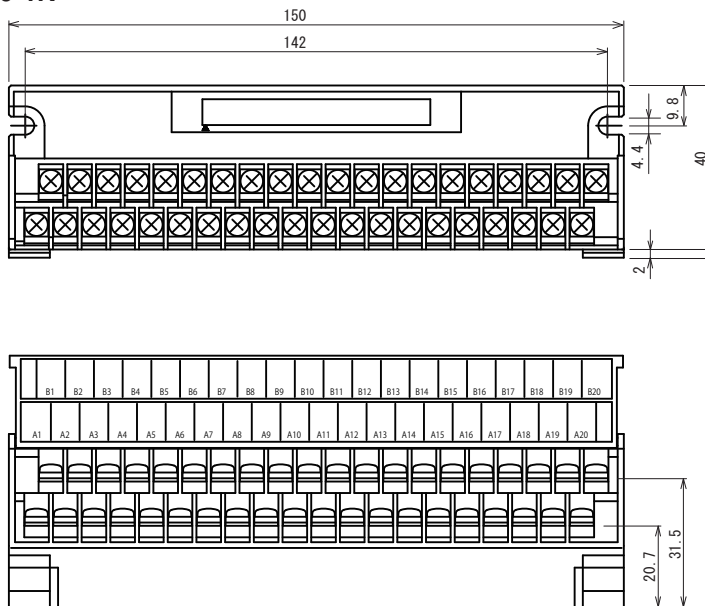


Mounting dimensions



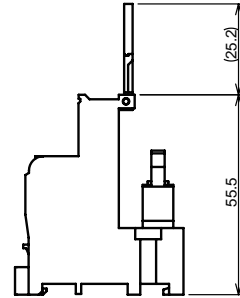
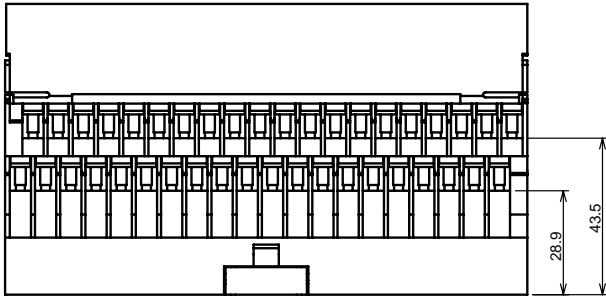
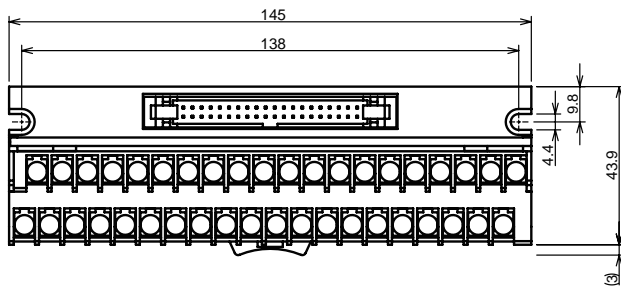
Weight: Approx. 0.26kg
 Normal allowable deviation: As per JEM1459
 Color: Gray

● TAS40-1N



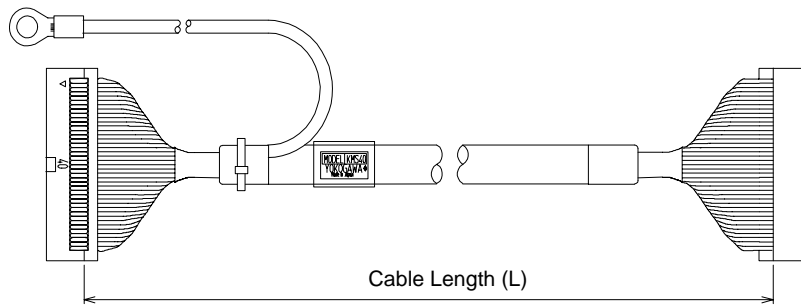
Weight: Approx. 0.16kg
 Color: Gray

● TAS40-2N



Weight: Approx. 0.21kg
Color: Black

● KMS40-□□□



L = 0.5 m, 1 m, 1.5 m, 2 m, 2.5 m, 3 m, 4 m, 5 m, 6 m, 7 m, 8 m, 9 m,
10 m, 15 m, 20 m, 25 m

Drawings

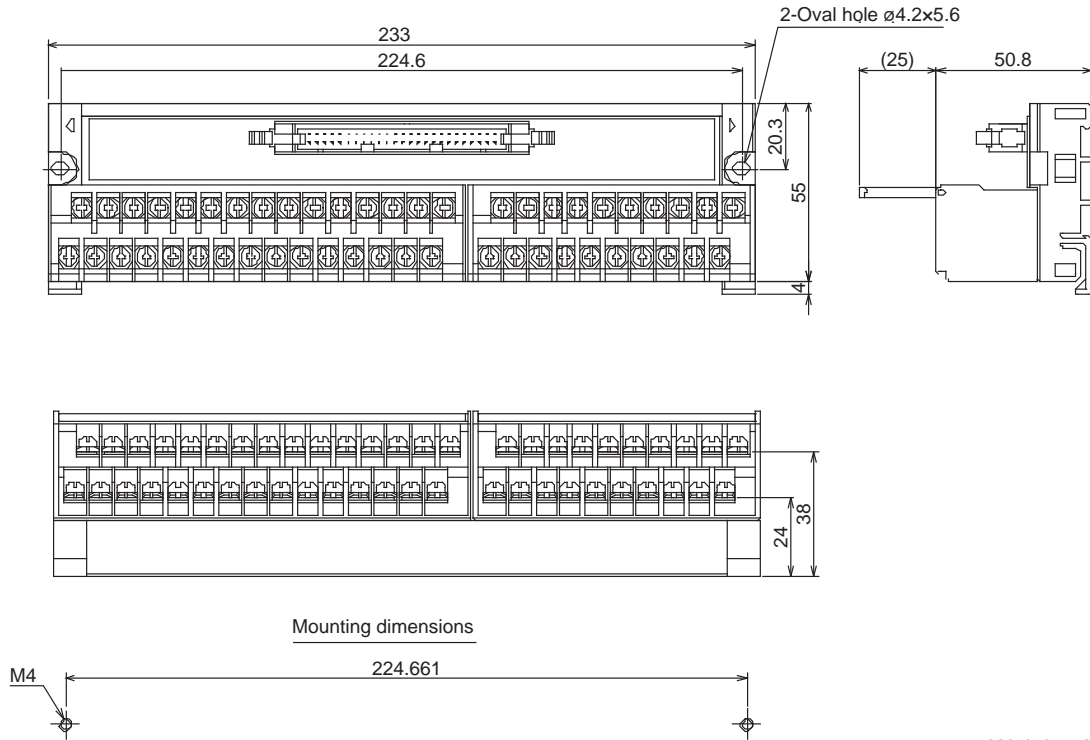
Model TAS50-□□
 MIL Connector Terminal Block
 Model KMS50-□□□
 MIL Connector Cable



SD 34P02Q41-92E

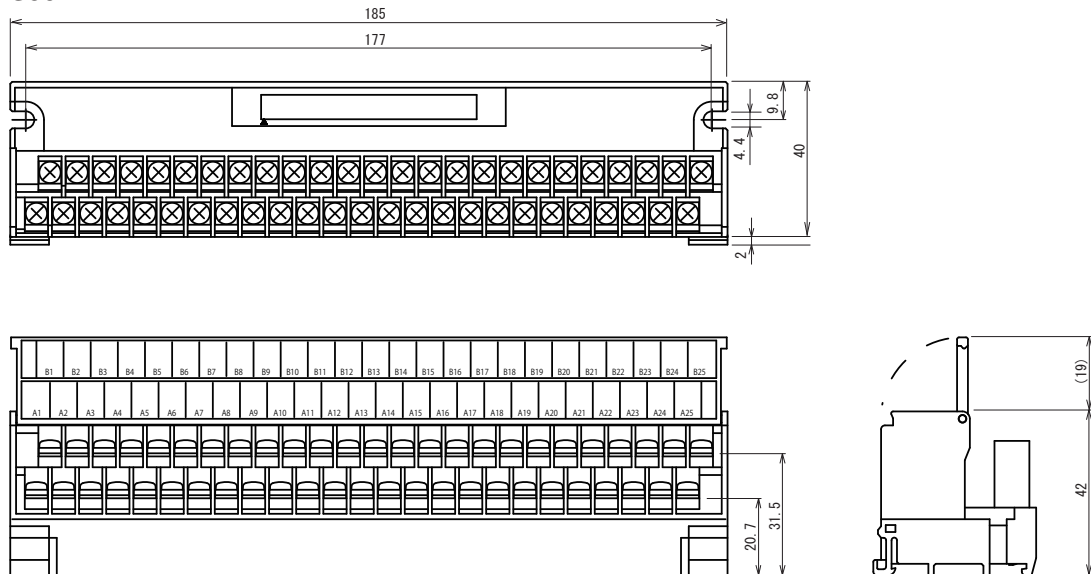
Unit : mm
 (approx. inch)

● TAS50-0N



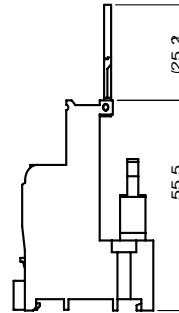
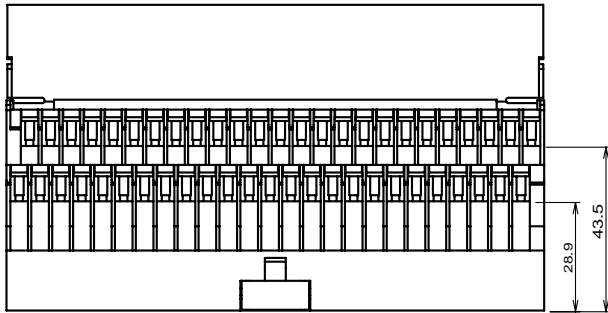
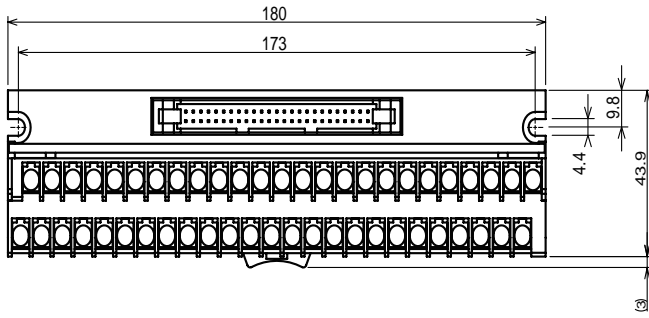
Weight: Approx. 0.33kg
 Normal allowable deviation: As per JEM1459
 Color: Gray

● TAS50-1N



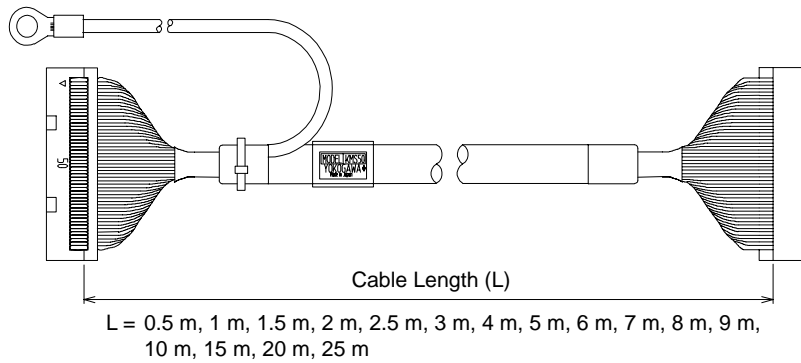
Weight: Approx. 0.20kg
 Color: Gray

● TAS50-2N



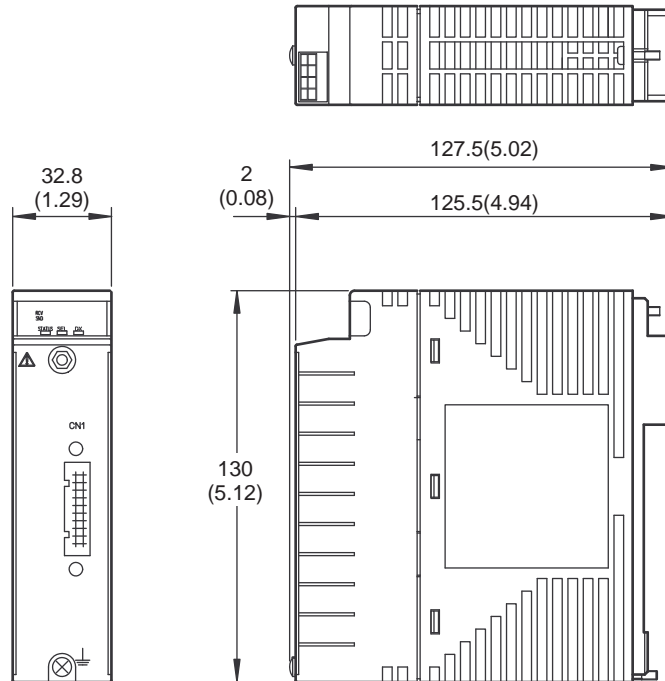
Weight: Approx. 0.26kg
Color: Black

● KMS50-□□□



Unit : mm
(approx. inch)

● NFLF111



Weight : approx. 0.4 kg (0.9 lb)

Normal tolerance is based on JEM1459.

Appendix 1. FM NI Control Drawing for STARDOM FCN

Yokogawa Electric Corporation		Model		FCN			
Title	Control drawing						
No.	NFM009-A13	Page	1	Revision	58	Date	2021-08-12

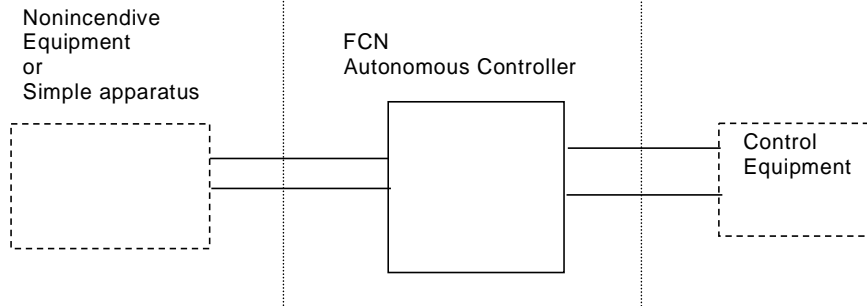
■ Applicable standards:

- FM 3600:2018
- FM 3611:2018
- FM 3810:2018
- ANSI/UL 121201 Ed. 9 (2019)
- ANSI/UL 61010-1 Ed. 3 (2012)
- ANSI/UL 61010-2-030 Ed. 1 (2012)
- ANSI/UL 61010-2-201 Ed. 1 (2014)

Hazardous (Classified)
Location
Class I, Division 2
Groups A, B, C, D

Hazardous (Classified)
Location
Class I, Division 2
Groups A, B, C, D

Nonhazardous
Location



Yokogawa Electric Corporation		Model		FCN	
Title	Control drawing				
No.	NFM009-A13	Page	2	Revision	58

Nonincendive field wiring parameters (Output parameters) (*1)

FCN

Model	Voc (V)	Isc (mA)	Ca (μ F)	La (mH)	Remarks
NFCP050	26.4	23.0	0.19	10.0	Current output
	3.3	1.0	0.8	10.0	Digital input
	–	–	–	–	RS232C (*2)
	–	–	–	–	RS422 / RS485 (*2)
	–	–	–	–	Ethernet (*2)
NFAI141	26.4	27.0	0.19	10.0	2-wire transmitter
NFAI841	26.4	27.0	0.19	10.0	2-wire transmitter
	26.4	23.0	0.19	10.0	Current output
NFAB841	26.4	23.0	0.19	10.0	Current output
NFAR181	5.25	1.0	5.00	100.0	Current output
NFAI135	29.3	31.0	0.12	10.0	2-wire transmitter
NFAI835	29.3	31.0	0.12	10.0	2-wire transmitter
	29.3	23.0	0.12	10.0	Current output
NFAP135	–	–	–	–	3-wire transmitter for 12 / 24 V dc (*2)
	–	–	–	–	2-wire transmitter for 12 / 24 V dc (*2)
	13.2	15.0	1.00	100.0	Relay pulse for 12 V dc (*3)
	26.4	0.4	0.20	100.0	Open-collector pulse for 24 V dc (*4)
	13.2	0.2	1.50	100.0	Open-collector pulse for 12 V dc (*4)
NFAV544	11.8	12.5	0.4	20.0	
NFAI143	25.5	24.4	0.19	10.0	2-wire transmitter
NFAI543	24.3	23.0	0.19	10.0	
NFLR111	–	–	–	–	(*2)
NFLR121	–	–	–	–	(*2)
NFLF111	–	–	–	–	(*2)
NFAF135	13.2	15.0	1.00	100.0	Relay pulse for 12 V dc (*3)
	26.4	0.4	0.20	100.0	Open-collector pulse for 24 V dc (*4)
	13.2	0.2	1.50	100.0	Open-collector pulse for 12 V dc (*4)

*1. These parameters apply to all modes of each module (Model).

*2. Nonincendive field wiring is not permitted.

*3. The parameters apply when the terminals INA and INB only are used.

*4. The parameters apply when the terminals INB and INC only are used.

Yokogawa Electric Corporation		Model		FCN	
Title	Control drawing				
No.	NFM009-A13	Page	3	Revision	58

Nonincendive field wiring parameters (Input parameters) (*1)

FCN

Model	Vmax (V)	I _{max} (mA)	C _i (μF)	L _i (μH)	Remarks
NFCP050	7.5	0.30	0.020	10.0	Voltage input
	–	–	–	–	Digital Output (*2)
	26.4	0.6	0.005	10.0	Voltage pulse input
	–	–	–	–	RS232C (*2)
	–	–	–	–	RS422 / RS485 (*2)
	–	–	–	–	Ethernet (*2)
NFAI141	24.0	30.00	0.005	10.0	4-wire transmitter
NFAI841	24.0	30.00	0.005	10.0	4-wire transmitter
NFAI135	24.0	31.00	0.005	10.0	4-wire transmitter
NFAI835	24.0	31.00	0.005	10.0	4-wire transmitter
NFAP135	26.4	30.00	0.005	10.0	Voltage pulse input
NFAV141	7.5	0.30	0.030	10.0	Voltage input
NFAB841	7.5	0.30	0.030	10.0	Voltage input
NFAT141	5.0	0.14	0.005	10.0	TC/mV input
NFDV151	30.0	5.50	0.001	10.0	
NFDV551	–	–	–	–	(*2)
NFDR541-Txx	30.0	100.00	0.001	10.0	
	75.0	20.00	0.001	10.0	
	110.0	15.00	0.001	10.0	
	125.0	10.00	0.001	10.0	
NFAV144	30	0.14	0.001	10	
NFAI143	25.5	26.3	0.007	10	4-wire transmitter
NFLR111	–	–	–	–	(*2)
NFLR121	–	–	–	–	(*2)
NFLF111	–	–	–	–	(*2)
NFAF135	26.4	30.00	0.005	10.0	Voltage pulse input

*1. These parameters apply to all modes of each module (Model).

*2. Nonincendive field wiring is not permitted.

Cable Parameters

Model	L (μH / m)	C (pF / m)	Remarks
KMS40	2.50	80	
KMS50	2.50	80	

Yokogawa Electric Corporation		Model		FCN	
Title	Control drawing				
No.	NFM009-A13	Page	4	Revision	58

Specific condition of use:

- The equipment shall be installed in a tool-secured metal cabinet. The suitability of the installation shall be determined by the authority having jurisdiction.

Notes:

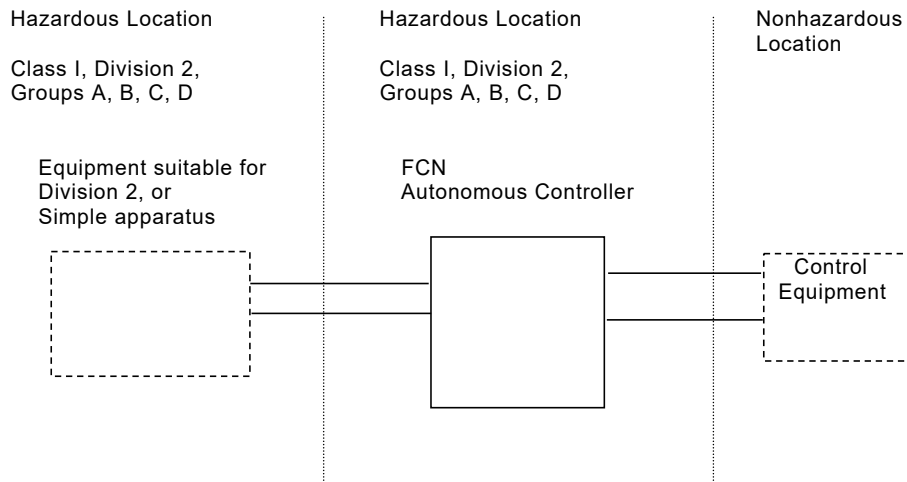
1. No revision to this drawing without prior approval of FM.
2. Installation must be in accordance with the National Electrical Code (NFPA 70) and relevant local codes.
3. In the course of installation, the related documents of GS (General specifications), TI (Technical Information of Installation Guidance), and IM (User's Manuals) should be referred to and the instructions described in the documents should be observed.
4. It must be observed during the installation that the venting slots of the devices are not blocked by cable parts, fixing accessories etc.
5. The doors of the cabinets must be closed when FCN Autonomous Controller is energized.
6. Nonincendive field wiring is permitted for the modules listed in tables of the nonincendive field wiring parameters.
 - 6.1 The nonincendive field wiring circuit concept allows interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus, using any of the wiring methods permitted for unclassified locations.
 - 6.2 Field equipment or other equipment connected to FCN Autonomous Controller by nonincendive field wiring must be FM approved.
 - 6.3 The control drawing of field equipment or other equipment must be followed at the installation.
 - 6.4 The following conditions must be met. See tables for the nonincendive field wiring parameters of FCN Autonomous Controller.
 $V_{max} \geq V_{oc} \text{ or } V_t$; $I_{max} \geq I_{sc} \text{ or } I_t$; $C_a \geq C_i + C_{cable}$; $L_a \geq L_i + L_{cable}$
 - 6.5 For current controlled circuits, I_{max} of the nonincendive field wiring apparatus is not required and need not be aligned with parameter I_{sc} or I_t of FCN Autonomous Controller or other associated nonincendive field wiring apparatus.
7. **WARNING – EXPLOSION HAZARD. DO NOT DISCONNECT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS FREE OF IGNITIBLE CONCENTRATIONS.**
8. **WARNING – EXPLOSION HAZARD. BATTERY MUST ONLY BE CHANGED IN AN AREA FREE OF IGNITIBLE CONCENTRATIONS.**

Appendix 2. CSA NI Control Drawing for STARDOM FCN

Yokogawa Electric Corporation		Model		FCN			
Title	Control drawing						
No.	NCS010-A13	Page	1	Revision	28	Date	2021-04-28
Revised pages	1-4						

■ Applicable standards:

- C22.2 No. 213-17
- CAN/CSA-C22.2 No. 61010-1-12+Amd1-18
- CAN/CSA-C22.2 No. 61010-2-030:18
- CAN/CSA-C22.2 No. 61010-2-201:18



Yokogawa Electric Corporation		Model		FCN	
Title	Control drawing				
No.	NCS010-A13	Page	2	Revision	28

Nonincendive Field Wiring Parameters (Output) (*1)

FCN

Model	Uo (Voc) (V)	Io (Isc) (mA)	Co (Ca) (μ F)	Lo (La) (mH)	Remarks
NF0P050	26.4	23.0	0.19	10.0	Current output
	3.3	1.0	0.8	10.0	Digital input
	–	–	–	–	RS232C (*2)
	–	–	–	–	RS422 / RS485 (*2)
	–	–	–	–	Ethernet (*2)
NFAI141	26.4	27.0	0.19	10.0	2-wire transmitter
NFAI841	26.4	27.0	0.19	10.0	2-wire transmitter
	26.4	23.0	0.19	10.0	Current output
NFAB841	26.4	23.0	0.19	10.0	Current output
NFAR181	5.25	1.0	5.00	100.0	Current output
NFAI135	29.3	31.0	0.12	10.0	2-wire transmitter
NFAI835	29.3	31.0	0.12	10.0	2-wire transmitter
	29.3	23.0	0.12	10.0	Current output
NFAP135	–	–	–	–	3-wire transmitter for 12 / 24 V dc (*2)
	–	–	–	–	2-wire transmitter for 12 / 24 V dc (*2)
	13.2	15.0	1.00	100.0	Relay pulse for 12Vdc (*3)
	26.4	0.4	0.20	100.0	Open-collector pulse for 24 V dc (*4)
	13.2	0.2	1.50	100.0	Open-collector pulse for 12 V dc (*4)
NFAV544	11.8	2.5	0.4	20.0	
NFAI143	25.5	24.4	0.19	10.0	2-wire transmitter
NFAI543	24.3	23.0	0.19	10.0	
NFLR111	–	–	–	–	(*2)
NFLR121	–	–	–	–	(*2)
NFLF111	–	–	–	–	(*2)
NFAF135	13.2	15.0	1.00	100.0	Relay pulse for 12 V dc (*3)
	26.4	0.4	0.20	100.0	Open-collector pulse for 24 V dc (*4)
	13.2	0.2	1.50	100.0	Open-collector pulse for 12 V dc (*4)

*1. These parameters apply to all modes of each module (Model).

*2. Nonincendive field wiring is not permitted.

*3. The parameters apply when the terminals INA and INB only are used.

*4. The parameters apply when the terminals INB and INC only are used.

Yokogawa Electric Corporation		Model	FCN		
Title	Control drawing				
No.	NCS010-A13	Page	3	Revision	28

Nonincendive Field Wiring Parameters (Input) (*1)

FCN

Model	Ui (Vmax) (V)	Ii (Imax) (mA)	Ci (μ F)	Li (μ H)	Remarks
NFCP050	7.5	0.30	0.020	10.0	Voltage input
	–	–	–	–	Digital Output (*2)
	26.4	0.6	0.005	10.0	Voltage pulse input
	–	–	–	–	RS232C (*2)
	–	–	–	–	RS422 / RS485 (*2)
–	–	–	–	Ethernet (*2)	
NFAI141	24.0	30.00	0.005	10.0	4-wire transmitter
NFAI841	24.0	30.00	0.005	10.0	4-wire transmitter
NFAI135	24.0	31.00	0.005	10.0	4-wire transmitter
NFAI835	24.0	31.00	0.005	10.0	4-wire transmitter
NFAP135	26.4	30.00	0.005	10.0	Voltage pulse input
NFAV141	7.5	0.30	0.030	10.0	Voltage input
NFAB841	7.5	0.30	0.030	10.0	Voltage input
NFAT141	5.0	0.14	0.005	10.0	TC/mV input
NFDV151	30.0	5.50	0.001	10.0	
NFDV551	–	–	–	–	(*2)
NFDR541-Txx	30.0	100.00	0.001	10.0	
	75.0	20.00	0.001	10.0	
	110.0	15.00	0.001	10.0	
	125.0	10.00	0.001	10.0	
NFAV144	30	0.14	0.001	10	
NFAI143	25.5	26.3	0.007	10	4-wire transmitter
NFLR111	–	–	–	–	(*2)
NFLR121	–	–	–	–	(*2)
NFLF111	–	–	–	–	(*2)
NFAF135	26.4	30.00	0.005	10.0	Voltage pulse input

*1: These parameters apply to all modes of each module (Model).

*2: Nonincendive field wiring is not permitted.

Cable Parameters

Model	L (μ H / m)	C (pF / m)	Remarks
KMS40	2.50	80	
KMS50	2.50	80	

Yokogawa Electric Corporation		Model		FCN	
Title	Control drawing				
No.	NCS010-A13	Page	4	Revision	28

Specific Conditions of Use:

- The equipment shall be installed in a tool-secured metal cabinet. The suitability of the installation shall be determined by the authority having jurisdiction.

Notes:

1. Installation must be in accordance with Canadian Electrical Code Part I (C22.1) and relevant local codes.
2. In the course of installation, the related documents of GS (General specifications), TI (Technical Information of Installation Guidance), and IM (User's Manuals) should be referred to and the instructions described in the documents should be observed.
3. It must be observed during the installation that the venting slots of the devices are not blocked by cable parts, fixing accessories etc.
4. The doors of the cabinets must be closed when FCN Autonomous Controller is energized.
5. Nonincendive field wiring is permitted for the modules listed in tables of the nonincendive field wiring parameters.
- 5.1 The nonincendive field wiring circuit concept allows interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus, using any of the wiring methods permitted for non-hazardous locations.
- 5.2 The control drawing of field equipment or other equipment must be followed at the installation.
- 5.3 The following conditions must be met. See tables for the nonincendive field wiring parameters of FCN Autonomous Controller.

$$V_{max} \geq V_{oc} \text{ or } V_t; I_{max} \geq I_{sc} \text{ or } I_t; C_a \geq C_i + C_{cable}; L_a \geq L_i + L_{cable}$$

- 5.4 For current controlled circuits, I_{max} of the nonincendive field wiring apparatus is not required and need not be aligned with parameter I_{sc} or I_t of FCN Autonomous Controller or other associated nonincendive field wiring apparatus.
6. **WARNING – EXPLOSION HAZARD. DO NOT DISCONNECT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS FREE OF IGNITIBLE CONCENTRATIONS.**

AVERTISSEMENT – RISQUE D'EXPLOSION. NE PAS DÉBRANCHER PENDANT QUE LE CIRCUIT EST SOUS TENSION OU À MOINS QUE L'EMPLACEMENT NE SOIT EXEMPT DE CONCENTRATIONS INFLAMMABLES.

7. **WARNING – EXPLOSION HAZARD. BATTERY MUST ONLY BE CHANGED IN AN AREA FREE OF IGNITIBLE CONCENTRATIONS.**

AVERTISSEMENT – RISQUE D'EXPLOSION – LES BATTERIES NE DOIVENT ÊTRE REMPLACÉES QUE DANS UN EMBLACEMENT EXEMPT DE CONCENTRATIONS INFLAMMABLES.

Revision Information

- Title : STARDOM FCN/FCJ Installation Guide
- Manual No. : TI 34P02Q91-01E

Aug. 2002/1st Edition/R1.03

Newly published

Dec. 2002/2nd Edition

- Correspondence to standards for hazardous location equipment.
- Errors were corrected.

Feb. 2003/3rd Edition

- Errors were corrected.

July 2003/4th Edition

- I/O modules (NFLR111, NFLR121, NFAI143 and NFAI543) were added.
- Errors were corrected.

Jan. 2004/5th Edition

- I/O modules (NFAV144 and NFAV544) were added.
- G3 Environment Compatibility.
- Errors were corrected.

Nov. 2004/6th Edition

- I/O modules (NFAV144, NFAV544, NFAI143, NFLR111, NFLR121) were approved of Non-Incendive requirements of FM standard.

Apr. 2005/7th Edition

- Notes for Non-Incendive requirements of FM standard were added.
- Errors were corrected.

Feb. 2006/8th Edition

- Correspondence to standards (Type “n”) for hazardous location equipment.
- I/O module (NFDV532) was added.
- Errors were corrected.

Aug. 2006/9th Edition

- Standard numbers for explosion-proof standards (Type “n”) were changed.
- “Intrinsic Safety Explosion Protection Instrumentation Using Barriers” was added.
- Detailed figure of input/output block in “4 Connections between I/O Modules and External Devices”

May 2007/10th Edition

- Correspondence to standards (CSA NI and CSA Type “n”) for hazardous location equipment.
- “3.6 CSA Non-Incendive and Type “n” ” was added.
- Errors were corrected.

Jun. 2008/11th Edition

- Update of Compliant Standards

Feb. 2009/12th Edition

- Update of Compliant Standards
- Addition of FCN-RTU

Aug. 2009/13th Edition

- Addition of base module NFBU050 for FCN.
- Update of Compliant Standards.
- Addition of “Installing DIN Rails to Control Panels.”
- Errors were corrected.

Jun. 2010/14th Edition

- RS-232-C serial port pin assignment were added.
- Errors were corrected.

Mar. 2011/15th Edition

- Addition of I/O Modules NFAF135, NFGS813 and NFGP813.
- Addition of terminal boards AEGS1D and AEGP1D.
- Additional information of the communication cable.
- Errors were corrected.

Jun. 2012/16th Edition

- Addition of communication modules (NFLC121, NFLP121).
- Update of Compliant Standards.

Apr. 2013/17th Edition

- Update of Compliant Standards.

Aug. 2013/18th Edition

- Update of Compliant Standards.

Dec. 2013/19th Edition

- Update of Compliant Standards.

May 2014/20th Edition

- Update of Compliant Standards.
- Grounding Type D (100 Ω or less) was deleted.

Nov. 2014/21st Edition

- Update of Compliant Standards.
- Errors were corrected.

Aug. 2015/22nd Edition

- Update of Compliant Standards.

Nov. 2015/23rd Edition

- Update of Compliant Standards.

Apr. 2016/24th Edition

- Addition of FCN-500.

Oct. 2016/25th Edition

- Addition of Explosion protection for FCN-500.

Dec. 2017/26th Edition

- Update of Compliant Standards.
- Delete FCN-100, FCJ.

Apr. 2018/27th Edition

- Addition of E2 bus, compact base modules.

Jun. 2018/28th Edition

- Addition of installation conditions for E2 bus.

Oct. 2018/29th Edition

- Addition of Marine Standards.

Jan. 2019/30th Edition

- Addition of Explosion protection for E2 bus.

Feb. 2019/31st Edition

- Errors were corrected.

May 2019/32nd Edition

- Errors were corrected.

May 2020/33rd Edition

- Addition of NFDR541-T module.

Jul. 2020/34th Edition

- Addition of ECAS-Ex.

Feb. 2021/35th Edition

- Addition of Explosion protection for NFDR541-T module.
- FCN-RTU Serial port pin assignment were added.

May 2021/36th Edition

- Update of Compliant Standards.

May 2021/37th Edition

- Delete NFDR541-P module.

Dec. 2021/38th Edition

- Update of Compliant Standards.

Apr. 2022/39th Edition

- Update of Control Drawing.

Aug. 2023/40th Edition

- Update of Compliant Standards.

Sep. 2024/41st Edition

- Update of Compliant Standards.
- Delete Blank page

Dec. 2024/42nd Edition

- Errors were corrected.

Mar. 2026/43rd Edition

- Addition of TAS40/50-2N.

■ For Questions and More Information

If you have any questions, you can send an E-mail to the following address.

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