User's
Manual

Hardware Manual

IM 34M06C11-01E

YOKOGAWA
Yokogawa Electric Corporation

IM 34M06C11-01E
23th Edition

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Applicable Product

● Range-free Multi-controller FA-M3

The document number for this manual is given below.

Refer to the document number in all communications, including when purchasing additional copies of this manual.

Document No. : IM 34M06C11-01E

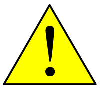
Media No. IM 34M06C11-01E (CD) 23th Edition :Oct. 01, 2013 (YHQ)

Important

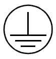
■ About This Manual

- This Manual should be passed on to the end user.
- Before using the controller, read this manual thoroughly to have a clear understanding of the controller.
- This manual explains the functions of this product, but there is no guarantee that they will suit the particular purpose of the user.
- Under absolutely no circumstances may the contents of this manual be transcribed or copied, in part or in whole, without permission.
- The contents of this manual are subject to change without prior notice.
- Every effort has been made to ensure accuracy in the preparation of this manual. However, should any errors or omissions come to the attention of the user, please contact the nearest Yokogawa Electric representative or sales office.

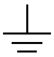
■ Safety symbols



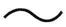
- **Danger.** This symbol on the product indicates that the operator must follow the instructions laid out in this user's manual to avoid the risk of personnel injuries, fatalities, or damage to the instrument. Where indicated by this symbol, the manual describes what special care the operator must exercise to prevent electrical shock or other dangers that may result in injury or the loss of life.



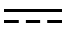
- **Protective Ground Terminal.** Before using the instrument, be sure to ground this terminal.



- **Function Ground Terminal.** Before using the instrument, be sure to ground this terminal.



- **Alternating current.** Indicates alternating current.



- **Direct current.** Indicates direct current.

The following symbols are used only in the user's manual.

WARNING

- Indicates a “Warning”.
- Draws attention to information essential to prevent hardware damage, software damage or system failure.

CAUTION

- Indicates a “Caution”
- Draws attention to information essential to the understanding of operation and functions.

TIP

- Indicates a “TIP”
- Gives information that complements the present topic.

SEE ALSO

- Indicates a “SEE ALSO” reference.
- Identifies a source to which to refer.

■ Safety Precautions when Using/Maintaining the Product

- For the protection and safe use of the product and the system controlled by it, be sure to follow the instructions and precautions on safety stated in this manual whenever handling the product. Take special note that if you handle the product in a manner other than prescribed in these instructions, the protection feature of the product may be damaged or impaired. In such cases, Yokogawa cannot guarantee the quality, performance, function and safety of the product.
- When installing protection and/or safety circuits such as lightning protection devices and equipment for the product and control system as well as designing or installing separate protection and/or safety circuits for fool-proof design and fail-safe design of processes and lines using the product and the system controlled by it, the user should implement it using devices and equipment, additional to this product.
- If component parts or consumable are to be replaced, be sure to use parts specified by the company.
- This product is not designed or manufactured to be used in critical applications which directly affect or threaten human lives and safety — such as nuclear power equipment, devices using radioactivity, railway facilities, aviation equipment, shipboard equipment, aviation facilities or medical equipment. If so used, it is the user’s responsibility to include in the system additional equipment and devices that ensure personnel safety.
- Do not attempt to modify the product.
- To avoid electrical shock, turn off the power before wiring.
- This product is classified as Class A for use in industrial environments.If used in a residential environment, it may cause electromagnetic interference (EMI).

  In such situations, it is the user's responsibility to adopt the necessary measures against EMI.

■ Exemption from Responsibility

- Yokogawa Electric Corporation (hereinafter simply referred to as Yokogawa Electric) makes no warranties regarding the product except those stated in the WARRANTY that is provided separately.

- Yokogawa Electric assumes no liability to any party for any loss or damage, direct or indirect, caused by the use or any unpredictable defect of the product.

■ Software Supplied by the Company

- Yokogawa Electric makes no other warranties expressed or implied except as provided in its warranty clause for software supplied by the company.
- Use the software with one computer only. You must purchase another copy of the software for use with each additional computer.
- Copying the software for any purposes other than backup is strictly prohibited.
- Store the original media that contain the software in a safe place.
- Reverse engineering, such as decompiling of the software, is strictly prohibited.
- Under absolutely no circumstances may the software supplied by Yokogawa Electric be transferred, exchanged, or sublet or leased, in part or as a whole, for use by any third party without prior permission by Yokogawa Electric.

■ General Requirements for Using the FA-M3 Controller

● Set the product in a location that fulfills the following requirements:

- Where the product will not be exposed to direct sunlight, and where the operating surrounding air temperature is from 0°C to 55°C (32°F to 131°F).

  There are modules that must be used in an environment where the operating surrounding air temperature is in a range smaller than 0°C to 55°C (32°F to 131°F). Refer to hardware user's manual or the applicable user's manual. In case of attaching such a module, the entire system's operating surrounding air temperature is limited to the module's individual operating surrounding air temperature.
- Where the relative humidity is from 10 to 90%.

  In places where there is a chance of condensation, use a space heater or the like to constantly keep the product warm and prevent condensation.
- For use in Pollution Degree 2 Environment.
- Where there are no corrosive or flammable gases.
- Where the product will not be exposed to mechanical vibration or shock that exceed specifications.
- Where there is no chance the product may be exposed to radioactivity.

● Use the correct types of wire for external wiring:

- USE COPPER CONDUCTORS ONLY.
- Use conductors with temperature rating above 75°C.

● Securely tighten screws:

- Securely tighten module mounting screws and terminal screws to avoid problems such as faulty operation.
- Tighten terminal block screws with the correct tightening torque as given in this manual. Refer to the hardware user's manual or the applicable user's manual for the appropriate tightening torque.

● Securely lock connecting cables:

- Securely lock the connectors of cables, and check them thoroughly before turning on the power.

● Interlock with emergency-stop circuitry using external relays:

- Equipment incorporating the FA-M3 controller must be furnished with emergency-stop circuitry that uses external relays. This circuitry should be set up to interlock correctly with controller status (stop/run).

● Ground for low impedance:

- For safety reasons, connect the [FG] grounding terminal to a protective earth (Comply with the regulation of each country.). For compliance to CE Marking, use braided or other wires that can ensure low impedance even at high frequencies for grounding.

● Configure and route cables with noise control considerations:

- Perform installation and wiring that segregates system parts that may likely become noise sources and system parts that are susceptible to noise. Segregation can be achieved by measures such as segregating by distance, installing a filter or segregating the grounding system.

● Configure for CE Marking Conformance:

- For compliance to CE Marking, perform installation and cable routing according to the description on compliance to CE Marking in the “Hardware Manual” (IM 34M06C11-01E).

● Keep spare parts on hand:

- We recommend that you stock up on maintenance parts, including spare modules, in advance.
- Preventive maintenance (replacement of the module) is required for using the module beyond 10 years.

● Discharge static electricity before touching the system:

- Because static charge can accumulate in dry conditions, first touch grounded metal to discharge any static electricity before touching the system.

● Wipe off dirt with a soft cloth:

- Gently wipe off dirt on the product's surfaces with a soft cloth.
- If you soak the cloth in water or a neutral detergent, tightly wring it out before wiping the product. Letting water enter the module interior can cause malfunctions.
- Do not use volatile solvents such as benzine or paint thinner or chemicals for cleaning, as they may cause deformity, discoloration, or malfunctioning.

● Avoid storing the FA-M3 controller in places with high temperature or humidity:

- Since the CPU module has a built-in battery, avoid storage in places with high temperature or humidity.
- Since the service life of the battery is drastically reduced by exposure to high temperatures, take special care (storage surrounding air temperature should be from -20°C to 75°C).
- There is a built-in lithium battery in a CPU module which serves as backup power supply for programs, device information and configuration information.

  The service life of this battery is more than 10 years in standby mode at room temperature. Take note that the service life of the battery may be shortened when installed or stored at locations of extreme low or high temperatures. Therefore, we recommend that modules with built-in batteries be stored at room temperature.

● Always turn off the power before installing or removing modules:

- Failing to turn off the power supply when installing or removing modules, may result in damage.

● Do not touch components in the module:

- In some modules you can remove the right-side cover and install ROM packs or change switch settings. While doing this, do not touch any components on the printed-circuit board, otherwise components may be damaged and modules may fail to work.

● Do not use unused terminals:

- Do not connect wires to unused terminals on a terminal block or in a connector. Doing so may adversely affect the functions of the module.

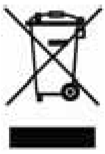
● Use the following power source:

- Use only F3PUxx-xx as the power supply module.
- If using this product as a UL-approved product, for the external power supply, use a limited voltage / current circuit power source or a Class 2 power source.

● Refer to the user's manual before connecting wires:

- Refer to the hardware user's manual or the applicable user's manual for the external wiring drawing.
- Refer to "A3.6.5 Connecting Output Devices" in the hardware user's manual before connecting the wiring for the output signal.
- Refer to "A3.5.4 Grounding Procedure" in the hardware user's manual for attaching the grounding wiring.

■ Waste Electrical and Electronic Equipment



Waste Electrical and Electronic Equipment (WEEE), Directive 2002/96/EC

(This directive is only valid in the EU.)

This product complies with the WEEE Directive (2002/96/EC) marking requirement.

The following marking indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category

With reference to the equipment types in the WEEE directive Annex 1, this product is classified as a “Monitoring and Control instrumentation” product.

Do not dispose in domestic household waste.

When disposing products in the EU, contact your local Yokogawa Europe B. V. office.

■ How to Discard Batteries

The following description on DIRECTIVE 2006/66/EC (hereinafter referred to as the EU new directive on batteries) is valid only in the European Union.

Some models of this product contain batteries that cannot be removed by the user. Make sure to dispose of the batteries along with the product.

Do not dispose in domestic household waste.

When disposing products in the EU, contact your local Yokogawa Europe B. V. office.

Battery type: Lithium battery

Note: The symbol above means that the battery must be collected separately as specified in Annex II of the EU new directive on batteries.

Introduction

■ Overview of the Manual

This manual explains the configuration, specifications and installation of the Range-Free Multi-controller FA-M3. It also discusses the individual specifications of power supply modules, base modules, I/O modules, cables and terminal block units.

■ Configuration of the Manual

This manual consists of three parts.

● Part A Standard Version

The main part of this manual explains all the details of the FA-M3 system except for those of the FA-M3 Value and FA-M3 Value II.

● Part B FA-M3 Value (F3SC21-1N) Version

The second part of the manual discusses the details specific to the FA-M3 Value (F3SC21-1N).

● Part C FA-M3 Value II (F3SC22-xx, F3SC23-xx) Version

The third part of the manual discusses the details specific to the FA-M3 Value II (F3SC22-xx, F3SC23-xx).

Chapters A3 (Installation and Wiring), A4 (Test Runs and Troubleshooting) and A5 (Maintenance and Inspection) are common to the standard FA-M3, the FA-M3 Value and the FA-M3 Value II. Be sure to read these chapters before using the FA-M3 Value and the FA-M3 Value II.

■ Other User's Manuals

For products other than the power supply module, base module, I/O module, cable and terminal block unit, refer to their respective manuals.

Copyrights and Trademarks

■ Copyrights

■ Trademarks

FA-M3

Hardware Manual

IM 34M06C11-01E 23th Edition

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Part A Standard Version

Part B FA-M3 Value (F3SC21-1N)

Part C FA-M3 Value II (F3SC22-xx, F3SC23-xx)

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Hardware Manual
Part A Standard Version

IM 34M06C11-01E   23th Edition

A1. System Configuration

A1.1 System Configuration

■ Basic Configuration

The basic configuration of FA-M3 is a unit.

A unit is a system with the minimum configuration consisting of the following modules. Install these modules on the base module to compose the unit.

Table A1.1 Modules (Components) of a Unit

Module	Description
Base module	Five types are available, allowing different number of modules to be mounted.
Power supply module	A unit must have at least one power supply module.
CPU module	Different types are available with different functionalities. A unit must have at least one CPU module.
I/O module	Various types are available with different I/O and number of I/O points.
Special module	Various types are available, including analog I/O and communication modules.

■ Main Unit

A unit in which a CPU module is installed is referred to as a main unit. Thus a main unit is comprised of only one unit.

The unit number of a main unit is 0.

■ Subunit

Subunits are used to increase the number of I/O ports. A subunit contains no CPU module. A maximum of seven subunits can be added to the system to handle up to 8192 (depending on the CPU module type) I/O points. The unit number of a subunit is either 1, 2, 3, 4, 5, 6, or 7.

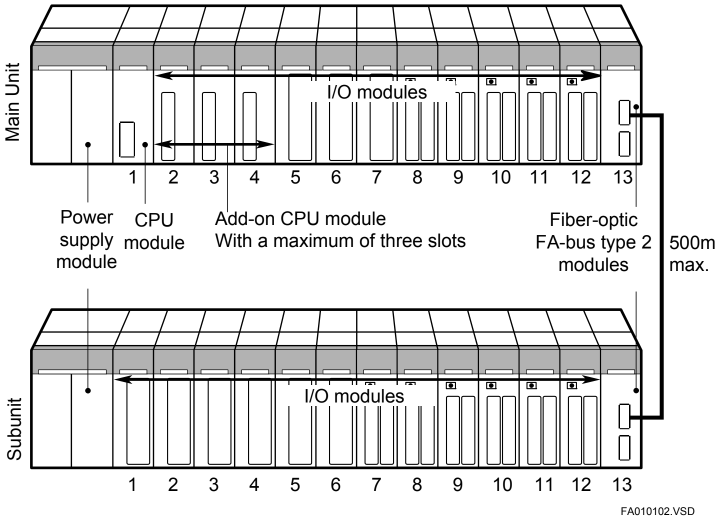


Figure A1.1 Main Unit and Subunit

■ Slot Number

A slot number identifies a slot of a base module in which a CPU module, an I/O module or some other module can be installed. A slot number is a 3-digit integer with the first digit representing a unit number. The unit number of the main unit is 0.

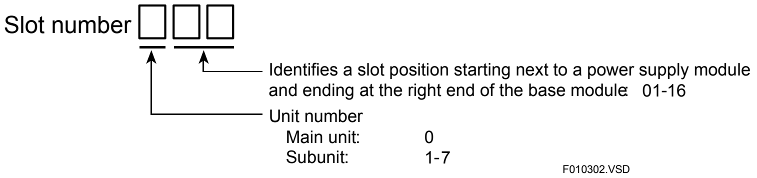

Slot number
Identifies a slot position starting next to a power supply module and ending at the right end of the base module: 01-16
Unit number
Main unit: 0
Subunit: 1-7
F010302.VSD

Figure A1.2 Slot Number Definition

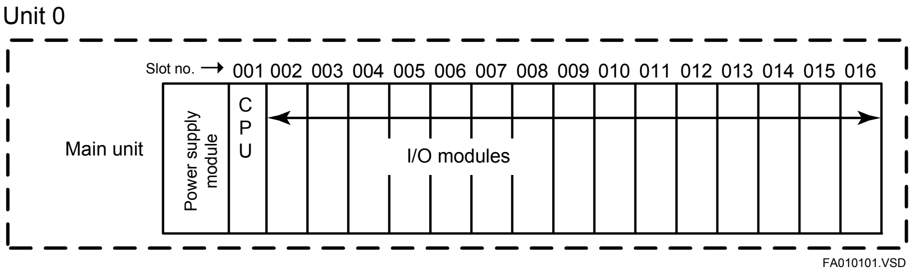


Figure A1.3 Slot Numbers for the Main Unit

■ Example of Increasing the Number of I/O Points Using Fiber-optic FA-bus Type 2 Modules

You can install fiber-optic FA-bus type 2 modules in both main and subunits and connect them with fiber-optic cables. This enables distributed arrangement of remote I/O points, increase in the number of I/O points, and control of I/O modules via high-speed, noise-immune communication.

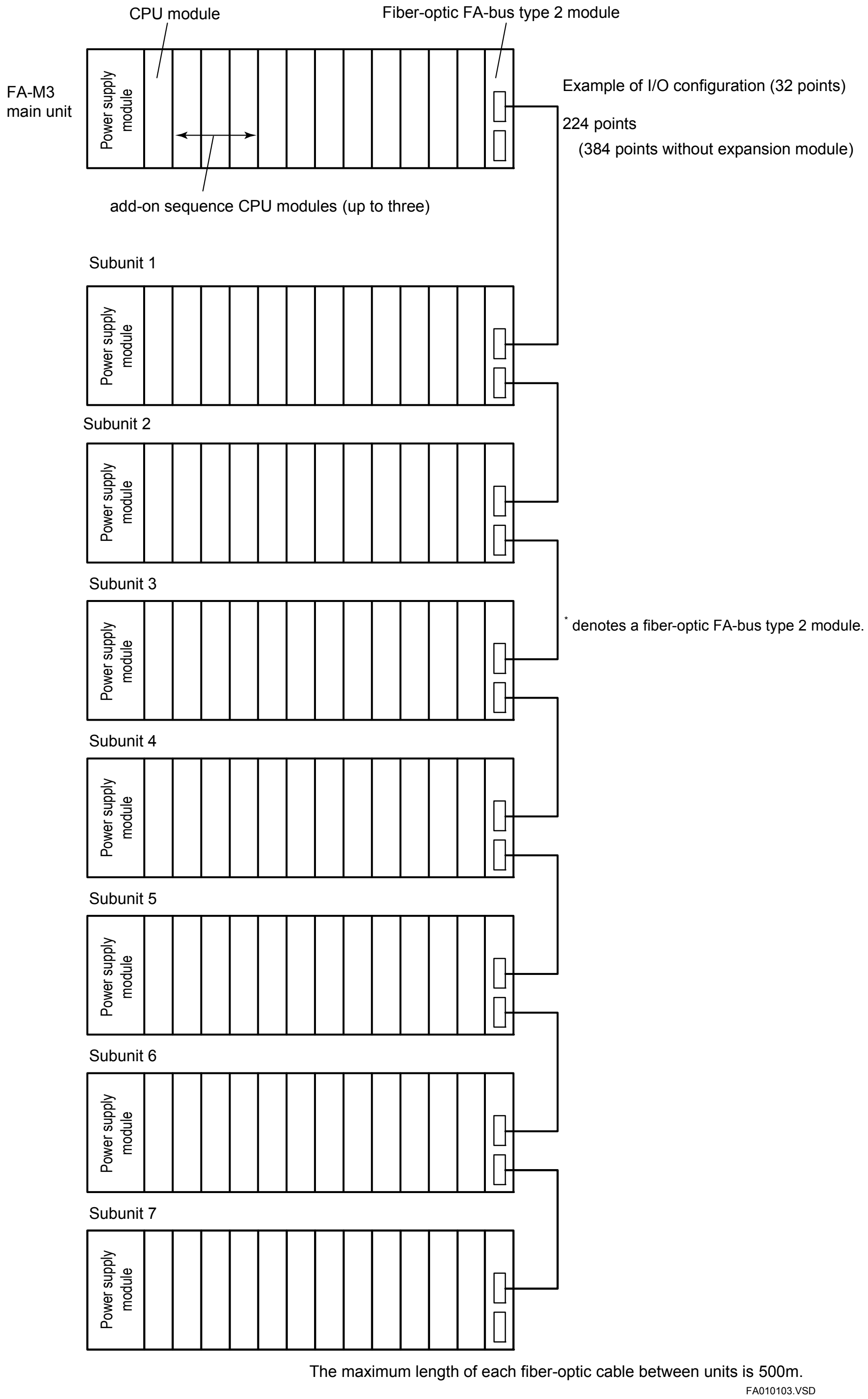

CPU module
Fiber-optic FA-bus type 2 module
FA-M3
main unit
Power supply module
Example of I/O configuration (32 points)
224 points
(384 points without expansion module)
add-on sequence CPU modules (up to three)
Subunit 1
Subunit 2
Subunit 3
* denotes a fiber-optic FA-bus type 2 module.
Subunit 4
Subunit 5
Subunit 6
Subunit 7
The maximum length of each fiber-optic cable between units is 500m.
FA010103.VSD

Figure A1.4 Increasing the Number of I/O Points Using Fiber-optic FA-bus Type 2 Modules

The maximum number of subunits that can be connected is 7.
Subunit numbers are determined depending on the setting of the rotary switch on the fiber-optic FA-bus type 2 module mounted to a subunit.

TIP

■ Example of increasing the number of I/O points using FA-bus type 2 modules

As with fiber-optic FA-bus type 2 modules, the number of I/O points can be increased using FA-bus type 2 modules.

FA-bus type 2 modules use shielded twisted-pair cables for the connection between subunits. (The cable length is restricted compared to fiber-optic FA-bus type 2 modules.)

A1.2 Restrictions on Module Installation

A1.2.1 Restrictions on Module Location

- A CPU module installed in slot 1 serves as the main CPU module.
- CPU modules installed in slots 2 to 4 serve as the add-on CPU modules.
- I/O modules may also be installed in slots 2 to 4. No add-on sequence CPU module or add-on BASIC CPU module can be installed in a slot with a slot number greater than those of the I/O modules.
- In an application where two or more CPU modules are installed, no I/O module can be installed between any two CPU modules.

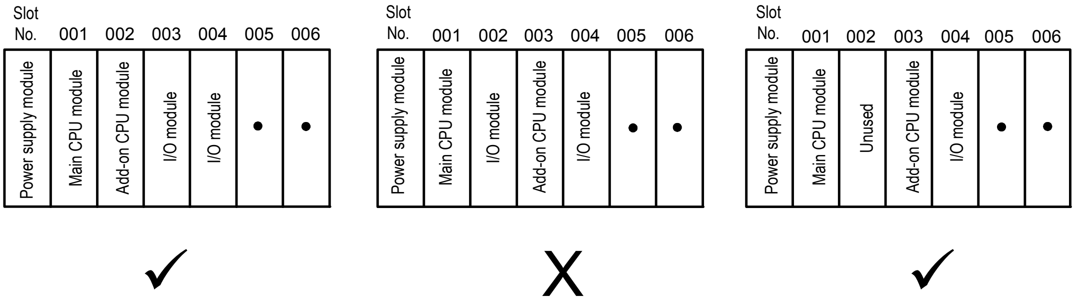


Figure A1.5 Restrictions on Module Location

A1.2.2 Restrictions on CPU Module Installation

A maximum of four CPU modules can be installed in slots 1 to 4.

Table A1.2 Combinations of Main CPU Modules with Add-on CPU Modules

Model		Maximum Qty.*1	Add-on CPU Module														
			F3SP21-0N	F3SP22-0S	F3SP25-2N	F3SP35-5N	F3SP28-3□	F3SP38-6□	F3SP53-4□	F3SP58-6□	F3SP59-7S	F3SP6□-□S	F3SP7□-□N	F3SP7□-□S	F3BP20-0N	F3BP30-0N	F3FP36-3N
Main CPU Module	F3SP21-0N	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓ *2	✓	✓	✓	✓
	F3SP22-0S	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3SP25-2N	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓ *2	✓	✓	✓	✓
	F3SP35-5N	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓ *2	✓	✓	✓	✓
	F3SP28-3□	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3SP38-6□	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3SP53-4□	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3SP58-6□	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3SP59-7S	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3SP6□-□S	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3SP7□-□N	4	✓ *2	✓	✓ *2	✓ *2	✓	✓	✓	✓	✓	✓	✓	✓ *3	✓ *2	✓ *2	–
	F3SP7□-□S	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓ *3	✓	✓	✓	–
	F3BP20-0N	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓ *2	✓	–	–	✓
	F3BP30-0N	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓ *2	✓	–	–	✓
	F3FP36-3N	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	–	✓	✓	–

*1: Indicates the maximum number of modules that can be used in total including the main CPU module when CPU modules with the same model name as the main CPU module are used as add-on CPU modules.

*2: A maximum of two modules can be installed in this combination.

*3: The combination of F3SP7□-□N + F3SP7□-□N + F3SP21 (25, 35/ F3BP20, 30) is not possible.
The combination of F3SP7□-□N + F3SP7□-□S + F3SP21 (25, 35/ F3BP20, 30) is not possible.
The combination of F3SP7□-□S + F3SP7□-□S + F3SP21 (25, 35/ F3BP20, 30) is possible.
The combination of F3SP7□-□N + F3SP7□-□S is possible.

A1.2.3 Restrictions on I/O Module Installation

Table A1.3 shows the types of modules that each CPU module can access directly, as well as the maximum number of modules of each type that can be installed at the same time. The maximum number referred to here means a limit to the quantity of modules when a multiple of the same I/O module is installed.

- "✓" identifies an I/O module that can be installed without limitation on its quantity.
- "–" identifies an I/O module to which the CPU module in question cannot have direct access.
- Each numeral means the maximum number of I/O modules that can be installed, provided that they are of the same type.

In addition to the restrictions on the quantity of each I/O module, there are system-wide limitations to the quantity of I/O modules that can be installed. For more information, see Appendix A1, "System-wide Restrictions on Module Installation."

In the table below, modules with shaded module names must be installed in the main unit.

Table A1.3 Modules that Each CPU can Access Directly and the Maximum Number that can be Installed (1/2)

Module Name	Model	Sequence CPU															BASIC CPU	
		F3SP21-0N	F3SP22-0S	F3SP25-2N	F3SP35-5N	F3SP28-3□	F3SP38-6□	F3SP53-4□	F3SP58-6□	F3SP59-7S	F3SP66-4S	F3SP67-6S	F3SP71-4N	F3SP76-7N	F3SP71-4S	F3SP76-7S	F3BP20-0N	F3BP30-0N
Memory card module	F3EM01-0N	2^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	–	–
Input module	F3XA□□-□N	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3XH04-3N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16^{*2}	16^{*2}
	F3XC08-0□	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3XD08-6F	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3XD08-6N	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3XD16-□F	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3XD16-3H	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3XD32-□F	64	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3XD16-□N	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3XD32-□N	64	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3XD64-□□	32	64	64	✓	64	✓	64	✓	✓	64	✓	64	✓	64	✓	✓	✓
Output module	F3YA08-2N	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3YC08-0C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3YC08-0N	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3YC16-0N	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3YD04-7N	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3YD08-□□	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3YD14-5□	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3YD32-1□	64	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	F3YD64-1□	32	64	64	✓	64	✓	64	✓	✓	64	✓	64	✓	64	✓	✓	✓
I/O module	F3WD64-□□	32	64	64	✓	64	✓	64	✓	✓	64	✓	64	✓	64	✓	✓	✓
Analog input module	F3AD04-0□	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
	F3AD08-□□	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
Analog output module	F3DA02-0N	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
	F3DA04-1N	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
	F3DA08-5N	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
High-speed data acquisition module	F3HA08-0N	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Temperature control and monitoring module	F3CT04-□N	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
	F3CR04-□N	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
PID control module	F3CV04-1N	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Temperature control and PID module	F3CU04-□□	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
Temperature monitoring module	F3CX04-0N	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
ASi Master module	F3LA01-0N	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
PROFIBUS-DP Interface module	F3LB01-0N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Personal computer link module	F3LC11-1F F3LC11-1N F3LC11-2□ F3LC12-1F	2^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}	6^{*1}

Table A1.3 Modules that Each CPU can Access Directly and the Maximum Number that can be Installed (2/2)

Module Name	Model	Sequence CPU																BASIC CPU	
		F3SP21-0N	F3SP22-0S	F3SP25-2N	F3SP35-5N	F3SP28-3□	F3SP38-6□	F3SP53-4□	F3SP58-6□	F3SP59-7S	F3SP66-4S	F3SP67-6S	F3SP71-4N	F3SP76-7N	F3SP71-4S	F3SP76-7S	F3FP36-3N	F3BP20-0N	F3BP30-0N
UT link module	F3LC51-2N	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
DeviceNet interface module	F3LD01-0N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Ethernet interface module	F3LE01-0T	2[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]
	F3LE01-5T	2[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]
	F3LE11-0T	2[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]
	F3LE12-0T	2[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]
YHLS master module	F3LH0□-0N	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
	F3LH01-1N	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
	F3LH02-1N	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
FL-net (OPCN-2) interface module	F3LX02-1N	–	–	–	–	1[*9]	2[*9]	1[*9]	2[*9]	2[*9]	1	2	1	2	1	2	–	–	–
NX interface module	F3NX01-□N	2[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	6[*1]	–	–
GP-IB communication module	F3GB01-0N[*7]	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
RS-232-C communication module	F3RS22-0N	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	36	36
RS-422-A communication module	F3RS41-0N	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	36	36
Ladder communication module	F3RZ81-0N	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	–	–
	F3RZ81-0F	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	–	–
	F3RZ82-0F	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	–	–
	F3RZ91-0□	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	–	–
FA link H module	F3LP02-0N	2[*3]	8[*3]	8[*3][*6]	8[*3][*6]	8[*3][*8]	8[*3][*8]	8[*3][*8]	8[*3][*8]	8[*3][*8]	8[*3][*8]	8[*3][*8]	–[*10]	–[*10]	8[*3][*8]	8[*3][*8]	8[*3][*4][*6]	–	–
Fiber-optic FA link H module	F3LP12-0N																	–	–
Fiber-optic FA-bus module	F3LR01-0N	7[*5]	7[*5]	7[*5][*6]	7[*5][*6]	7[*5][*6]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5][*6]	7[*5]	7[*5]
Fiber-optic FA-bus type 2 module	F3LR02-0N																		
FA-bus type 2 module	F3LR02-1W	7[*5]	7[*5]	7[*5][*6]	7[*5][*6]	7[*5][*6]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5]	7[*5][*6]	7[*5]	7[*5]
High-speed counter module	F3XP01-0H	32	64	64	✓	64	✓	64	✓	✓	64	✓	64	✓	64	✓	64	✓	✓
	F3XP02-0H	32	64	64	✓	64	✓	64	✓	✓	64	✓	64	✓	64	✓	64	✓	✓
Pulse input module	F3XS04-□N	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
Positioning module (with multi-channel pulse output)	F3YP04-0N	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
	F3YP08-0N	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
	F3YP14-0N	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
	F3YP18-0N	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
	F3YP22-0P	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	F3YP24-0P	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	F3YP28-0P	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
(advanced model with pulse output)	F3NC11-0N	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
	F3NC12-0N	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
(with pulse output)	F3NC32-0N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	F3NC34-0N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
(with analog voltage output)	F3NC51-0N	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
	F3NC52-0N	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
(for torque control)	F3NC61-0N	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
(MECHATROLIN K-II)	F3NC96-0N	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
(MECHATROLINK-III)	F3NC97-0N	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8

Modules with shaded module names and models must be installed in main units.

*1: Each number denotes the largest combined number of personal computer link modules, Ethernet interface modules, GP-IB communication modules (when in slave mode), FL-net interface modules and memory card modules that can be installed. If two or more CPU modules having different maximum limits are installed, the smallest limit applies.

*2: The pulse-capture feature is disabled.

*3: Each number denotes the largest combined number of FA link H modules and fiber-optic FA link H modules that can be installed. If two or more CPU modules having different maximum limits are installed, the smallest limit applies.

*4: Configure the module using WideField, WideField2, WideField3 or Ladder Diagram Support Program M3.

*5: Each number denotes the largest combined number of fiber-optic FA-bus, fiber-optic FA-bus type 2 and FA-bus type 2 modules that can be installed in a main unit. If two or more CPU modules having different maximum limits are installed, the smallest limit applies. If subunits are grouped using fiber-optic FA-bus type 2 modules, the maximum limit may be increased depending on the grouping pattern. For more information, see the Fiber-optic FA-bus Module and Fiber-optic FA-bus Type 2 Module, FA-bus Type 2 Module (IM 34M06H45-01E).

*6: FA link H, fiber-optic FA link H, fiber-optic FA-bus type 2 and FA-bus type 2 modules must be used with sequence CPU modules version 8 or later. For information on the version of a sequence CPU module, refer to the mark on its side. There is no usage limitation, however, for F3SP□□-□S.

*7: The maximum number of each module that can be installed depends on the operating mode. The left number and right number in each cell apply when the module is in master mode and slave mode respectively.

*8: Up to 7 modules can be installed if used with FL-net (OPCN-2) interface module, provided link device capacities are not exceeded.

*9: FL-net (OPCN-2) interface module can be used with sequence CPU modules rev. 5 or higher. There is no restriction when used with F3SP□□-□S modules.

*10: FA link, FA link H and fiber-optic FA link H modules cannot coexist with F3SP7□-□N.

A1.2.4 Restrictions due to Current Consumption

Design your system making sure that the total sum of current consumed by modules in each unit does not exceed the capacity of the power supply module.

For more information, see Section A2.9, "Module Current Consumption Tables"

A1.3 Peripheral Tools Supporting the Program Development of the FA-M3

You can conveniently create and debug your programs on your personal computer.

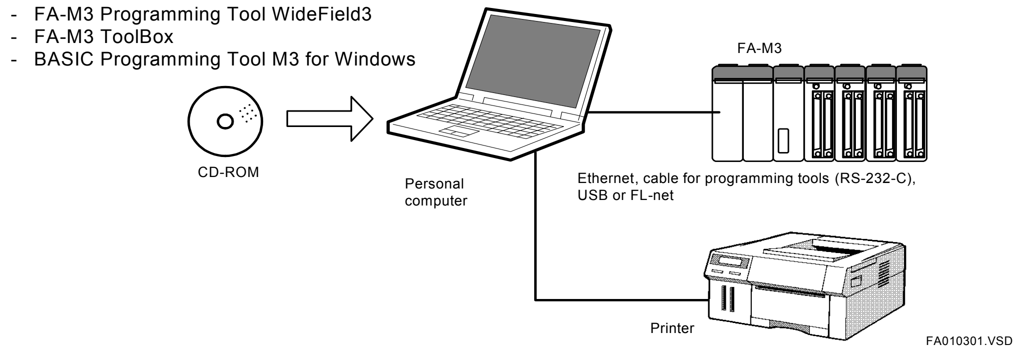

- FA-M3 Programming Tool WideField3
- FA-M3 ToolBox
- BASIC Programming Tool M3 for Windows
CD-ROM
Personal computer
FA-M3
Ethernet, cable for programming tools (RS-232-C), USB or FL-net
Printer
FA010301.VSD

Figure A1.5 Support Tools for the FA-M3

A2. Specifications and Configuration

A2.1 Specifications

■ Common Specifications

Item				Specifications
Environment	Surrounding air temperature range			Operating : 0 to 55°C *1
				Storage : -20°C to 75°C
	Surrounding humidity range			Operating : 10 to 90% RH (non-condensing)
				Storage : 10 to 90% RH (non-condensing)
	Surrounding atmosphere			Must be free of corrosive gases, flammable gases or heavy dust.
	Grounding			AC Power supply module : Protective earth (Comply with the regulation of each country.) DC Power supply module : Functional earth
	Noise immunity			Tested using a noise simulator with a noise voltage of 1500 Vp-p, pulse width of 1 μs, rise time of 1 ns, and repetition frequency of 25 to 60 Hz. For CE Marking-compliant modules, compliant to EN61326-1, EN61326-2-3*6 and EN61000-6-2
	Vibration resistance			Tested in compliance with JIS C0040 under the following conditions: - Frequency ranges: 10 to 57 Hz with an amplitude of 0.075 mm 57 to 150 Hz with an acceleration of 9.8 m/s² (1 G) - Direction and sweep cycles: 10 times each in the X, Y, and Z directions
	Shock resistance			Tested in compliance with JIS C0041 under the following conditions: - Direction and sweep cycles: 3 times each in the X, Y, and Z directions with an acceleration of 147 m/s² (98 m/s² with DIN-rail mounting)
Structure & Appearance	Structure			Designed for mounting inside a panel enclosure
	Altitude of installation			Max. of 2000 m above sea level
	Compliance with safety and EMC standards *2	UL		UL508 approved, File No.E188707 (Overvoltage Category*3 II, Pollution Degree*4 2)
		CE	EMC Directive*7	EN 61326-1 Class A, Table 2 (For use in industrial locations) EN 61326-2-3*6, EN 55011 Class A, Group 1 EN 61000-6-2, EN 61000-3-2, EN 61000-3-3 compliance
			Low Voltage Directive	EN 61010-1 compliance (Overvoltage Category*3 II, Pollution Degree*4 2) EN 61010-2-030 compliance (Measurement Category O*8)
		C-Tick	EMC Framework	EN 55011 Class A, Group 1 compliance EN 61326-1 Class A, Table 2 (For use in industrial locations) compliance
		KC	EMC Regulations	Korea Electromagnetic Conformity Standard (한국 전자파적합성기준) compliance
	Cooling method			Natural-air cooled
	Mounting			Direct mounting with M4-size setscrews *5 or DIN-rail mounting (except for F3BU16-0N module)
	Finish color			Light cobalt blue, equivalent to Munsell 6.2PB 4.6/8.8; Lampblack, equivalent to Munsell 0.8Y 2.5/0.4
	External dimensions			See the dimensional figures in Section A2.10, "External Dimensions."

*1: Some FA-M3 modules may have a narrower surrounding temperature range than 0-55°C. A system incorporating such modules must be used within the narrower surrounding temperature range for such modules.

*2: For details on conforming modules, see "UL-approved, CE marking, C-Tick mark and KC mark - compliant Modules" (GS 34M06C11-21E) general specification brochure.

*3: The term Overvoltage Category involves prescriptions on resistance to surge voltage reduction due to lightning and has four categories. Overvoltage Category II applies to systems with a rated voltage of 220/230/240 V and applies to electrical appliances, portable devices, etc.

*4: The term Pollution Degree represents the degree of pollution with foreign matter, solid, liquid or gaseous, that may produce a reduction of dielectric strength or surface resistivity in the operating environment of the equipment. Pollution degree 2 refers to an environment where normally only non-conductive pollution occurs but occasionally temporary conductivity caused by condensation is to be expected.

*5: For details on the number of mounting screws, see subsection A3.2.2.

*6: EN61326-2-3 is applicable only to F3CU04-0S and F3CU04-1S.

*7: This product is classified as Class A for use in industrial environments.If used in a residential environment, it may cause electromagnetic interference (EMI). In such situations, it is the user's responsibility to adopt the necessary measures against EMI.

*8: EN 61010-2-030 is applicable only to modules with analog input terminal.

Don't use analog input terminals of the FA-M3 for measurement on Mains Circuit, since it has no measurement category.

■ Power Supply Specifications

Item	**Specifications**					
	F3PU10-0N **F3PU10-0S**	**F3PU20-0N** **F3PU20-0S**	**F3PU30-0N** **F3PU30-0S**	**F3PU16-0N**	**F3PU26-0N**	**F3PU36-0N** **F3PU36-0S**
Supply voltage range	100 to 240 V AC, single phase 50/60 Hz			24 V DC		
Range of supply voltage change	85 to 264 V AC 50/60Hz±3Hz			15.6 to 31.2 V DC		
Power consumption	35 VA	85 VA	100 VA	15.4 W	33.1 W	46.2 W
Insulation resistance	5 MΩ min. when tested between a group of external AC terminals and the FG terminal using a 500 VDC insulation resistance tester			5 MΩ min. when tested across a group of external DC terminals and the FG terminal using a 500 VDC insulation resistance tester		
Withstanding voltage	1500 V AC for one minute between a group of external AC terminals and the FG terminal			1500 V AC for one minute between a group of external DC terminals and the FG terminal		
FAIL-signal contact output	Located on the front terminal block of power supply module; contact ratings: 24 V DC, 0.3 A (Equipped with both normally-open and normally-closed terminals)					
Allowable common mode voltage of FAIL-signal contact	120 V AC or DC max. (between the COM terminal of FAIL OUTPUT and the FG terminal)					
Leakage current	3.5 mA max.			———		
Allowable momentary power failure time	20 ms					

* For detailed power supply module specifications, see A2.3, "Power Supply Modules."

A2.2 FA-M3 Controller Configuration

A2.2.1 Components

■ Module Names

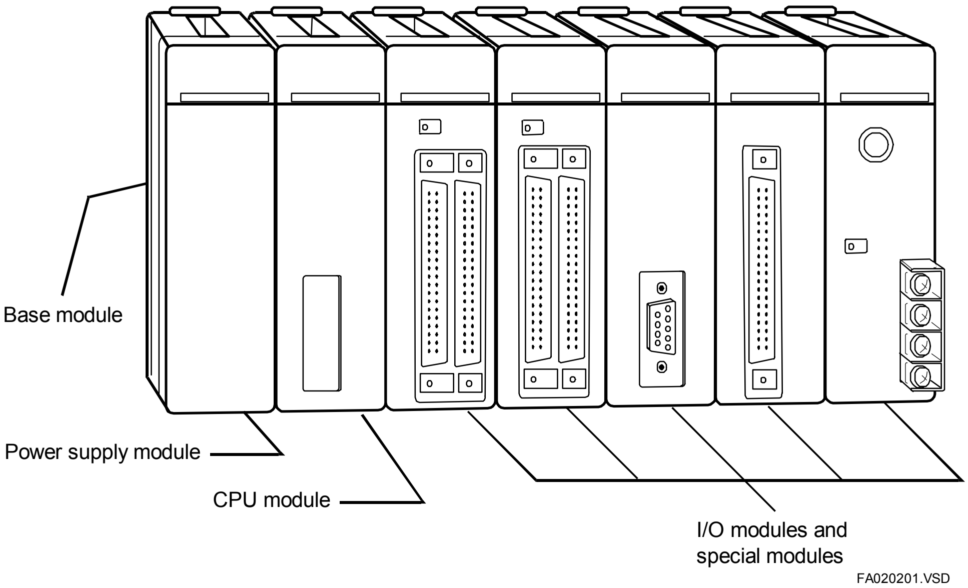


Figure A2.1 FA-M3 Controller

■ FA-M3 Components

Modules indicated by the triangle symbol (▲) in the tables below are no longer available.

● Base Modules

Module Description	Model	Specifications
Base module	F3BU04-0N	Slot for F3PU10/16 power supply module plus 4 slots (for CPU and I/O modules)
	F3BU06-0N	Slot for F3PU10/16 power supply module plus 6 slots (for CPU and I/O modules)
	F3BU05-0D	Slot for F3PU20/26/30/36 power supply module plus 5 slots (for CPU and I/O modules)
	F3BU09-0N	Slot for F3PU20/26/30/36 power supply module plus 9 slots (for CPU and I/O modules)
	F3BU13-0N	Slot for F3PU20/26/30/36 power supply module plus 13 slots (for CPU and I/O modules)
	F3BU16-0N	Slot for F3PU20/26/30/36 power supply module plus 16 slots (for CPU and I/O modules)

*: For detailed base module specifications, see A2.4, "Base Modules."

● Power Supply Modules

Module Description		Model	Specifications
Power supply module	▲	F3PU10-0N	100 to 240 V AC, for F3BU04 and F3BU06
		F3PU10-0S	
		F3PU16-0N	24 V DC, for F3BU04 and F3BU06
	▲	F3PU20-0N	100-240 V AC, for F3BU05, F3BU09, F3BU13 and F3BU16
		F3PU20-0S	
		F3PU26-0N	24 V DC, for F3BU05, F3BU09, F3BU13 and F3BU16
	▲	F3PU30-0N	100-240 V AC, for F3BU05, F3BU09, F3BU13 and F3BU16
		F3PU30-0S	
	▲	F3PU36-0N	24 V DC, for F3BU05, F3BU09, F3BU13 and F3BU16
		F3PU36-0S	

*: For detailed power supply module specifications, see A2.3, "Power Supply Modules."

● CPU Modules

Module Description		Model	Specifications
Sequence CPU module (with memory)	▲	F3SP21-0N	10K ladder steps, 0.18 to 0.36 µs execution time for basic instructions
	▲	F3SP25-2N	20K ladder steps, 0.12 to 0.24 µs execution time for basic instructions
	▲	F3SP35-5N	100K ladder steps, 0.09 to 0.18 µs execution time for basic instructions
	▲	F3SP28-3N	30K ladder steps, 0.045 to 0.18 µs execution time for basic instructions
	▲	F3SP38-6N	120K ladder steps, 0.045 to 0.18 µs execution time for basic instructions
	▲	F3SP53-4H	56K ladder steps, 0.0175 to 0.07 µs execution time for basic instructions
	▲	F3SP58-6H	120K ladder steps, 0.0175 to 0.07µs execution time for basic instructions
		F3SP22-0S	10K ladder steps, 0.045 to 0.18 µs execution time for basic instructions
		F3SP28-3S	30K ladder steps, 0.045 to 0.18 µs execution time for basic instructions
		F3SP38-6S	120K ladder steps, 0.045 to 0.18 µs execution time for basic instructions
		F3SP53-4S	56K ladder steps, 0.0175 to 0.07 µs execution time for basic instructions
		F3SP58-6S	120K ladder steps, 0.0175 to 0.07µs execution time for basic instructions
		F3SP59-7S	254K ladder steps, 0.0175 to 0.07µs execution time for basic instructions
Sequence CPU module (with network functions)		F3SP66-4S	56K ladder steps, 0.0175 to 0.07µs execution time for basic instructions
		F3SP67-6S	120K ladder steps, 0.0175 to 0.07µs execution time for basic instructions
	▲	F3SP71-4N	60K ladder steps, 0.00375 µs or more execution time for basic instructions
	▲	F3SP76-7N	260K ladder steps, 0.00375 µs or more execution time for basic instructions
		F3SP71-4S	60K ladder steps, 0.00375 µs or more execution time for basic instructions
		F3SP76-7S	260K ladder steps, 0.00375 µs or more execution time for basic instructions
Sequence CPU module (with memory)	▲	F3FP36-3N	For SFC/ladder language; 40K ladder steps Contact coil 0.09µs per instruction
BASIC CPU module		F3BP20-0N	120 KB for BASIC
		F3BP30-0N	510 KB for BASIC

● ROM Packs

Module Description		Model	Specifications
ROM pack		RK10-0N	5K ladder steps (F3SP21)
		RK30-0N	20K ladder steps; 120KB for BASIC (F3SP21/25/35, F3BP20)
	▲	RK50-0N	100K ladder steps; 510KB for BASIC (F3SP21/25/35, F3BP30)
		RK33-0N	56K ladder steps (F3SP21/22/25/28/35/38/53/58)
		RK53-0N	100K ladder steps; 510KB for BASIC (F3SP21/25/35, F3BP30)
		RK73-0N	120K ladder steps (F3SP22/28/38/53/58/59)
		RK93-0N	254K ladder steps (F3SP38/58/59)

*: CPU modules F3SP66, 67, 71 and 76 do not support the ROM pack.

*: For detailed ROM pack specifications, see A2.6, "ROM Packs."

● Memory Card Module

Module Description	Model	Specifications
Memory card module	F3EM01-0N	Media : Compact Flash, FAT16 compatible

● I/O Modules

For detailed I/O module specifications, see A2.5, "I/O Modules."

Module Description		Model	Specifications
High-speed input module		F3XH04-3N	24 V DC high-speed input points with pulse-capture feature, 4 points
AC input module		F3XA08-1N	100 to 120 V AC, 8 points
		F3XA08-2N	200 to 240 V AC, 8 points
		F3XA16-1N	100 to 120 V AC, 16 points
DC input module		F3XD08-6F	DC Input sink/source, 12 to 24 V DC, 8 points *1
		F3XD16-3F	DC Input sink/source, 24 V DC, 16 points *1
		F3XD16-4F	DC Input sink/source, 12 V DC, 16 points *1
		F3XD16-3H	DC Input sink (positive common), 24 V DC, 16 points (High speed input)
		F3XD32-3F	DC Input sink/source, 24 V DC, 32 points *1
		F3XD32-4F	DC Input sink/source, 12 V DC, 32 points *1
		F3XD32-5F	DC Input sink/source, 5 V DC, 32 points *1
		F3XD64-3F	DC Input sink/source, 24 V DC, 64 points *1
		F3XD64-4F	DC Input sink/source, 12 V DC, 64 points *1
	▲	F3XD08-6N	DC input sink/ source, 12 to 24 V DC, 8 points
	▲	F3XD16-3N	DC Input sink/source, 24 V DC, 16 points
	▲	F3XD16-4N	DC Input sink/source, 12 V DC, 16 points
	▲	F3XD32-3N	DC Input sink/source, 24 V DC, 32 points
	▲	F3XD32-4N	DC Input sink/source, 12 V DC, 32 points
	▲	F3XD32-5N	DC Input sink/source, 5 V DC, 32 points
	▲	F3XD64-3N	DC Input sink/source, 24 V DC, 64 points
	▲	F3XD64-4N	DC Input sink/source, 12 V DC, 64 points
		F3XD64-6M	DC Input matrix scan, 12 to 24 V DC, 64 points
No-voltage contact input module		F3XC08-0N	No-voltage contact input, 8 points
		F3XC08-0C	No-voltage contact input, 8 points, independent commons
Triac output module		F3YA08-2N	Triac output (100 to 240 V AC), 1 A, 8 points
Relay output module		F3YC08-0C	Relay output (24 V DC, 100 to 240 V AC), 2 A, 8 points, all independent
		F3YC08-0N	Relay output (24 V DC, 100 to 240 V AC), 2 A, 8 points
		F3YC16-0N	Relay output (24 V DC, 100 to 240 V AC), 2 A, 16 points
Transistor output module		F3YD04-7N	TR output, 24 V DC, 2 A, all independent, 4 points
		F3YD08-6A	TR output sink type, 12 to 24 V DC, 1 A, 8 points
		F3YD08-6B	TR output source type, 12 to 24 V DC, 1 A, 8 points
		F3YD08-7A	TR output sink type, 12 to 24 V DC, 2 A, 8 points
		F3YD14-5A	TR output sink type, 12 to 24 V DC, 0.5 A, 14 points
		F3YD14-5B	TR output source type, 12 to 24 V DC, 0.5 A, 14 points
	▲	F3YD32-1A	TR output sink type, 12 to 24 V DC, 0.1 A, 32 points
	▲	F3YD32-1B	TR output source type, 12 to 24 V DC, 0.1 A, 32 points
		F3YD32-1H	TR output sink type, 12 to 24 V DC, 0.1 A, 32 points (High speed output)
		F3YD32-1P	TR output sink type (with short-circuit protector), 12 to 24 V DC, 0.1 A, 32 points
		F3YD32-1R	TR output source type (with short-circuit protector), 12 to 24 V DC, 0.1 A, 32 points
		F3YD32-1T	TTL output, 5 V DC, 16 mA, 32 points
	▲	F3YD64-1A	TR output sink type, 24 V DC, 0.1 A, 64 points
	▲	F3YD64-1F	TR output sink type, 24 V DC, 0.1 A, 64 points *2
		F3YD64-1M	TR output matrix scan, 12 to 24 V DC, 0.1 A, 64 points
		F3YD64-1P	TR output sink type (with short-circuit protector), 12 to 24 V DC, 0.1 A, 64 points *2
		F3YD64-1R	TR output source type (with short-circuit protector), 12 to 24 V DC, 0.1 A, 64 points *2
I/O module	▲	F3WD64-3F	DC input sink/source, 24 V DC, 32 points *1 TR output sink type, 24 V DC, 0.1 A, 32 points *2
	▲	F3WD64-4F	DC input sink/source, 12 V DC, 32 points *1 TR output sink type, 12 V DC, 0.1 A, 32 points *2
	▲	F3WD64-3N	DC input sink/source, 24 V DC, 32 points TR output sink type, 24 V DC, 0.1 A, 32 points
	▲	F3WD64-4N	DC input sink/source, 12 V DC, 32 points TR output sink type, 12 V DC, 0.1 A, 32 points
		F3WD64-3P	DC input sink/source, 24 V DC, 32 points TR output sink type (with short-circuit protector), 24 V DC, 0.1 A, 32 points
		F3WD64-4P	DC input sink/source, 12 V DC, 32 points TR output sink type (with short-circuit protector), 12 V DC, 0.1 A, 32 points

*1: Input sampling time of 100 µs or more can be configured when using F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 CPU modules.

*2: You can configure the module to either HOLD or RESET external outputs in the event of a major failure when using F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 CPU modules.

● Analog I/O and Temperature Control Modules

Module Description		Model	Specifications
Analog input module		F3AD04-0N	0 to 5 V DC /1 to 5 V DC /-10 to 10 V DC, 4 points, 12-bit ADC
		F3AD04-0R	0 to 5 V DC /1 to 5 V DC /-10 to 10 V DC, 4 points, 16-bit ADC
		F3AD04-0V	0 to 5 V DC /1 to 5 V DC /-10 to 10 V DC, 4 points, 12-bit ADC
		F3AD08-1N	0 to 5 V DC /1 to 5 V DC /-10 to 10 V DC, 8 points
		F3AD08-1R	0 to 5 V DC /1 to 5 V DC / -10 to 10 V DC, 8 points (differential inputs), 16-bit ADC
		F3AD08-4R	0 to 20 mA DC / 4 to 20 mA DC, 8 points (differential inputs), 16-bit ADC
		F3AD08-5R	0 to 5 V DC /1 to 5 V DC, -10 to 10 V DC, 0 to 10 V DC 8 points (differential inputs), 16-bit ADC
		F3AD08-6R	0 to 5 V DC /1 to 5 V DC /-10 to 10 V DC /0 to 10 V DC /0 to 20 mA DC, 4 to 20 mA DC, 8 points (differential inputs), 16-bit ADC
		F3AD08-1V	0 to 5 V DC /1 to 5 V DC /-10 to 10 V DC, 8 points (differential inputs), 12-bit ADC
		F3AD08-4V	0 to 20 mA DC /4 to 20 mA DC, 8 points (differential inputs), 12-bit ADC
Analog output module		F3DA02-0N	- 10 to 10 V DC /4 to 20 mA DC, 2 points, 12bitDAC
		F3DA04-1N	- 10 to 10 V DC /4 to 20 mA DC, 4 points, 12bitDAC
		F3DA08-5N	- 10 to 10 V DC output, 8 points, 12bitDAC
		F3DA04-6R	- 10 to 10 VDC/0 to 10 VDC/0 to 5 VDC/1 to 5 VDC/ 4 to 20 mADC/0 to 20 mADC/ - 20 to 20 mADC, output 4 points, 16-bit DAC, 2µs/ch
		F3DA08-5R	- 10 to 10 V DC /0 to 10 V DC /0 to 5 V DC /1 to 5 V DC / output 8 points, 16-bit DAC, 2µs/ch
High-speed data acquisition module		F3HA08-0N	0 to 5 V DC / -10 to 10 V DC, 8 points (Concurrent sampling for 4 points)
Temperature control/monitoring module	▲	F3CT04-0N	Thermocouple or mV input, 0.5 s scan, 4 loops
	▲	F3CT04-1N	Thermocouple or mV input, 0.5 s scan, 4 to 20 mA DC output, 4 loops
	▲	F3CR04-0N	RTD input, 0.5 s scan, 4 loops
	▲	F3CR04-1N	RTD input, 0.5 s scan, 4 to 20 mA DC output, 4 loops
PID control module	▲	F3CV04-1N	DC-voltage input, 0.5 s scan, 4 loops
Temperature control and PID module	▲	F3CU04-0N	4 loops, universal input, time-proportional PID output (open collector), single-slot size
		F3CU04-0S	4 loops, universal input, time-proportional PID output (open collector), single-slot size
	▲	F3CU04-1N	4 loops, universal input, universal output (open collector, 4-20 mA continuous output), double-slot size
		F3CU04-1S	4 loops, universal input, universal output (open collector, 4-20 mA continuous output), double-slot size
Temperature monitoring module		F3CX04-0N	4 channels, universal input, single-slot size

● Communication Modules

Module Description		Model	Specifications
ASi Master module		F3LA01-0N	1 AS-interface V2.1 port
PROFIBUS-DP Interface module		F3LB01-0N	1 PROFIBUS-DP port; 12Mbps max.
Personal computer link module		F3LC11-1F	1 RS-232-C port; 115.2 kbps max.
	▲	F3LC11-1N	1 RS-232-C port; 19200 bps max.
		F3LC11-2F	1 RS-422-A/RS-485 port; 115.2 kbps max.
	▲	F3LC11-2N	1 RS-422-A/RS-485 port; 19200 bps max.
		F3LC12-1F	2 RS-232-C ports; 115.2 kbps max.
UT link module		F3LC51-2N	1 RS-422-A/RS-485 port of 38400bps max. for easy connection with a temperature controller
DeviceNet interface module		F3LD01-0N	1 DeviceNet port of 500 kpps max., with master/scanner functions
Ethernet interface module		F3LE01-0T	10Mbps, 10BASE-T
	▲	F3LE01-5T	10Mbps, 10BASE5/10BASE-T
		F3LE11-0T	10/100Mbps, 10BASE-T/100BASE-TX
		F3LE12-0T	10/100Mbps, 10BASE-T/100BASE-TX, message communications
YHLS master module		F3LH01-1N	12 Mbps max., YHLS port x 1
		F3LH02-1N	12 Mbps max., YHLS port x 2
	▲	F3LH02-0N	12Mbps max., 126 slaves max., 300 m range max., 2 ports
	▲	F3LH04-0N	12Mbps max., 252 slaves max., 300 m range max., 4 ports
FL-net (OPCN-2) interface module		F3LX02-1N	10Mbps, 10BASE5/10BASE-T, FL-net (OPCN-2) Ver2.00
NX interface module	▲	F3NX01-0N	10Mbps, 10BASE5/10BASE-T, equipped with autonomous decentralized protocol
		F3NX01-1N	10Mbps/100Mbps, 10BASE-T/100BASE-TX, equipped with autonomous decentralized protocol
RS-232-C communication module		F3RS22-0N	2 RS-232-C ports; 19200 bps max.
RS-422 communication module		F3RS41-0N	1 RS-422-A/RS-485 port; 19200 bps max.
Ladder communication module		F3RZ81-0F	1 RS-232-C port, 115 kbps max.
	▲	F3RZ81-0N	1 RS-232-C port; 19200 bps max.
		F3RZ82-0F	2 RS-232-C ports, 115 kbps max.
		F3RZ91-0F	1 RS-422-A/RS-485 port; 115 kbps max.
	▲	F3RZ91-0N	1 RS-422/RS-485 port, 19200 bps max.
GP-IB communication module		F3GB01-0N	1 GP-IB communication port

● FA Link and FA-bus Modules

Module Description	Model	Specifications
FA link H module	F3LP02-0N	32 stations max., total transmission distance 1 km, 1.25Mbps max.
Fiber-optic FA link H module	F3LP12-0N	32 stations max., total transmission distance 10 km, 1.25Mbps
Fiber-optic FA-bus module	F3LR01-0N	7 stations max., total transmission distance 200 m, 10Mbps
Fiber-optic FA-bus Type 2 module	F3LR02-0N	56[*1] stations max., total transmission distance 1.4 km[*2], 10Mbps
FA-bus Type 2 module	F3LR02-1W	7 stations max., total transmission distance 70m, max., distance between stations 10m, using twisted-pair cables

*1: Up to 32 stations per system.
*2: When 3 stations are interconnected.

● Counter and Positioning Modules

Module Description	Model	Specifications
High-speed counter module	F3XP01-0H	100 kpps, 1 channel, 32 bits
	F3XP02-0H	100 kpps, 2 channels, 32 bits
Pulse input module	F3XS04-3N	20 kHz, 4 channels, 24 V input, 16 bits
	F3XS04-4N	20 kHz, 4 channels, 12 V input, 16 bits
Positioning module (advanced model with pulse output)	F3NC11-0N	1-axis position and speed control with max. speed of 249.75 kpps
	F3NC12-0N	2-axis position and speed control with max. speed of 249.75 kpps
Positioning module (with pulse output)	F3NC32-0N	2-axis position and speed control with max. speed of 5 Mpps when servo motor is used and max. speed of 1 Mpps when stepper motor is used. 2 counters for input from encoder (including absolute encoder)
	F3NC34-0N	4-axis position and speed control with max. speed of 5 Mpps when servo motor is used and max. speed of 1 Mpps when stepper motor is used. 4 counters for input from encoder (including absolute encoder)
Positioning module (with analog voltage output)	F3NC51-0N	1-axis position and speed control with max. speed of 2 Mpps
	F3NC52-0N	2-axis position and speed control with max. speed of 2 Mpps
Positioning module (for torque control)	F3NC61-0N	1-axis position-loop control, -10 to +10 V speed reference voltage output, with max. speed of 2 Mpps, analog input/output
Positioning module (with MECHATROLINK-II interface)	F3NC96-0N	15-axis control with MECHATROLINK-II interface
Positioning module (with MECHATROLINK-III interface)	F3NC97-0N	15-axis control with MECHATROLINK-III interface
Positioning module (with multi-channel pulse output)	▲ F3YP04-0N	4-axis position control with max. speed of 250 kpps
	▲ F3YP08-0N	8-axis position control with max. speed of 250 kpps
	F3YP14-0N	4-axis position control with max. speed of 3.998 Mpps when servo motor is used and max. speed of 499.750 kpps when stepper motor is used.
	F3YP18-0N	8- axis position control with max. speed of 3.998 Mpps when servo motor is used and max. speed of 499.750 kpps when stepper motor is used.
	F3YP22-0P	2-axis position control with max. speed of 7.996 Mpps when servo motor is used and max. speed of 1.999 Mpps when stepper motor is used. 1ch pulse counter, max. 8 Mpps pulse input
	F3YP24-0P	4-axis position control with max. speed of 7.996 Mpps when servo motor is used and max. speed of 1.999 Mpps when stepper motor is used. 1ch pulse counter, max. 8 Mpps pulse inpu
	F3YP28-0P	8-axis position control with max. speed of 7.996 Mpps when servo motor is used and max. speed of 1.999 Mpps when stepper motor is used. 1ch pulse counter, max. 8 Mpps pulse input

● Cables

For detailed cable specifications, see A2.7, "Cables."

Cable Description		Model	Style Code	Specifications
Cable for programming tools		KM11-2T	*A	D-sub, 9-pin, male, 3 m long*1
	▲	KM11-3T	*A	D-sub, 9-pin, male, 5 m long*1
	▲	KM11-4T	*A	D-sub, 9-pin, male, 10 m long*1
		KM13-1S	—	USB 1.1 compliant USB-serial converter, approx. 3 m long
Monitor cable (for F3SP08-2□, -3□, and -5□)		KM21-2A	—	D-sub,25-pin, male on device side, 3 m long, connected to programming port
		KM21-2B	—	D-sub, 9-pin, female on device side, 3 m long, connected to programming port
Monitor cable (for F3SP66 and F3SP67)		KM21-2T	—	D-sub, 9-pin, female on PC side, 3 m long
		KM21-2N	—	D-sub, 25-pin, male on PC side, 3 m long
SIO port/D-sub 9-pin adapter cable		KM10-0S	—	SIO port/D-sub 9-pin adaptor cable, 0.5 m long
CPU port/D-sub 9-pin adapter cable		KM10-0C	—	D-sub, 9-pin, female, approx. 0.5 m long
Fiber-optic cord*2 *3 for wiring inside panel enclosure (compatible with F3LR01, F3LR02 and F3LP12)		KM60-S06	—	Cord for system expansion inside panel enclosure; 0.6 m long
		KM60-001	—	Cord for system expansion inside panel enclosure; 1 m long
		KM60-003	—	Cord for system expansion inside panel enclosure; 3 m long
Fiber-optic cable*2 *3 for indoor wiring, supplied with tension member (compatible with F3LR01, F3LR02 and F3LP12)		KM61-010	—	Cable for indoor system expansion; 10 m long
		KM61-100	—	Cable for indoor system expansion; 100 m long (with one pulling eye)
		KM61-150	—	Cable for indoor system expansion; 150 m long (with one pulling eye)
		KM61-200	—	Cable for indoor system expansion; 200 m long (with one pulling eye)
Fiber-optic cable*2 *3 for indoor wiring (compatible with F3LR01, F3LR02 and F3LP12)		KM65-001	—	Cable for indoor system expansion; 1 m long
		KM65-002	—	Cable for indoor system expansion; 2 m long
		KM65-003	—	Cable for indoor system expansion; 3 m long
		KM65-004	—	Cable for indoor system expansion; 4 m long
		KM65-005	—	Cable for indoor system expansion; 5 m long
		KM65-007	—	Cable for indoor system expansion; 7 m long
		KM65-010	—	Cable for indoor system expansion; 10 m long
		KM65-012	—	Cable for indoor system expansion; 12 m long
		KM65-015	—	Cable for indoor system expansion; 15 m long
		KM65-020	—	Cable for indoor system expansion; 20 m long
		KM65-025	—	Cable for indoor system expansion; 25 m long
		KM65-030	—	Cable for indoor system expansion; 30 m long
Fiber-optic cable*2 *3 for outdoor wiring, supplied with tension member (compatible with F3LR01 [up to 200 m], F3LR02 [up to 200 m], and F3LP12 [up to 1000 m])		KM62-100	—	Cable for outdoor system expansion; 100 m long (with one pulling eye)
		KM62-200	—	Cable for outdoor system expansion; 200 m long (with one pulling eye)
		KM62-300	—	Cable for outdoor system expansion; 300 m long (with one pulling eye)
		KM62-400	—	Cable for outdoor system expansion; 400 m long (with one pulling eye)
		KM62-500	—	Cable for outdoor system expansion; 500 m long (with one pulling eye)
		KM62-600	—	Cable for outdoor system expansion; 600 m long (with one pulling eye)
		KM62-700	—	Cable for outdoor system expansion; 700 m long (with one pulling eye)
		KM62-800	—	Cable for outdoor system expansion; 800 m long (with one pulling eye)
		KM62-900	—	Cable for outdoor system expansion; 900 m long (with one pulling eye)
		KM62-L01	—	Cable for outdoor system expansion; 1000 m long (with one pulling eye)
Fiber-optic cable*2 for outdoor wiring, supplied with tension member (compatible with F3LR02 (200 to 500 m))	▲	KM67-300	—	Cable for outdoor system expansion; 300 m long (with one pulling eye)
		KM67-400	—	Cable for outdoor system expansion; 400 m long (with one pulling eye)
		KM67-500	—	Cable for outdoor system expansion; 500 m long (with one pulling eye)
Fiber-optic cable*2 for outdoor wiring, supplied with tension member (compatible with F3LR01,F3LR02)		KM69-010	—	Cable for outdoor system expansion;10 m long, flame-retardant cable(equivalent of VW-1)

*1: Supports DOS/V.
*2: For details, see “Fiber-optic FA-bus Module and Fiber-optic FA-bus Type 2 Module” (IM 34M06H45-01E).
*3: For details, see “FA Link H Module, Fiber-optic FA Link H Module” (IM 34M06H43-01E).

For detailed cable specifications, see A2.7, "Cables."

Cable Description	Model	Style Code	Specifications
Cable for connector terminal blocks[*4]	KM55-005	—	For connection between module and connector terminal block; 0.5 m long
	KM55-010	—	For connection between module and connector terminal block; 1 m long
	KM55-015	—	For connection between module and connector terminal block; 1.5 m long
	KM55-020	—	For connection between module and connector terminal block; 2 m long
	KM55-025	—	For connection between module and connector terminal block; 2.5 m long
	KM55-030	—	For connection between module and connector terminal block; 3 m long

*4: Cannot be used with F3YP04, F3YP08, F3YP14, F3YP18, F3YP22, F3YP24, F3YP28, F3NC32 and F3NC34 as they use 48-pin connectors..

● YHLS Cables

Name	Model	Specifications
YHLS fixed cables	KM80-010	Fixed cable, 10 m long
	KM80-050	Fixed cable, 50 m long
	KM80-100	Fixed cable, 100 m long
	KM80-200	Fixed cable, 200 m long
	KM80-300	Fixed cable, 300 m long
YHLS flexible cables	KM81-010	Flexible cable, 10 m long
	KM81-050	Flexible cable, 50 m long
	KM81-100	Flexible cable, 100 m long
	KM81-200	Flexible cable, 200 m long
	KM81-300	Flexible cable, 300 m long

● YHLS Slave Units

Name		Model	Specifications
TAH series		TAHWD32-3PAM	16 inputs (with positive common) and 16 outputs (sink type)
		TAHWD32-3NBM	16 inputs (with negative common) and 16 outputs (source type)
		TAHXD16-3PEM	16 inputs (with positive common)
		TAHXD16-3NEM	16 inputs (with negative common)
		TAHYD16-3EAM	16 outputs (sink type)
		TAHYD16-3EBM	16 outputs (source type)
TAC series	▲	TACXD08-3AE	8 DC inputs (sink type), 24 V DC, e-CON
	▲	TACXD16-3AM	16 DC inputs (sink type), 24 V DC, MIL
	▲	TACYD08-1AE	8 TR outputs (sink type), 24 V DC, 0.1 mA, e-CON
	▲	TACYD16-1AM	16 TR outputs (sink type), 24 V DC, 0.1 mA, MIL
	▲	TACYC04-0NB	4 relay outputs, 24 V DC/250 V AC 1 A, European
	▲	TACWD08-3NE	4 inputs and 4 outputs, 24 V DC, e-CON
	▲	TACWD16-3NM	8 inputs and 8 outputs, 24 V DC, MIL

● Terminal Block

Name		Model	Specifications
Terminal block unit*1		TA40-0N	40 points; voltage rating: 5 to 24 V DC
Connector terminal block*1		TA50-0N	Connector terminal block 40 points (M3.5 screw)
		TA50-1N	Connector terminal block 40 points (M3 screw)
		TA50-2N	Connector terminal block 40 points (M3 screw)
	▲	TA60-0N	Connector terminal block 40 points (Europe terminal type)

*1: Cannot be used with F3YP04, F3YP08, F3YP14, F3YP18, F3YP22, F3YP24, F3YP28, F3NC32 and F3NC34 as they use 48-pin connectors.

*2: For detailed terminal block specifications, see A2.8, "Terminal Block Unit and Connector Terminal Block."

● Spare Parts

Description	Part Number	Compatible Module
Terminal for 10-point terminal block	A1474JT	F3XH04, F3XA08, F3XD08, F3YD04, F3YA08, F3YC08-0N, F3YD08, F3AD04, F3DA02
Terminal cover for 10-point terminal block	A1472JT	
Terminal for 18-point terminal block	A1496JT	F3XA16, F3XD16, F3YD14, F3YC08-0C, F3YC16, F3CR04, F3CV04, F3AD08, F3DA04, F3DA08, F3XS04, F3HB08
Terminal cover for 18-point terminal block	A1494JT	
Soldered connector (40-pin plug)	A1451JD*1	F3XD32, F3XD64, F3WD64, F3XP01, F3XP02 F3YD32, F3YD64, F3NC01, F3NC02 F3NC11, F3NC12, F3NC51, F3NC52
Cover for connector (40-pin plug)	A1452JD*1	
Soldered connector (48-pin plug)	A1612JD*1	F3YP04, F3YP08, F3YP14, F3YP18, F3YP22, F3YP24, F3YP28, F3NC32, F3NC34
Cover for connector (48-pin plug) - 2 units	A1613JD*1	
Dustproof connector cover - 20 units	T9031AS	F3BU04, F3BU06, F3BU05, F3BU09, F3BU13, F3BU16
Rail-mounting kit	T9031AP*1	F3BU04, F3BU06, F3BU05
	T9031AQ*1	F3BU09, F3BU13

*1: Not supplied with the product.

● Other Components

Description	Model	Specifications
Blank module	F3BL00-0N	For empty I/O slots

A2.3 Power Supply Modules

(1) F3PU10-0N/F3PU10-0S/F3PU20-0N/F3PU20-0S Power Supply Modules

● Specifications

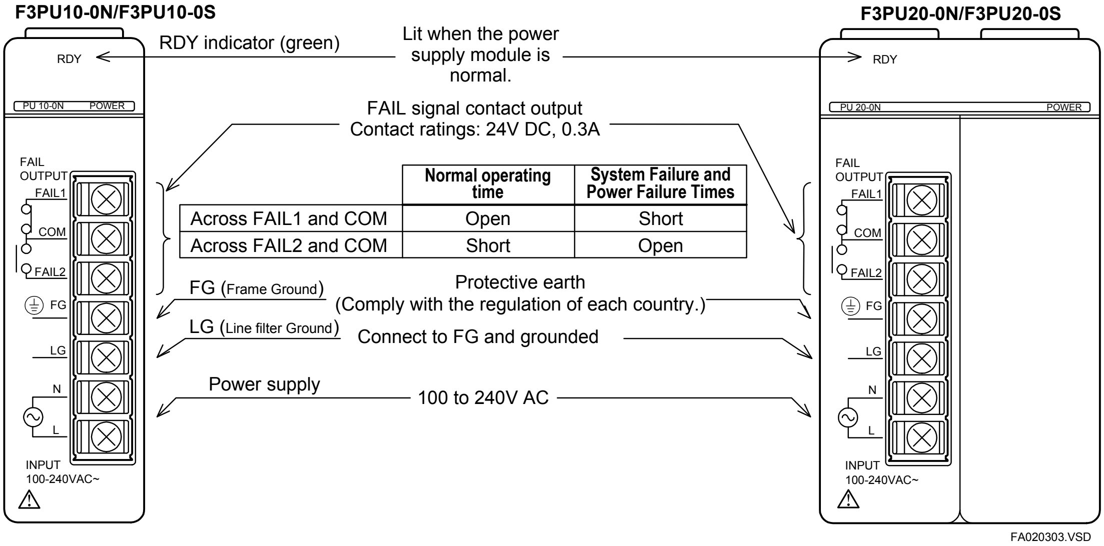
Item	Specifications	
	F3PU10-0N/ F3PU10-0S *1	**F3PU20-0N/ F3PU20-0S *1**
Supply voltage range	100 to 240 V AC, single phase 50/60 Hz	
Range of supply voltage change	85 to 264 V AC 50/60 Hz±3 Hz	
Power consumption	35VA	85VA
Inrush current	20 A max. (120 V AC, Ta=25°C) 45 A max. (240 V AC, Ta=25°C)	
Fuse	1 A time-lag fuse (Built into the L and N terminals and cannot be replaced.)	2 A time-lag fuse (Built into the L and N terminals and cannot be replaced.)
Rated output voltage	5 V DC	
Rated output current	2.0 A	4.3 A
Insulation resistance	5 MΩ min. when tested between a group of external AC terminals and the FG terminal using a 500 VDC insulation resistance tester	
Withstanding voltage	1500 V AC for one minute between a group of external AC terminals and the FG terminal	
Leakage current	3.5 mA max	
Allowable momentary power failure time	20 ms	
External dimensions	28.9 (W) × 100 (H) × 83.2 (D) mm *2	58 (W) × 100 (H) × 83.2 (D) mm *2
Weight	190 g	320 g
Compatible base module	Dedicated to F3BU04 and F3BU06	Dedicated to F3BU05, F3BU09, F3BU13 and F3BU16

*1: F3PU10-0N (respectively F3PU20-0N) and F3PU10-0S (respectively F3PU20-0S) have terminal blocks with different screw sizes but are otherwise exactly the same.

*2: Excluding protrusions (see the dimensional figures for more information)

● Components and Their Functions

The figure below shows the power supply modules with their covers removed.



	Normal operating time	System Failure and Power Failure Times
Across FAIL1 and COM	Open	Short
Across FAIL2 and COM	Short	Open

Figure A2.2 F3PU10-0N/F3PU10-0S and F3PU20-0N/F3PU20-0S Power Supply Modules

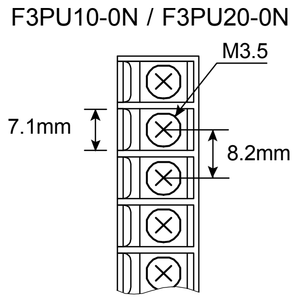
DANGER

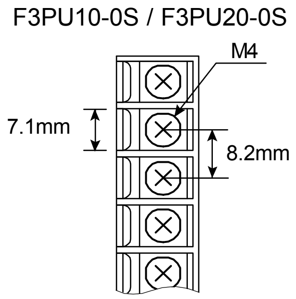
To avoid electrical shock, turn off the power before wiring.

CAUTION

LG terminal has a half potential of the input power supply voltage when LG terminal isn't connected to FG terminal.

● Terminal dimensions





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● Adaptable crimp-on terminal

Vendor	Model	Compatible Conductor	Compatible Modules and Crimping Torque	
			F3PU10-0N F3PU20-0N	**F3PU10-0S F3PU20-0S**
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M3	AWG22 to 18 (0.33 to 0.82 mm^2) (Copper wire)	0.8 N·m (7.1 lbf·in)	May not be used
Nippon Tanshi Co., Ltd.	RAV1.25-3.5			
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M4			1.2 N·m (10.6 lbf·in)
Japan Solderless Terminal Mfg Co., Ltd.	V2-M4	AWG16 to 14 (1.3 to 2.1 mm^2) (Copper wire)		

CAUTION

When crimping terminals, be sure only to use the tool specified by each terminal manufacturer.

Once the power supply module is installed in the base module, both the FG terminal of the power supply module and the signal ground (GND terminal of the module's 5 V output) of the FA-M3 automatically come into contact with the metal chassis of the base module. The FG terminal and the signal ground are isolated from each other inside the power supply module.

For details on the grounding lines of the FA-M3, see subsection A3.3.2, "Grounding Lines."

CAUTION

- F3PU10-0N (respectively F3PU20-0N) and F3PU10-0S (respectively F3PU20-0S) have the same dimensions, internal circuitry and other characteristics, except that F3PU10-0N (respectively F3PU20-0N) uses M3.5-screw terminals while F3PU10-0S (respectively F3PU20-0S) uses M4-screw terminals.
- F3PU10-0N and F3PU20-0N are not CE Marking compliant.
  F3PU10-0S and F3PU20-0S are CE Marking compliant.
- For compliance to CE Marking of the final product incorporating these modules, F3PU10-0S or F3PU20-0S must be used.

(2) F3PU30-0N/F3PU30-0S Power Supply Modules

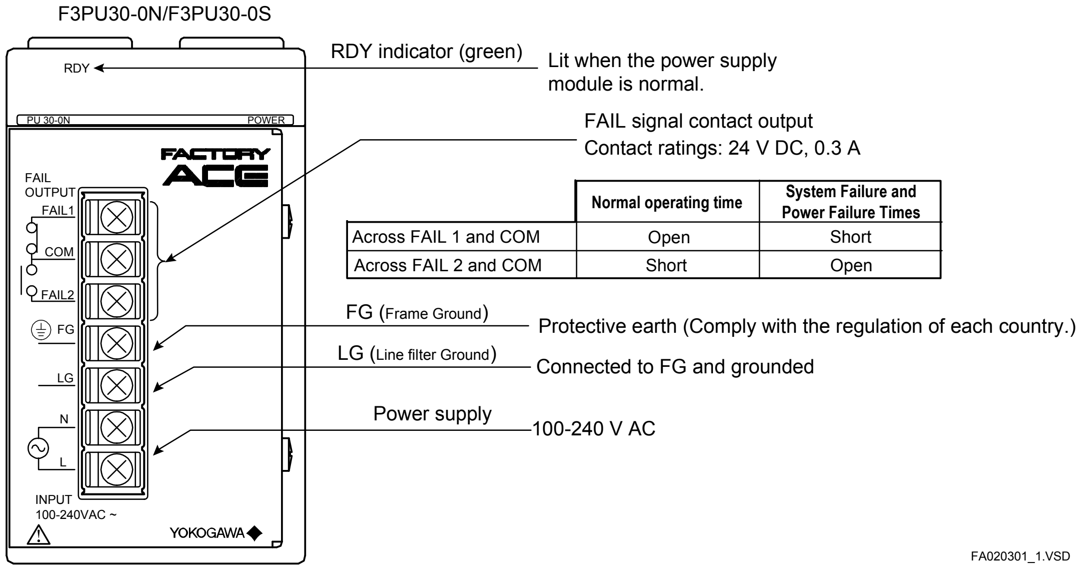
● Specifications

Item	Specifications
	F3PU30-0N/F3PU30-0S[1]
Supply voltage	100 to 240V AC, single phase, 50/60 Hz
Range of supply voltage change	85 to 264 V AC, 50/60 Hz ±3Hz
Power consumption	100 VA
Inrush current	20 A max. (120V AC, Ta=25°C), 45A max. (240V AC, Ta=25°C)
Fuse	2 A time-lag fuse (Built into the L and N terminals and cannot be replaced.)
Rated output voltage	5V DC
Rated output current	6.0A
Insulation resistance	5 MΩ min. when tested between a group of external AC terminals and the FG terminal using a 500 VDC insulation resistance tester
Withstanding voltage	1500 V AC for one minute between a group of external AC terminals and the FG terminal
Leakage current	3.5 mA max.
Allowable momentary power failure time	20 ms
External dimensions	58.0 (W) x 100 (H) x 126.1(D)mm [2]
Weight	380 g
Compatible base module	Dedicated to F3BU05, F3BU09, F3BU13 and F3BU16

*1: The only difference between modules F3PU30-0N and F3PU30-0S lies in the screw diameter of their screw terminal blocks.

*2: Excluding protrusions (see the dimensional figures for more information)

● Components and Their Functions



RDY indicator (green) — Lit when the power supply module is normal.

FAIL signal contact output
Contact ratings: 24 V DC, 0.3 A

	Normal operating time	System Failure and Power Failure Times
Across FAIL 1 and COM	Open	Short
Across FAIL 2 and COM	Short	Open

FG (Frame Ground) — Protective earth (Comply with the regulation of each country.)

LG (Line filter Ground) — Connected to FG and grounded

Power supply — 100-240 V AC

Figure A2.3 F3PU30-0N/F3PU30-0S Power Supply Modules

DANGER

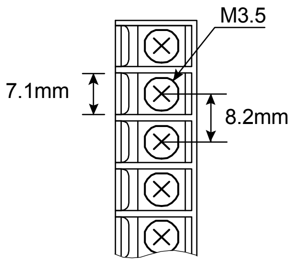
To avoid electrical shock, turn off the power before wiring.

CAUTION

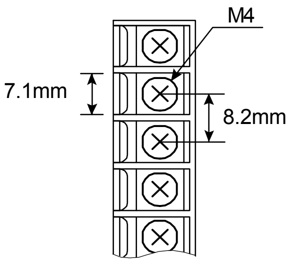
LG terminal has a half potential of the input power supply voltage when LG terminal isn't connected to FG terminal.

Terminal dimensions

F3PU30-0N



F3PU30-0S



Adaptable crimp-on terminals

Vendor	Model	Compatible Conductor	Crimping Torque	
			F3PU30-0N	**F3PU30-0S**
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M3	AWG22 to 18 (0.33 to 0.82 mm^2) (Copper wire)	0.8 N·m (7.1 lbf·in)	May not be used
Nippon Tanshi Co., Ltd.	RAV1.25-3.5			
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M4			1.2 N·m (10.6 lbf·in)
Japan Solderless Terminal Mfg Co., Ltd.	V2-M4	AWG16 to 14 (1.3 to 2.1 mm^2) (Copper wire)		

CAUTION

When crimping terminals, be sure only to use the tool specified by each terminal manufacturer.

Once the power supply module is installed in the base module, both the FG terminal of the power supply module and the signal ground (GND terminal of the module’s 5 V output) of the FA-M3 automatically come into contact with the metal chassis of the base module. The FG terminal and the signal ground are isolated from each other inside the power supply module.

For details on the grounding lines of the FA-M3, see subsection A3.3.2, “Grounding Lines.”

CAUTION

- F3PU30-0S module is the same as F3PU30-0N module, but it uses M4 terminal screws instead of M3.5 terminal screws. Other than terminal screw diameter, their dimensions and internal circuitries are identical.
- F3PU30-0N is not CE Marking compliant.
  F3PU30-0S is CE Marking compliant.
- For compliance to CE Marking of the final product incorporating these modules, F3PU30-0S must be used.

(3) F3PU16-0N and F3PU26-0N Power Supply Modules

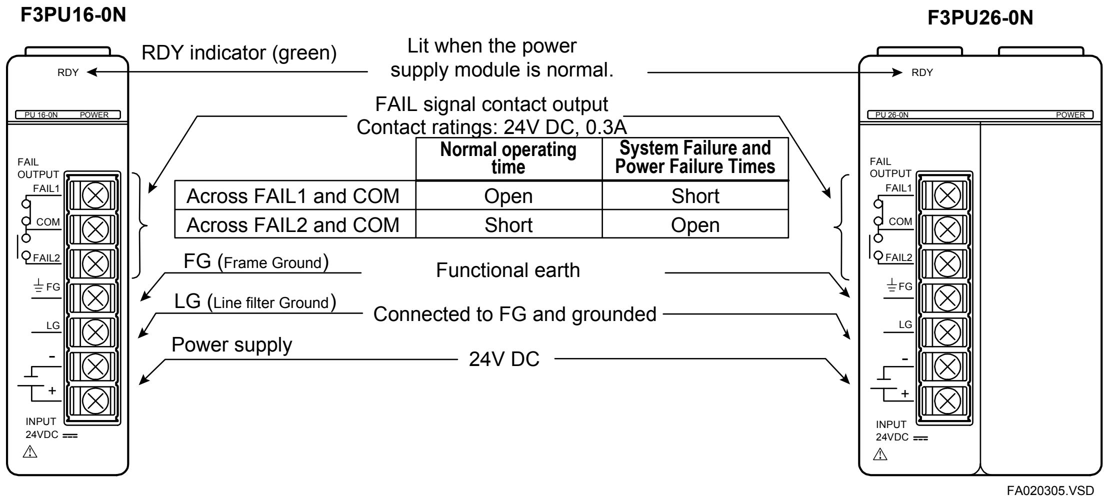
● Specifications

Item	Specifications	
	F3PU16-0N	**F3PU26-0N**
Supply voltage	24 V DC	
Range of supply voltage change	15.6 to 31.2 V DC	
Power consumption	15.4W	33.1W
Inrush current	20 A max. (31.2 V DC, Ta=25°C)	
Fuse	3.15 A time-lag fuse (Built into the positive and negative terminals and cannot be replaced.)	5 A time-lag fuse (Built into the positive terminal and cannot be replaced.)
Rated output voltage	5 V DC	
Rated output current	2.0 A	4.3 A
Insulation resistance	5 MΩ min. when tested between a group of external DC terminals and the FG terminal using a 500 VDC insulation resistance tester	
Withstanding voltage	1500 V AC for one minute between a group of external DC terminals and the FG terminal	
Allowable momentary power failure time	20 ms	
External dimensions	28.9 (W) × 100 (H) × 83.2 (D) mm *	58 (W) × 100 (H) × 83.2 (D) mm *
Weight	190 g	320 g
Compatible base module	Dedicated to F3BU04 and F3BU06	Dedicated to F3BU05, F3BU09, F3BU13 and F3BU16

*: Excluding protrusions (see the dimensional figures for more information)

● Components and Their Functions

The figure below shows the power supply modules with their covers removed.



	Normal operating time	System Failure and Power Failure Times
Across FAIL1 and COM	Open	Short
Across FAIL2 and COM	Short	Open

Figure A2.4 F3PU16-0N and F3PU26-0N Power Supply Modules

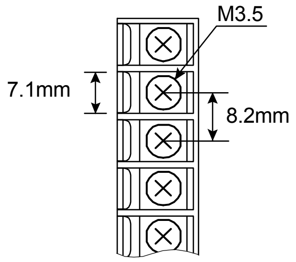
DANGER

To avoid electrical shock, turn off the power before wiring.

CAUTION

LG terminal has a half potential of the input power supply voltage when LG terminal isn’t connected to FG terminal.

- **Terminal dimensions**



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● Adaptable crimp-on terminals

Vendor	Model	Compatible Conductor	Crimping Torque
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M3	AWG22 to 18 (0.33 to 0.82 mm^2) (Copper wire)	0.8 N·m (7.1 lbf·in)
Nippon Tanshi Co., Ltd.	RAV1.25-3.5		
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M4		
Japan Solderless Terminal Mfg Co., Ltd.	V2-M4	AWG16 to 14 (1.3 to 2.1 mm^2) (Copper wire)	

CAUTION

When crimping terminals, be sure only to use the tool specified by each terminal manufacturer.

Once the power supply module is installed in the base module, both the FG terminal of the power supply module and the signal ground (GND terminal of the module’s 5 V output) of the FA-M3 automatically come into contact with the metal chassis of the base module. The FG terminal and the signal ground are isolated from each other inside the power supply module.

For details on the grounding lines of the FA-M3, see subsection A3.3.2, “Grounding Lines.”

(4) F3PU36-0N/F3PU36-0S Power Supply Module

● Specifications

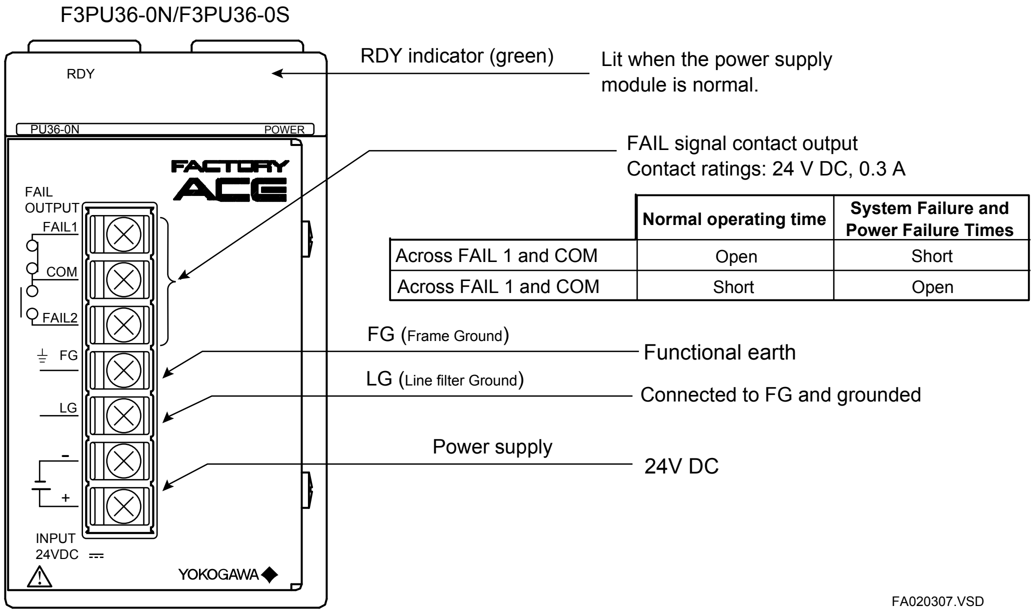
Item	Specifications
	F3PU36-0N/F3PU36-0S[*1]
Supply voltage	24 V DC
Range of supply voltage change	15.6 to 31.2 V DC
Power consumption	46.2 W
Inrush current	20 A max. (31.2 V DC, Ta=25°C)
Fuse	5 A time-lag fuse (Built into the positive terminal and cannot be replaced.)
Rated output voltage	5 V DC
Rated output current	6.0 A
Insulation resistance	5 MΩ min. when tested between a group of external DC terminals and the FG terminal using a 500 VDC insulation resistance tester
Withstanding voltage	1500 V AC for one minute between a group of external DC terminals and the FG terminal
Allowable momentary power failure time	20 ms
External dimensions	58 (W) × 100 (H) × 126.1 (D) mm [*2]
Weight	410 g
Compatible base module	Dedicated to F3BU05, F3BU09, F3BU13 and F3BU16

*1: The only difference between modules F3PU30-0N and F3PU30-0S lies in the screw diameter of their screw terminal blocks.

*2: Excluding protrusions (see the dimensional figures for more information)

● Components and Their Functions

The figure below shows the power supply modules with their covers removed.



	Normal operating time	System Failure and Power Failure Times
Across FAIL 1 and COM	Open	Short
Across FAIL 1 and COM	Short	Open

Figure A2.5 F3PU36-0N/F3PU36-0S Power Supply Module

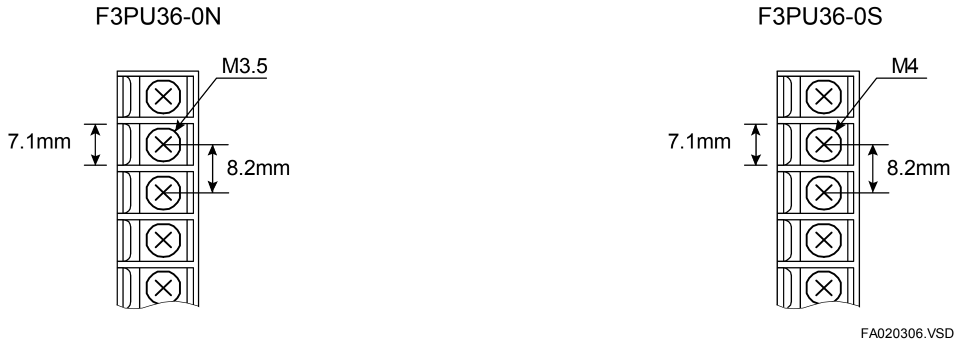
DANGER

To avoid electrical shock, turn off the power before wiring.

CAUTION

LG terminal has a half potential of the input power supply voltage when LG terminal isn’t connected to FG terminal.

Terminal dimensions



Adaptable crimp-on terminals

Vendor	Model	Compatible Conductor	Crimping Torque	
			F3PU36-0N	F3PU36-0S
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M3	AWG22 to 18 (0.33 to 0.82 mm^2) (Copper wire)	0.8 N·m (7.1 lbf·in)	May not be used
Nippon Tanshi Co., Ltd.	RAV1.25-3.5			
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M4			1.2 N·m (10.6 lbf·in)
Japan Solderless Terminal Mfg Co., Ltd.	V2-M4	AWG16 to 14 (1.3 to 2.1 mm^2) (Copper wire)		

CAUTION

When crimping terminals, be sure only to use the tool specified by each terminal manufacturer.

Once the power supply module is installed in the base module, both the FG terminal of the power supply module and the signal ground (GND terminal of the module’s 5 V output) of the FA-M3 automatically come into contact with the metal chassis of the base module. The FG terminal and the signal ground are isolated from each other inside the power supply module.

For details on the grounding lines of the FA-M3, see subsection A3.3.2, “Grounding Lines.”

CAUTION

- F3PU36-0S module is the same as F3PU36-0N module, but it uses M4 terminal screws instead of M3.5 terminal screws. Other than terminal screw diameter, their dimensions and internal circuitries are identical.
- F3PU36-0N is not compliant to CE Marking.
  F3PU36-0S is compliant to CE Marking.
- For compliance to CE Marking of the final product incorporating these modules, F3PU36-0S must be used.

A2.4 Base Modules

There are six types of base modules: 4-, 6-, 5-, 9-, 13-, and 16-slot modules. Select an appropriate type of module according to your application needs.

Model	Number of Slots	Number of I/O Slots	Weight
F3BU04-0N	4	3	150 g
F3BU06-0N	6	5	210 g
F3BU05-0D	5	4	210 g
F3BU09-0N	9	8	340 g
F3BU13-0N	13	12	470 g
F3BU16-0N	16	15	550 g

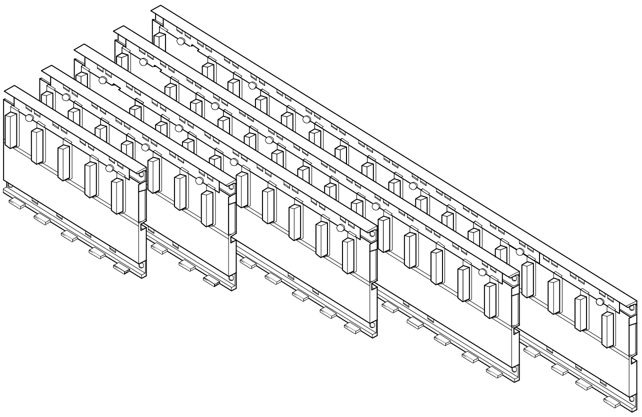


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Figure A2.6 Base Modules

CAUTION

Once the power supply module is installed in the base module, both the FG terminal of the power supply module and the signal ground (GND terminal of the module’s 5 V output) of the FA-M3 automatically come into contact with the metal chassis of the base module.

When any module having a SHIELD terminal is installed in the base module, the SHIELD terminal automatically comes into contact with the metal chassis of the base module.

Likewise, when any module having a D-sub or GP-IB connector is installed in the base module, the connector’s metal shell automatically comes into contact with the metal chassis of the base module.

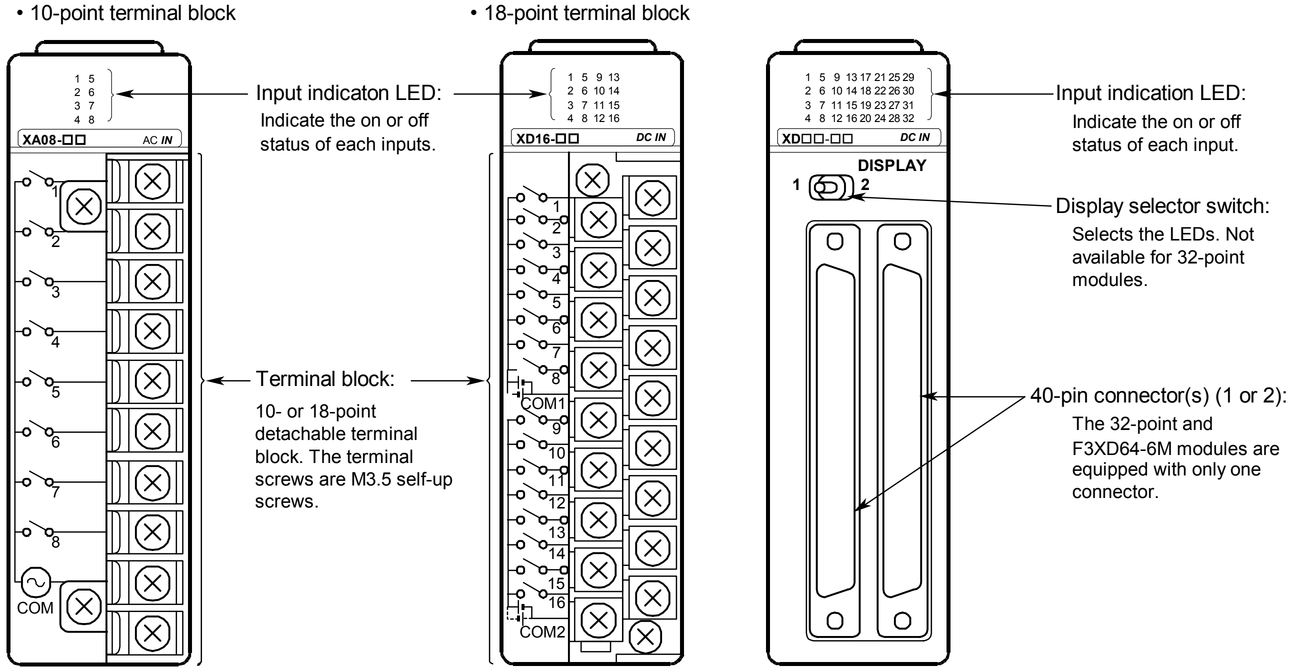
For details on the grounding lines of the FA-M3, see subsection A3.3.2, “Grounding Lines.”

A2.5 I/O Modules

■ Components and Their Functions

● Terminal Block Type

● Connector Type



Input indicaton LED: Indicate the on or off status of each inputs.

Terminal block: 10- or 18-point detachable terminal block. The terminal screws are M3.5 self-up screws.

Input indication LED: Indicate the on or off status of each input.

Display selector switch: Selects the LEDs. Not available for 32-point modules.

40-pin connector(s) (1 or 2): The 32-point and F3XD64-6M modules are equipped with only one connector.

Display Selector Switch	Contents of 1 to 32 input LEDs
1	Indicates the on/off state of input terminals 1 to 32.
2	Indicates the on/off state of input terminals 33 to 64.

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Figure A2.7 I/O Module Front View

■ External Dimensions

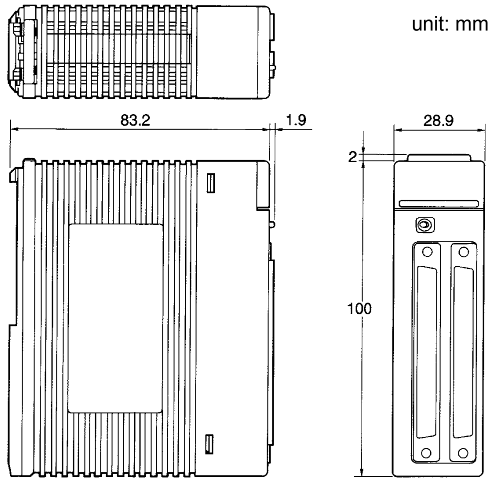

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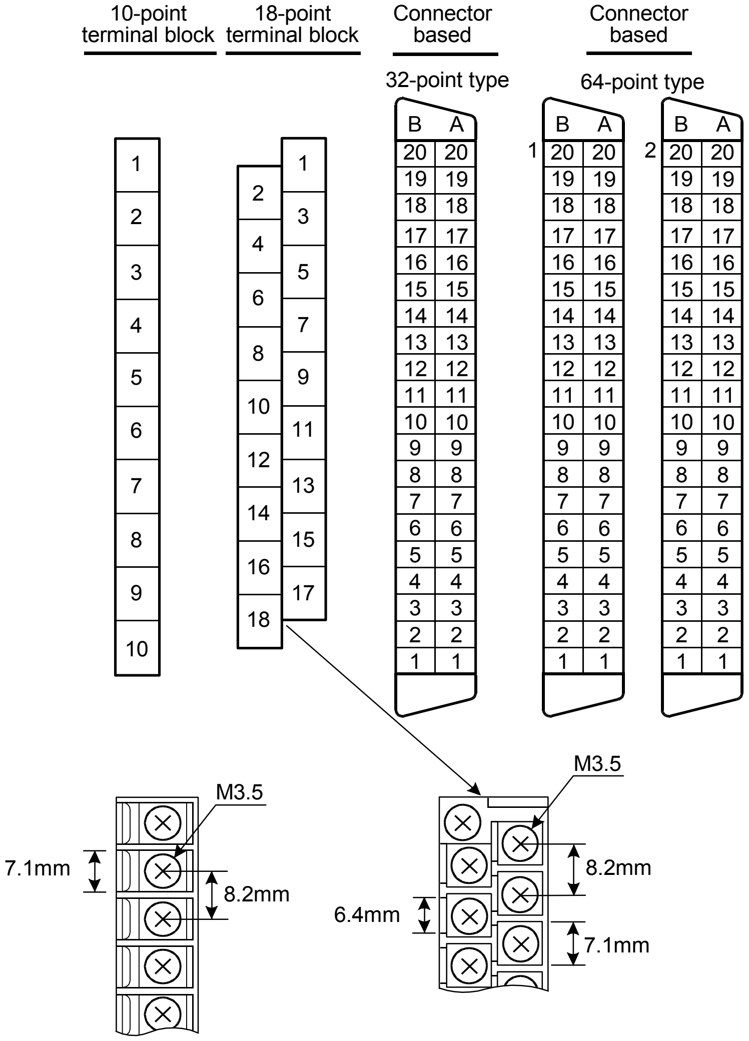
Figure A2.8 I/O Module External Dimensions (F3XD64-3N)

■ Isolation Methods

The internal circuit is isolated from the field using one of the following methods:

Photocoupler isolation : Withstands 1500 V AC for 1 minute.
Mechanical isolation : Withstands 1500 V AC for 1 minute.
Transformer isolation : Withstands 500 V AC for 1 minute.

■ Terminal Arrangement



Note:Viewed from the front side of the module.

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■ External Connection

There are two ways of connecting an input/output module externally: through a terminal block (10 or 18 points) and through a connector. See Section A3.6, “Wiring I/O Modules,” for more details on wiring.

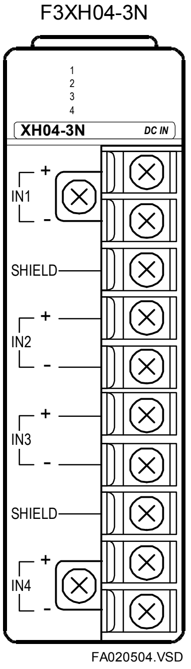
(1) F3XH04-3N High-speed Input Module

Item		Specifications
Input type		DC voltage
Number of points		4
Common line type		4 independent points
Insulation method		Photo-coupler insulation
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection (excluding SHIELD) and the internal circuit
Rated input voltage		24 V DC
Operating voltage range		20.4 to 26.4 V DC
Rated input current		11.2 mA/point (24 V DC)
Input impedance		2.1 kΩ
Operating voltage/ Current	ON	16 V DC min. 7.2 mA min.
	OFF	6.0 V DC max. 2.5 mA max.
Response time	OFF→ON	50 μs max.
	ON→OFF	50 μs max.
Minimum input pulse width		50 μs

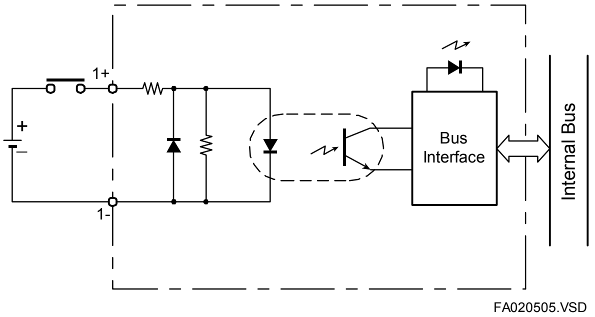
Item		Specifications
Pulse-capture features *	Selection	Selected by DIP switches
Interrupt features *	Selection	Selected by DIP switches
	Setting	Set for each point using Ladder Diagram Support Program M3.
	Input hold time	The input signal is held for 512 μs after detection of an off-to-on transition.
Dissipating current		30 mA (5 V DC)
Input display		LED (Lit when input is on)
External connection		10-point terminal block with M3.5 screws
Weight		130 g
Maximum ratio of inputs turned on simultaneously		100%

*: The pulse capture feature and the interrupt feature cannot be used together.

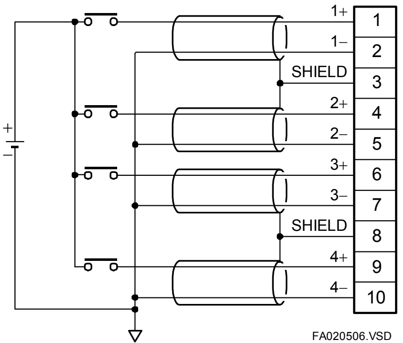
● Front View



● Internal Circuit Configuration



● External Connection Diagram



Note: Viewed from the front side of the module.

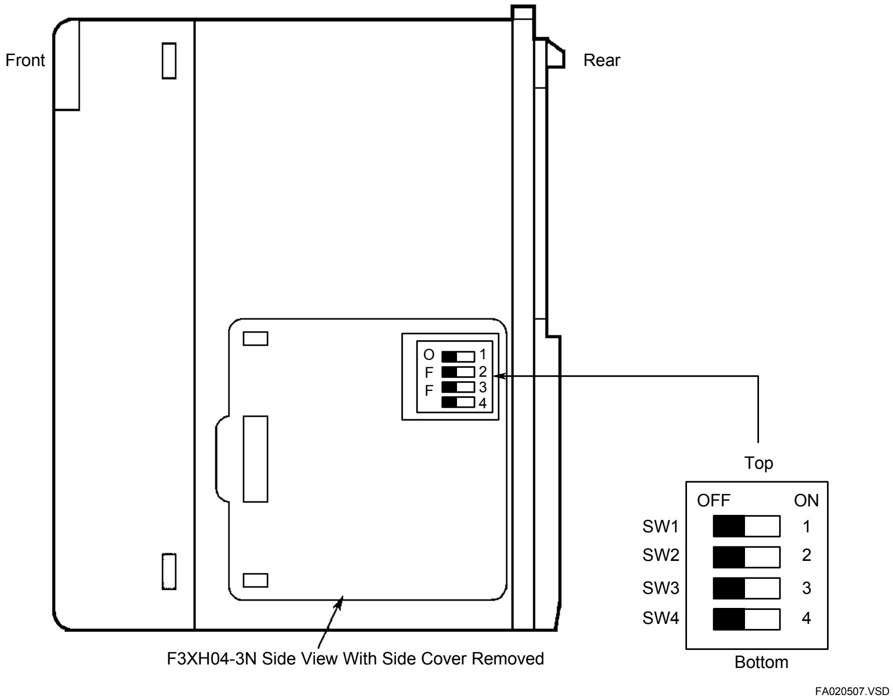
● Setting up the Pulse-capture and Interrupt Functions

The F3XH04-3N allows you to enable the pulse-capture or interrupt function by setting its internal DIP switch (DIP SW).

(1) Hardware Setup

Remove the side cover and select the desired function with internal DIP SW 1.
The pulse-capture function is selected as default at the factory.

Side View of Module



DIP.SW No.	OFF	ON	Default
1	Pulse-capture function	Interrupt function	OFF
2	Not used	Not used	OFF
3	Not used	Not used	OFF
4	Not used	Not used	OFF

Figure A2.9 Setting the Pulse-capture/Interrupt Functions

(2) Software Setting

You can use the pulse-capture function by specifying terminal numbers 17-20 in a ladder program. There is no need to make special settings. Set the interrupt function for each input point. In either case, make sure that the correct function is selected as explained in the paragraph entitled “Hardware Setup.”

(3) Accessing a Module

- **Pulse-capture function**
  This function is available only through a ladder program. Inputs 1-4 correspond to terminal numbers 17-20.

  Xℓmm17-Xℓmm20

  ℓ : Unit number (0 to 7)

  mm : Slot position

Figure A2.10 Input Relay Number

- **Interrupt function**

The interrupt function may be used from either a ladder or BASIC program.

Inputs 1-4 correspond to terminal numbers 1-4.

(1) Interrupt processing in a ladder program

When using the interrupt function as an interrupt input, make an “I/O interrupt definition” using the INTP instruction.

You can perform I/O interrupt definitions for a maximum of 4 points per single CPU module. When an interrupt input is presented from the F3XH04-3N, an interrupt program that begins with an INTP instruction and ends with an IRET instruction is executed.

The interrupt response time, which is the time required for the CPU module to recognize an interrupt input from the F3XH04-3N and start executing the interrupt program, is dependant on the CPU module model and has the following approximate values.

F3SP21/25/35	: approximately 0.5 ms
F3SP22/28/38	: approximately 120 µs
F3SP53/58/59/66/67	: approximately 100 µs
F3SP71/76	: approximately 100 µs

CAUTION

Do not perform "I/O Interrupt Definition" for the same F3XH04-3N input module from multiple CPU modules. The CPU module cannot be correctly notified of an interrupt from the F3XH04-3N input module.

Define the following interrupt period as a standard:

- Interrupt input . . . only one point defined per CPU 1 ms and above
  If the interrupt period is 1 to 2 ms, ensure that the scan time is 2 ms or longer. If the scan time is less than 2 ms, use the constant scan time feature.
- Interrupt input . . . 2 to 4 points defined per CPU 10 ms and above
  If the interrupt period is short, the interrupt program will be executed frequently, affecting normal program execution. It may also cause delay in responding to commands from programming tool or personal computer links.

(2) Interrupt processing in a BASIC program

Declare the acceptance of interrupts with an ON INT statement after declaring the use of a module with an ASSIGN statement.

For more information, see Section C4.3, “Interrupts” , in the BASIC CPU Modules and YM-BASIC/FA Programming Language (IM 34M06Q22-01E).

(4) Functional Description

- Pulse-capture Function

The pulse-capture function is designed to reliably catch input pulses shorter than the scan time.

As the CPU module usually reads the data of I/O modules during I/O refresh cycle, when a normal input module is used, the CPU may fail to read input pulses shorter than the scan time. The F3XH04-3N module provides a pulse capture function, which can, once it detects pulses longer than 50 μs, hold the data until the next timing for data reading so that such pulses can be reliably captured by the the CPU during I/O refreshing. However, the F3XH04-3N module cannot catch input pulses shorter than 50 μs.

The timing diagram of this function is shown below.

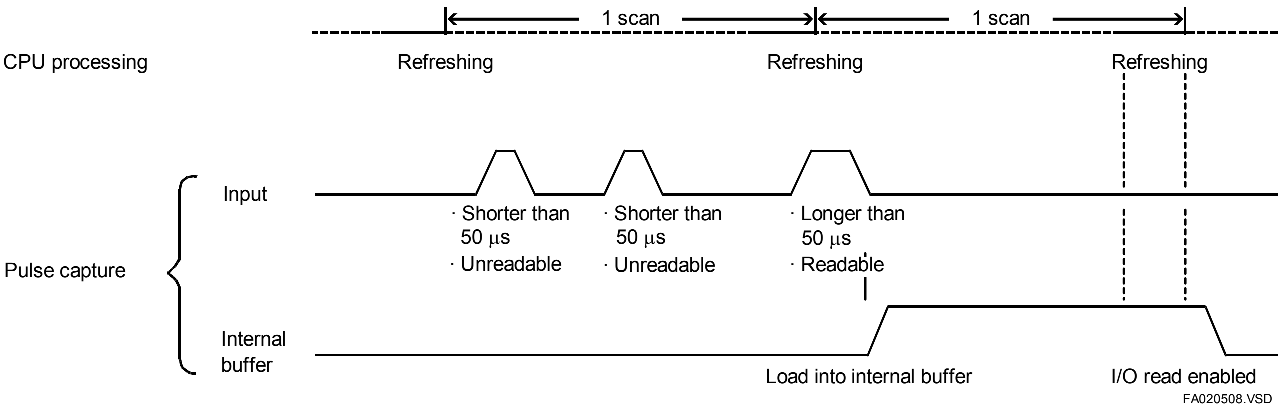


Figure A2.11 Behavior when Pulses Shorter than the Scan Time are Inputted

When a pulse longer than the scan time is inputted, the input is regarded as having been on only for the duration of one scan time.

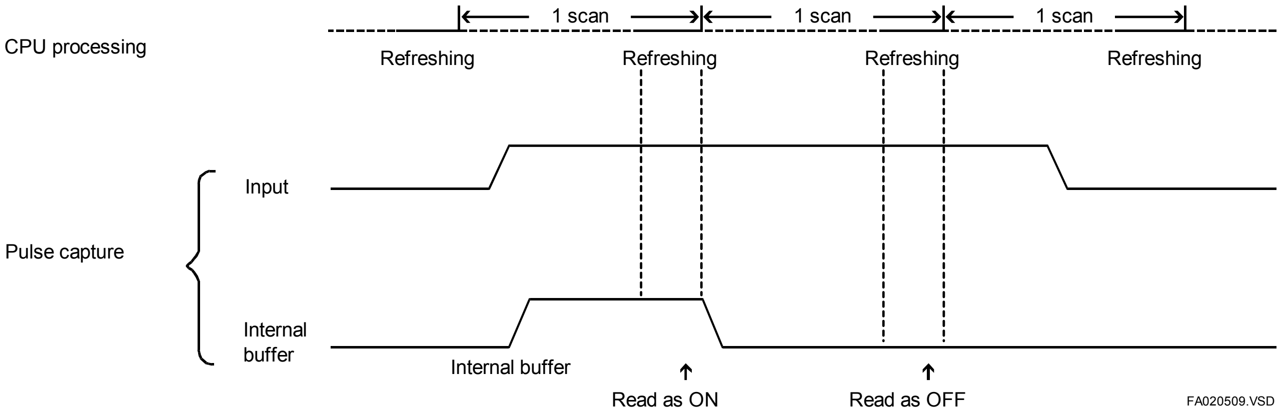


Figure A2.12   Behavior when Pulses Longer than the Scan Time are Inputted

- Interrupt Function

If the interrupt function is selected, the F3XH04-3N module continues to hold its input on for the duration of 512 μs once it detects an off-to-on transition in the input. The interrupt program therefore may not be executed if an input pulse shorter than 512 μs is used as the interrupt signal. If a module that responds very quickly to a change in the input signal, like this F3XH04-3N module, is used as the means for inputting interrupt signals, the CPU module will continue to run the interrupt program for an input of consecutive high-speed pulses and fail to run its regular programs. To avoid this, the F3XH04-3N module is designed to hold the given input signal for a specific length of time once it detects a pulse in order to prohibit itself from detecting any subsequent pulses. This function thus prevents the CPU module from running the interrupt program repeatedly.

The timing diagram of the interrupt function is show below.

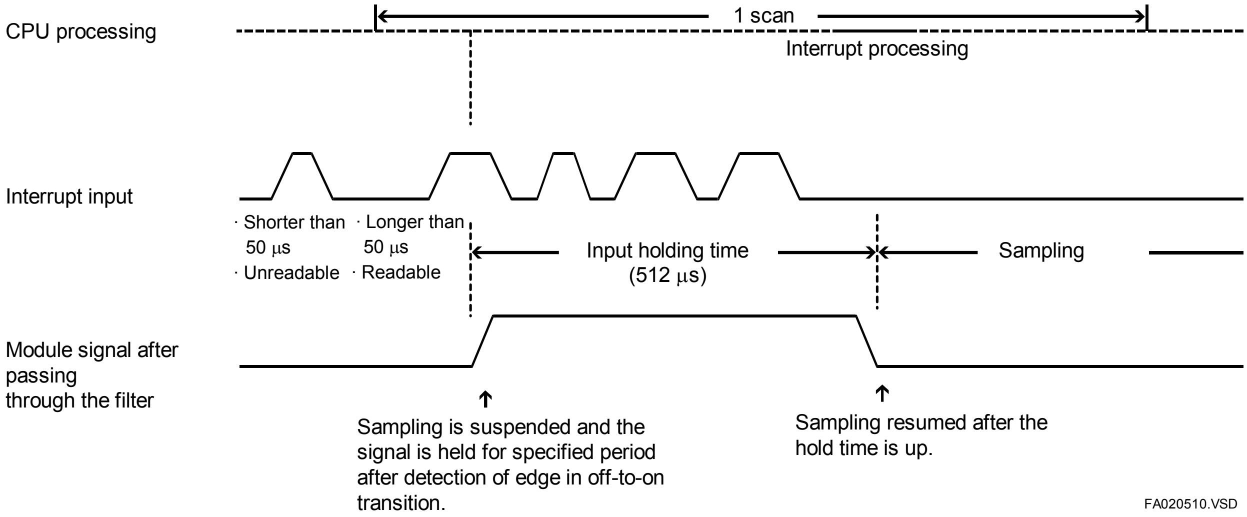

CPU processing
1 scan
Interrupt processing
Interrupt input
· Shorter than 50 µs
· Unreadable
· Longer than 50 µs
· Readable
Input holding time (512 µs)
Sampling
Module signal after passing through the filter
Sampling is suspended and the signal is held for specified period after detection of edge in off-to-on transition.
Sampling resumed after the hold time is up.
FA020510.VSD

Figure A2.13 Behavior when an Interrupt Occurs

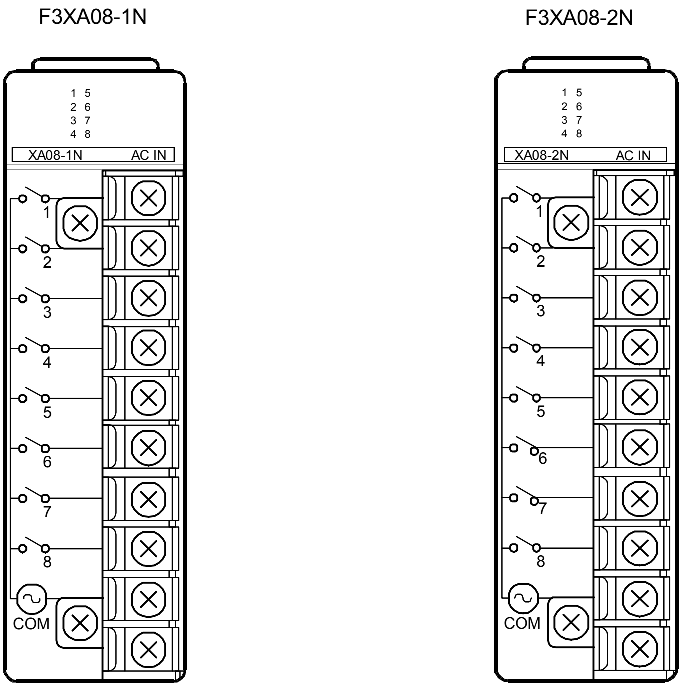
CAUTION

Do not allow the input relays of any single F3XH04-3N module to be shared by more than one CPU module. Otherwise, the pulse-capture or interrupt function may not work correctly. (This is still applicable even if two or more CPU modules share a relay having a different number.)

(2) F3XA08-1N/F3XA08-2N AC Input Modules

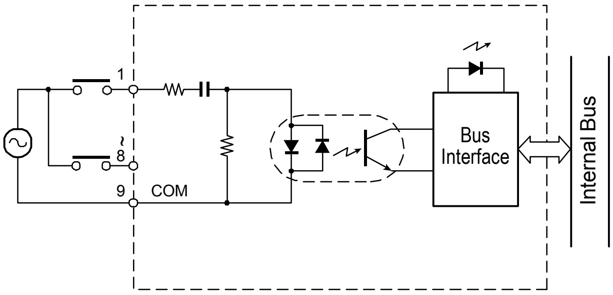
Item		Specifications	
		F3XA08-1N	F3XA08-2N
Input type		AC voltage	
Number of points		8	
Common line type		8 points/common line	
Isolation method		Photocoupler insulation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated input voltage		100 to 120 V AC 50/60Hz	200 to 240 V AC 50/60Hz
Operating voltage range		85 to 132 V AC 50/60Hz	170 to 264 V AC 50/60Hz
Rated input current		5.4-6.5 mA/point (100-120V AC, 60Hz)	5.1-6.1 mA/point (200-240V AC, 60Hz)
Input impedance		21.9 kΩ 50Hz 18.5 k Ω 60Hz	47.1 k Ω 50Hz 39.4 k Ω 60Hz
Operating voltage/current	ON	80 V AC min. 5 mA min.	160 V AC min. 4 mA min.
	OFF	40 V AC max. 1 mA max.	70 V AC max. 1 mA max.
Response time	OFF→ON	15 ms max. or 30 ms, selectable	
	ON→OFF	25 ms max. or 40 ms, selectable	
Interrupt		Can be specified for each input point	
Current consumption		40 mA (5 V DC)	
Input display		LED (lit when input is turned on)	
External connection		10-point terminal block with M3.5 screws	
Weight		130 g	
Maximum ratio of inputs turned on simultaneously		100 %	

● Front View



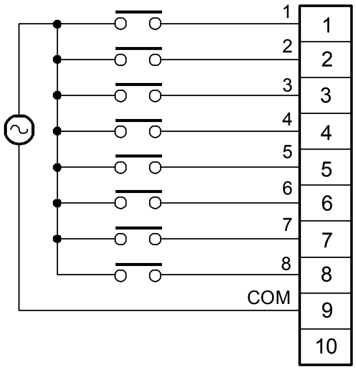
FA020511.VSD

● Internal Circuit Configuration



FA020512.VSD

● External Connection Diagram



FA020513.VSD

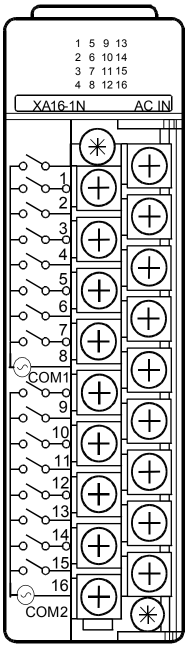
Note: Viewed from the front side of the module.

(3) F3XA16-1N AC Input Module

Item	Specifications	Item		Specifications
Input type	AC voltage	Operating voltage /current	ON	80 V AC min., 5 mA min.
Number of points	16		OFF	40 V AC max., 1 mA min.
Common line type	8 points/common line	Response time	OFF→ON	15 ms max. or 30 ms, selectable
Isolation method	Transformer insulation		ON→OFF	25 ms max. or 40 ms, selectable
Withstanding voltage	1500 V AC for one minute between the group of terminals for external connection and the internal circuit	Interrupt		Can be specified for each input point
		Dissipating current		65 mA (5 V DC)
Rated input voltage	100 to 120 V AC 50/60Hz	Input display		LED (lit when input is turned on)
Operating voltage range	85 to 132 V AC 50/60Hz	External connection		18-point terminal block with M3.5 screws
Rated input current	5.4-6.5mA/point (100-120V AC, 60Hz)	Weight		180g
Input impedance	21.9kΩ 50Hz 18.5kΩ 60Hz	Maximum ratio of inputs turned on simultaneously		100%

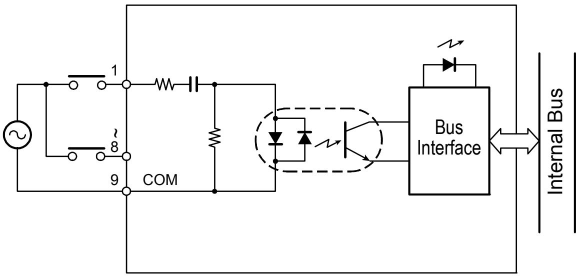
● Front View

F3XA16-1N



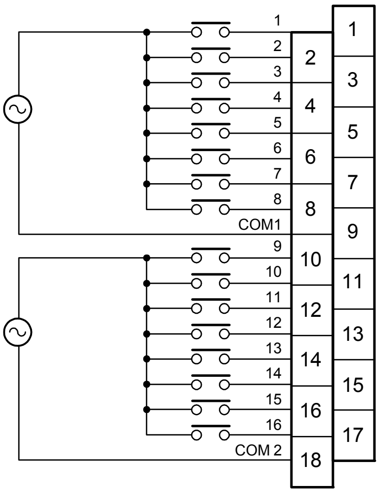
FA020516_1.VSD

● Internal Circuit Configuration



FA020512.VSD

● External Connection Diagram



Note: Viewed from the front side of the module.

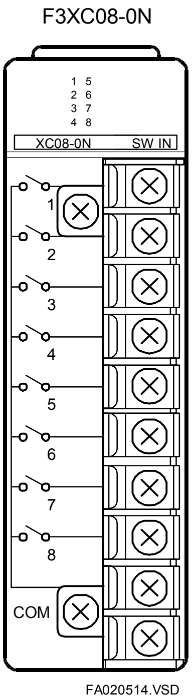
FA020516_2.vsd

(4) F3XC08-0N No-voltage Contact Input Module

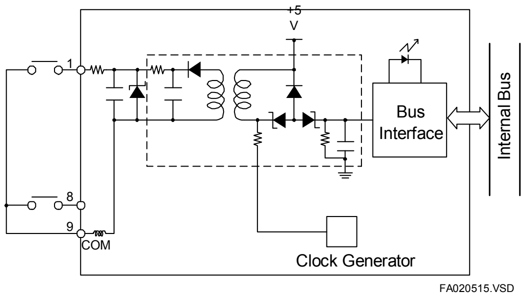
Item	Specifications	Item		Specifications
Input type	No-voltage contact[*1]	Response time	OFF→ON	2.0 ms max. or 17 ms, selectable
Number of points	8			
Common line type	8 points/common line		ON→OFF	2.0 ms max. or 17 ms, selectable
Isolation method	Transformer insulation			
Withstanding voltage	500 V AC for one minute between the group of terminals for external connection and the internal circuit	Interrupt		Can be specified for each input point
Open voltage when contact is OFF	5 to 7V[*2]	Dissipating current		75 mA (5 V DC)
Current when contact is ON	1 to 3 mA[*2]	Input display		LED (lit when input is turned on)
On resistance	200 Ω max.	External connection		10-point terminal block with M3.5 screws
Off resistance	100 kΩ min.	Weight		140 g

*1: Do not apply an external voltage to an input terminal of the F3XC08 or it will cause a failure.
*2: External contacts connecting to input terminals of the F3XC08 must be able to turn on/off under these conditions.

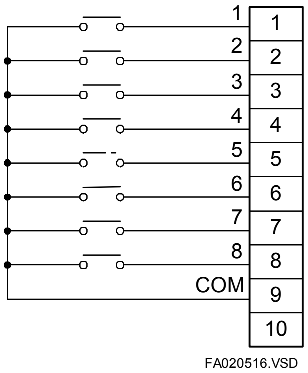
● Front View



● Internal Circuit Configuration



● External Connection Diagram



Note: Viewed from the front side of the module

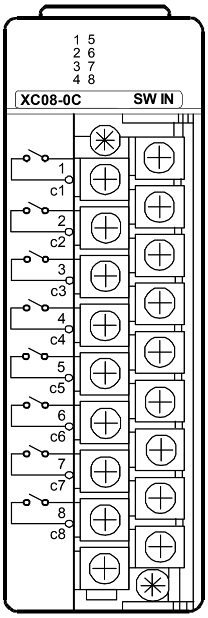
(5) F3XC08-0C No-voltage Contact Input Module (independent commons)

Item	Specifications	Item		Specifications
Input type	No-voltage contact[*1]	Response time	OFF→ON	Can be specified for 5 steps: Always (0 μs), 62.5 μs, 250 μs, 1 ms, and 16 ms
Number of points	8			
Common line type	Independent commons		ON→OFF	Can be specified for 5 steps: Always (0 μs), 62.5 μs, 250 μs, 1 ms, and 16 ms
Isolation method	Transformer insulation			
Withstanding voltage	500 V AC for one minute between the group of terminals for external connection and the internal circuit	Interrupt		Can be specified for each input point
Open voltage when contact is OFF	5 to 7V[*2]	Dissipating current		75 mA (5 V DC)
Current when contact is ON	1 to 3 mA[*2]	Input display		LED (lit when input is turned on)
On resistance	200 Ω max.	External connection		10-point terminal block with M3.5 screws
Off resistance	100 kΩ min.	Weight		170 g

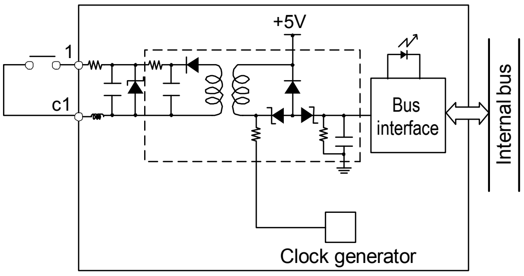
*1: Do not apply an external voltage to an input terminal of the F3XC08 or it will cause a failure.
*2: External contacts connecting to input terminals of the F3XC08 must be able to turn on/off under these conditions.
*3: If input interrupt is to be used, set the input sampling time to 62.5 μs or more.

● Front View

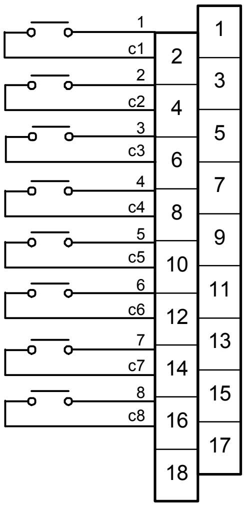
F3XC08-0C



● Internal Circuit Configuration



● External Connection Diagram



Note: Viewed from the front side of the module.

(6) F3XD08-6F DC Input Module

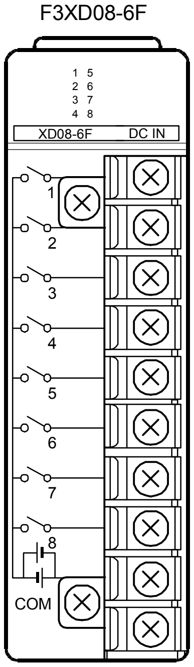
Item		Specifications
Input type		DC voltage
Number of points		8
Common line type		8 points/common line
Isolation method		Photocoupler isolation
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit
Rated input voltage		12-24 V DC
Operating voltage range		10.2 to 26.4 V DC
Rated input current		4.1 mA/point（12V DC） 8.5 mA/point（24V DC）
Input impedance		2.9 kΩ
Operating voltage/current	ON	8.0 V DC min. 2.6 mA min.
	OFF	3.4 V DC max. 1.0 mA max.

Item		Specifications
Response time	OFF→ON	Input sampling time can be specified for 5 steps: Always (0 μs), 62.5 μs, 250 μs, 1 ms, and 16 ms.[*1]
	ON→OFF	Input sampling time can be specified for 5 steps: Always (0 μs), 62.5 μs, 250 μs, 1 ms, and 16 ms.[*1]
Interrupt[*2]		Can be specified for each input point
Dissipating current		40 mA (5 V DC)
Input display		LED (lit when input is turned on)
External connection		10-point terminal block with M3.5 screws
Weight		130 g
Maximum ratio of inputs turned on simultaneously		100%

*1: These values are applicable when using the module with CPU module F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module. If other CPU modules are used, the values are the same as those for F3XD08-6N modules. The actual response time is obtained by adding about 100 μs for OFF→ON and about 300 μs for ON→OFF to the specified value.
If the input sampling time is set to a very small value, the modules become susceptible to noise. In such a case, implement countermeasures against noise as described in Section A3.4 "Noise Control Considerations" and Section A3.9 "CE Marking Compliance".

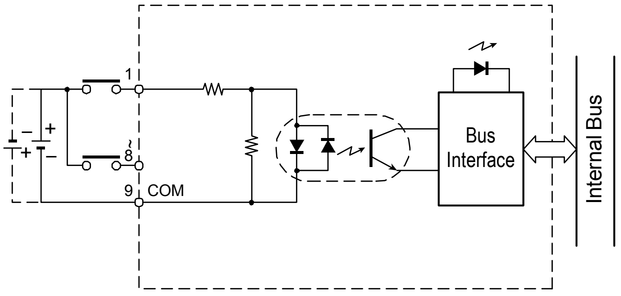
*2: If input interrupt is to be used, set the input sampling time to 62.5 μs or more.

● Front View



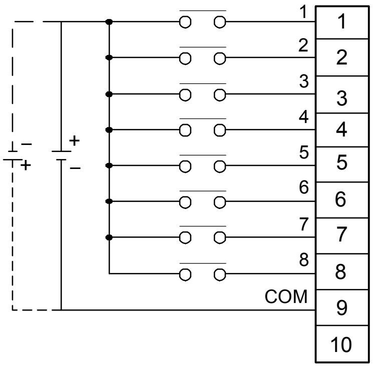
FA020517.VSD

● Internal Circuit Configuration



FA020518.VSD

● External Connection Diagram



FA020519.VSD

Note: Viewed from the front side of the module.

(7) F3XD16-3F/F3XD16-4F/F3XD16-3H DC Input Modules

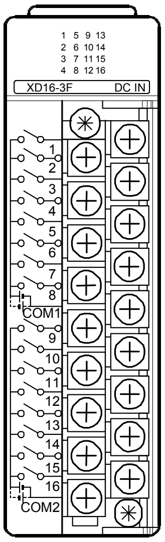
Item		**Specifications**		
		F3XD16-3F	**F3XD16-4F**	**F3XD16-3H**
Input type		DC voltage		DC voltage (positive common)
Number of points		16		
Common line type		8 points/common line		
Isolation method		Photocoupler isolation		
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit		
Rated input voltage		24 V DC	12 V DC	24 V DC
Operating voltage range		20.4 to 26.4 V DC	10.2 to 13.2 V DC	20.4 to 26.4 V DC
Rated input current		4.1 mA/point (24 V DC)	4.1 mA/point (12 V DC)	4.7 mA/point (24 V DC)
Input impedance		5.9 kΩ	2.9 kΩ	5.1 kΩ
Operating voltage/current	ON	16.0 V DC min. 3.2 mA min.	8.0 V DC min. 2.6 mA min.	16.0 V DC min. 3.2 mA min.
	OFF	5.8 V DC max. 0.9 mA max.	3.4 V DC max. 1.0 mA max.	5.8 V DC max. 0.9 mA max.
Response time	OFF→ON	Input sampling time can be specified for 5 steps : Always (0 μs), 62.5 μs, 250 μs, 1 ms and 16 ms[*1]		
	ON→OFF	Input sampling time can be specified for 5 steps : Always (0 μs), 62.5 μs, 250 μs, 1 ms and 16 ms[*1]		
Interrupt[*2]		Can be specified for each input point		
Dissipating current		65 mA (5 V DC)		
Input display		LED (lit when input is turned on)		
External connection		18-point terminal block with M3.5 screws		
Weight		160 g		
Maximum ratio of inputs turned on simultaneously		100%		

*1: These values are applicable when using the module with CPU module F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module. If other CPU modules are used, the values are the same as those for F3XD16-□F modules. The actual response time is obtained by adding about 100 μs for OFF→ON and about 300 μs for ON→OFF to the specified value for F3XD16-□F modules and by adding about 10 μs to the specified value for F3XD16-3H modules.
If the input sampling time is set to a very small value, the modules become susceptible to noise. In such a case, implement countermeasures against noise as described in Section A3.4 "Noise Control Considerations" and Section A3.9 "CE Marking Compliance".

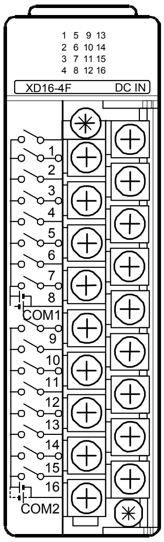
*2: For F3XD16-□F modules, set the input sampling time to 62.5 μs or more if input interrupt is to be used.

● Front View

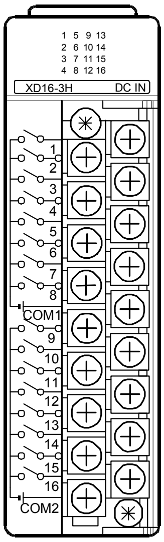
F3XD16-3F



F3XD16-4F



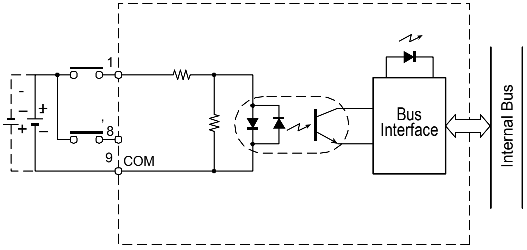
F3XD16-3H



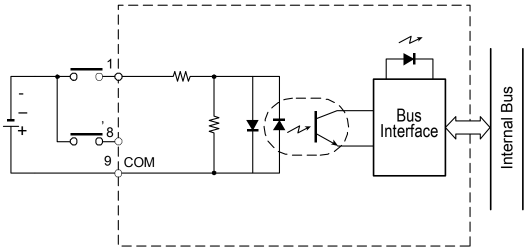
FA020520.VSD

● Internal Circuit Configuration

F3XD16-3F, F3XD16-4F



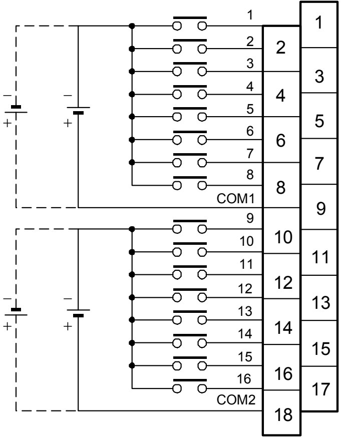
F3XD16-3H



FA020521.VSD

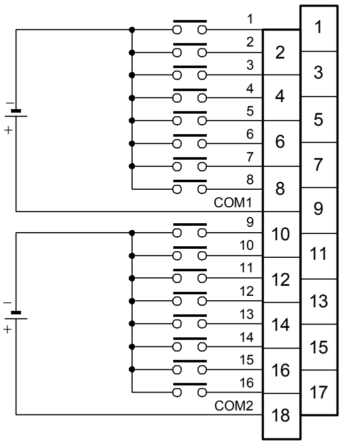
● External Connection Diagram

F3XD16-3F,F3XD16-4F



Note: Viewed from the front of the module

F3XD16-3H



FA020522.VSD

Note: Viewed from the front of the module

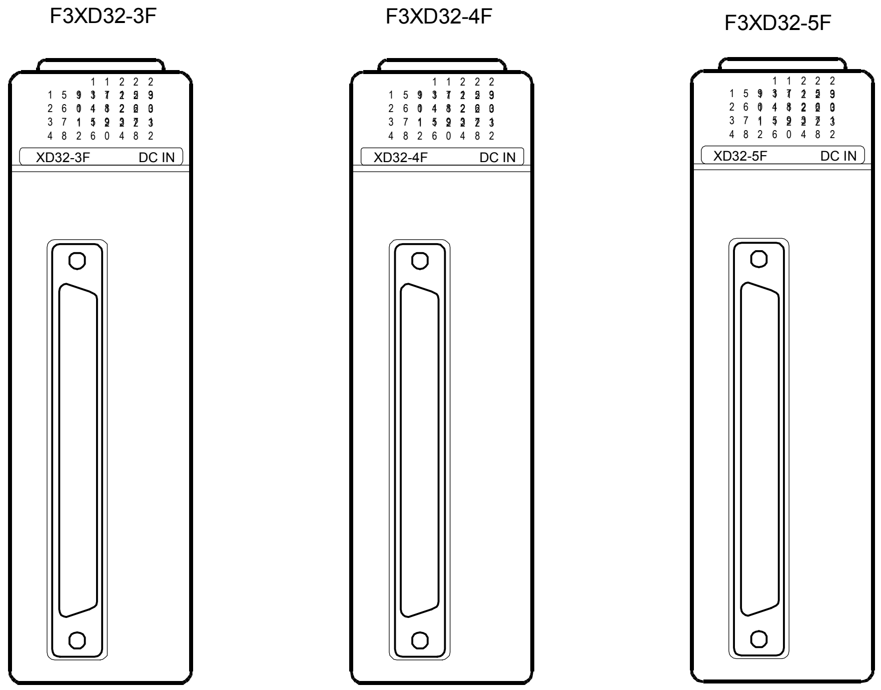
(8) F3XD32-3F/F3XD32-4F/F3XD32-5F DC Input Modules

Item		Specifications		
		F3XD32-3F	**F3XD32-4F**	**F3XD32-5F**
Input type		DC voltage		
Number of points		32		
Common line type		8 points/common line		
Isolation method		Photocoupler isolation		
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit		
Rated input voltage		24 V DC	12 V DC	5 V DC
Operating voltage range		20.4 to 26.4 V DC	10.2 to 13.2 V DC	4.5 to 5.5 V DC
Rated input current		4.1 mA/point (24 V DC)	4.1 mA/point (12 V DC)	4.0 mA/point (5 V DC)
Input impedance		5.9 kΩ	2.9 kΩ	1.3 kΩ
Operating voltage/current	ON	16.0 V DC min. 3.2 mA min.	8.0 V DC min. 2.6 mA min.	3.5 V DC min. 2.0 mA min.
	OFF	5.8 V DC max. 0.9 mA max.	3.4 V DC max. 1.0 mA max.	1.0 V DC max. 0.2 mA max.
Response time	OFF→ON	Input sampling time can be specified for 5 steps : Always (0 μs), 62.5 μs, 250 μs, 1 ms and 16 ms[*1]		
	ON→OFF	Input sampling time can be specified for 5 steps : Always (0 μs), 62.5 μs, 250 μs, 1 ms and 16 ms[*1]		
Interrupt [*2]		Can be specified for each input point		
Dissipating current		75 mA (5 V DC)		
Input display		LED (lit when input is turned on)		
External connection		One 40-pin connector		
Weight		120 g		
Maximum ratio of inputs turned on simultaneously		100%		

*1: These values are applicable when using the module with CPU module F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module. If other CPU modules are used, the values are the same as those for F3XD32-☐F modules. The actual response time is obtained by adding about 100 μs for OFF→ON and about 300 μs for ON→OFF to the specified value.
If the input sampling time is set to a very small value, the modules become susceptible to noise. In such a case, implement countermeasures against noise as described in Section A3.4 "Noise Control Considerations" and Section A3.9 "CE Marking Compliance".

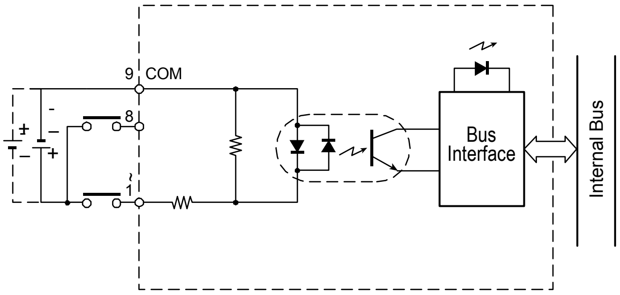
*2: If input interrupt is to be used, set the input sampling time to 62.5 μs or more.

● Front View



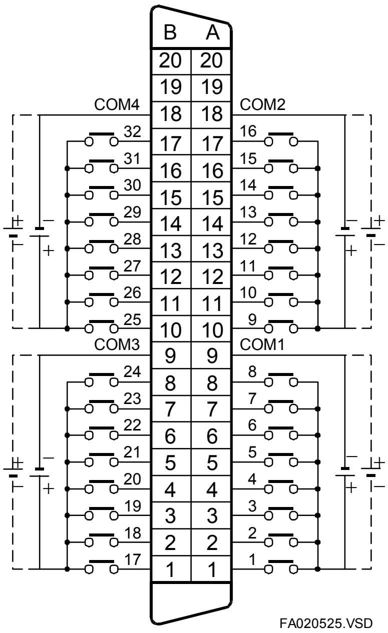
FA020523.VSD

● Internal Circuit Configuration



FA020524.VSD

● External Connection Diagram



FA020525.VSD

Note :View from the front side of the module.

(9) F3XD64-3F/F3XD64-4F DC Input Modules

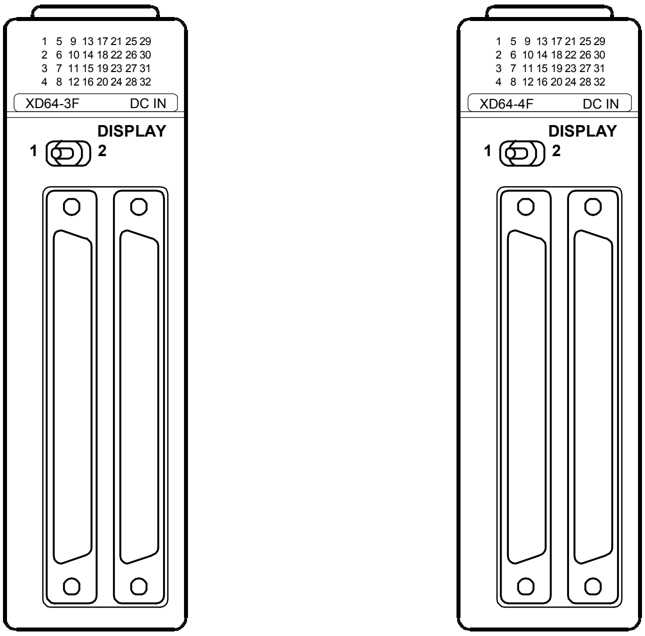
Item		**Specifications**	
		F3XD64-3F	**F3XD64-4F**
Input type		DC voltage	
Number of points		64	
Common line type		8 points/common line	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated input voltage		24 V DC	12 V DC
Operating voltage range		20.4 to 26.4 V DC	10.2 to 13.2 V DC
Rated input current		4.1 mA/point (24 V DC)	4.1 mA/point (12 V DC)
Input impedance		5.9 kΩ	2.9 kΩ
Operating voltage/current	ON	16.0 V DC min. 3.2 mA min.	8.0 V DC min. 2.6 mA min.
	OFF	5.8 V DC max. 0.9 mA max.	3.4 V DC max. 1.0 mA max.
Response time	OFF→ON	Input sampling time can be specified for 4 steps : Always (0 μs), 62.5 μs, 250 μs and 1 ms[*1]	
	ON→OFF	Input sampling time can be specified for 4 steps : Always (0 μs), 62.5 μs, 250 μs and 1 ms[*1]	
Interrupt		None	
Dissipating current		100 mA (5 V DC)	
Input display		LED (lit when input is turned on) 32 points are displayed at a time as selected by a selector switch.	
External connection		Two 40-pin connectors	
Weight		160 g	
Maximum ratio of inputs turned on simultaneously		60%	

*1: These values are applicable when using the module with CPU module using F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module. If other CPU modules are used, the values are the same as those for F3XD64-☐N modules. The actual response time is obtained by adding about 100 μs for OFF→ON and about 300 μs for ON→OFF to the specified value.
If the input sampling time is set to a very small value, the modules become susceptible to noise. In such a case, implement countermeasures against noise as described in Section A3.4 "Noise Control Considerations" and Section A3.9 "CE Marking Compliance".

*2: If input interrupt is to be used, set the input sampling time to 62.5 μs or more.

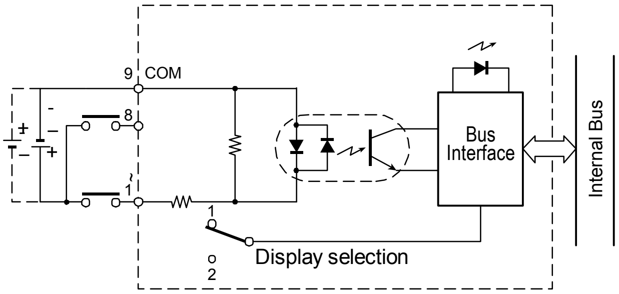
● Front View

F3XD64-3F F3XD64-4F



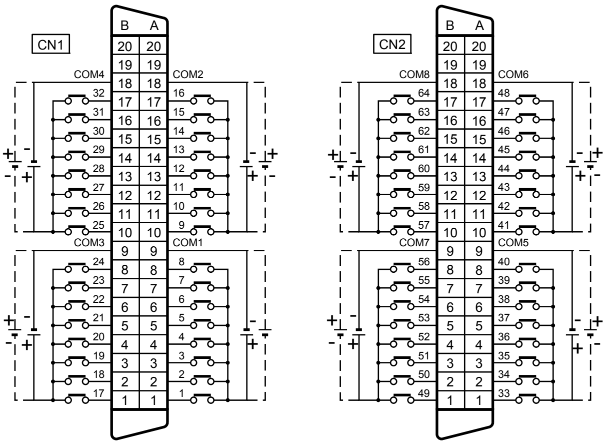
FA020526.VSD

● Internal Circuit Configuration



FA020527.VSD

● External Connection Diagram



Note: Viewed from the front side of the module.

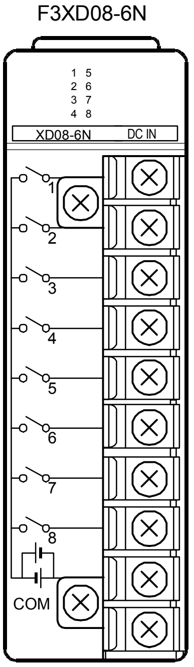
FA020528.VSD

(10) F3XD08-6N DC Input Module

Item		Specifications
Input type		DC voltage
Number of points		8
Common line type		8 points/common line
Isolation method		Photocoupler isolation
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit
Rated input voltage		12-24 V DC
Operating voltage range		10.2 to 26.4 V DC
Rated input current		4.1 mA/point（12 V DC） 8.5 mA/point（24 V DC）
Input impedance		2.9 kΩ
Operating voltage/current	ON	8.0 V DC min. 2.6 mA min.
	OFF	3.4 V DC max. 1.0 mA max.

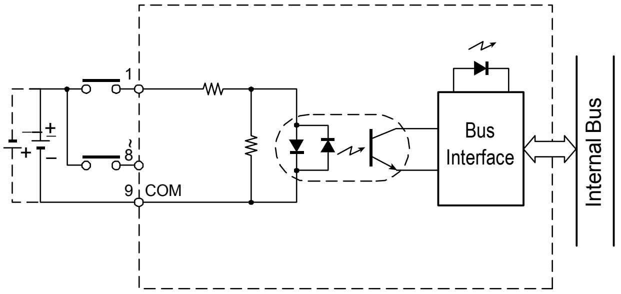
Item		Specifications
Response time	OFF→ON	2.0 ms max. or 16 ms, selectable
	ON→OFF	3.5 ms max. or 18.5 ms, selectable
Interrupt		Can be specified for each input point
Dissipating current		40 mA (5 V DC)
Input display		LED (lit when input is turned on)
External connection		10-point terminal block with M3.5 screws
Weight		130 g
Maximum ratio of inputs turned on simultaneously		100%

Front View



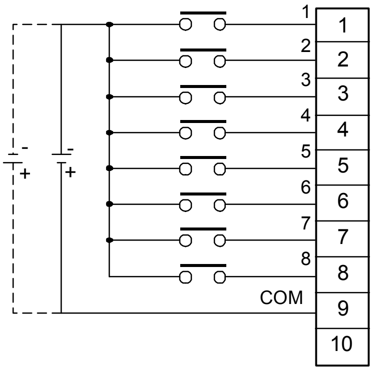
FA020529.VSD

Internal Circuit Configuration



FA020530.VSD

External Connection Diagram



FA020531.VSD

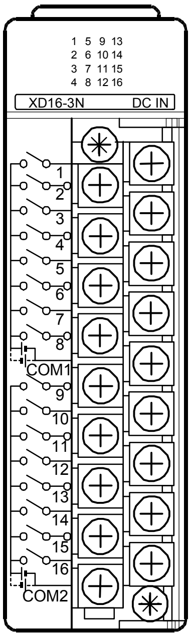
Note: Viewed from the front side of the module.

(11) F3XD16-3N/F3XD16-4N DC-Input Modules

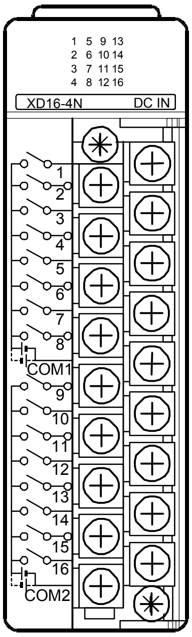
Item		Specifications	
		F3XD16-3N	F3XD16-4N
Input type		DC voltage	
Number of points		64	
Common line type		8 points/common line	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated input voltage		24 V DC	12 V DC
Operating voltage range		20.4 to 26.4 V DC	10.2 to 13.2 V DC
Rated input current		4.1 mA/point (24 V DC)	4.1 mA/point (12 V DC)
Input impedance		5.9 kΩ	2.9 kΩ
Operating voltage/current	ON	16.0 V DC min. 3.2 mA min.	8.0 V DC min. 2.6 mA min.
	OFF	5.8 V DC max. 0.9 mA max.	3.4 V DC max. 1.0 mA max.
Response time	OFF→ON	2.0 ms max. or 17 ms, selectable	
	ON→OFF	3.5 ms max. or 18.5 ms, selectable	
Interrupt		Can be specified for each input point	
Dissipating current		65 mA (5 V DC)	
Input display		LED (lit when input is turned on)	
External connection		10-point terminal block with M3.5 screws	
Weight		160 g	
Maximum ratio of inputs turned on simultaneously		100%	

Front View

F3XD16-3N

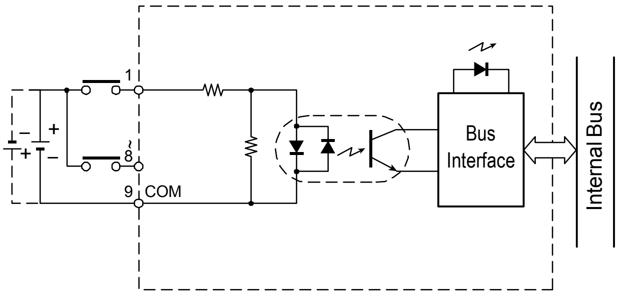


F3XD16-4N



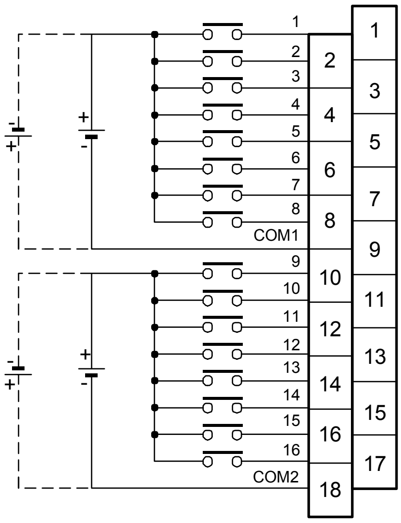
FA020532.VSD

Internal Circuit Configuration



FA020533.VSD

External Connection Diagram



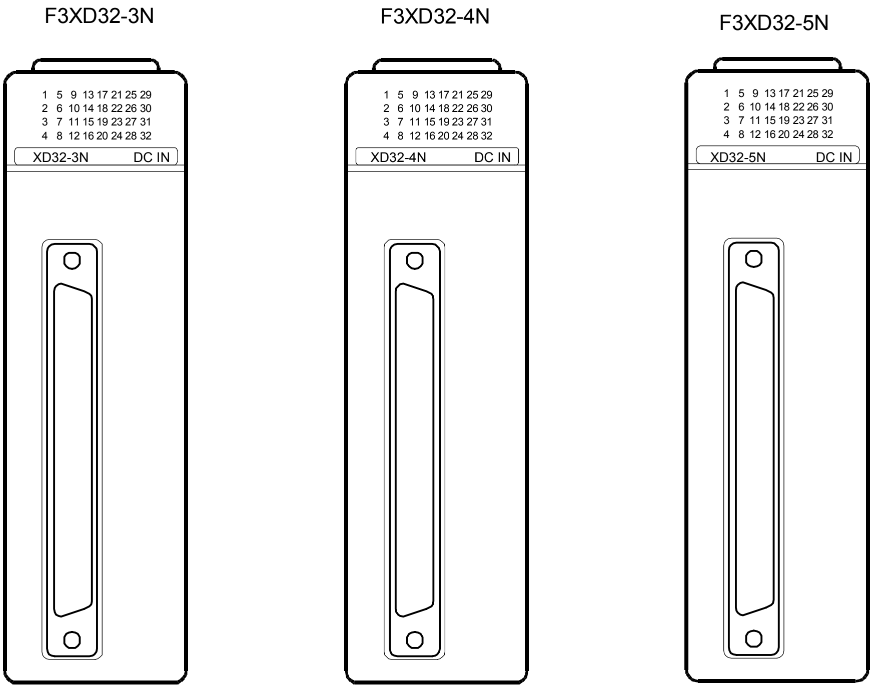
FA020534.VSD

Note: Viewed from the front side of the module.

(12) F3XD32-3N/F3XD32-4N/F3XD32-5N DC Input Modules

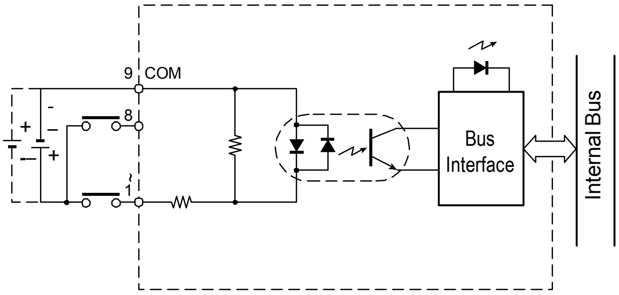
Item		**Specifications**		
		F3XD32-3N	**F3XD32-4N**	**F3XD32-5N**
Input type		DC voltage		
Number of points		32		
Common line type		8 points/common line		
Isolation method		Photocoupler isolation		
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit		
Rated input voltage		24 V DC	12 V DC	5 V DC
Operating voltage range		20.4 to 26.4 V DC	10.2 to 13.2 V DC	4.5 to 5.5 V DC
Rated input current		4.1 mA/point (24 V DC)	4.1 mA/point (12 V DC)	4.0 mA/point (5 V DC)
Input impedance		5.9 kΩ	2.9 kΩ	1.3 kΩ
Operating voltage/current	ON	16.0 V DC min. 3.2 mA min.	8.0 V DC min. 2.6 mA min.	3.5 V DC min. 2.0 mA min.
	OFF	5.8 V DC max. 0.9 mA max.	3.4 V DC max. 1.0 mA max.	1.0 V DC max. 0.2 mA max.
Response time	OFF→ON	2.0 ms max. or 17 ms, selectable		
	ON→OFF	3.5 ms max. or 18.5 ms, selectable		
Interrupt		Can be specified for each input point		
Dissipating current		75 mA (5 V DC)		
Input display		LED (lit when input is turned on)		
External connection		One 40-pin connector		
Weight		120 g		
Maximum ratio of inputs turned on simultaneously		100%		

Front View



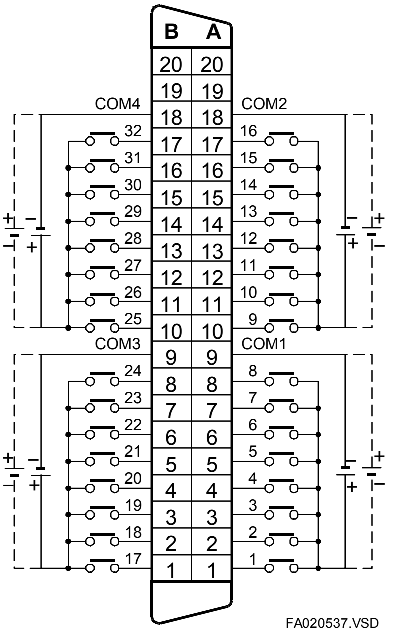
FA020535.VSD

Internal Circuit Configuration



FA020536.VSD

External Connection Diagram



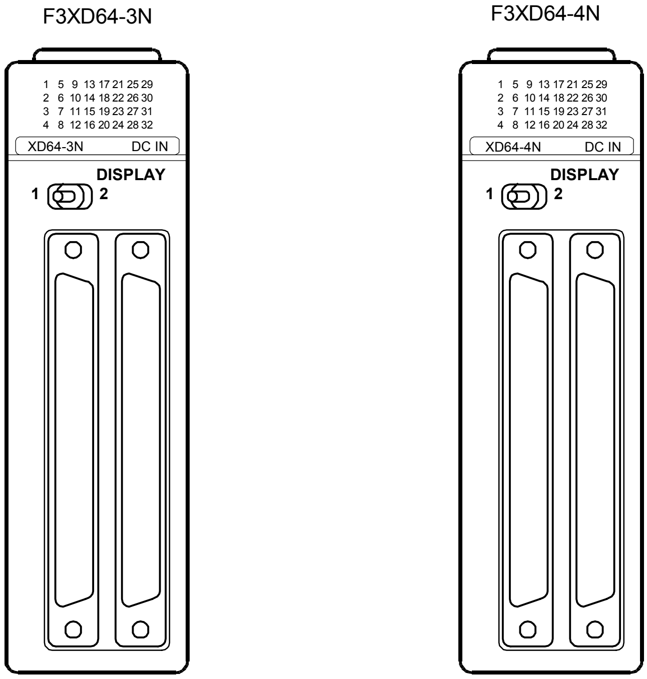
FA020537.VSD

Note: Viewed from the front side of the module.

(13) F3XD64-3N/F3XD64-4N DC Input Modules

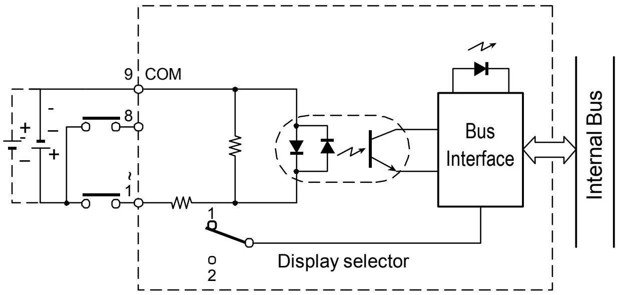
Item		Specifications	
		F3XD64-3N	F3XD64-4N
Input type		DC voltage	
Number of points		64	
Common line type		8 points/common line	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated input voltage		24 V DC	12 V DC
Operating voltage range		20.4 to 26.4 V DC	10.2 to 13.2 V DC
Rated input current		4.1 mA/point (24 V DC)	4.1 mA/point (12 V DC)
Input impedance		5.9 kΩ	2.9 kΩ
Operating voltage/current	ON	16.0 V DC min. 3.2 mA min.	8.0 V DC min. 2.6 mA min.
	OFF	5.8 V DC max. 0.9 mA max.	3.4 V DC max. 1.0 mA max.
Response time	OFF→ON	1.0 ms max.	
	ON→OFF	2.5 ms max.	
Interrupt		None	
Dissipating current		100 mA (5 V DC)	
Input display		LED (lit when input is turned on) 32 points are displayed at a time as selected by a selector switch.	
External connection		Two 40-pin connectors	
Weight		160 g	
Maximum ratio of inputs turned on simultaneously		60%	

● Front View



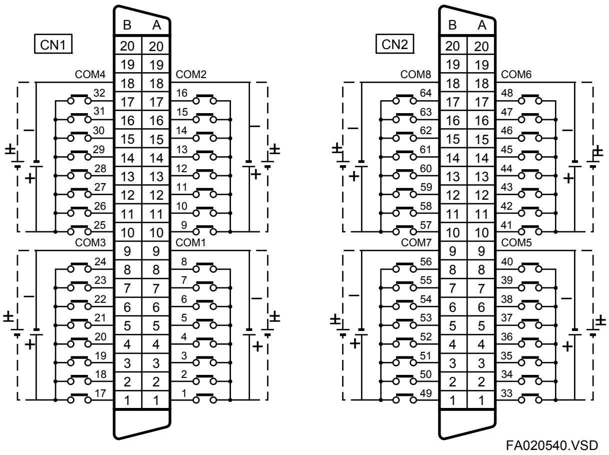
FA020538.VSD

● Internal Circuit Configuration



FA020539.VSD

● External Connection Diagram



FA020540.VSD

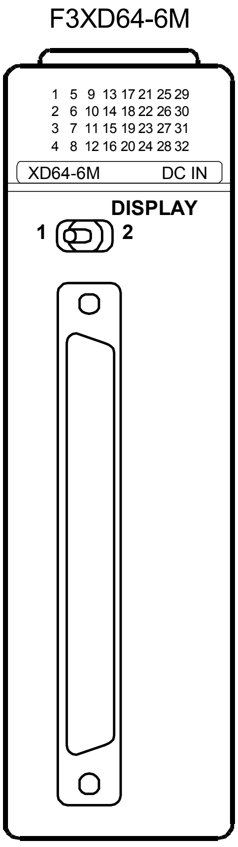
Note: Viewed from the front side of the module.

(14) F3XD64-6M DC Input Module

Item		Specifications
Input type		DC voltage
Number of points		64
Common line type		8 × 8 matrix scan
Isolation method		Photocoupler isolation
Withstanding voltage		1500 V AC for one minute between the group of connectors for external connection and the internal circuit
Rated input voltage		12-24 V DC
Operating voltage range		10.2 to 26.4 V DC
Rated input current		3.9 mA (12 V DC) 8.2 mA (24 V DC)
Input impedance		2.9 kΩ
Operating Voltage/ current	ON	8.0 V DC min. 2.6 mA min.
	OFF	3.4 V DC max. 1.0 mA max.

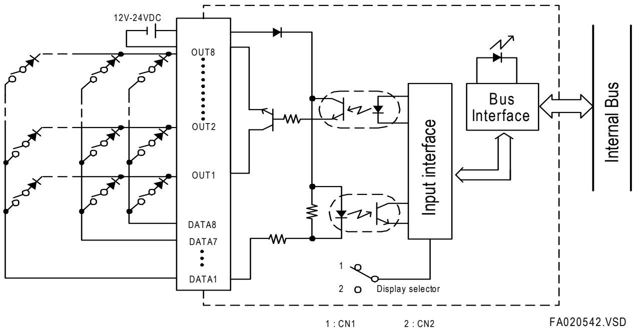
Item		Specifications
Response time	OFF→ON	16 ms max.
	ON→OFF	16 ms max.
Interrupt		None
Dissipating current		110 mA (5 V DC)
Input display		LED (Lit when inputs are turned on) Status is displayed for 32 points selected by a switch.
External power supply		12-24 V DC 70 mA
External connection		One 40-pin connector
Weight		130 g

● Front View



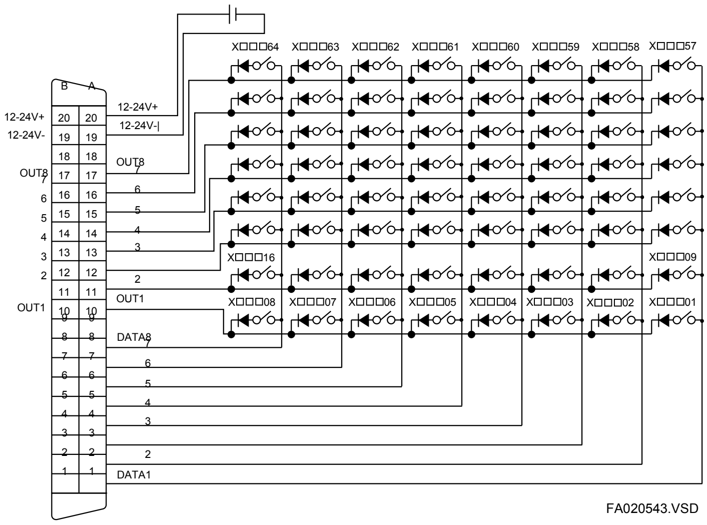
FA020541.VSD

● Internal Circuit Configuration



FA020542.VSD

● External Connection Diagram



FA020543.VSD

Note: Viewed from the front side of the module.

(15) F3YD04-7N Transistor Output Module

Item		Specifications
Output type		Transistor contact
Number of points		4
Common line type		All points independent
Isolation method		Photocoupler isolation
Withstanding voltage		1500 V AC for one minute between the group of connectors for external connection and the internal circuit
Rated load Voltage (Operating load voltage range)	DC	24 V DC (20.4 to 26.4 V DC)
	AC	—
Maximum load current		2A/point
Response time	OFF→ON	5 ms max.
	ON→OFF	3 ms max.
ON voltage		0.5 V DC max.
Off-time leak current		0.1 mA max.

Item		Specifications
Service life	Mechanical	—
	Electrical	—
Surge protector[*1]		Zener diode
Fuse[*2]		3.15A time-lag fuse (Built into each type-N terminal and cannot be replaced.)
Dissipating current		85 mA (5 V DC)
Output display[*3]		LED (Lit when output is on)
Output status when the program stops HOLD/RESET[*4]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis.
		When a BASIC CPU module is used: No setting function The status is always HOLD
External power supply		Not required.
External connection		10-point terminal block with M3.5 screws
Weight		140 g

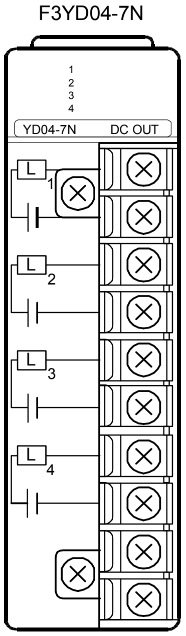
*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

*2: Fuses in the output module are for the purpose of preventing abnormal heat generation or burnout of external wiring due to continuous flow of excess short-circuit current resulting from a short-circuited load.
They are not intended for protecting output elements in the module against possible damage.
The fuses may fail to blow in failure modes other than short-circuited loads.

*3: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

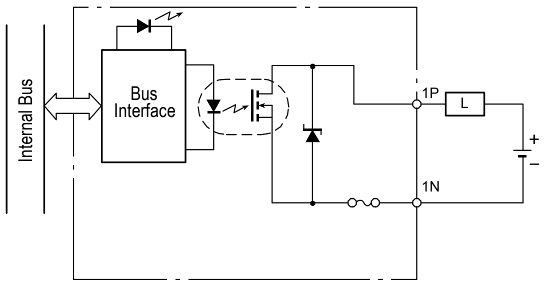
*4: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

● Front View



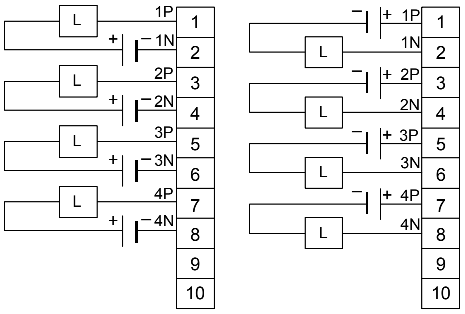
FA020544.VSD

● Internal Circuit Configuration



FA020545.VSD

● External Connection Diagram



FA020546.VSD

(16) F3YA08-2N Triac Output Module

Item		Specifications	Item		Specifications
Output type		Triac contact	Service life	Mechanical	—
Number of points		8		Electrical	—
Common line type		8 points/common	Surge protector[*1]		CR absorber, varistor
Isolation method		Photocoupler isolation	Fuse[*2]		4 A time-lag fuse (Built into the COM terminal and cannot be replaced.)
Withstanding voltage		1500 V AC for one minute between the group of connectors for external connection and the internal circuit	Dissipating current		130 mA (5 V DC)
Rated load voltage range (maximum load voltage)	DC	—	Output display[*3]		LED (Lit when output is on)
	AC	100-240V (264V)			
Maximum load current		1A/point (0 to 40°C) 0.7A/point (40 to 55°C) 3A/common line	Output status when the program stops HOLD/RESET[*4]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis.
Minimum load voltage/current		24V AC,10 mA/point			When a BASIC CPU module is used: No setting function The status is always HOLD
Response time	OFF→ON	1 ms max.			
	ON→OFF	1/2cycle + 1 ms max.	External power supply		Not required
ON voltage		1.5V AC max.	External connection		10-points terminal block with M3.5 screws
Off-time leak current		3 mA max.	Weight		150 g

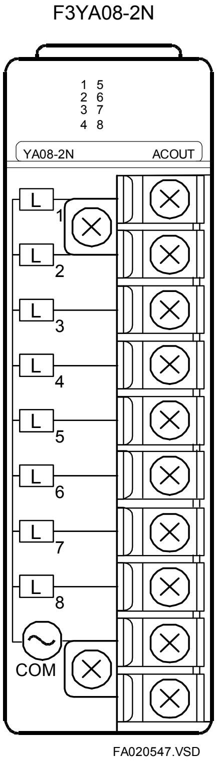
*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

*2: Fuses in the output module are for the purpose of preventing abnormal heat generation or burnout of external wiring due to continuous flow of excess short-circuit current resulting from a short-circuited load.
They are not intended for protecting output elements in the module against possible damage.
The fuses may fail to blow in failure modes other than short-circuited loads.

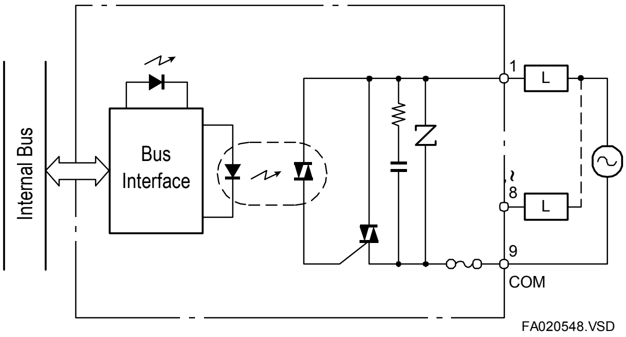
*3: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*4: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

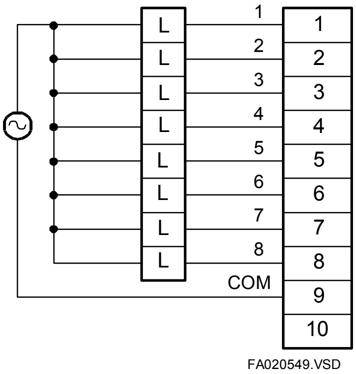
● Front View



● Internal Circuit Configuration



● External Connection Diagram



Note: Viewed from the front side of the module

(17) F3YC08-0C/F3YC08-0N Relay Output Module

Item		**Specifications**	
		F3YC08-0C	**F3YC08-0N**
Output type		Relay contact	
Number of points		8	
Common line type		All points independent	8 points/common
Isolation method		Mechanical insulation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated load voltage range（maximum load voltage）	DC	5-24V （125V）	
	AC	100-240 V （264 V）	
Maximum load current		2 A/point （resistive load）	2A/point, 8A/common line（resistive load）
Maximum switching capacity		530 VA/point, or 60 W/point (for resistive load)	
Minimum load voltage/current		5 V DC, 10 mA	
Response time	OFF→ON	10 ms max.	
	ON→OFF	10 ms max.	
ON voltage		———	
Off-time leak current		———	
Service life	Mechanical	20 million operations or more	
	Electrical	100,000 operations or more（rated load）	
Surge protector[1]		None	
Fuse		None	
Dissipating current		205 mA （5 V DC）	
Output display[2]		LED（Lit when output is on）	
Output status when the program stops HOLD/RESET[3]		When a sequence CPU module is used: Default: RESET; can be set globally on a module-by-module basis.	
		When a BASIC CPU module is used: No setting function; the status is always HOLD.	
External power supply		Not required	
External connection		18-point terminal block with M3.5 screws	10-point terminal block with M3.5 screws
Weight		180 g	160 g

[1] If an inductive load, such as a relay, is to be connected, a surge protector is required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

[2] The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

[3] For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

DANGER

Don’t connect DC load and AC load to single module together.

Don’t connect loads from different AC sources to single module together.

In case of using these loads at once, connect to different relay output modules separately.

CAUTION

The relays in the relay output modules are not of hermetically sealed type.

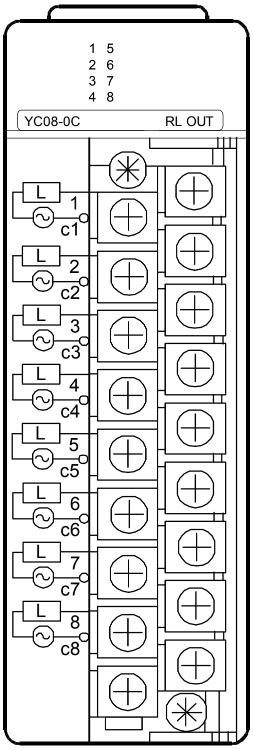
Dust or corrosive gases in the installation environment adversely affect the service life of the relays.

Relays that are switched on and off in an atmosphere containing silicone gases from silicone-based materials may suffer from poor electrical contact due to SiO_2 (silicon dioxide) formed and deposited on the surfaces of their contacts.

Risks of bad contact due to silicon gases are especially high under load conditions below 24 VDC and 500 mA. In such environments, we recommend the use of transistor output modules or other modules employing semiconductor elements instead.

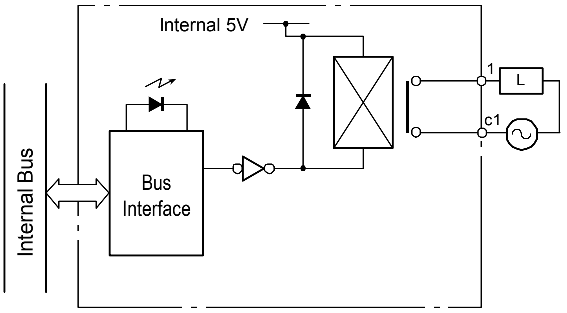
● Front View

F3YC08-0C



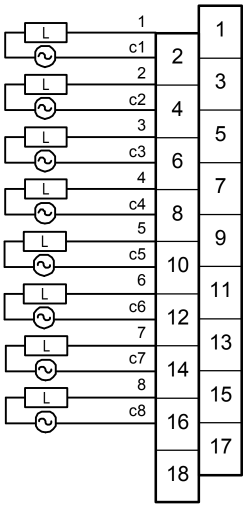
FA020550.VSD

● Internal Circuit Configuration



FA020551.VSD

● External Connection Diagram

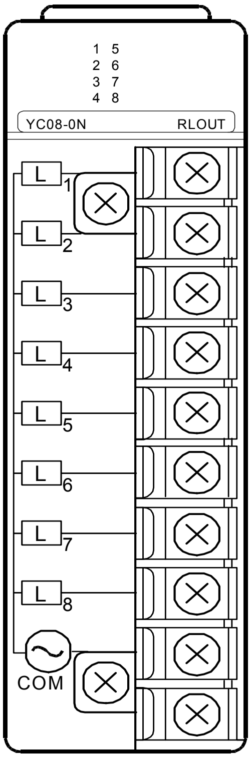


FA020552.VSD

Note: Viewed from the front side of the module.

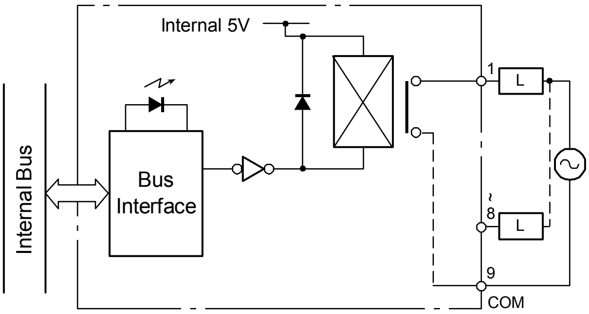
● Front View

F3YC08-0N



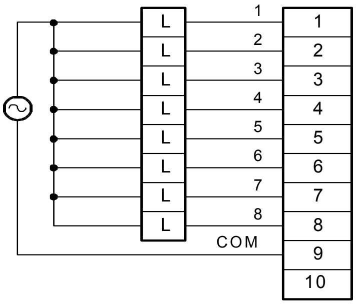
FA020553.VSD

● Internal Circuit Configuration



FA020554.VSD

● External Connection Diagram



FA020555.VSD

Note: Viewed from the front side of the module.

(18) F3YD08-6A/F3YD08-6B Transistor Output Modules

Item		**Specifications**	
		F3YD08-6A	**F3YD08-6B**
Output type		Transistor contact (sink type)	Transistor contact (source type)
Number of points		8	
Common line type		8 points/common	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated load voltage (Operating load voltage range)	DC	12-24 V DC (10.2 to 26.4 V DC)	
	AC	———	
Maximum load current		1 A/point, 4 A/common line	
Response time	OFF→ON	1 ms max.	
	ON→OFF	1 ms max.	
ON voltage		0.5 V DC max.	
Off-time leak current		0.1 mA max.	
Service life	Mechanical	———	
	Electrical	———	
Surge protector[*1]		Active clamp circuit	
Fuse[*2]		6.3 A time-lag fuse (Built into the COM terminal and cannot be replaced.)	
Dissipating current		60 mA (5 V DC)	
Output display[*3]		LED (Lit when output is on)	
Output status when the program stops HOLD/RESET[*4]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis.	
		When a BASIC CPU module is used: No setting function The status is always HOLD	
External power supply		12-24 V DC, 10 mA	
External connection		10-point terminal block with M3.5 screws	
Weight		130 g	

*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

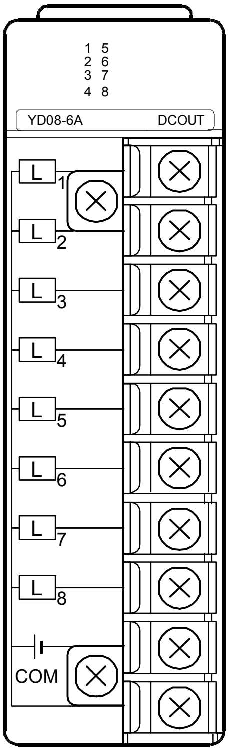
*2: Fuses in the output module are for the purpose of preventing abnormal heat generation or burnout of external wiring due to continuous flow of excess short-circuit current resulting from a short-circuited load.
They are not intended for protecting output elements in the module against possible damage.
The fuses may fail to blow in failure modes other than short-circuited loads.

*3: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*4: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

● Front View

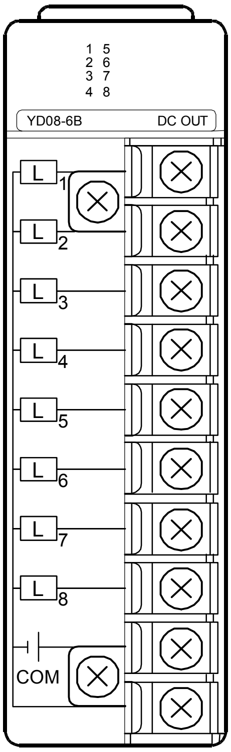
F3YD08-6A



FA020556.VSD

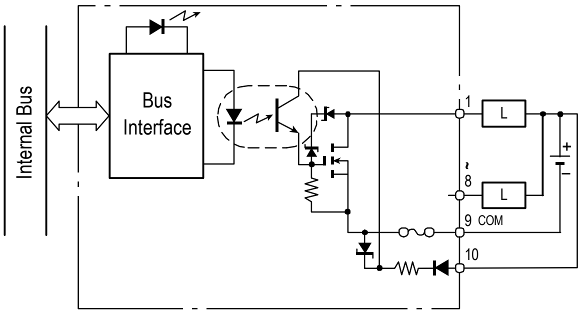
● Front View

F3YD08-6B



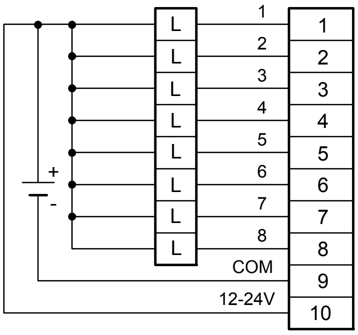
FA020559.VSD

● Internal Circuit Configuration



FA020557.VSD

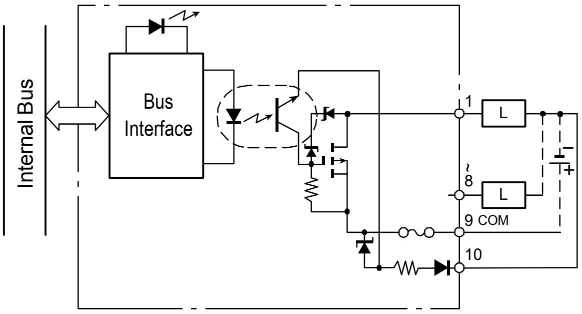
● External Connection Diagram



FA020558.VSD

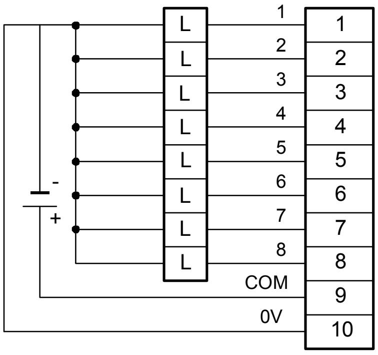
Note: Viewed from the front side of the module.

● Internal Circuit Configuration



FA020560.VSD

● External Connection Diagram



FA020561.VSD

Note: Viewed from the front side of the module.

(19) F3YD08-7A Transistor Output Module

Item		Specifications
		F3YD08-7A
Output type		Transistor contact (sink type)
Number of points		8
Common line type		8 points/common
Isolation method		Photocoupler isolation
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit
Rated load voltage (Operating load voltage range)	DC	12-24 V DC (10.2 to 26.4 V DC)
	AC	———
Maximum load current		2 A/point, 8 A/common line
Response time	OFF→ON	1 ms max.
	ON→OFF	1 ms max.
ON voltage		0.5 V DC max.
Off-time leak current		0.1 mA max.
Service life	Mechanical	———
	Electrical	———
Surge protector[*1]		Active clamp circuit
Fuse[*2]		None
Dissipating current		80 mA (5 V DC)
Output display[*3]		LED (Lit when output is on)
Output status when the program stops HOLD/RESET[*4]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis.
		When a BASIC CPU module is used: No setting function The status is always HOLD
External power supply		12-24 V DC, 10 mA
External connection		10-point terminal block with M3.5 screws
Weight		130 g

*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

*2 : The module does not contain any fuse but incorporates a short-circuit protector function. Note that the function protects against short-circuit only when the polarity of the external power supply is correct.

*3: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

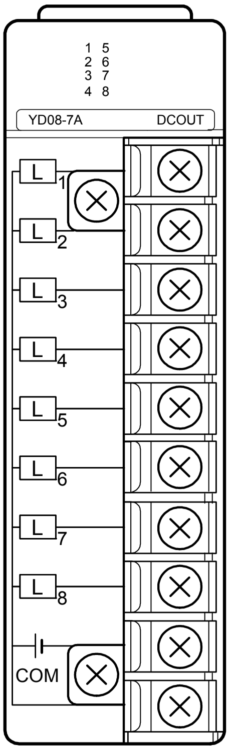
*4: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

WARNING

Make sure that the polarity of the external power supply is correct.
If incorrect polarity and shorted load occur at the same time, the output element will be damaged and smoking or scattering chips may occur.

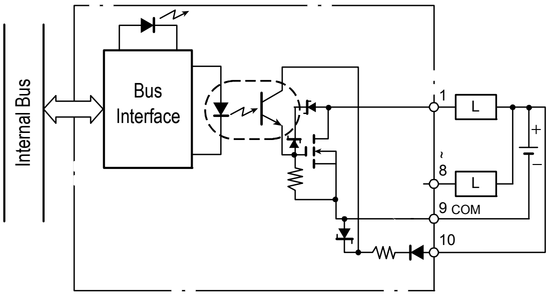
● Front View

F3YD08-7A



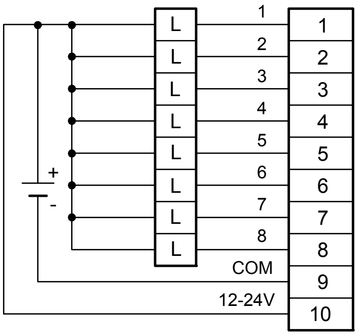
FA0205561.VSD

● Internal Circuit Configuration



FA0205571.VSD

● External Connection Diagram



FA020558.VSD

Note: Viewed from the front side of the module.

(20) F3YD14-5A/F3YD14-5B Transistor Output Modules

Item		Specifications	
		F3YD14-5A	F3YD14-5B
Output type		Transistor contact (sink type)	Transistor contact (source type)
Number of points		14	
Common line type		8 points/common, 6 points/common	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated load voltage (Operating load voltage range)	DC	12-24 V DC (10.2 to 26.4 V DC)	
	AC	———	
Maximum load current		0.5A/point, 2A/common line	
Response time	OFF→ON	1 ms max.	
	ON→OFF	1 ms max.	
ON voltage		0.5 V DC max.	
Off-time leak current		0.1 mA max.	
Service life	Mechanical	———	
	Electrical	———	
Surge protector[*1]		Active clamp circuit	
Fuse[*2]		5 A time-lag fuse (Built into the COM terminal and cannot be replaced.)	
Dissipating current		120 mA (5 V DC)	
Output display[*3]		LED (Lit when output is on)	
Output status when the program stops HOLD/RESET[*4]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis.	
		When a BASIC CPU module is used: No setting function The status is always HOLD	
External power supply		12-24 V DC, 20 mA	
External connection		18-point terminal block with M3.5 screws	
Weight		160 g	

*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

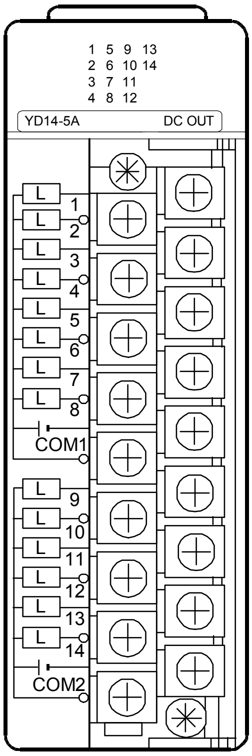
*2: Fuses in the output module are for the purpose of preventing abnormal heat generation or burnout of external wiring due to continuous flow of excess short-circuit current resulting from a short-circuited load.
They are not intended for protecting output elements in the module against possible damage.
The fuses may fail to blow in failure modes other than short-circuited loads.

*3: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*4: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

Front View

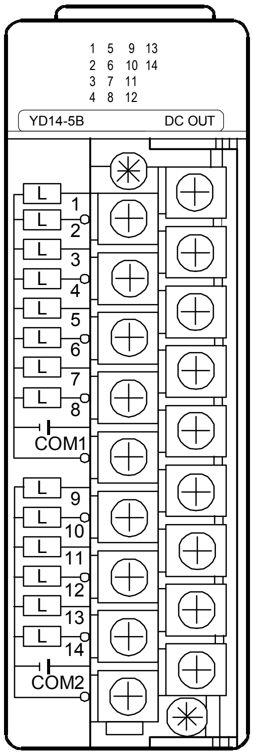
F3YD14-5A



FA020562.VSD

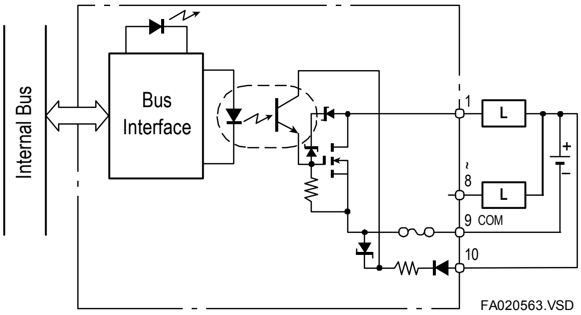
Front View

F3YD14-5B



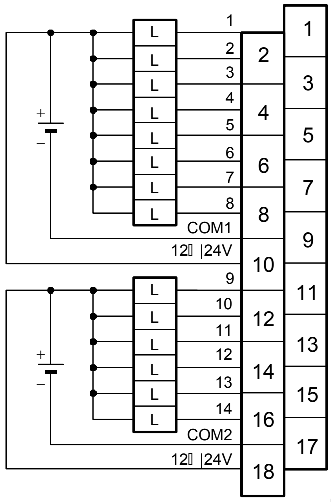
FA020565.VSD

Internal Circuit Configuration



FA020563.VSD

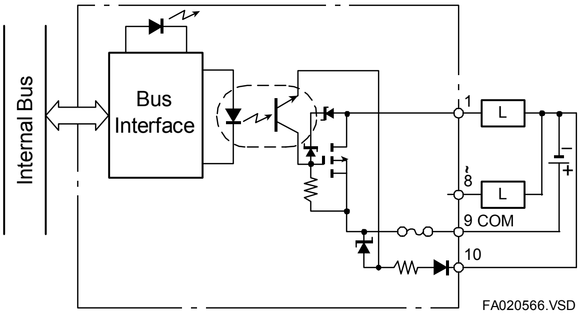
External Connection Diagram



FA020564.VSD

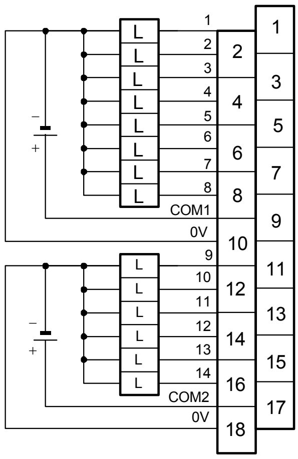
Note: Viewed from the front side of the module.

Internal Circuit Configuration



FA020566.VSD

External Connection Diagram



FA020567.VSD

Note: Viewed from the front side of the module.

(21) F3YC16-0N Relay Output Module

Item		Specifications
Output type		Relay contact
Number of points		16
Common line type		8 points/common
Isolation method		Mechanical insulation
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit
Rated load voltage range (maximum load voltage)	DC	5-24 V (125 V)
	AC	100-240 V (264 V)
Maximum load current		2 A/point, 8 A/common line (resistive load)
Maximum switching capacity		530 VA/point, or 60 W/point (for resistive load)
Minimum load voltage/current		5 V DC, 10 mA
Response time	OFF→ON	10 ms max.
	ON→OFF	10 ms max.
ON voltage		—
Off-time leak current		—

Item		Specifications
Service life	Mechanical	20 million operations or more
	Electrical	100,000 operations or more (rated load)
Surge protector[*1]		None
Fuse		None
Dissipating current		380 mA (5 V DC)
Output display[*2]		LED (Lit when output is on)
Output status when the program stops HOLD/RESET[*3]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis.
		When a BASIC CPU module is used: No setting function The status is always HOLD
External power supply		Not required
External connection		18-point terminal block with M3.5 screws
Weight		220 g

*1: If an inductive load, such as a relay, is to be connected, a surge protector is required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

*2: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*3: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

DANGER

Don’t connect DC load and AC load to single module together.

Don’t connect loads from different AC sources to single module together.

In case of using these loads at once, connect to different relay output modules separately.

CAUTION

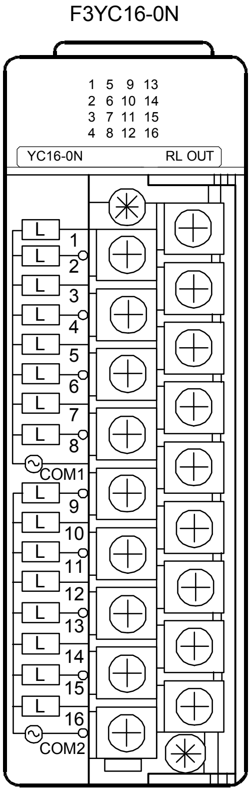
The relays in the relay output modules are not of hermetically sealed type.

Dust or corrosive gases in the installation environment adversely affect the service life of the relays.

Relays that are switched on and off in an atmosphere containing silicone gases from silicone-based materials may suffer from poor electrical contact due to SiO_2 (silicon dioxide) formed and deposited on the surfaces of their contacts.

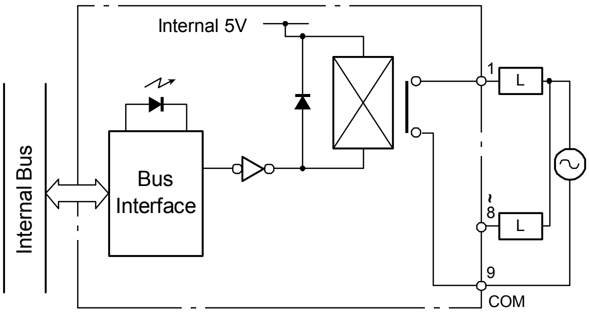
Risks of bad contact due to silicon gases are especially high under load conditions below 24 VDC and 500 mA. In such environments, we recommend the use of transistor output modules or other modules employing semiconductor elements instead.

● Front View



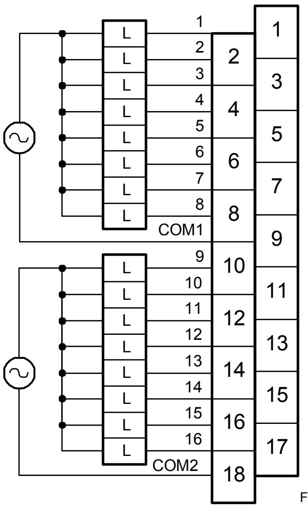
FA020568.VSD

● Internal Circuit Configuration



FA020569.VSD

● External Connection Diagram



FA020570.VSD

Note: Viewed from the front side of the module.

(22) F3YD32-1A/F3YD32-1B Transistor Output Modules

Item		Specifications	
		F3YD32-1A	F3YD32-1B
Output type		Transistor contact (sink type)	Transistor contact (source type)
Number of points		32	
Common line type		8 points/common	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated load voltage range (Operating load voltage range)	DC	12-24 V DC (10.2 to 26.4 V DC)	
	AC	———	
Maximum load current		0.1A/point, 0.5A/common line	
Response time	OFF→ON	1 ms max.	
	ON→OFF	1 ms max.	
ON voltage		0.5 V DC max.	
Off-time leak current		0.1 mA max.	
Service life	Mechanical	———	
	Electrical	———	
Surge protector[*1]		Zener diode	
Fuse		None	
Dissipating current		210 mA (5 V DC)	
Output display[*2]		LED (Lit when output is on)	
Output status when the program stops HOLD/RESET[*3]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis.[*4]	
		When a BASIC CPU module is used: No setting function The status is always HOLD	
External power supply		12-24 V DC, 115 mA	
External connection		One 40-pin connector	
Weight		100 g	

*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

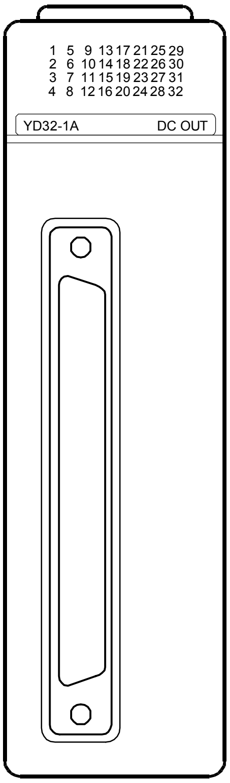
*2: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*3: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

*4: When F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module is used, this setting can be specified in 16-point units.

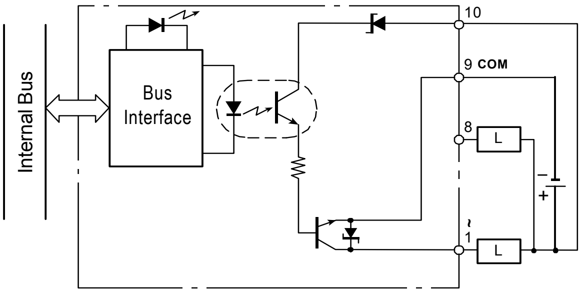
● Front View

F3YD32-1A



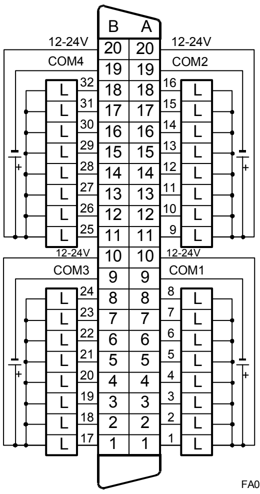
FA020571.VSD

● Internal Circuit Configuration



FA020572.VSD

● External Connection Diagram

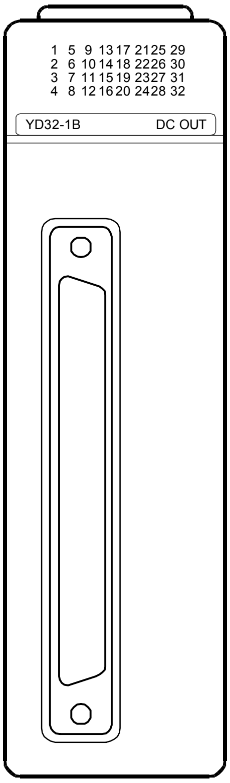


FA020573.VSD

Note: Viewed from the front side of the module.

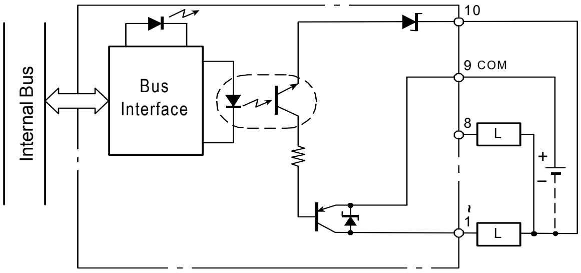
● Front View

F3YD32-1B



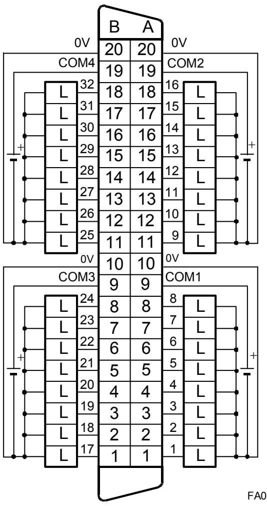
FA020574.VSD

● Internal Circuit Configuration



FA020575.VSD

● External Connection Diagram



FA020576.VSD

Note: Viewed from the front side of the module.

(23) F3YD32-1H Transistor Output Module (for high speed output)

Item		Specifications
Output type		Transistor contact (sink type)
Number of points		32
Common line type		8 points/common
Isolation method		Photocoupler isolation
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit
Rated load voltage (operating load voltage range)	DC	12-24 V DC (10.2-26.4 V DC)
	AC	—
Maximum load current		0.1 A/point, 0.5 A/common line
Response time	OFF→ON	0.1 ms max.
	ON→OFF	0.1 ms max.
ON voltage		0.5 V DC max.
Off-time leak current		0.1 mA max.

Item		Specifications
Service life	Mechanical	—
	Electrical	—
Protection circuitry	Short-circuit	Controlled short-circuit current
	Overheat	Output shutdown
Surge protector *1		Active clamp circuit
Fuse		None
Dissipating current		165 mA (5 V DC)
Output display *2		LED (Lit when output is on)
Output status when the program stops HOLD/RESET *3		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis *4
		When a BASIC CPU module is used: No setting function The status is always HOLD
External power supply		12-24 V DC, 30 mA
External connection		One 40-pin connector
Weight		110 g

*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

*2: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*3: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

*4: When F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module is used, this setting can be specified in 16-point units.

WARNING

Ensure that the polarity of the external power supply is correct. Otherwise, a short-circuit condition may damage an output element and cause smoldering and scattering of chips. Beware that wrongly connecting a connector wired for F3XD32 or F3XD64 to the module may disable the protectors and damage internal elements.

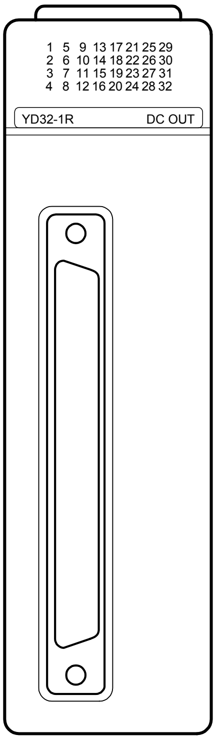
CAUTION

Operation of the protection circuitry:

- If short-circuit occurs, the ON voltage increases and the short-circuit current is limited within the range 1-3 A.
- If the short-circuit condition is removed, normal operation resumes.
- If the short-circuit condition persists, the short-circuit current may cause the temperature of the output element to reach approx. 160°C, triggering the overheat protector to shut down the output.
- If the temperature of the overheated output element then drops by about 10°C, normal operation resumes.
- The overheat protector will not be triggered if the module is operated normally within its specifications with no short-circuit condition.
- Both the short-circuit protector and overheat protector are designed to control outputs individually. Under some short-circuit conditions, however, the overheat protector may shut down not only its associated output but also other outputs.
- Short-circuit and overheat protectors are designed to protect the output element against short-term short-circuit. Never leave the module in prolonged short-circuit condition. Otherwise, the module enclosure may deteriorate or the PCB may be discolored.

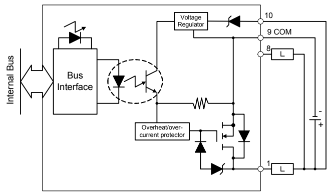
● Front View

F3YD32-1R



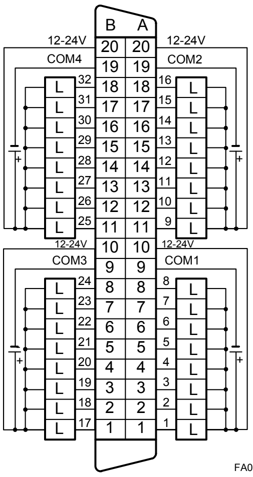
FA020571_3.VSD

● Internal Circuit Configuration



FA020571_2.vsd

● External Connection Diagram



FA020573.VSD

Note: Viewed from the front side of the module.

(24) F3YD32-1P/F3YD64-1P Transistor Output Modules (with short-circuit protector)

Item		F3YD32-1P	F3YD64-1P
Output type		Transistor contact (sink type)	
Number of points		32	64
Common line type		8 points/common	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated load voltage (operating load voltage range)		12-24 V DC (10.2-26.4 V DC)	
Maximum load current		0.1 A/point, 0.5 A/common line	0.1 A/point, 0.4 A/common line
Response time	OFF→ON	1 ms max.	
	ON→OFF	1 ms max.	
ON voltage		0.5 V DC max.	
Off-time leak current		0.1 mA max.	
Service life	Mechanical	—	
	Electrical	—	

Item		F3YD32-1P	F3YD64-1P
Protection circuitry	Short-circuit	Controlled short-circuit current	
	Overheat	Output shutdown	
Surge protector[*1]		Active clamp circuit	
Fuse		None	
Dissipating current		160 mA (5 V DC)	275 mA (5 V DC)
Output display[*2]		LED (Lit when output is on)	LED (Lit when output is on for 32 outputs selectable by a switch)
Output status when the program stops HOLD/RESET[*3]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis[*4]	
		When a BASIC CPU module is used: No setting function The status is always HOLD	
External power supply		12-24 V DC, 55 mA	12-24 V DC, 95 mA
External connection		One 40-pin connector	Two 40-pin connectors
Weight		110 g	130 g

*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

*2: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*3: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

*4: When F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module is used, this setting can be specified in 16-point units.

WARNING

Ensure that the polarity of the external power supply is correct. Otherwise, a short-circuit condition may damage an output element and cause smoldering and scattering of chips. Beware that wrongly connecting a connector wired for F3XD32 or F3XD64 to the module may disable the protectors and damage internal elements.

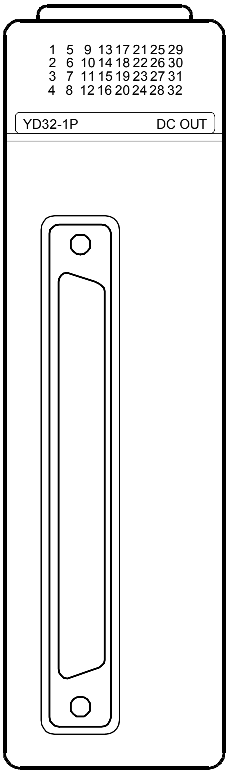
CAUTION

Operation of the protection circuitry:

- If short-circuit occurs, the ON voltage increases and the short-circuit current is limited within the range 1-3 A.
- If the short-circuit condition is removed, normal operation resumes.
- If the short-circuit condition persists, the short-circuit current may cause the temperature of the output element to reach approx. 160°C, triggering the overheat protector to shut down the output.
- If the temperature of the overheated output element then drops by about 10°C, normal operation resumes.
- The overheat protector will not be triggered if the module is operated normally within its specifications with no short-circuit condition.
- Both the short-circuit protector and overheat protector are designed to control outputs individually. Under some short-circuit conditions, however, the overheat protector may shut down not only its associated output but also other outputs.
- Short-circuit and overheat protectors are designed to protect the output element against short-term short-circuit. Never leave the module in prolonged short-circuit condition. Otherwise, the module enclosure may deteriorate or the PCB may be discolored.

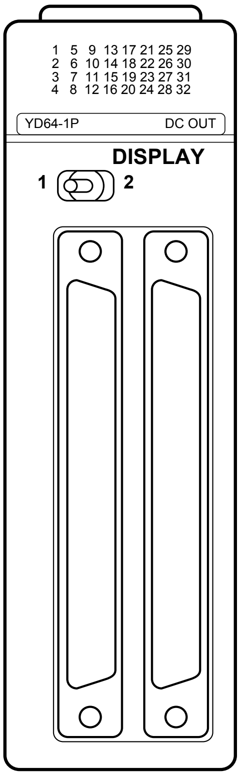
Front View

F3YD32-1P



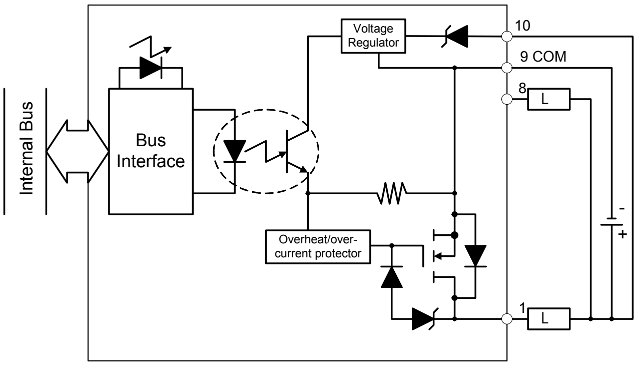
FA020571_1.VSD

F3YD64-1P



FA020580_1.VSD

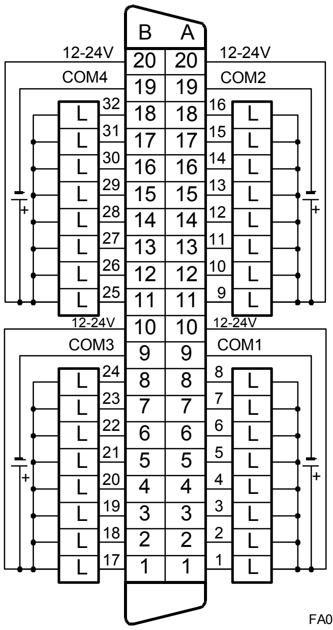
Internal Circuit Configuration



FA020571_2.vsd

External Connection Diagram

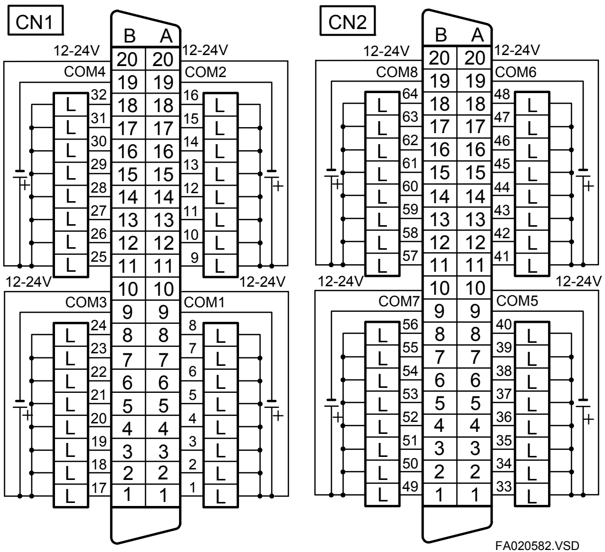
F3YD32-1P



FA020573.VSD

Note: Viewed from the front side of the module.

F3YD64-1P



FA020582.VSD

Note: Viewed from the front side of the module.

(25) F3YD32-1R/F3YD64-1R Transistor Output Modules (with short-circuit protector)

Item		F3YD32-1R	F3YD64-1R
Output type		Transistor contact (source type)	
Number of points		32	64
Common line type		8 points/common	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated load voltage (operating load voltage range)		12-24 V DC (10.2-26.4 V DC)	
Maximum load current		0.1 A/point, 0.5 A/common line	0.1 A/point, 0.4 A/common line
Response time	OFF→ON	1 ms max.	
	ON→OFF	1 ms max.	
ON voltage		0.5 V DC max.	
Off-time leak current		0.1 mA max.	
Service life	Mechanical	—	
	Electrical	—	
Protection circuitry	Short-circuit	Controlled short-circuit current	
	Overheat	Output shutdown	
Surge protector[*1]		None	
Fuse		None	
Dissipating current		170 mA (5 V DC)	275 mA (5 V DC)
Output display[*2]		LED (Lit when output is on)	LED (Lit when output is on for 32 outputs selectable by a switch)
Output status when the program stops HOLD/RESET[*3]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis[*4]	
		When a BASIC CPU module is used: No setting function The status is always HOLD	
External power supply		12-24 V DC, 60 mA	12-24 V DC, 110 mA
External connection		One 40-pin connector	
Weight		110 g	130 g

*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

*2: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*3: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

*4: When F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module is used, this setting can be specified in 16-point units.

WARNING

Ensure that the polarity of the external power supply is correct. Otherwise, a short-circuit condition may damage an output element and cause smoldering and scattering of chips. Beware that wrongly connecting a connector wired for F3XD32 or F3XD64 to the module may disable the protectors and damage internal elements.

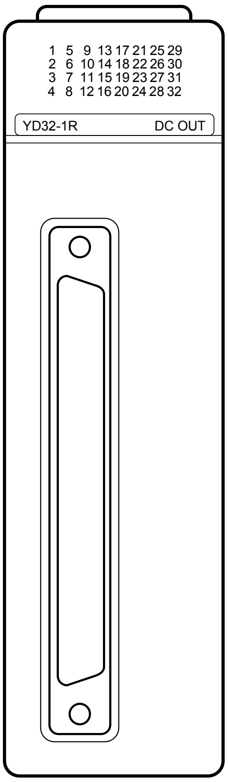
CAUTION

Operation of the protection circuitry:

- If short-circuit occurs, the ON voltage increases and the short-circuit current is limited within the range 1-3 A.
- If the short-circuit condition is removed, normal operation resumes.
- If the short-circuit condition persists, the short-circuit current may cause the temperature of the output element to reach approx. 160°C, triggering the overheat protector to shut down the output.
- If the temperature of the overheated output element then drops by about 10°C, normal operation resumes.
- The overheat protector will not be triggered if the module is operated normally within its specifications with no short-circuit condition.
- Short-circuit protectors are designed to control outputs individually. On the other hand, the overheat protectors control outputs in pairs: OUT1 and OUT2, OUT3 and OUT4, …, OUT63 and OUT64..Under some short-circuit conditions, however, the overheat protector may shut down not only its associated outputs but also other outputs.
- Short-circuit and overheat protectors are designed to protect the output elements of the module against short-term short-circuit conditions. Never leave the module in prolonged short-circuit condition. Otherwise, the module enclosure may deteriorate or the PCB may be discolored.
- Output loads must be driven by the external power supply only. Never try to use a power supply other than the external power supply to drive the output loads even if its output voltage is the same as that of the external power supply. Otherwise, the output elements may be damaged.

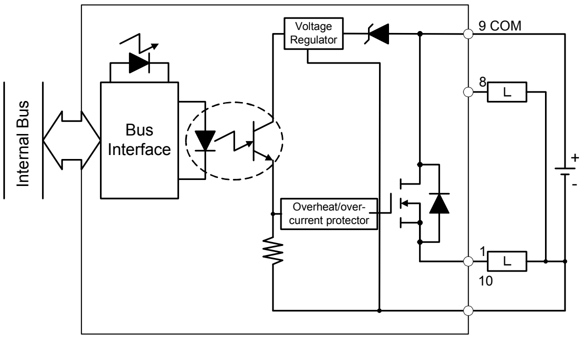
● Front View

F3YD32-1R



FA020571_3.VSD

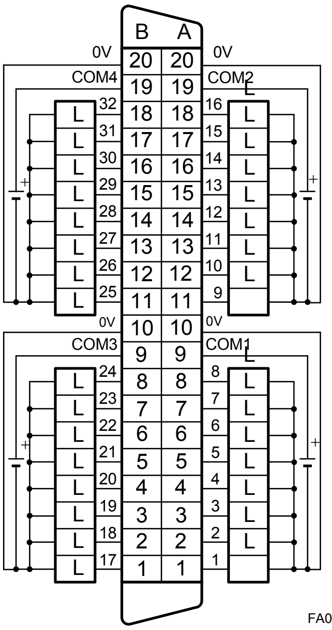
● Internal Circuit Configuration



FA020571_4.vsd

● External Connection Diagram

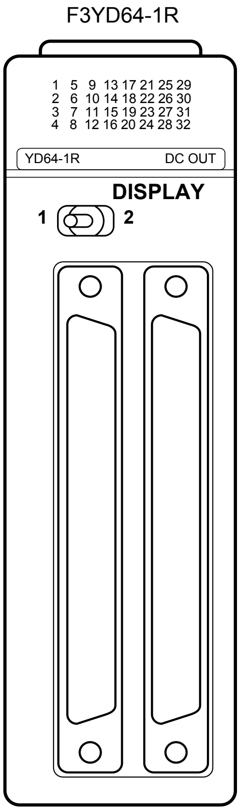
F3YD32-1R



FA020576.VSD

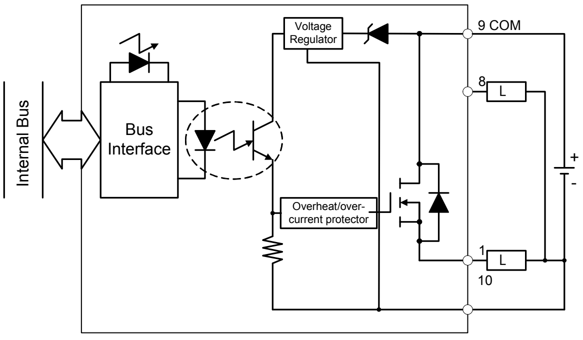
Note: Viewed from the front side of the module.

● Front View



FA020580_3.VSD

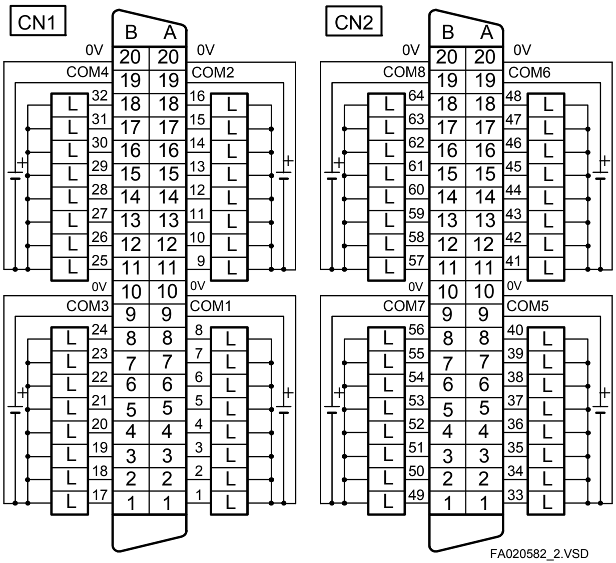
● Internal Circuit Configuration



FA020571_4.vsd

● External Connection Diagram

F3YD64-1R



FA020582_2.VSD

Note: Viewed from the front side of the module.

(26) F3YD32-1T TTL Output Module

Item		Specifications
Output type		Transistor contact (TTL output)
Number of points		32
Common line type		8 points/common
Isolation method		Photocoupler isolation
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit
Rated load voltage	DC	5 V DC
	AC	—
Operating load voltage range		4.5 to 5.5 V DC
Output current	Off time	0.4 mA/point (source)
	On time	16 mA/point (sink)
Maximum load current		16 mA/point 128 mA/common line
Surge protector[*1]		Zener diode

Item		Specifications
Fuse		None
Output voltage	Off time	4.9 V min. (no load) 3.0 V min. (with 0.4 mA load)
	On time	0.4V max. (over entire load range)
Response time	OFF→ON	1 ms max.
	ON→OFF	1 ms max.
Dissipating current		210 mA (5 V DC)
Output display[*2]		LED (Lit when output is on)
Output status when the program stops HOLD/RESET[*3]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis[*4]
		When a BASIC CPU module is used: No setting function The status is always HOLD
External power supply		5 V DC, 60 mA
External connection		One 40-pin connector
Weight		110 g

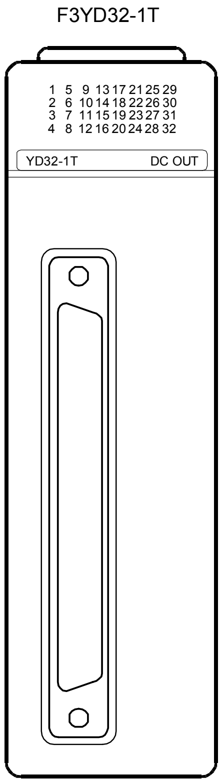
*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

*2: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*3: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

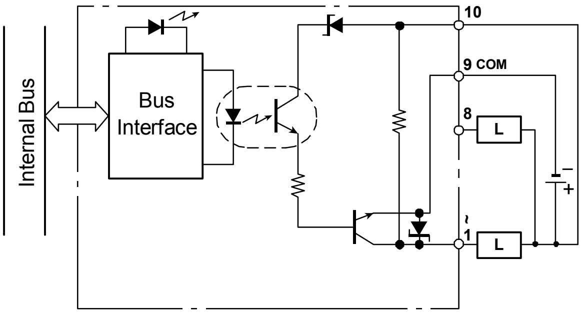
*4: When F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module is used, this setting can be specified in 16-point units.

● Front View



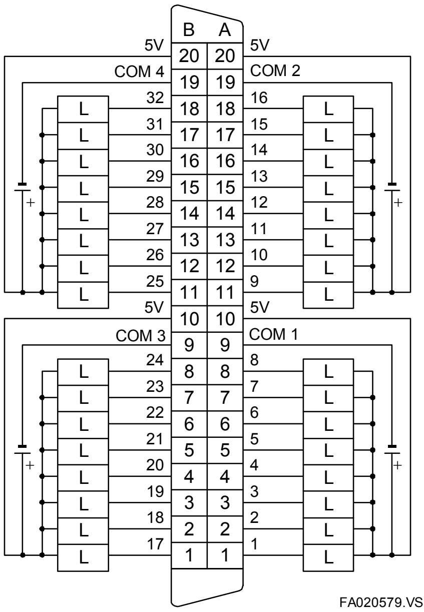
FA020577.VSD

● Internal Circuit Configuration



FA020578.VSD

● External Connection Diagram



FA020579.VSD

Note: Viewed from the front side of the module.

(27) F3YD64-1A Transistor Output Module

Item		Specifications	Item		Specifications
Output type		Transistor contact (sink type)	Service life	Mechanical	—
				Electrical	—
Number of points		64	Surge protector[*1]		Zener diode
Common line type		8 points/common	Fuse		None
Isolation method		Photocoupler isolation	Dissipating current		275 mA (5 V DC)
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	Output display[*2]		LED (Lit when output is on) Status displayed for 32 points selected by a switch
Rated load voltage (Operating load voltage range)	DC	24 V DC (20.4 to 26.4 V DC)	Output status when the program stops HOLD/RESET [*3]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis.[*4]
	AC	—			
Maximum load current		0.1 A/point 0.4 A/common line			When a BASIC CPU module is used: No setting function The status is always HOLD
Response time	OFF→ON	1 ms max.			
	ON→OFF	1 ms max.	External power supply		24 V DC, 150 mA
ON voltage		0.5 V DC max.	External connection		Two 40-pin connectors
Off-time leak current		0.1 mA max.	Weight		160 g

*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

*2: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*3: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

*4: When F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module is used, this setting can be specified in 16-point units.

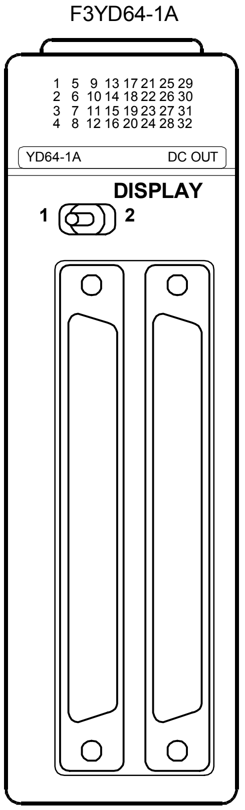
CAUTION

Differences between F3YD64-1F and F3YD64-1A

- For F3YD64-1F, the output status can be configured to HOLD or RESET in the event of a major sequence CPU module failure when the F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 CPU module is used. For other CPU modules, the output is always HOLD in the event of a major sequence CPU module failure.
- For F3YD64-1A, the output status is always HOLD in the event of a major sequence CPU module failure regardless of the CPU module used.

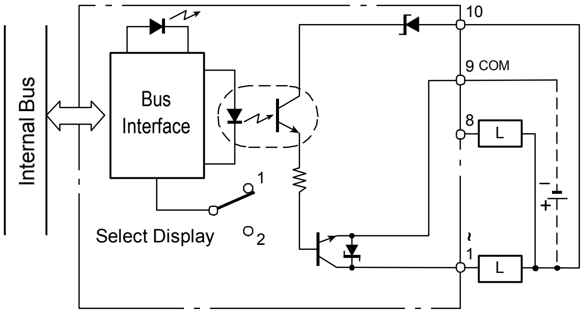
For more information, see Section A4.3.3 "Indicating Problem Severity and Status of Output Module."

● Front View



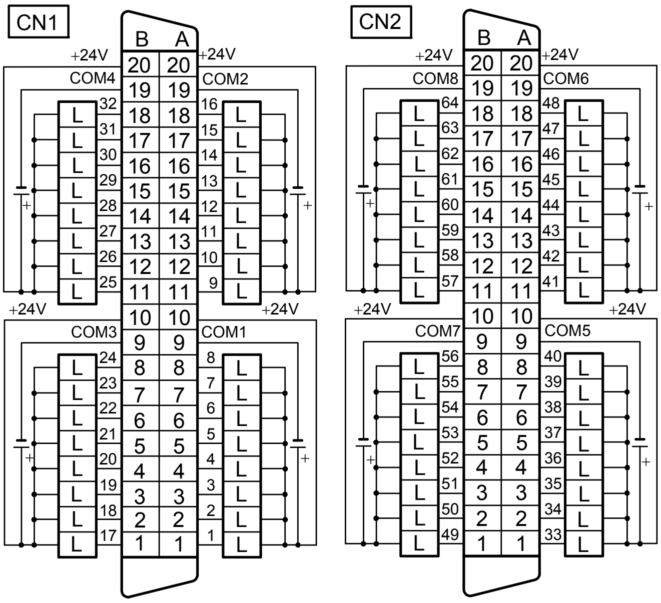
FA020583.VSD

● Internal Circuit Configuration



FA020584.VSD

● External Connection Diagram



FA020585.VSD

Note: Viewed from the front side of the module.

(28) F3YD64-1F Transistor Output Module

Item		Specifications	Item		Specifications
Output type		Transistor contact (sink type)	Service life	Mechanical	—
				Electrical	—
Number of points		64	Surge protector*1		Zener diode
Common line type		8 points/common	Fuse		None
Isolation method		Photocoupler isolation	Dissipating current		275 mA (5 V DC)
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	Output display*2		LED (Lit when output is on) Status displayed for 32 points selected by a switch
Rated load voltage (Operating load voltage range)	DC	24 V DC (20.4 to 26.4 V DC)	Output status when the program stops HOLD/RESET *3		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis.*4
	AC	—			
Maximum load current		0.1 A/point, 0.4 A/common line			When a BASIC CPU module is used: No setting function The status is always HOLD
Response time	OFF→ON	1 ms max.			
	ON→OFF	1 ms max.	External power supply		24 V DC, 150 mA
ON voltage		0.5 V DC max.	External connection		Two 40-pin connectors
Off-time leak current		0.1 mA max.	Weight		160 g

*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

*2: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*3: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

*4: When F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module is used, this setting can be specified in 16-point units.

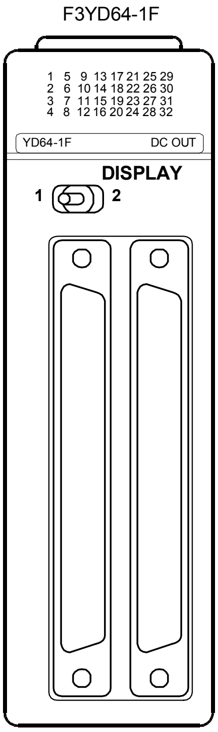
CAUTION

Differences between F3YD64-1F and F3YD64-1A

- For F3YD64-1F, the output status can be configured to HOLD or RESET in the event of a major sequence CPU module failure when the F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 CPU module is used. For other CPU modules, the output is always HOLD in the event of a major sequence CPU module failure.
- For F3YD64-1A, the output status is always HOLD in the event of a major sequence CPU module failure regardless of the CPU module used.

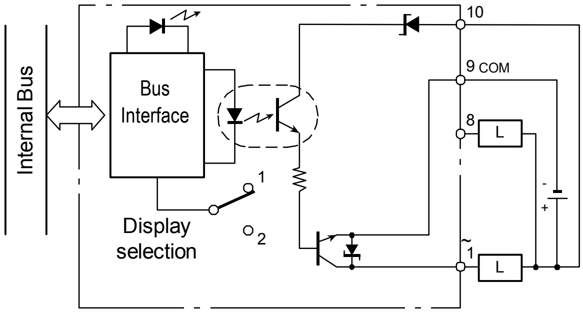
For more information, see Section A4.3.3 "Indicating Problem Severity and Status of Output Module."

Front View



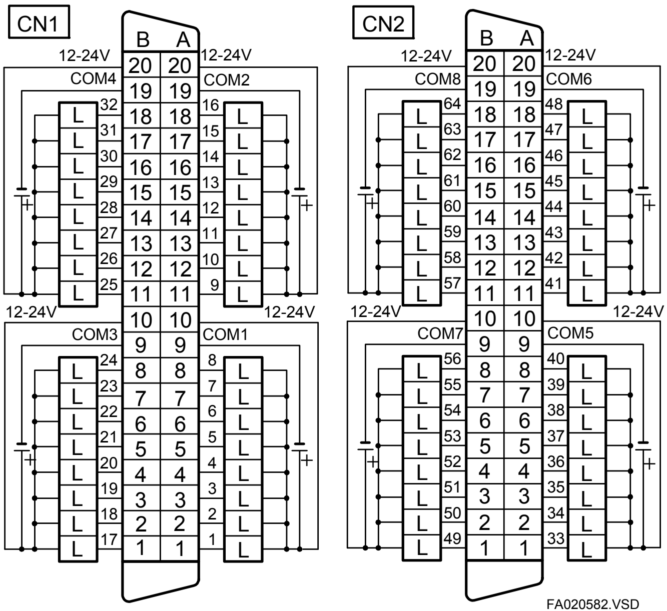
FA020580.VSD

Internal Circuit Configuration



FA020581.VSD

External Connection Diagram



FA020582.VSD

Note: Viewed from the front side of the module.

(29) F3YD64-1M Transistor Output Module

Item		Specifications
Output type		Transistor contact (matrix scan)
Number of points		64
Common line type		8 × 8 matrix
Isolation method		Photocoupler isolation
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit
Rated load voltage (Operating load voltage range)	DC	12-24 V DC (10.2 to 26.4 V DC)
	AC	—
Maximum load current		0.1 A
Response time	OFF→ON	16 ms max.
	ON→OFF	16 ms max.
ON voltage		1.5 V DC max.
Off-time leak current		0.1 mA max.

Item		Specifications
Service life	Mechanical	—
	Electrical	—
Surge protector		Zener diode
Fuse		None
Dissipating current		125 mA (5 V DC)
Output display[*1]		LED (Lit when output is on) Status displayed for 32 points selected by a switch
Output status when the program stops HOLD/RESET[*2]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis.[*3]
		When a BASIC CPU module is used: No setting function The status is always HOLD
External power supply		12-24 V DC, 40 mA
External connection		One 40-pin connector
Weight		110 g

*: The F3YD64-1M module is designed to drive an 8 × 8 matrix of LEDs and cannot be used for loads other than LEDs.

*: No resistor for limiting load current is included in the module. Add current-limiting resistors to the DATA1 to DATA8 lines before connecting the load to the module. Any LED display whose LED components are equipped with a current-limiting resistor cannot be used as the load.

*: Use the output terminals in units of 8-terminal groups classified as Y0001-Y0008, Y0009-Y0016, Y0017-Y0024, Y0025-Y0032, Y0033-Y0040, Y0041-Y0048, Y0049-Y0056 and Y0057-Y0064. If there are any output terminals in the same group to which no load is connected, connect a diode to that terminal. For the diode, select one that has the reverse voltage rating (VR) of at least 30 V and an average rectified current rating (IO) of at least 0.3 A. There is no need to connect diodes to a group where no load is connected at all.

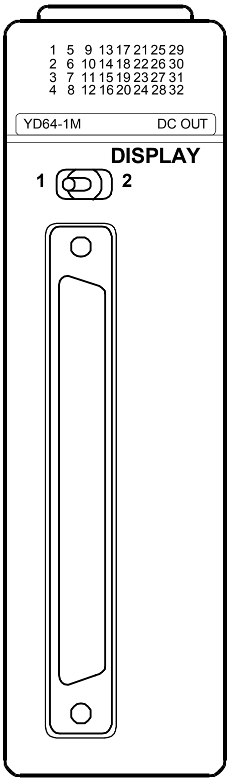
*1: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*2: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

*3: When F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module is used, this setting can be specified in 16-point units.

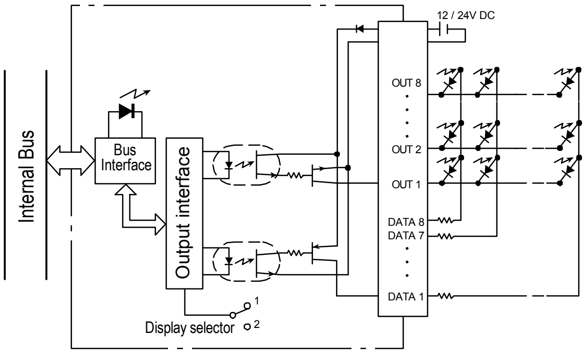
Front View

F3YD64-1M



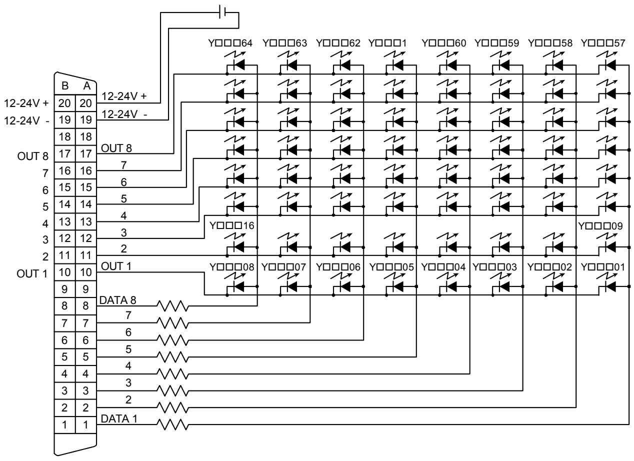
FA020586.VSD

Internal Circuit Configuration



FA020587.VSD

External Connection Diagram



Note: Viewed from the front side of the module.

FA020588.VSD

(30) F3WD64-3P/F3WD64-4P Input/Output Modules (with short-circuit protector)

● Input Block

Item		F3WD64-3P	F3WD64-4P
Input type		DC voltage	
Number of points		32 (terminal Nos. 01 - 32)	
Common line type		8 points/common	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated input voltage （operating voltage range)		24V DC （20.4 to 26.4V DC）	12V DC （10.2 to 13.2V DC）
Rated input current		4.1 mA/point (24 V DC)	4.1 mA/point (12 V DC)
Input impedance		5.9 kΩ	2.9 kΩ
Operating voltage/current	ON	16.0 V DC min. 3.2 mA min.	8.0 V DC min. 2.6 mA min.
	OFF	5.8 V DC max. 0.9 mA max.	3.4 V DC max. 1.0 mA max.
Response time	OFF→ON	Input sampling time can be specified for 4 steps: Always (0 μs), 62.5 μs, 250 μs, and 1 ms.*1	
	ON→OFF	Input sampling time can be specified for 4 steps: Always (0 μs), 62.5 μs, 250 μs, and 1ms.*1	
Interrupt		None	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Input display *2		Lit when input is on (Input or output status indication can be selected using a switch.)	
Dissipating current		170 mA (5V DC) (for input and output)	
External connection		One 40-pin connector	
Weight		120 g (for input and output)	
Maximum ratio of inputs turned on simultaneously		60%	100%

*1: These values are applicable when using the module with CPU module using F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module. If other CPU modules are used, the values for OFF→ON and for ON→OFF are 1.0 ms and 2.5 ms max. respectively. The actual response time is obtained by adding about 100 μs for OFF→ON and about 300 μs for ON→OFF to the specified value.
If input interrupt is to be used, set the input sampling time to 62.5 μs or more.

*2: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

● Output Block

Item		F3WD64-3P	F3WD64-4P
Output type		Transistor contact (sink type)	
Number of points		32 (terminal Nos. 33 - 64)	
Common line type		8 points/common	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated load voltage (Operating load voltage range)		24 V DC (20.4 to 26.4 V DC)	12 V DC (10.2 to 13.2 V DC)
Maximum load current		0.1A/point, 0.4A/common line	
Response time	OFF→ON	1 ms max.	
	ON→OFF	1 ms max.	
ON voltage		0.5 V DC max.	
Off-time leak current		0.1 mA max.	
Protection circuitry	Short-circuit	Controlled short-circuit current	
	Overheat	Output shutdown	
Surge protector *3		Active clamp	
Fuse		None	
Output status when the program stops HOLD/RESET *4		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis *5	
		When a BASIC CPU module is used: No setting function The status is always HOLD	
External power supply		24 V DC, 55 mA	12 V DC, 55 mA
Output status display *6		Lit when output is on (Input or output status indication can be selected using a switch.)	
Dissipating current		170 mA (5V DC) (for input and output)	
External connection		One 40-pin connector	
Weight		120 g (for input and output)	

*3: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

*4: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

*5: When F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module is used, this setting can be specified in 16-point units.

*6: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

WARNING

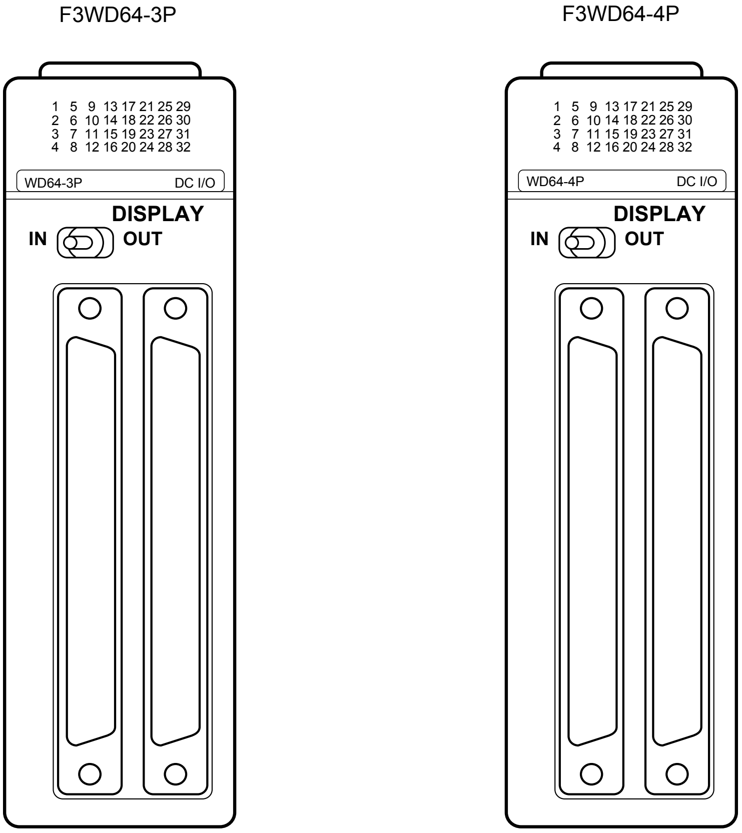
Make sure that the polarity of the external power supply is correct. If incorrect polarity and shorted load occur at the same time, the output element will be damaged and smoking or scattering chips may occur.
Never connect to these modules a connector wired for F3XD32 or F3XD64. Otherwise, the protector function would not work and the internal elements may be damaged.

CAUTION

Operation of the protection circuitry:

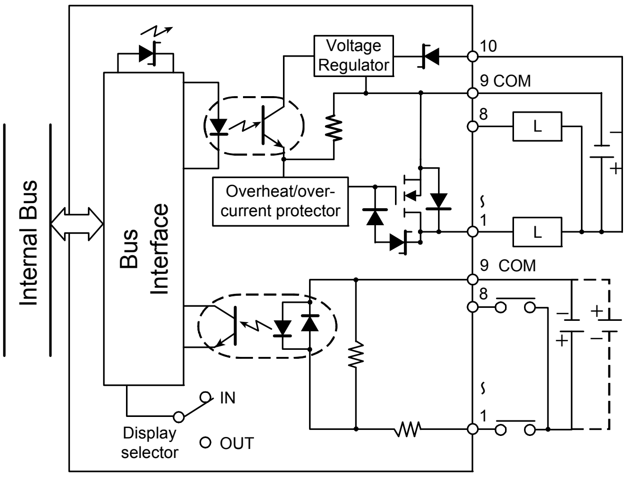
- If short-circuit occurs, the ON voltage increases and the short-circuit current is limited within the range 1-3 A.
- Once the short-circuit condition disappears, output behavior is restored to normal.
- If the short-circuit condition continues, the temperature of the output element increases due to the short-circuit current. If the temperature reaches approx. 160°C, the overheat protector will be activated and will shut down the output.
- If the temperature drops by approx. 10°C after the overheat protector had been activated, the output is restored.
- The overheat protector is not activated as long as there is no short-circuit condition and the module is operated normally within its specifications.
- Both the short-circuit protector and overheat protector are designed to control outputs individually. Under some short-circuit conditions, however, the overheat protector may shut down not only its associated output but also other outputs.
- Both the short-circuit protector and overheat protector are designed to protect the output elements of the module against short-term short-circuit conditions. Never leave the module in prolonged short-circuit condition. Otherwise, the module enclosure may deteriorate or the PCB may be discolored.

● Front View



FA020589_2.VSD

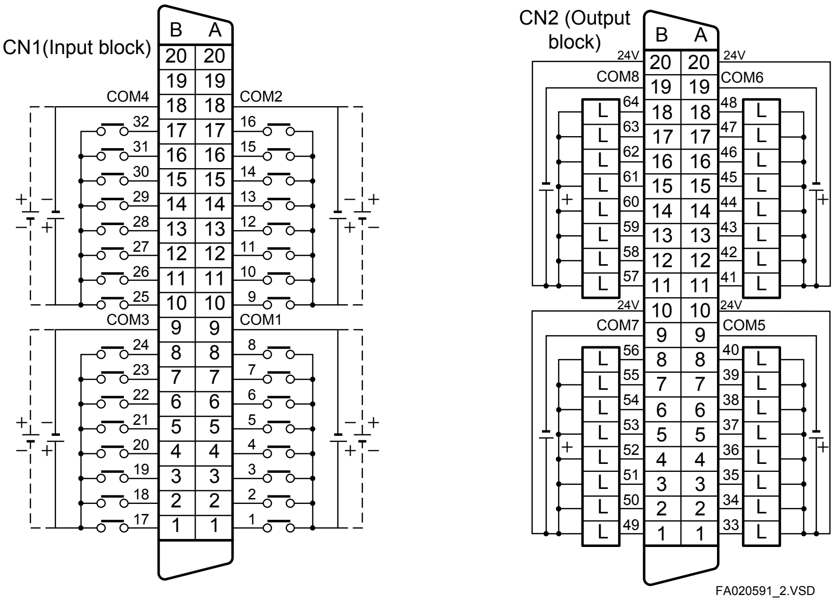
● Internal Circuit Configuration



FA020590_2.VSD

● External Connection Diagram

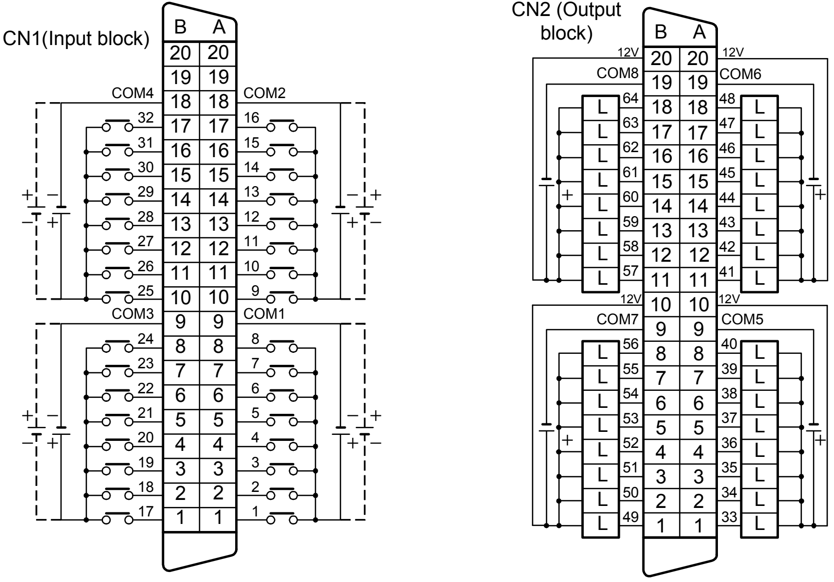
F3WD64-3P



FA020591_2.VSD

Note: Viewed from the front side of the module.

F3WD64-4P



FA020592_2.VSD

Note: Viewed from the front side of the module.

(31) F3WD64-3F/F3WD64-4F Input/Output Modules

● Input Block

Item		**Specifications**	
		F3WD64-3F	**F3WD64-4F**
Input type		DC voltage	
Number of points		32 (terminal Nos. 01 - 32)	
Common line type		8 points/common	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated input voltage		24 V DC	12 V DC
Operating voltage range		20.4 to 26.4 V DC	10.2 to 13.2 V DC
Rated input current		4.1 mA/point (24 V DC)	4.1 mA/point (12 V DC)
Input impedance		5.9 kΩ	2.9 kΩ
Operating voltage/current	ON	16.0 V DC min. 3.2 mA min.	8.0 V DC min. 2.6 mA min.
	OFF	5.8 V DC max. 0.9 mA max.	3.4 V DC max. 1.0 mA max.
Response time	OFF→ON	Input sampling time can be specified for 4 steps: Always (0 μs), 62.5 μs, 250 μs, and 1 ms.*1	
	ON→OFF	Input sampling time can be specified for 4 steps: Always (0 μs), 62.5 μs, 250 μs, and 1 ms.*1	
Interrupt		None	
Dissipating current		200 mA (5 V DC) (for input and output)	
Input display		LED (Lit when inputs are turned on) If the selector switch is set to IN, the input state is displayed.	
External connection		One 40-pin connector	
Weight		160 g (for input and output)	
Maximum ratio of inputs turned on simultaneously		60%	100%

*1: These values are applicable when using the module with CPU module using F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module. If other CPU modules are used, the values are the same as those for F3WD64-□N modules. The actual response time is obtained by adding about 100 μs for OFF→ON and about 300 μs for ON→OFF to the specified value.
If the input sampling time is set to a very small value, the modules become susceptible to noise. In such a case, implement countermeasures against noise as described in Section A3.4 "Noise Control Considerations" and Section A3.9 "CE Marking Compliance".
If input interrupt is to be used, set the input sampling time to 62.5 μs or more.

Output Block

Item		Specifications	
		F3WD64-3F	F3WD64-4F
Output type		Transistor contact (sink type)	
Number of points		32 (terminal Nos. 33 - 64)	
Common line type		8 points/common	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated load voltage (Operating load voltage range)		24 V DC (20.4 to 26.4 V DC)	12 V DC (10.2 to 13.2 V DC)
Maximum load current		0.1A/point, 0.4A/common line	
Response time	OFF→ON	1 ms max.	
	ON→OFF	1 ms max.	
ON voltage		0.5 V DC max.	
Off-time leak current		0.1 mA max.	
Service life	Mechanical	—	
	Electrical	—	
Surge protector[*1]		Zener diode	
Fuse		None	
Dissipating current		200 mA (5 V DC) (for input and output)	
Output display[*2]		LED (Lit when output is on) If the selector switch is set to OUT, the output state is displayed.	
Output status when the program stops HOLD/RESET[*3]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis.[*4]	
		When a BASIC CPU module is used: No setting function The status is always HOLD	
External power supply		24 V DC, 60 mA	12 V DC, 60 mA
External connection		Two 40-pin connectors	
Weight		160 g (for input and output)	

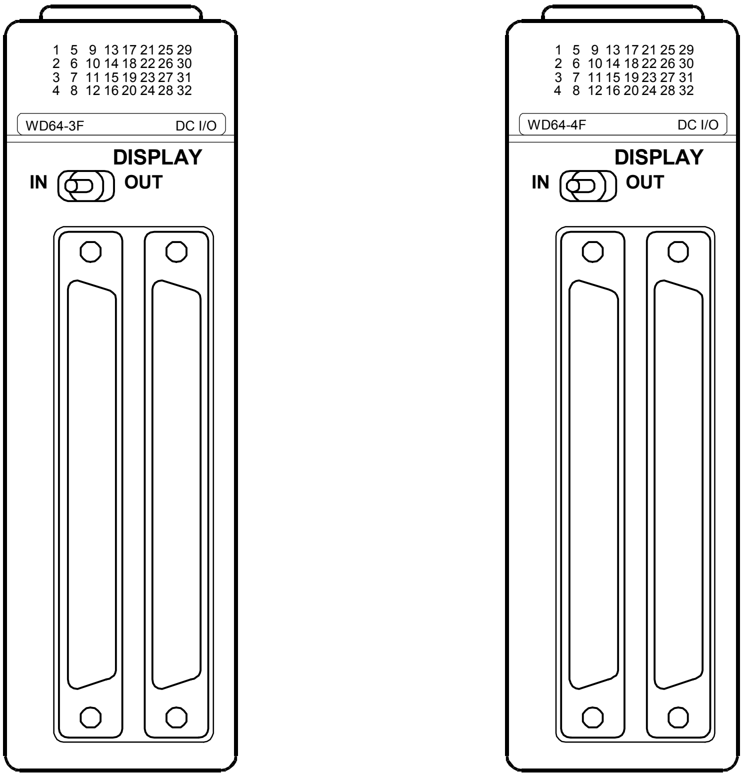
*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

*2: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*3: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

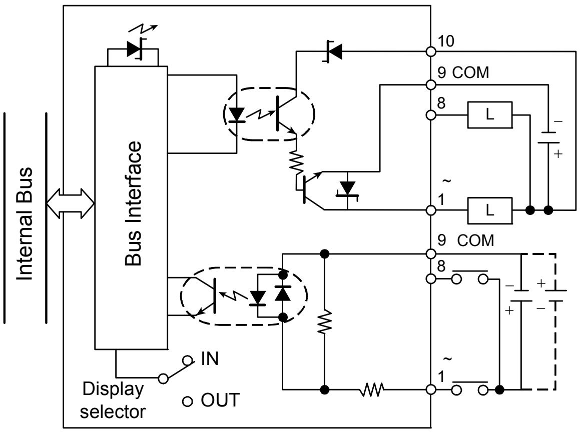
*4: When F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module is used, all points can be specified in 16-point units.

● Front View


F3WD64-3F F3WD64-4F

FA020589.VSD

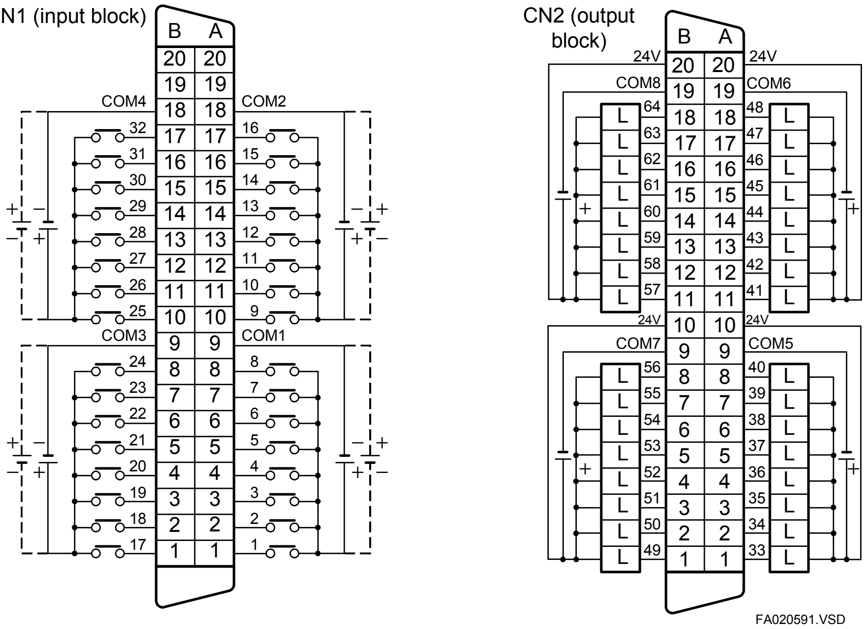
● Internal Circuit Configuration



FA020590.VSD

● External Connection Diagram

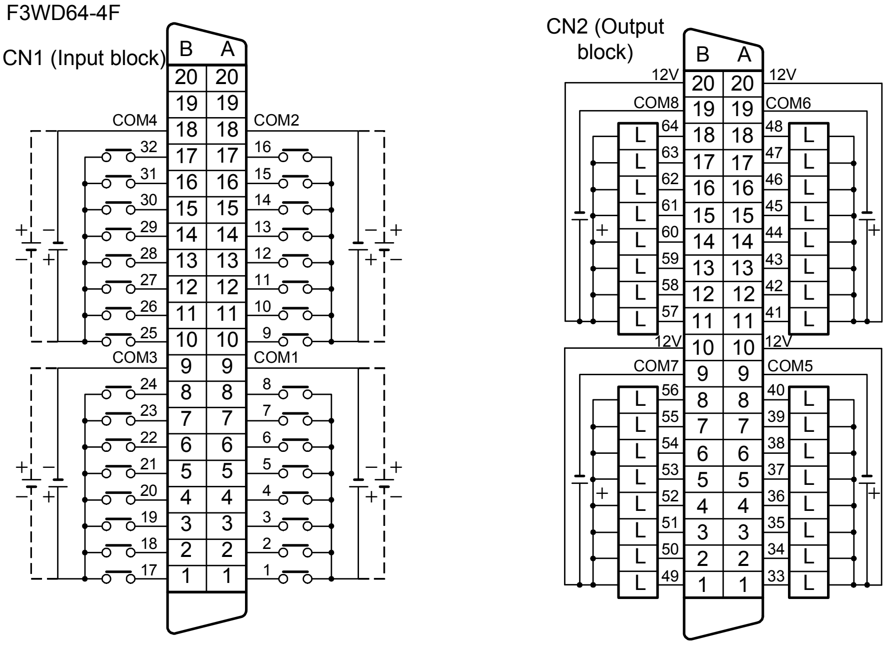
F3WD64-3F



FA020591.VSD

Note: Viewed from the front side of the module.

F3WD64-4F



FA020592.VSD

Note: Viewed from the front side of the module.

(32) F3WD64-3N/F3WD64-4N Input/output Modules

● Input Block

Item		Specifications	
		F3WD64-3N	**F3WD64-4N**
Input type		DC voltage	
Number of points		32 (terminal Nos. 01 - 32)	
Common line type		8 points/common	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated input voltage		24 V DC	12 V DC
Operating voltage range		20.4 to 26.4 V DC	10.2 to 13.2 V DC
Rated input current		4.1 mA/point (24 V DC)	4.1 mA/point (12 V DC)
Input impedance		5.9 kΩ	2.9 kΩ
Operating voltage/current	ON	16.0 V DC min. 3.2 mA min.	8.0 V DC min. 2.6 mA min.
	OFF	5.8 V DC max. 0.9 mA max.	3.4 V DC max. 1.0 mA max.
Response time	OFF→ON	1.0 ms max.	
	ON→OFF	2.5 ms max.	
Interrupt		None	
Dissipating current		200 mA (5 V DC) (for input and output)	
Input display		LED (Lit when inputs are turned on) Input state is displayed when the display selector is set to “IN”	
External connection		One 40-pin connector	
Weight		160 g (for input and output)	
Maximum ratio of inputs turned on simultaneously		60%	100%

● Output Block

Item		Specifications	
		F3WD64-3N	F3WD64-4N
Output type		Transistor contact (sink type)	
Number of points		32 (terminal Nos. 33 - 64)	
Common line type		8 points/common	
Isolation method		Photocoupler isolation	
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit	
Rated load voltage (Operating load voltage range)		24 V DC (20.4 to 26.4 V DC)	12 V DC (10.2 to 13.2 V DC)
Maximum load current		0.1A/point, 0.4A/common line	
Response time	OFF→ON	1 ms max.	
	ON→OFF	1 ms max.	
ON voltage		0.5 V DC max.	
Off-time leak current		0.1 mA max.	
Service life	Mechanical	——	
	Electrical	——	
Surge protector*1		Zener diode	
Fuse		None	
Dissipating current		200 mA (5 V DC) (for input and output)	
Output display*2		LED (Lit when output is on) Output state is displayed when the display selector is set to “OUT”	
Output status when the program stops HOLD/RESET *3		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis.*4	
		When a BASIC CPU module is used: No setting function The status is always HOLD	
External power supply		24 V DC, 60 mA	12 V DC, 60 mA
External connection		One 40-pin connector	
Weight		160 g (for input and output)	

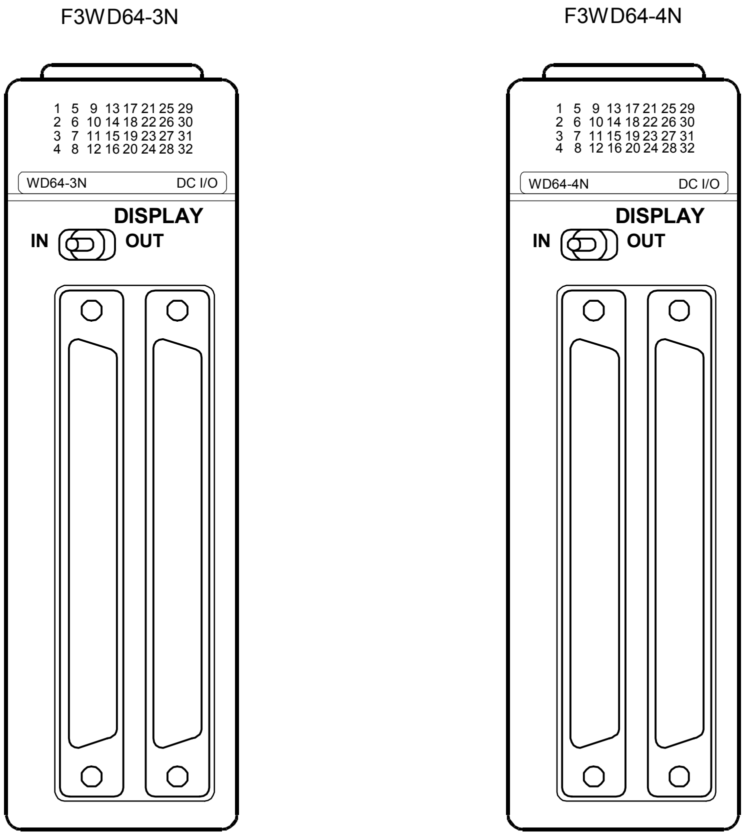
*1: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range. For details, see Subsection A3.6.5, “Connecting Output Devices.”

*2: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*3: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

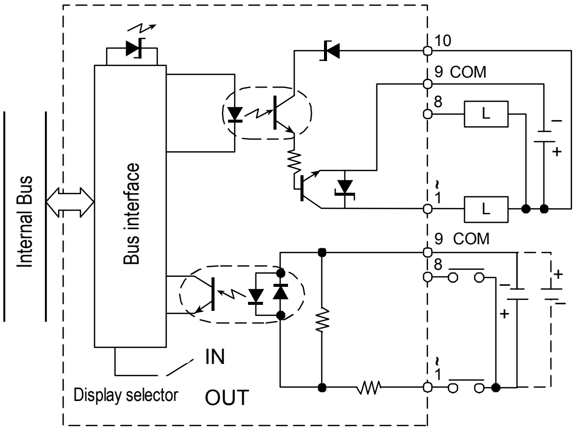
*4: When F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76 module is used, this setting can be specified in 16-point units.

● Front View



FA020593.VSD

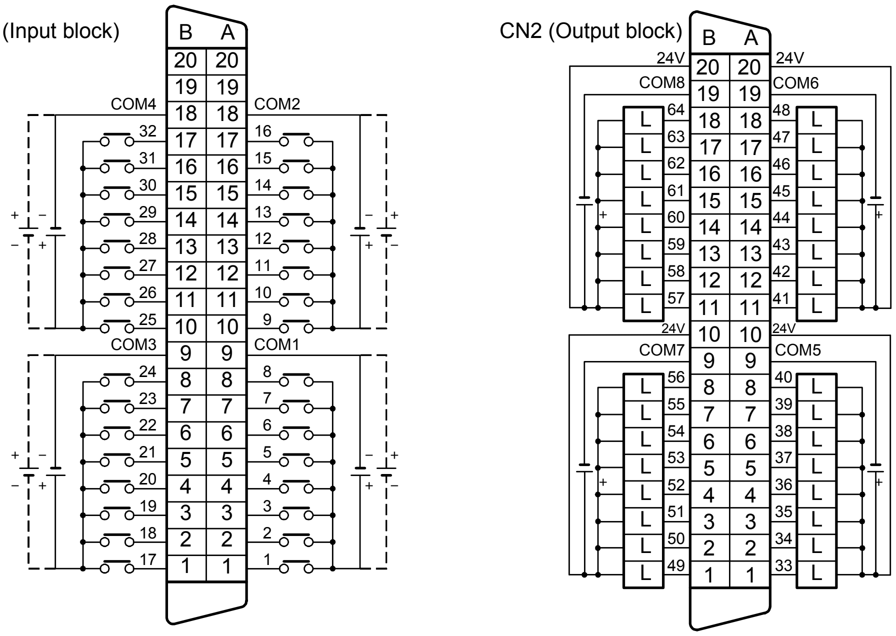
● Internal Circuit Configuration



FA020594.VSD

● External Connection Diagram

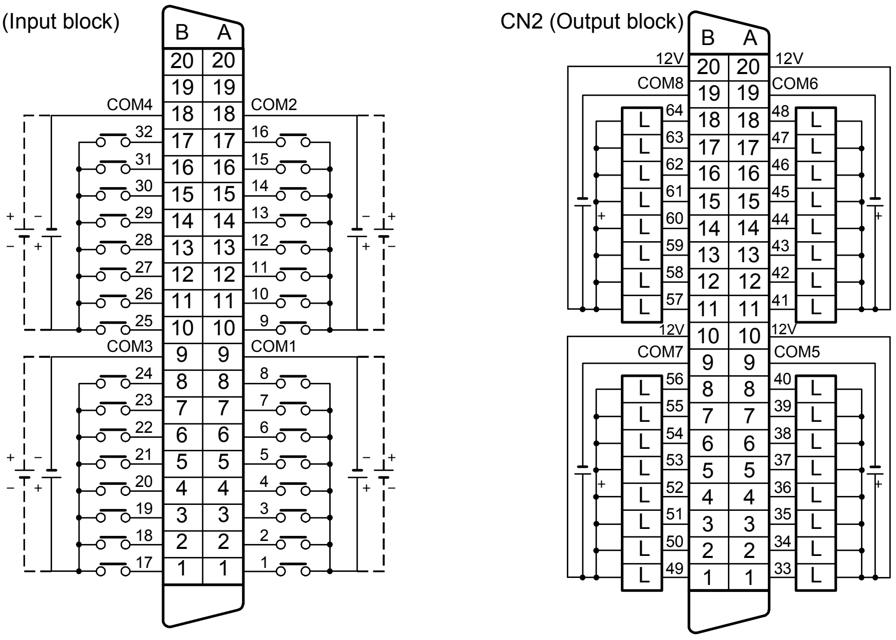
F3WD64-3N



FA020595.VSD

Note: Viewed from the front side of the module.

F3WD64-4N



FA020596.VSD

Note: Viewed from the front side of the module.

A2.6 ROM Packs

ROM packs can be installed in sequence CPU modules and BASIC CPU modules and used to store programs or data.

You can write to a ROM pack from the programming tool. At CPU startup, programs and data are read from the ROM pack into the memory for execution.

Data written to a ROM pack includes program control information, programs, configuration data, various control tables, preset value tables for timers and counters, and comment management data.

When used with sequence CPU modules, a ROM pack can store 1024 words of data.

When used with sequence CPU modules F3SP22/28/38/53/58/59, a ROM pack can store circuit comments, subcomments and tag name definition (includes I/O comments.)

You may not use ROM packs with F3SP66/67/71/76 sequence CPU modules (with network functions). You can use SD memory cards instead.

● Specifications

Item		Specifications						
		RK10-0N	**RK30-0N**	**RK50-0N**	**RK33-0N**	**RK53-0N**	**RK73-0N**	**RK93-0N**
Program that can be stored	When using F3SP05-0P	5K steps*1	5K steps	5K steps	5K steps	5K steps	Not available	Not available
	When using F3SP08-0P	5K steps*1	10K steps	10K steps	10K steps	10K steps	Not available	Not available
	When using F3SP22-0S	Not available	Not available	Not available	10K steps	Not available	10K steps*6	Not available
	When using F3SP21-0N	5K steps*1	10K steps	10K steps	10K steps	10K steps	Not available	Not available
	When using F3SP25-2N	Not available	20K steps	20K steps	20K steps	20K steps	Not available	Not available
	When using F3SP35-5N	Not available	20K steps*2	100K steps*3	20K steps*2	100K steps*3	Not available	Not available
	When using F3SP28-3N	Not available	Not available	Not available	30K steps	Not available	30K steps	Not available
	When using F3SP38-6N	Not available	Not available	Not available	56K steps	Not available	120K steps	Not available
	When using F3SP53-4H	Not available	Not available	Not available	56K steps	Not available	56K steps	Not available
	When using F3SP58-6H	Not available	Not available	Not available	56K steps	Not available	120K steps	Not available
	When using F3SP28-3S	Not available	Not available	Not available	30K steps	Not available	30K steps*6	Not available
	When using F3SP38-6S	Not available	Not available	Not available	56K steps	Not available	120K steps	120K steps*7
	When using F3SP53-4S	Not available	Not available	Not available	56K steps	Not available	56K steps*6	Not available
	When using F3SP58-6S	Not available	Not available	Not available	56K steps	Not available	120K steps	120K steps*7
	When using F3SP59-7S	Not available	Not available	Not available	56K steps	Not available	120K steps	254K steps*7
	When using F3SP71-4N	Not available	Not available	Not available	Not available	Not available	Not available	Not available
	When using F3SP76-7N	Not available	Not available	Not available	Not available	Not available	Not available	Not available
	When using F3SP71-4S	Not available	Not available	Not available	Not available	Not available	Not available	Not available
	When using F3SP76-7S	Not available	Not available	Not available	Not available	Not available	Not available	Not available
	When using F3BP20-0N	Not available	120K bytes*4	Not available	Not available	Not available	Not available	Not available
	When using F3BP30-0N	Not available	Not available	510K bytes*5	Not available	510K bytes*5	Not available	Not available

*1: Up to 400 lines of circuit comments and subcomments in total (not applicable to F3SP66 and F3SP67).

*2: Can store up to 2048 points of timers and counters in total.
Can store up to 128 program blocks.

*3: Can store programs of up to 80K steps if the number of program blocks is 33 or more.

*4: Can store up to 120K bytes of user programs and common area data in total.

*5: Can store up to 510K bytes of user programs and common area data in total.

*6: Can store up to 120K steps of programs and tag name definition data in total.

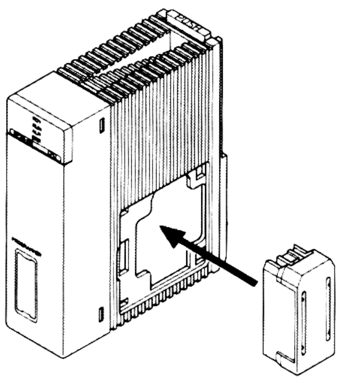
*7: Can store up to 360K steps of programs and tag name definition data in total.

Maximum Writing Operations and Weight

	RK10	RK30	RK50	RK33	RK53	RK73	RK93
Max. writing operations	10,000 times		100,000 times				
Weight	7 g						

Installing a ROM Pack

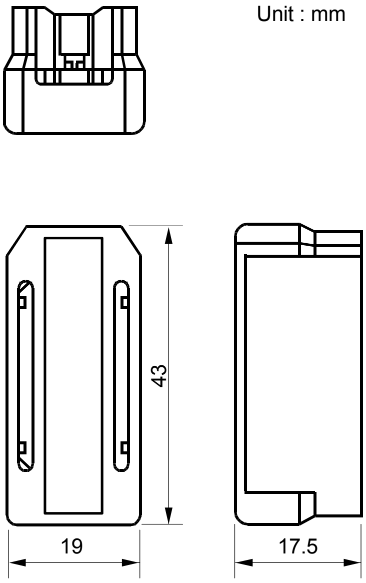
Remove the side cover of the CPU module and attach the ROM pack to the internal connector.



FA020601.VSD

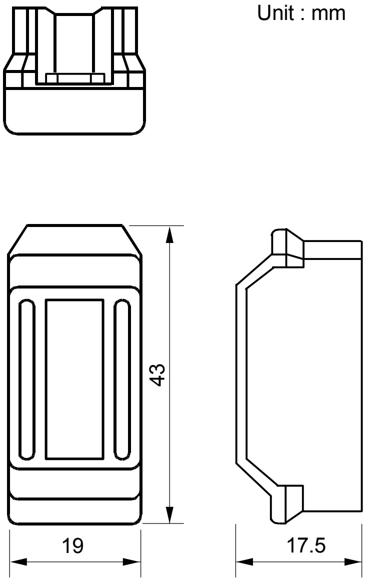
External Dimensions

(1) RK10, RK30, RK50



FA020602.VSD

(2) RK33, RK53, RK73, RK93

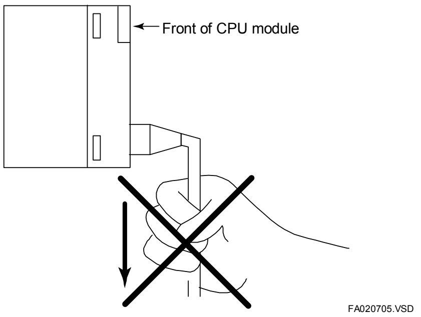


FA020603.VSD

A2.7 Cables

CAUTION

Be sure to hold the cable's connector when connecting or disconnecting the cable. The cable may break if you pull it forcibly while holding any part other than the connector or if you apply stress to the cable joint when the cable is bent at an angle of almost 90° from the connector.



(1) Cables for Programming Tool

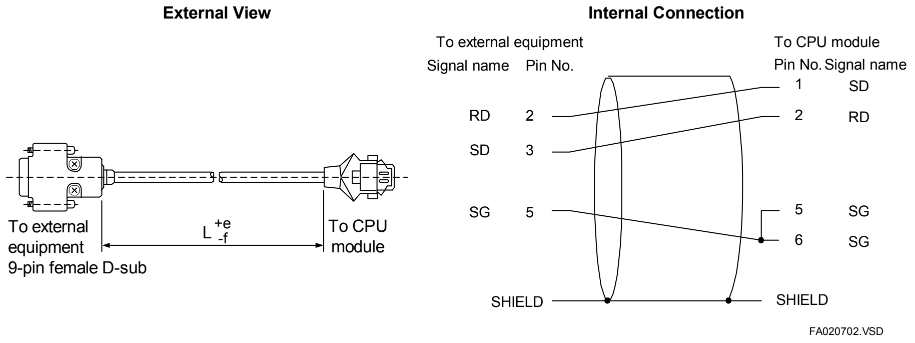
The programming tool cable is used to connect CPU modules, such as sequence CPU modules, to external equipment such as a personal computer or a display unit.

Connect the cable to the connector labeled PROGRAMMER on the CPU module's front.

TIP

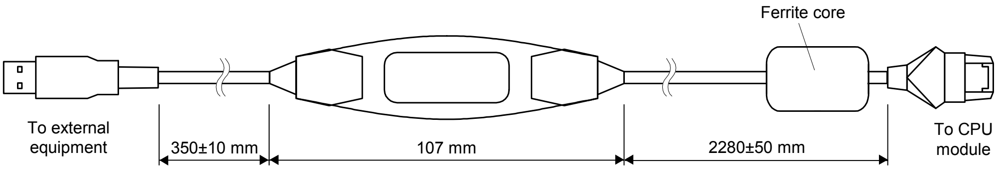
This cable cannot be used with the F3SP66-4S, F3SP67-6S, F3SP71 or F3SP76 sequence CPU module.

● KM11-2T/KM11-3T/KM11-4T (for DOS/V (IBM PC/AT Compatibles))



Model	Length L (m)	Tolerance +e (cm)	Tolerance –f (cm)	Maximum number of insertions	
				Equipment end	CPU module end
KM11-2T	3	20	0	500 times	1000 times
KM11-3T	5	20	0		
KM11-4T	10	30	30		

● KM13-1S (USB-serial Converter)



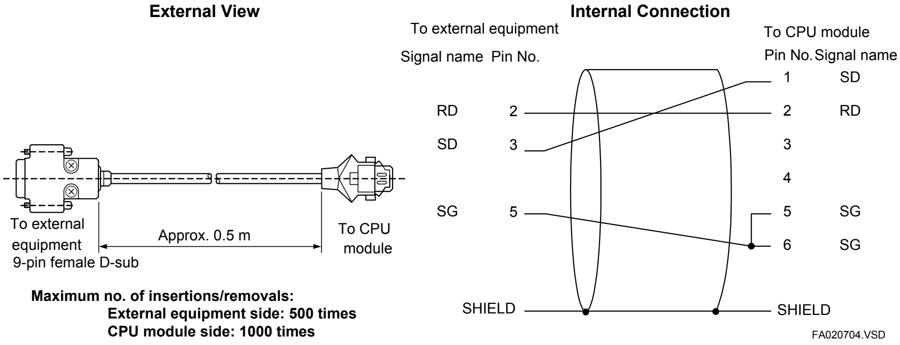
Item	Description
Input/output signal level	RS232C compliant
Connection interface	USB (Universal Serial Bus) 1.1 compliant
Number of I/O ports	1 port
Size	85 mm (L) x 28 mm (W) x 11 mm (H). For cable length, see the figure above.
Weight	128 g
Communications protocol	Asynchronous communication
Transmission speed	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400 bps[*1]
Transmission distance	15 m max.
Power supply voltage	+5 V DC (supplied by USB bus)
Current consumption	Average 30 mA at 5 V (50 mA max. at 5 V)
Communications parameters	7 or 8 bits; 1 start bit; 1, 1.5 or 2 stop bits; Odd, even, or no parity
LED display	PWR: Power LED (lit when 5 V is available from USB bus) TXD: LED for data transmission (from PC to device) RXD: LED for data receiving (from device to PC)
Operating temperature/ humidity ranges	0 to 50°C/10 to 90% (non-condensing)
Storage temperature/ humidity ranges	-20 to 65°C/10 to 90% ((non-condensing)
Maximum number of insertions	1000 insertions for USB side, 1000 insertions for CPU side

*1 The actual maximum achievable transmission speed depends on the specifications of the PC.

(2) CPU Port/D-sub 9-pin Adapter Cable

The CPU Port/D-sub 9-pin adapter cable is used to adapt the programming tool connector to a standard D-sub 9–pin female connector. An additional cable is required, however, for connecting a display unit.

● KM10-0C


External View

Internal Connection

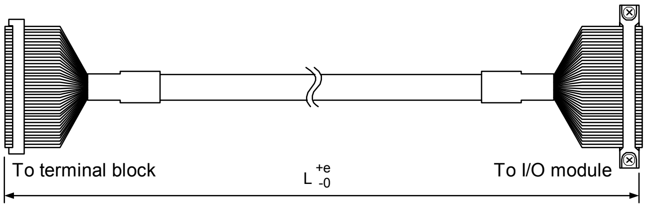
Maximum no. of insertions/removals:
External equipment side: 500 times
CPU module side: 1000 times

FA020704.VSD

(3) Cables for Connector Terminal Blocks

Connector terminal block cables connects connector terminal block TA50-□N, TA60-0N to I/O modules of connector specifications.

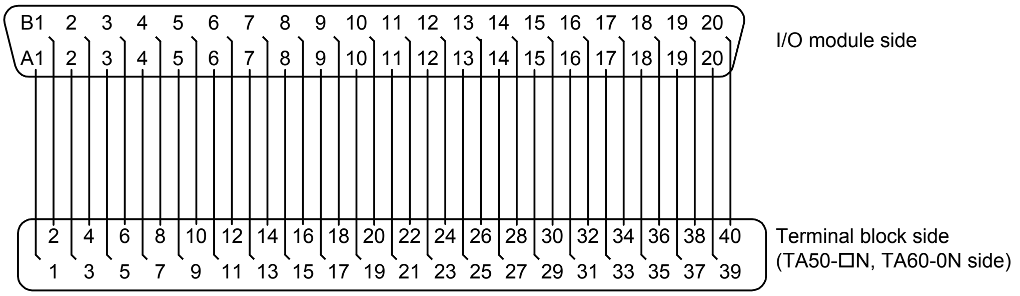
● KM55-005, KM55-010, KM55-015, KM55-020, KM55-025, KM55-030



Model	Length L (m)	Tolerance +e (cm)
KM55-005	0.5	5
KM55-010	1	
KM55-015	1.5	10
KM55-020	2	
KM55-025	2.5	
KM55-030	3	

FA20706.VSD

Connection Diagram



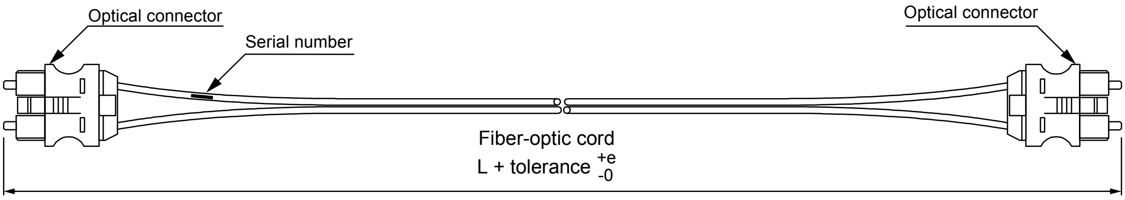
FA020707.VSD

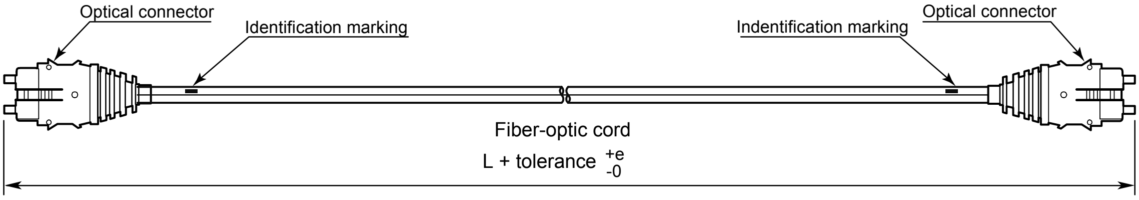
Note: The terminal arrangement of the terminal block is the same as that of the connector on a module.

(4) Fiber-Optic Cord

KM60 fiber-optic cord is used for wiring inside the panel enclosure on Fiber-optic FA link H modules, Fiber-optic FA-bus modules and Fiber-optic FA-bus type 2 modules.

● KM60





Length L (m)	Tolerance +e (m)
L ≦ 3	0.20

FA020708.VSD

Note: There are 2 types of fiber-optic cords (KM60) with optical connectors of different shapes but the cable type cannot be specified by the customer.

Fiber-optic Cable for Connections inside Panel (with bonding and polishing treatment on optical connector)

Model	Suffix Code	Style Code	Option Code	Description	Max. Transmission Loss (dB)	Compatible Modules
KM60	-S06	—	—	Cable length 0.6 m	2.60	F3LR01, F3LR02, F3LP12
	-001	—	—	Cable length 1 m	2.60	
	-003	—	—	Cable length 3 m	2.60	

CAUTION

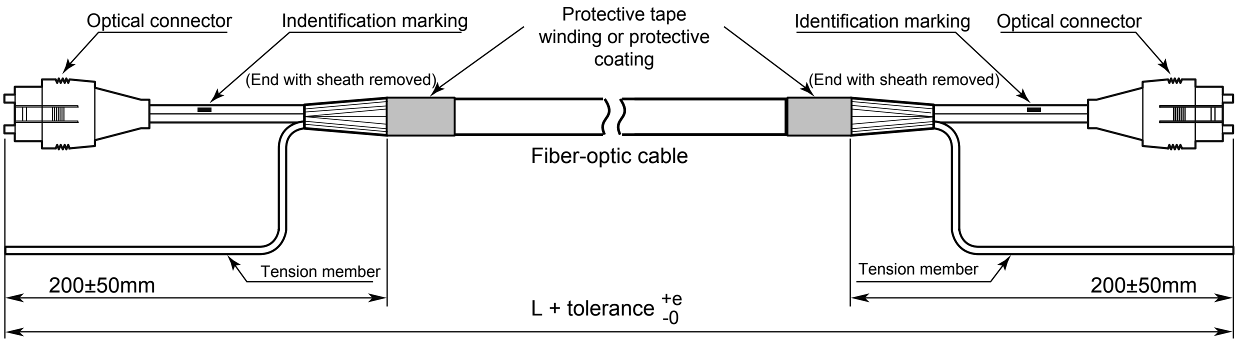
Handle the fiber-optic cord very carefully since it may break readily if bent or tied like regular electrical cables. The cable is more likely to break at a point near the optical connector. For details on its installation, see the relevant instruction manual.

(5) Fiber-optic Cables

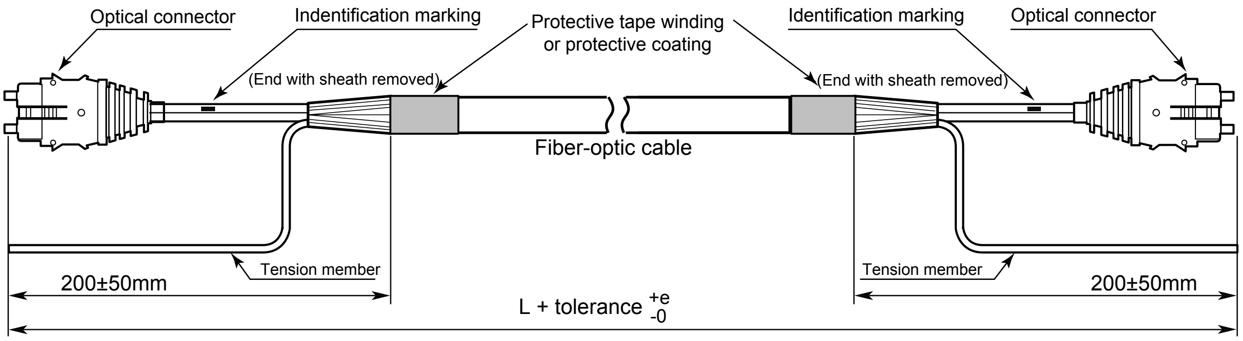
KM61, KM62, KM65, KM67 and KM69 fiber-optic cables are designed for use on Fiber-optic FA link H modules, Fiber-optic FA-bus modules and Fiber-optic FA-bus type 2 modules. KM61 and KM65 are used for indoor wiring whilst KM62 and KM67 are used for outdoor wiring. KM69 is used for wiring which is required flame-retardant characteristic.

● KM61, KM62, KM67, KM69

A



B

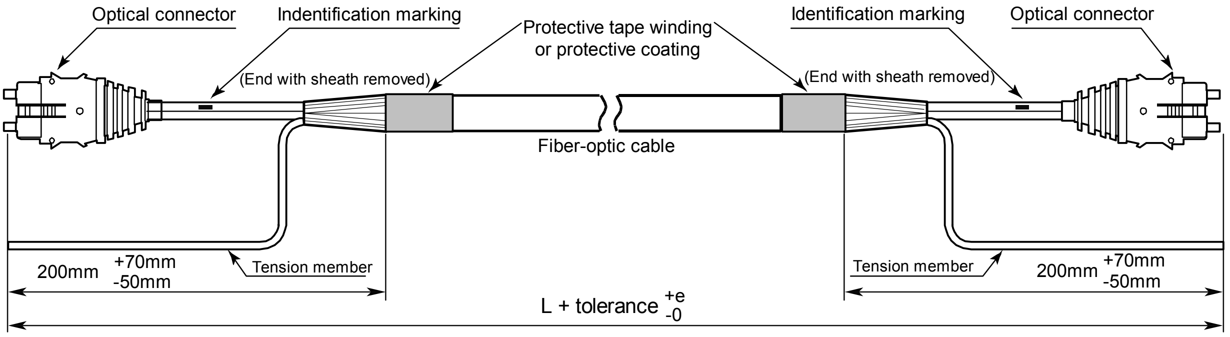


Length L (m)	Tolerance +e (m)
10 < L ≦ 30	0.50
30<L	L x 0.03 (3%)

FA020709.VSD

Note: Fiber-optic cable (KM61, KM62, KM67) is available in two types of "A" and "B" with optical connectors of different shapes, but customers cannot specify the connector type when placing an order. Fiber-optic cable (KM69) is supplying a type "B" constantly.

● KM65



Length L (m)	Tolerance +e (m)
L ≦ 15	0.20
5<L ≦ 15	0.30
15<L ≦ 30	0.50

FA020709B.VSD

Fiber-optic Cable for Indoor Use with Tension Members (with bonding and polishing treatment on optical connector)

Model	Suffix Code	Style Code	Option Code	Description	Max. Transmission Loss (dB)	Compatible Module
KM61	-010	—	—	Cable length: 10 m	1.10	F3LR01, F3LR02, and F3LP12
	-100	—	—	Cable length: 100 m, a pulling eye on one end	1.10	
	-150	—	—	Cable length: 150 m, a pulling eye on one end	1.54	
	-200	—	—	Cable length: 200 m, a pulling eye on one end	1.95	

Note: For information on pulling eyes, see the fiber-optic lead-in cable laying pulling-eye assembly diagram in this manual.
Note: Use the KM62 cable in wet environments (but not submerged environments).

Fiber-optic Cable for Indoor Use with Tension Members (with crimping and cutting treatment on optical connector)

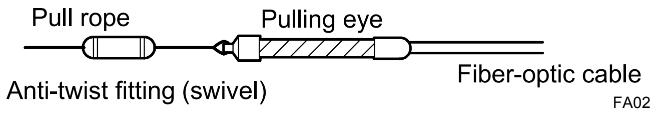
Model	Suffix Code	Style Code	Option Code	Description	Max. Transmission Loss (dB)	Compatible Module
KM65	-001	—	—	Cable length: 1 m	2.00	F3LR01 (Max. 200 m) F3LR02 (Max. 200 m) F3LP12 (Max. 1000m)
	-002	—	—	Cable length: 2 m	2.00	
	-003	—	—	Cable length: 3 m	2.00	
	-004	—	—	Cable length: 4 m	2.00	
	-005	—	—	Cable length: 5 m	2.00	
	-007	—	—	Cable length: 7 m	2.00	
	-010	—	—	Cable length: 10 m	2.00	
	-012	—	—	Cable length: 12 m	2.00	
	-015	—	—	Cable length: 15 m	2.00	
	-020	—	—	Cable length: 20 m	2.00	
	-025	—	—	Cable length: 25 m	2.00	
	-030	—	—	Cable length: 30 m	2.00	

Note: Use the KM62 cable in wet environments (but not submerged environments).
Note: KM65 cables are not supplied with pulling eyes. If pulling eye is required, use the KM61 or KM62 cables.

Fiber-optic Cable for Outdoor Use with Tension Members (with bonding and polishing treatment on optical connector)

Model	Suffix Code	Style Code	Option Code	Description	Max. Transmission Loss (dB)	Compatible Module
KM62	-100	—	—	Cable length: 100 m, a pulling eye on one end	1.10	F3LR01 (Max. 200 m) F3LR02 (Max. 200 m) F3LP12 (Max. 1000m)
	-200	—	—	Cable length: 200 m, a pulling eye on one end	1.95	
	-300	—	—	Cable length: 300 m, a pulling eye on one end	2.72	
	-400	—	—	Cable length: 400 m, a pulling eye on one end	3.43	
	-500	—	—	Cable length: 500 m, a pulling eye on one end	4.10	
	-600	—	—	Cable length: 600 m, a pulling eye on one end	4.73	
	-700	—	—	Cable length: 700 m, a pulling eye on one end	5.33	
	-800	—	—	Cable length: 800 m, a pulling eye on one end	5.91	
	-900	—	—	Cable length: 900 m, a pulling eye on one end	6.46	
	-L01	—	—	Cable length: 1000 m, a pulling eye on one end	7.00	
KM67	-300	—	—	Cable length: 300 m, a pulling eye on one end	3.34	F3LR02 (200 to 500 m)
	-400	—	—	Cable length: 400 m, a pulling eye on one end	4.15	
	-500	—	—	Cable length: 500 m, a pulling eye on one end	4.90	
KM69	-010	—	—	Cable length: 10m, frame-retardant cable (equivalent of VW-1)	1.10	F3LR01 F3LR02

When leading the cable in, connect the pulling eye to a pull rope through an anti-twist fitting, such as one shown below attached to the head of the pulling eye.



FA020710.VSD

CAUTION

- Use the specified fiber-optic cables to avoid problems, malfunctions or under-performance.
- KM6☐ cables cannot be used in submerged environments. Contact Yokogawa sales office for assistance.

CAUTION

Handle the fiber-optic cable very carefully since it may break readily if bent or tied like regular electrical cables. The cable is more likely to break at a point near the optical connector. For details on its installation, see the relevant instruction manual.

CAUTION

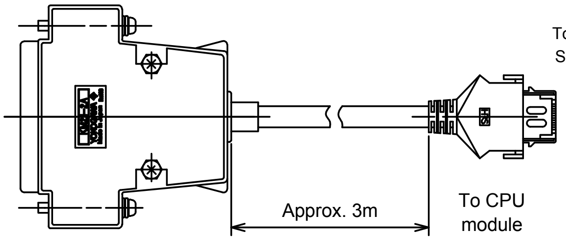
- Before laying cables, customers should check the cables (immediately after delivery) for any defect. In principle, the provided warranty does not cover functional defects (e.g., cable discontinuity) discovered after installation.
- Fiber-optic cables KM61, KM62, KM65, KM67, and KM69 are made-to-order products. Hence, replacement of a defective cable may require a week for KM65 cables, a month for KM61, KM62, and KM67 cables, and two months for KM69 cables.

(6) Monitor Cables (for F3SP08-2x, -3x, and -5x)

These cables are used to connect to the sequence CPU modules F3SP08-2x, -3x, and -5x only. They are connected to the programming port labeled PROGRAMMER of the CPU module to provide for higher-level link (personal computer link) service.

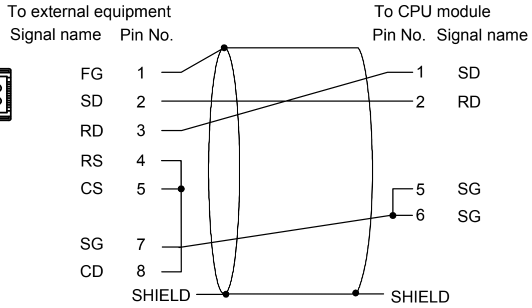
They cannot be used to provide connection for the FA-M3 programming tool WideField3.

● KM21-2A (D-sub 25-pin)

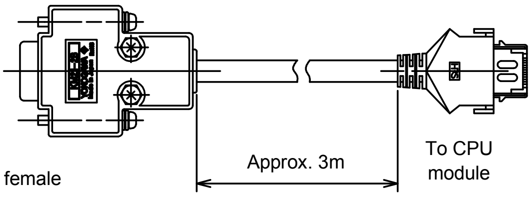


To external equipment
D-sub 25-pin male

Maximum number of insertions/removals:
External equipment end: 500 times
CPU module end: 1000 times

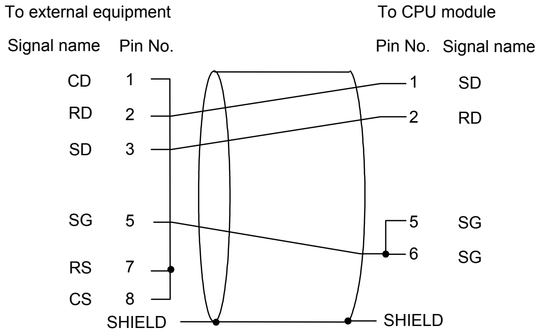


● KM21-2B (D-sub 9-pin)



To external equipment
D-sub 9-pin female

Maximum number of insertions/removals:
External equipment end: 500 times
CPU module end: 1000 times



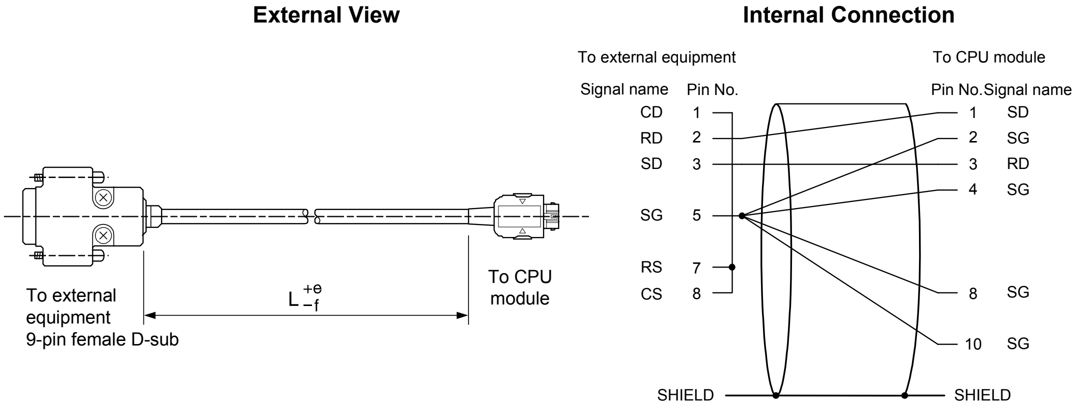
Model	Length L1 (m)	Tolerance +L2 (cm)	Tolerance –L3 (cm)	Maximum number of insertions/removals	
				External equipment	CPU module
KM21-2A	3	15	0	500 times	1000 times
KM21-2B	3	15	0		

(7) Monitor Cables (for F3SP66-4S and F3SP67-6S)

These cables are used to connect sequence CPU modules (F3SP66-4S and F3SP67-6S) to a personal computer or a display unit for higher-level link (personal computer link) service.

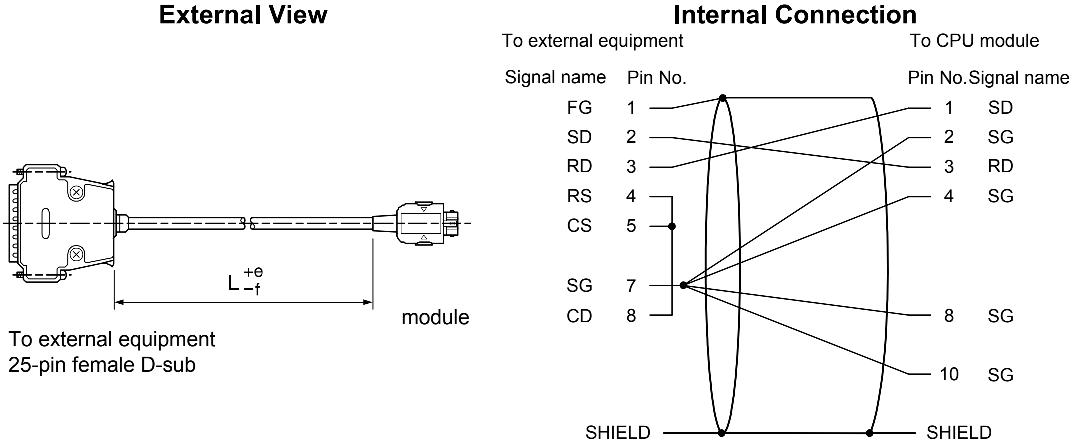
Connect the cable to the connector labeled SIO on the front of the F3SP66-4S or F3SP67-6S sequence CPU module.

● KM21-2T (D-sub 9-pin)



FA020711.VSD

● KM21-2N (D-sub 25-pin)



FA020712 .VSD

Model	Length L (m)	Tolerance +e (cm)	Tolerance –f (cm)	Maximum number of insertions/removals	
				External equipment	CPU module
KM21-2T	3	20	0	500 times	1000 times
KM21-2N	3	20	0		

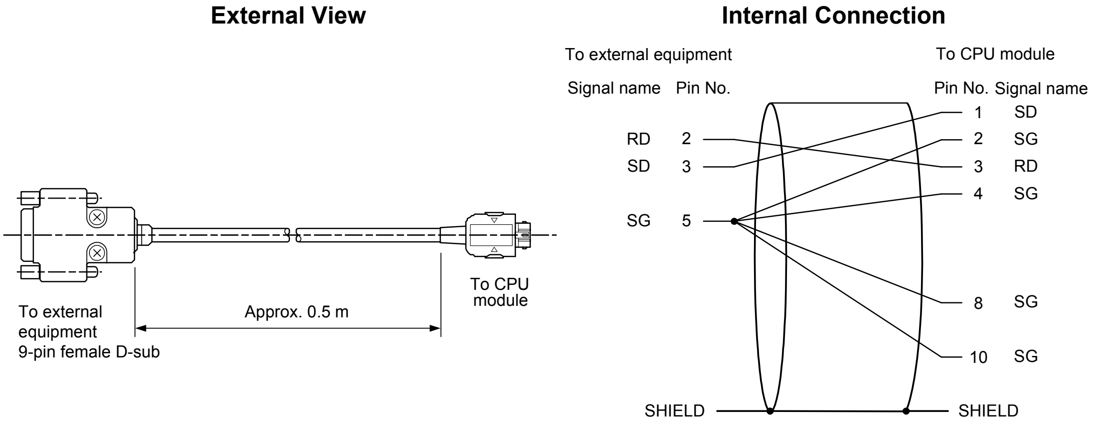
TIP

The KM21-2N and KM21-2T monitor cables are dedicated for higher-level link service (personal computer link functions) only, and cannot be used for connection to the FA-M3 programming tool WideField3.

(8) SIO port/D-sub 9-pin Adaptor Cable (for F3SP66-4S and F3SP67-6S)

● KM10-0S

The SIO port/D-sub 9-pin adapter cable adapts the SIO connector to the standard D-sub 9-pin female connector. An additional cable is necessary however to connect such equipment as a display unit.



FA020713.VSD

Model	Length L (m)	Tolerance +e (cm)	Tolerance –f (cm)	Maximum number of insertions/removals	
				External equipment	CPU module
KM10-0S	0.5	5	0	500 times	1000 times

TIP

The monitor cables and the SIO port of the F3SP66-4S and F3SP67-6S sequence CPU modules are dedicated for higher-level link service (personal computer link function) only, and cannot be used for connection to the FA-M3 programming tool WideField3.

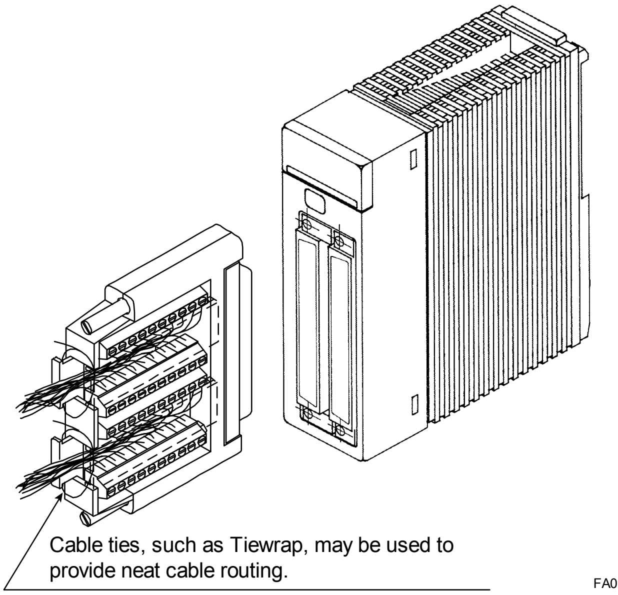
A2.8 Terminal Block Unit and Connector Terminal Block

(1) TA40-0N

The TA40-0N terminal block unit is installed and used on I/O modules of connector specifications.

● Features

- Allows 1:1 conversion of the connector of the I/O module to European type screw terminal.
- Using the European type terminal block eliminates the need for soldering, using crimp-on terminals or terminating I/O cables.
- Does not require a cable for connecting the terminal block unit to the I/O module since it is directly installed to the I/O module.
- Can be secured to the I/O module using screws.
- With a slim connector size, it can be installed even adjacent to 64-point I/O modules.
- Suitable for applications requiring permanent mounting, as well as applications where the system is temporarily wired for testing and debugging.


Cable ties, such as Tiewrap, may be used to provide neat cable routing.

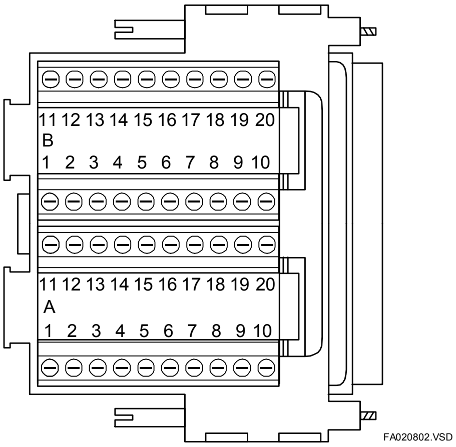
FA020801.VSD

Specifications

Item	Specifications
Number of I/O points	40
Rated voltage	5 to 24 V DC
Operating voltage range	4.5 to 26.4 V DC
Maximum current	0.5A DC/point
Compatible cable	AWG28 to 23 (0.08 to 0.26 mm^2)
Terminal block screw	Slotted M2-size screw
Mounting screw	Slotted M2.6-size screw
Color	Black
Weight	50 g

Note: The TA40-0N terminal block unit cannot be used with F3YP04,F3YP08,F3YP14,F3YP18,F3YP22, F3YP24,F3YP28,F3NC32 and F3NC34 modules.

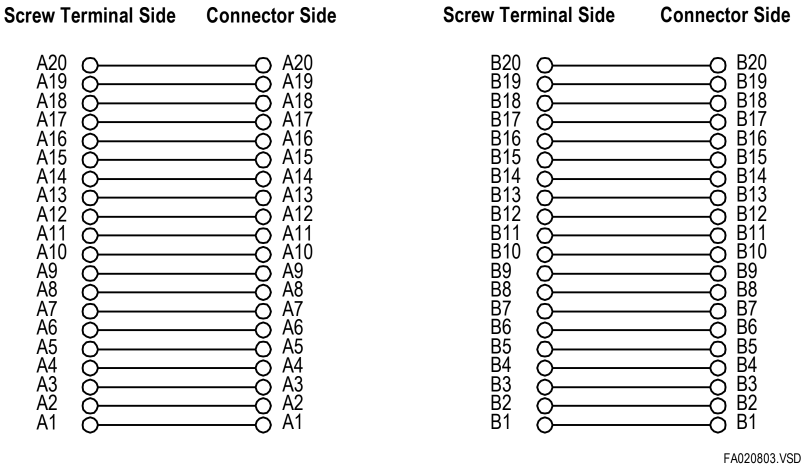
Terminal Arrangement



Operating Environment Specifications

Item	Specifications
Surrounding air temperature range	Operating : 0 to 55°C
	Storage : -20°C to 75°C
Surrounding humidity range	Operating : 10 to 90% RH (non-condensing)
	Storage : 10 to 90% RH (non-condensing)
Surrounding atmosphere	Must be free of corrosive gases, flammable gases or heavy dust.

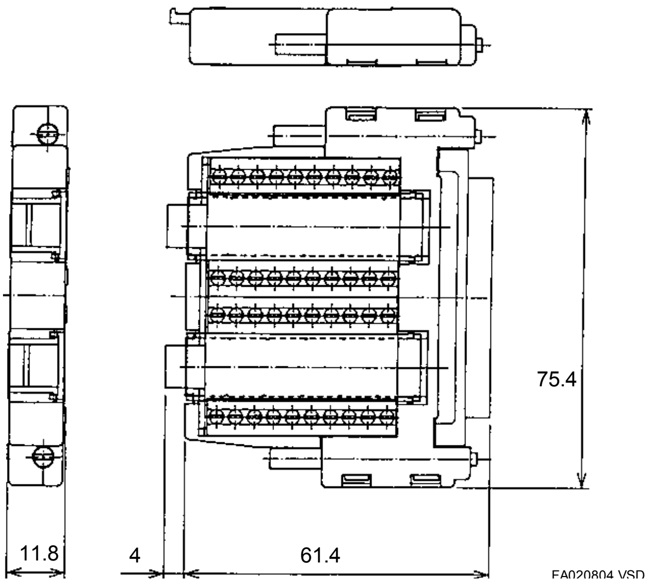
Internal Connection


Screw Terminal Side
Connector Side
Screw Terminal Side
Connector Side
A20 A19 A18 A17 A16 A15 A14 A13 A12 A11 A10 A9 A8 A7 A6 A5 A4 A3 A2 A1
A20 A19 A18 A17 A16 A15 A14 A13 A12 A11 A10 A9 A8 A7 A6 A5 A4 A3 A2 A1
B20 B19 B18 B17 B16 B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1
B20 B19 B18 B17 B16 B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1
FA020803.VSD

- The terminal arrangement of the screw terminal is the same as that of the connector on a module.

● External Dimensions

Unit: mm



WARNING

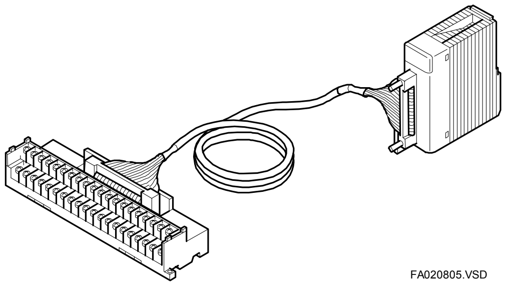
The correct tightening torque of the terminal block screws is 0.22 N·m (1.9 lbf·in). Use a screwdriver of the correct size; otherwise the screw head may be damaged.

(2) TA50-0N/TA50-1N/TA50-2N

TA50-0N, TA50-1N and TA50-2N connector terminal blocks are designed for use with I/O modules of connector specifications.

● Features

- Allows 1:1 expansion of the connector of the I/O module to screw terminal.
- Connects to an I/O module using a dedicated connector terminal block KM55-0xx cable, thus saving wiring.
- Can be mounted using either a DIN rail or screws.



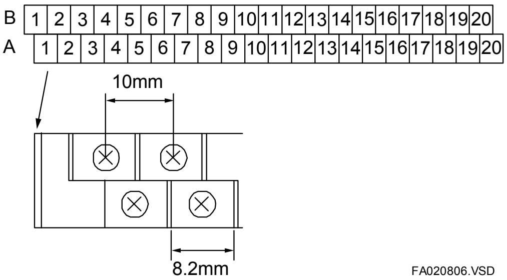
FA020805.VSD

● Specifications

Item	Specifications		
	TA50-0N	TA50-1N	TA50-2N
Number of I/O points	40		
Rated voltage	5 to 24 V DC		
Operating voltage range	4.5 to 26.4 V DC		
Maximum current	0.5A DC/point		
Compatible cable	2 mm^2 maximum	1.25 mm^2 maximum	
Terminal block screw	M3.5	M3	
Compatible terminal	Crimp-on terminal with a diameter of up 8 mm	Crimp-on terminal with a diameter of up 5.8 mm	
Connector	HIF3BA-40PA-2.54DSA（71） (compliant to MIL standard)		
Mounting	35 mm wide DIN rail or screws		
Mounting screw (When screw-mounted)	M4-size screws (2 places)		
Color	Black	Gray	
Weight	300 g	175 g	162 g

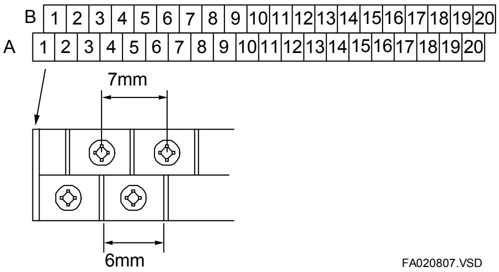
This connector terminal block cannot be used on F3YP04, F3YP08, F3YP14, F3YP18, F3NC32 and F3NC34.
You need to separately procure the KM55-0xx cable for connecting the module and the connector terminal block as it is not supplied with the connector terminal block.

● Terminal Arrangement (TA50-0N)


B 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
A 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
10mm
8.2mm

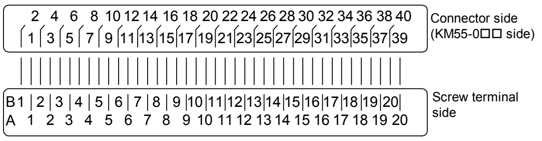
FA020806.VSD

● Terminal Arrangement (TA50-1N/TA50-2N)


B 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
A 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
7mm
6mm

FA020807.VSD

● Internal Connection


2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39
Connector side (KM55-0□□ side)
B 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
A 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Screw terminal side

FA020808.VSD

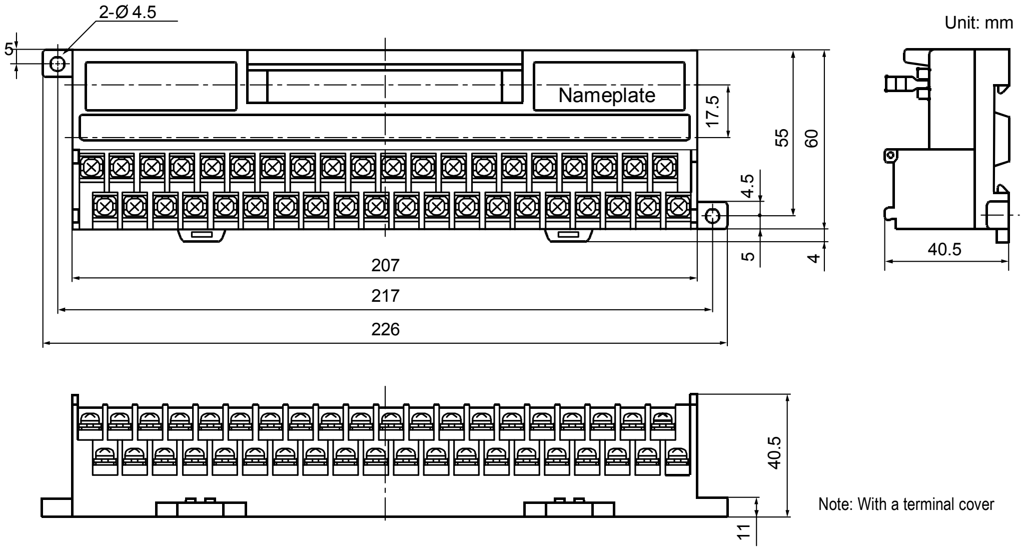
Note: The terminal arrangement of the terminal block is the same as that of the connector on a module.

●Operating Environment Specifications

Item	Specifications
Surrounding air temperature range	Operating : 0 to 55°C
	Storage : -20°C to 75°C
Surrounding humidity range	Operating : 10 to 90% RH (non-condensing)
	Storage : 10 to 90% RH (non-condensing)
Surrounding atmosphere	Must be free of corrosive gases, flammable gases or heavy dust.

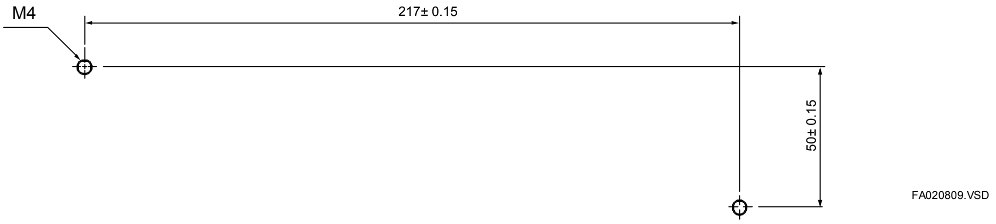
● External Dimensions

TA50-0N

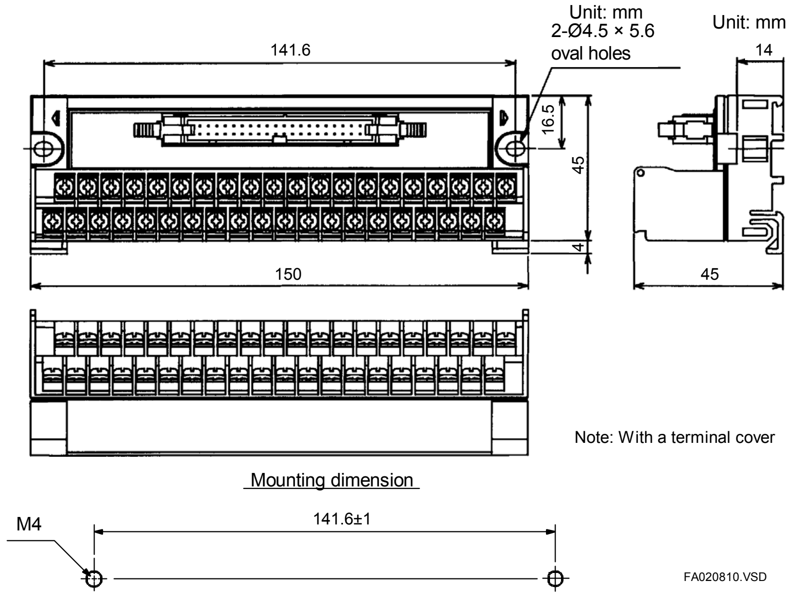


Note: With a terminal cover

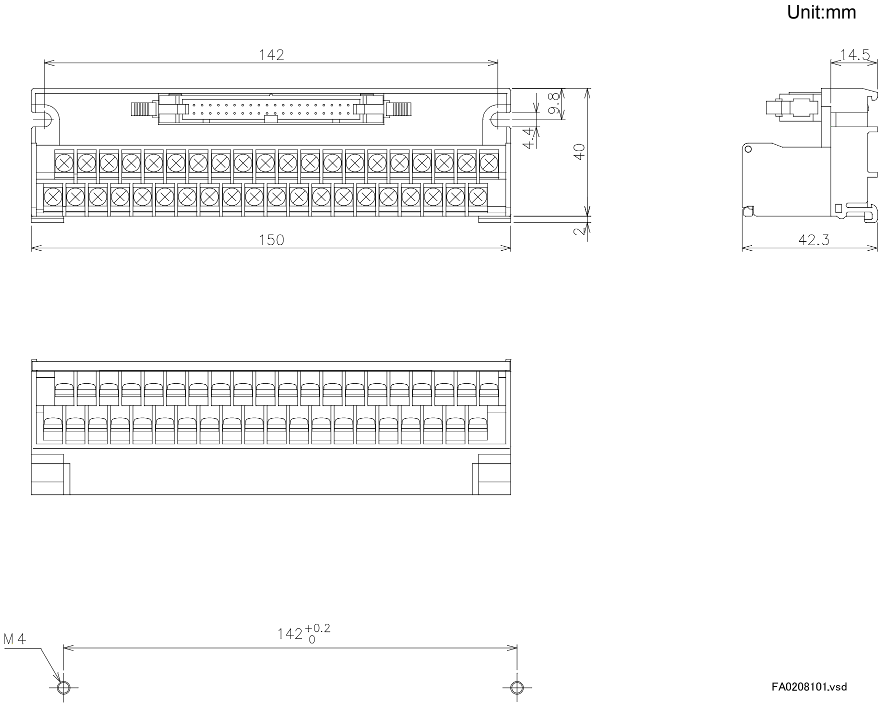
External Dimensions



TA50-1N



TA50-2N



WARNING

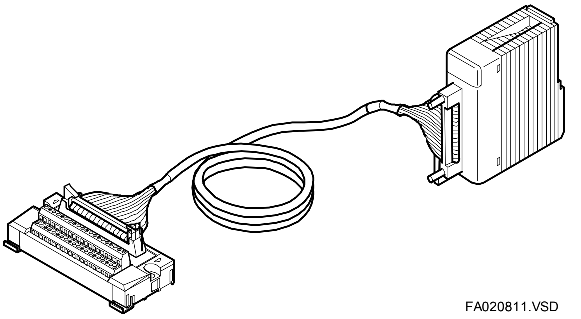
The correct tightening torque of the terminal block screws is 0.8 N·m (7.1 lbf·in). Use a screwdriver of the correct size; otherwise the screw head may be damaged.

(3) TA60-0N

The TA60-0N connector terminal block is designed for use with I/O modules of connector specifications.

Features

- Allows 1:1 expansion of the connector of the I/O module to European type screw terminal.
- Using the European type terminal block eliminates the need for installing soldered and crimp-on terminals and end processing of I/O cables.
- Compact design saves space.
- Connects to an I/O module using a dedicated connector terminal block KM55-0xx cable, thus saving wire.
- Can be mounted using either a DIN rail or screws.



Specifications

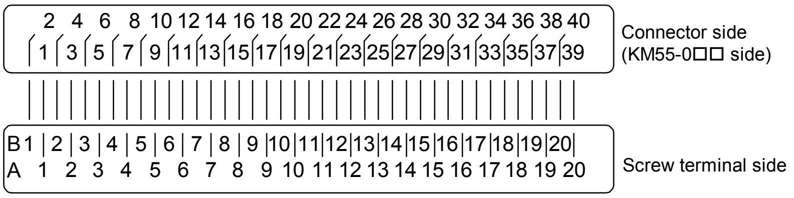
Item	Specifications
Number of I/O points	40
Rated voltage	5 to 24 V DC
Operating voltage range	4.5 to 26.4 V DC
Maximum current	0.5A DC/point
Compatible cable	AWG28 to 23 (0.08 to 0.26 mm^2)
Connector	M2 (European Terminal type)
Connector	HIF3BA-40PA- 2.54DSA (Conforming to MIL standard)
Mounting	35 m wide DIN rail or screws
Mounting screw (When screw-mounted)	M4 screws (2 places)
Color	Gray
Weight	80 g

- This connector terminal block cannot be used on F3YP04,F3YP08,F3YP14,F3YP18,F3YP22,F3YP24,F3YP28, F3NC32 and F3NC34.
- You need to separately procure the KM55-0xx cable for connecting the module and the connector terminal block as it is not supplied with the connector terminal block.

Operating Environment Specifications

Item	Specifications
Surrounding air temperature range	Operating : 0 to 55°C
	Storage : -20°C to 75°C
Surrounding humidity range	Operating : 10 to 90% RH (non-condensing)
	Storage : 10 to 90% RH (non-condensing)
Surrounding atmosphere	Must be free of corrosive gases, flammable gases or heavy dust.

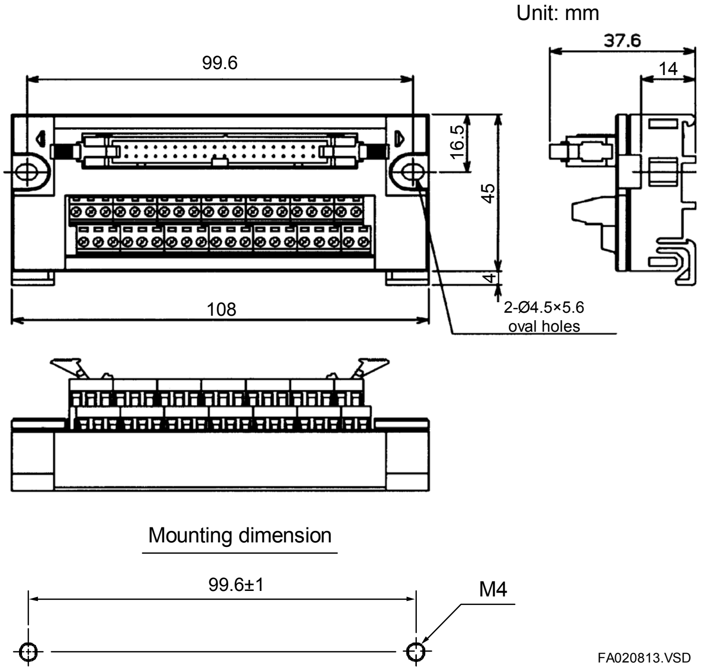
●Internal Connection



FA020812.VSD

Note: The terminal arrangement of the screw terminal is the same as that of the connector on a module.

●External Dimensions



FA020813.VSD

WARNING

The correct tightening torque of the terminal block screws is 0.22 N·m (1.9 lbf·in). Use a screwdriver of the correct size; otherwise the screw head may be damaged.

A2.9 Module Current Consumption Tables

Design your system making sure that the total sum of current consumed by modules with a 5 V supply does not exceed the capacity of the internal 5 V source of the power supply module. If necessary, separately procure an external power supply, which meets the specifications.

■ Base Modules

Module Description	Model	Max. Current at 5 V Supply (mA)	Power Supply from External Sources	
			Voltage (VDC)	Current (mA)
Base module	F3BU04-0N	50	—	—
	F3BU06-0N	50	—	—
	F3BU05-0D	50	—	—
	F3BU09-0N	50	—	—
	F3BU13-0N	50	—	—
	F3BU16-0N	50	—	—

■ Power Supply Modules

Module Description	Model	Capacity of Internal 5 V Source (mA)	Supply Current to External Devices (mA)
Power supply module	F3PU10-0N F3PU10-0S	2000	None
	F3PU16-0N	2000	None
	F3PU20-0N F3PU20-0S	4300	None
	F3PU26-0N	4300	None
	F3PU30-0N F3PU30-0S	6000	None
	F3PU36-0N F3PU36-0S	6000	None

■ CPU Modules

Module Description	Model	Max. Current at 5 V Supply (mA)	Power Supply from External Sources	
			Voltage (VDC)	Current (mA)
Sequence CPU module	F3SP21-0N	350	—	—
	F3SP22-0S	450	—	—
	F3SP25-2N	420	—	—
	F3SP35-5N	560	—	—
	F3SP28-3N	450	—	—
	F3SP38-6N	450	—	—
	F3SP53-4H	890	—	—
	F3SP58-6H	890	—	—
	F3SP28-3S	450	—	—
	F3SP38-6S	450	—	—
	F3SP53-4S	890	—	—
	F3SP58-6S	890	—	—
	F3SP59-7S	890	—	—
	F3SP66-4S	850	—	—
	F3SP67-6S	850	—	—
	F3SP71-4N	460	—	—
	F3SP76-7N	460	—	—
	F3SP71-4S	460	—	—

Module Description	Model	Max. Current at 5 V Supply (mA)	Power Supply from External Sources	
			Voltage (VDC)	Current (mA)
Sequence CPU module	F3SP76-7S	460	—	—
	F3FP36-3N	560	—	—
BASIC CPU module	F3BP20-0N	200	—	—
	F3BP30-0N	200	—	—

■ Memory Card Module

Module Description	Model	Max. Current at 5 V Supply (mA)	Power Supply from External Sources	
			Voltage (VDC)	Current (mA)
Memory card module	F3EM01-0N	300	—	—

■ I/O Modules

Module Description	Model	Max. Current at 5 V Supply (mA)	Power Supply from External Sources	
			Voltage (VDC)	Current (mA)
High-speed input module	F3XH04-3N	30	—	—
AC input module	F3XA08-1N	40	—	—
	F3XA08-2N	40	—	—
	F3XA16-1N	65	—	—
DC input module	F3XD08-6F	40	—	—
	F3XD16-3F	65	—	—
	F3XD16-4F	65	—	—
	F3XD16-3H	65	—	—
	F3XD32-3F	75	—	—
	F3XD32-4F	75	—	—
	F3XD32-5F	75	—	—
	F3XD64-3F	100	—	—
	F3XD64-4F	100	—	—
	F3XD08-6N	40	—	—
	F3XD16-3N	65	—	—
	F3XD16-4N	65	—	—
	F3XD32-3N	75	—	—
	F3XD32-4N	75	—	—
	F3XD32-5N	75	—	—
	F3XD64-3N	100	—	—
	F3XD64-4N	100	—	—
	F3XD64-6M	110	12 to 24	70
No-voltage contact input module	F3XC08-0N	75	—	—
	F3XC08-0C	75	—	—
Triac output module	F3YA08-2N	130	—	—
Relay output module	F3YC08-0C	205	—	—
	F3YC08-0N	205	—	—
	F3YC16-0N	380	—	—
Transistor output module	F3YD04-7N	85	—	—
	F3YD08-6A	60	12 to 24	10
	F3YD08-6B	60	12 to 24	10
	F3YD08-7A	80	12 to 24	10
	F3YD14-5A	120	12 to 24	20
	F3YD14-5B	120	12 to 24	20
	F3YD32-1A	210	12 to 24	115
	F3YD32-1B	210	12 to 24	115
	F3YD32-1H	165	12 to 24	30
	F3YD32-1P	160	12 to 24	55
	F3YD32-1R	170	12 to 24	60
	F3YD32-1T	210	5	60
	F3YD64-1F	275	24	150
	F3YD64-1A	275	24	150
	F3YD64-1M	125	12 to 24	40
	F3YD64-1P	275	12 to 24	95
	F3YD64-1R	275	12 to 24	110

Module Description	Model	Max. Current at 5 V Supply (mA)	Power Supply from External Sources	
			Voltage (VDC)	Current (mA)
I/O module	F3WD64-3F	200	24	60
	F3WD64-4F	200	12	60
	F3WD64-3N	200	24	60
	F3WD64-4N	200	12	60
	F3WD64-3P	170	24	55
	F3WD64-4P	170	12	55

■ Analog I/O and Temperature Modules

Module Description	Model	Max. Current at 5 V Supply (mA)	Power Supply from External Sources	
			Voltage (VDC)	Current (mA)
Analog input module	F3AD04-0N	210	—	—
	F3AD04-0R	210	—	—
	F3AD04-0V	210	—	—
	F3AD08-1N	210	—	—
	F3AD08-1R	210	—	—
	F3AD08-4R	210	—	—
	F3AD08-5R	210	—	—
	F3AD08-6R	210	—	—
	F3AD08-1V	210	—	—
	F3AD08-4V	210	—	—
Analog output module	F3DA02-0N	100	24	150
	F3DA04-1N	100	24	180
	F3DA08-5N	100	24	100
	F3DA04-6R	60	24	200
	F3DA08-5R	60	24	200
High-speed data acquisition module	F3HA08-0N	450	—	—
Temperature control/monitoring module	F3CT04-0N	250	24	200
	F3CT04-1N	250	24	200
	F3CR04-0N	250	24	200
	F3CR04-1N	250	24	200
PID control module	F3CV04-1N	250	24	200
Temperature control and PID module	F3CU04-0N	460	24	10
	F3CU04-0S	460	24	10
	F3CU04-1N	470	24	250
	F3CU04-1S	470	24	250
Temperature monitoring module	F3CX04-0N	440	—	—

■ Communication Modules

Module Description	Model	Max. Current at 5 V Supply (mA)	Power Supply from External Sources	
			Voltage (VDC)	Current (mA)
ASi Master module	F3LA01-0N	330	30	2,000 / 200*
PROFIBUS-DP Interface module	F3LB01-0N	610	—	—
Personal computer link module	F3LC11-1F	320	—	—
	F3LC11-1N	100	—	—
	F3LC11-2F	350	—	—
	F3LC11-2N	170	—	—
	F3LC12-1F	350	—	—
UT link module	F3LC51-2N	290	—	—
DeviceNet interface module	F3LD01-0N	200	11 to 25	40
Ethernet interface module	F3LE01-0T	500	—	—
	F3LE01-5T	330	12	500
	F3LE11-0T	500	—	—
	F3LE12-0T	500	—	—
YHLS master module	F3LH02-0N	440	—	—
	F3LH01-1N	360	—	—
	F3LH02-1N	480	—	—
FL-net (OPCN-2) interface module	F3LX02-1N	460	12	500

Module Description	Model	Max. Current at 5 V Supply	Power Supply from External Sources	
NX interface module	F3NX01-0N	330	12	500
NX interface module	F3NX01-1N	500	—	—
RS-232-C communication module	F3RS22-0N	350	—	—
RS-422-A communication module	F3RS41-0N	350	—	—
Ladder communication module	F3RZ81-0F	320	—	—
	F3RZ81-0N	100	—	—
	F3RZ82-0F	350	—	—
	F3RZ91-0F	350	—	—
	F3RZ91-0N	210	—	—
GP-IB communication module	F3GB01-0N	250	—	—

*: The maximum current which can be supplied to communication line through F3LA01-0N is 2000mA. (Include current consumption of F3LA01-0N, 200mA.)

■ FA Link and Fiber-optic FA-bus Modules

Module Description	Model	Max. Current at 5 V Supply (mA)	Power Supply from External Sources	
			Voltage (VDC)	Current (mA)
Fiber-optic FA link H module	F3LP12-0N	495	—	—
Fiber-optic FA-bus module	F3LR01-0N	220	—	—
Fiber-optic FA-bus type 2 module	F3LR02-0N	460	—	—
FA-bus type 2 module	F3LR02-1W	320	—	—

■ Counter and Positioning Modules

Module Description	Model	Max. Current at 5 V Supply (mA)	Power Supply from External Sources	
			Voltage (VDC)	Current (mA)
High-speed counter module	F3XP01-0H	100	—	—
	F3XP02-0H	150	—	—
Pulse input module	F3XS04-3N	230	—	—
	F3XS04-4N	230	—	—
Positioning module (advanced model with pulse output)	F3NC11-0N	180	5	200
	F3NC12-0N	180	5	200
Positioning module (with pulse output)	F3NC32-0N	450	24	80
	F3NC34-0N	540	24	120
Positioning module (with analog voltage output)	F3NC51-0N	390	24	10
	F3NC52-0N	400	24	10
Positioning module (for torque control)	F3NC61-0N	580	24	10
Positioning module (with MECHATROLINK-II Interface)	F3NC96-0N	570	—	—
Positioning module (with MECHATROLINK-III Interface)	F3NC97-0N	530	—	—
Positioning module (with multi-channel pulse output)	F3YP04-0N	300	5	350
	F3YP08-0N	350	5	700
	F3YP14-0N	320	5	350
	F3YP18-0N	380	5	700
	F3YP22-0P	210	24	70*
	F3YP24-0P	240	24	110*
	F3YP28-0P	280	24	200*

*: Sum of current for the pulse output and the counter contact output.

A2.10 External Power Supply

Use an external power supply that meets the following requirements.

Item	Specifications	
Output Voltage	24 V DC 12 V DC	5 V DC
Ripple	240 mV p-p max.	100 mV p-p max.
Noise	360 mV p-p max.	150 mV p-p max.
Overcurrent protection	Should be included	

If the product is used as a UL-approved product, the external power supply must be provided from a limited voltage/current circuit*1 or class 2 power supply*2.

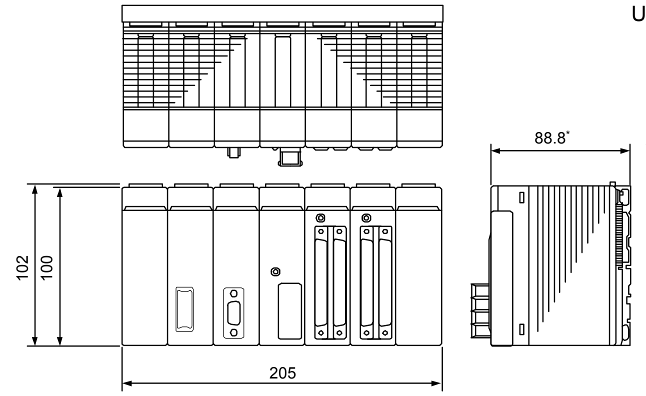
*1 A limited voltage/current circuit is a UL508-approved isolated power supply which is limited to 30 VAC or 42.4 V peak in output voltage and to 8 A in output current.

*2 A class 2 power supply is a UL1310-approved power supply which is tested and proved by UL that its output voltage is 30 VDC max. and its output current is 8 A max.

A2.11 External Dimensions

● External View of the FA-M3 Controller (when F3BU06-0N Base Module is used)

Unit : mm



* : To obtain the depth including the base module, add 5.6 mm to the depth of the installed module. When mounting on the DIN rail, add another 6.5 mm.

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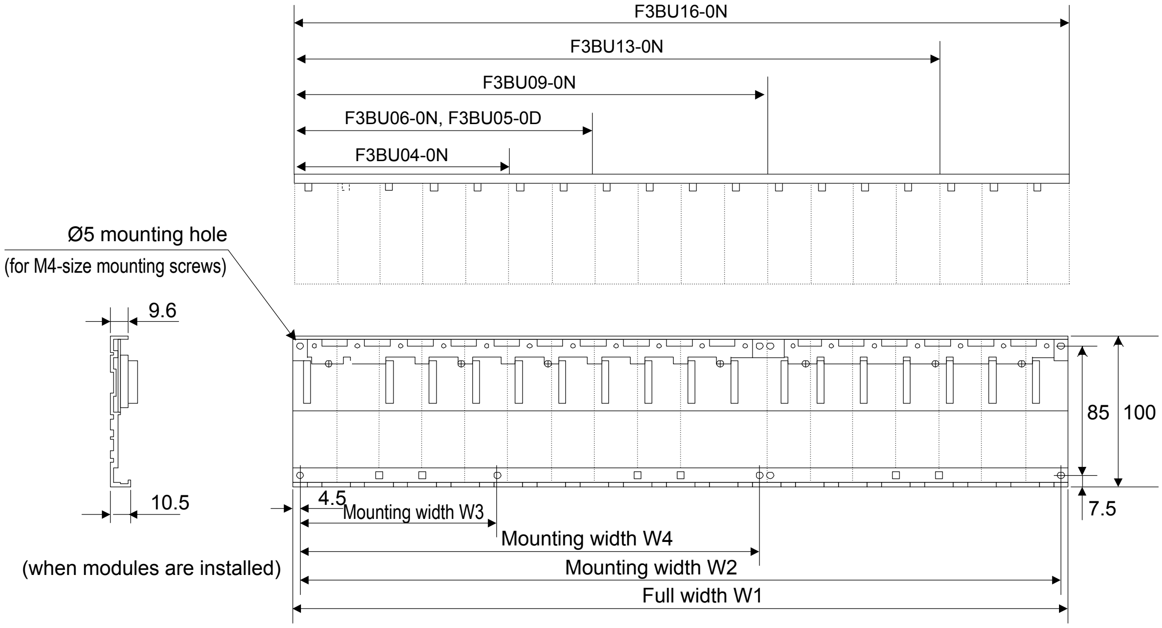
● Base Modules

The external dimensions of a base module vary depending on the number of slots the module provides, as shown below.

Unit: mm

Model	Number of Slots	Number of I/0Slots	Full Width (W1)	Mounting Width (W2)	Mounting Width (W3)	Mounting Width (W4)
F3BU04-0N	4	3	147	138	—	—
F3BU06-0N	6	5	205	196	—	—
F3BU05-0D	5	4	205	196	—	—
F3BU09-0N	9	8	322	313	138	—
F3BU13-0N	13	12	439	430	196	—
F3BU16-0N	16	15	527	517	138	313



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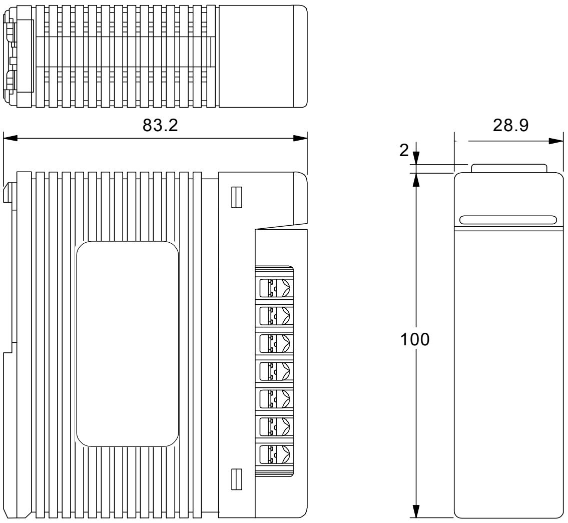
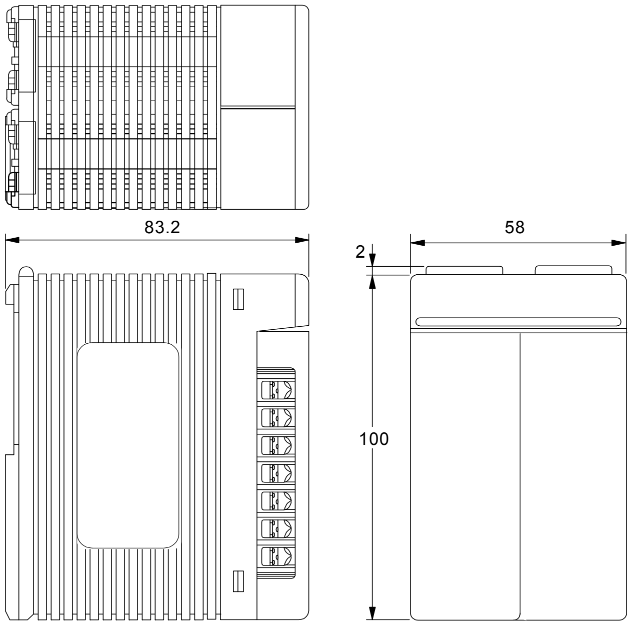
● Power Supply Modules

Unit: mm

F3PU01, F3PU10, F3PU16



F3PU20, F3PU26



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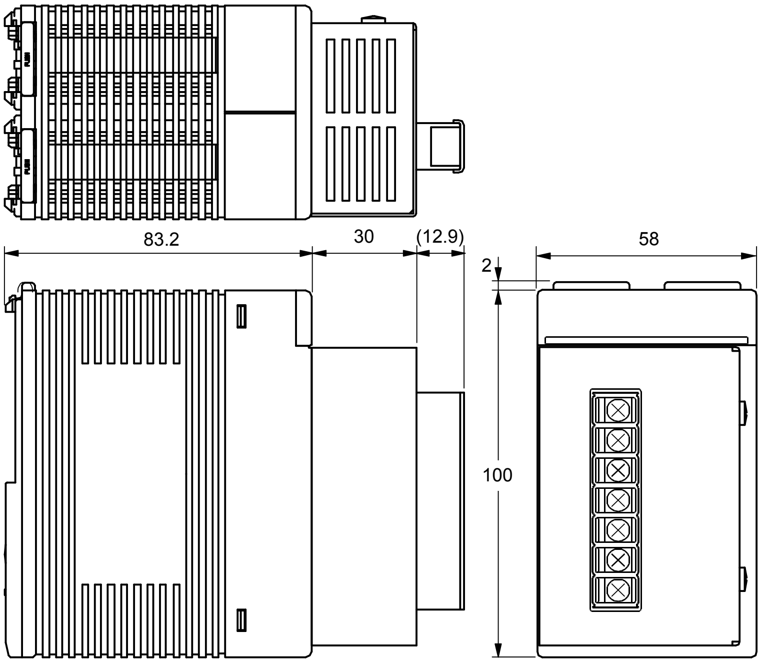
F3PU30, F3PU36



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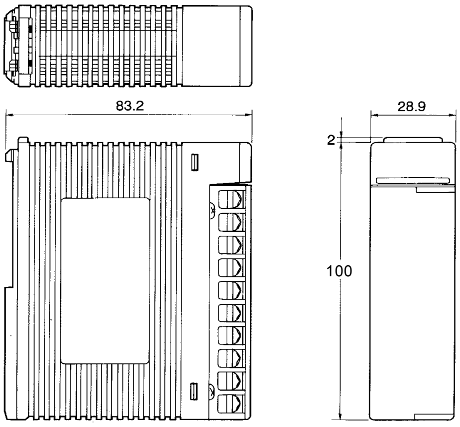
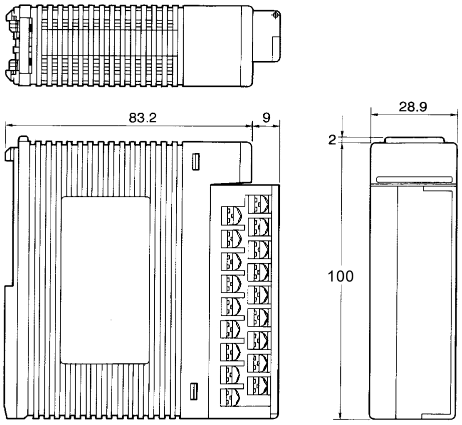
● I/O Modules

Unit: mm

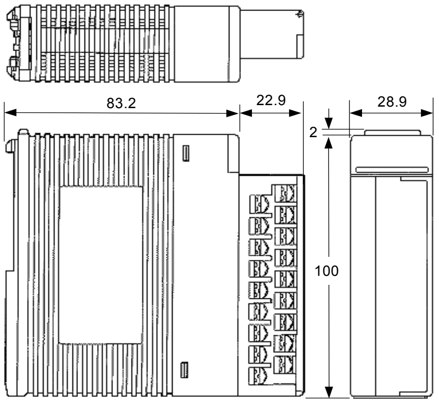
F3XH04, F3XA08, F3XC08-0N, F3XD08



F3XD16-0C, F3XD16



F3XA16



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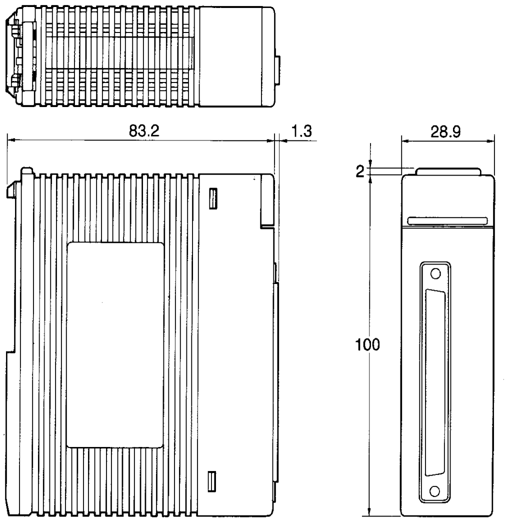
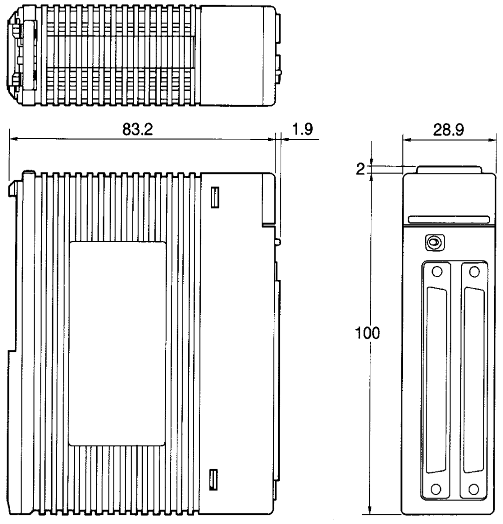
Unit: mm

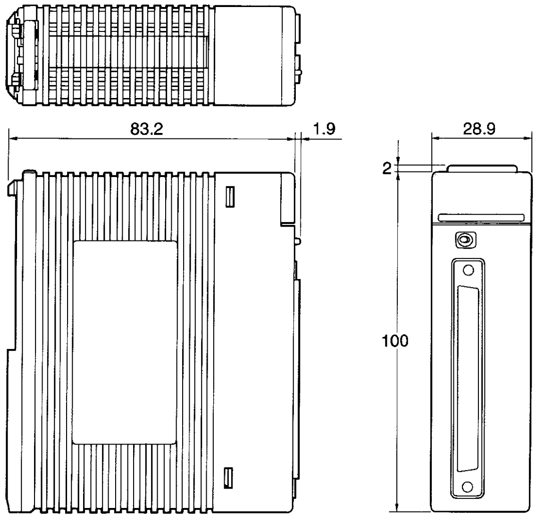
F3XD32



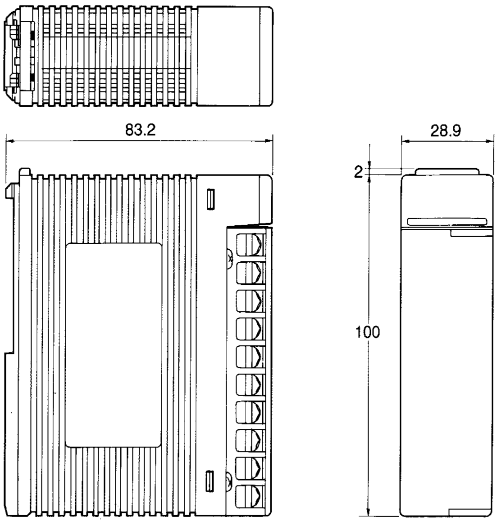
F3XD64-3N, F3XD64-4N, F3XD64-3F, F3XD64-4F



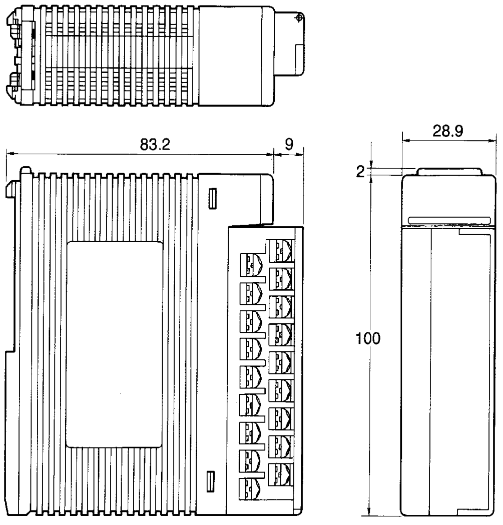
F3XD64-6M



F3YA08, F3YD04
F3YC08-0N, F3YD08



F3YD14, F3YC08-0C, F3YC16



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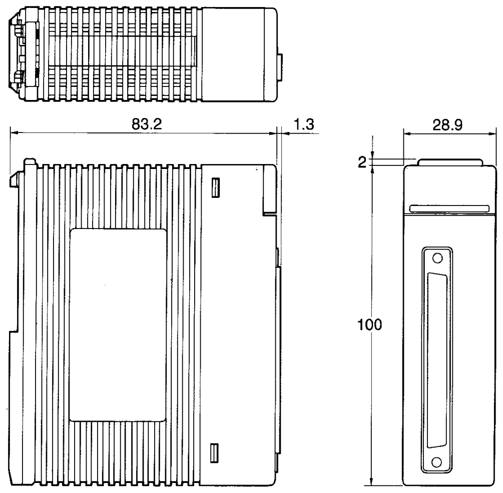
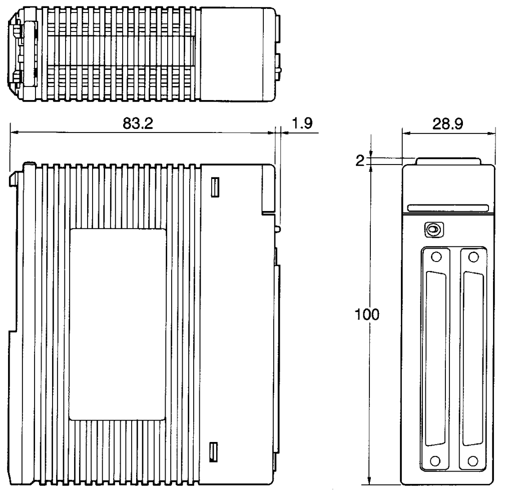
Unit: mm

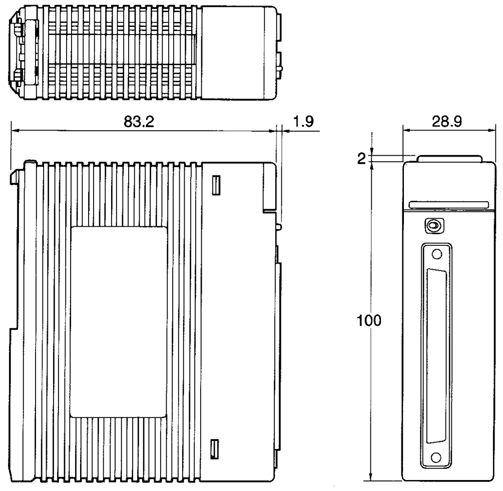
F3YD32



F3YD64-1A, F3YD64-1F, F3YD64-1P, F3YD64-1R,
F3WD64



F3YD64-1M



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A3. Installation and Wiring

A3.1 Environmental Conditions for Installation within a Panel Enclosure

Refer to the following considerations when designing the interior of the panel enclosure to ensure operability, maintainability, and environmental durability.

Figure A3.1 shows a typical example of a layout within a panel enclosure.

■ Temperature Considerations

- Provide good ventilation to prevent heat from being trapped inside the panel enclosure. If two or more FA-M3 controller units are installed vertically within the same panel enclosure, provide a clearance of at least 8 cm between them.
- Ensure that the upper and lower vents near the FA-M3 controller are not blocked either by wiring or otherwise.
- Avoid mounting the controller directly above any equipment that generate large amounts of heat.
- If there will be times where the temperature inside the panel enclosure reaches 55°C (131°F) or higher, use a fan or an air conditioner for cooling. Consider providing a safety mechanism such as a temperature sensor inside the panel enclosure to raise an alarm upon failure of the fan or air conditioner as such failures may adversely affect the system. Conversely, if temperature is likely to fall below 0°C (32°F) during morning startup, include a small heater, lamp, or other heat source to preheat the panel enclosure.
  Figure A3.2 shows examples of cooling systems.

■ Humidity Considerations

Condensation may occur due to sudden temperature changes resulting from the turning on and off of an air conditioner. If condensation occurs on any of the circuit boards, the instrument may malfunction due to shorted internal circuitry. If there is a risk of condensation, either keep the power turned on at all times, or use a space heater or other alternative means to keep the controller constantly preheated.

■ Vibration and Shock Considerations

- As a countermeasure to keep shock or vibration below the specified limit, place the panel enclosure as far away as possible from any source of vibration or shock, or place the panel enclosure on vibration-proof rubber.
- As a countermeasure to keep mechanical shock from electromagnetic switches mounted inside the panel enclosure below the specified limits, install such devices on vibration-proof rubber.

CAUTION

Be wary of any vibration and shock to the hard disk module.

Any mechanical vibration or shock occurring during transportation of equipment or facilities into which the FA-M3 has been assembled must also be within the specifications limits. The specification range for vibration and shock is especially stringent for the hard disk module, as compared to other modules. When transporting, use the same packaging in which the product was originally shipped.

■ Atmospheric Considerations

In a dusty location, either hermetically seal the panel enclosure, or purge the panel enclosure with clean air ensuring the interior of the panel enclosure is pressurized slightly higher than its surroundings to prevent the intrusion of outside dust.

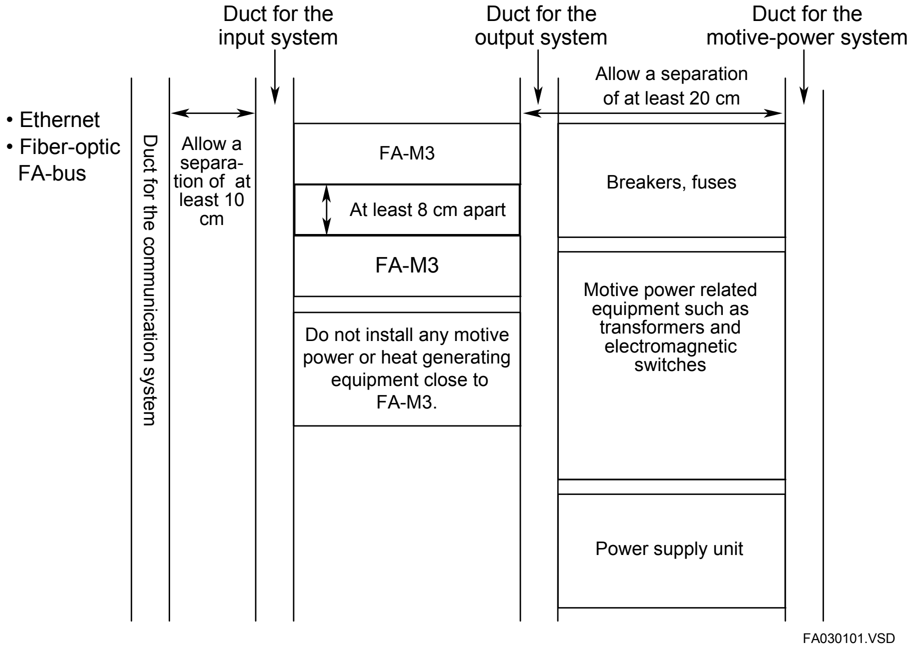
Duct for the input system
Duct for the output system
Duct for the motive-power system
Allow a separation of at least 20 cm
• Ethernet
• Fiber-optic FA-bus
Duct for the communication system
Allow a separation of at least 10 cm
FA-M3
At least 8 cm apart
FA-M3
Do not install any motive power or heat generating equipment close to FA-M3.
Breakers, fuses
Motive power related equipment such as transformers and electromagnetic switches
Power supply unit
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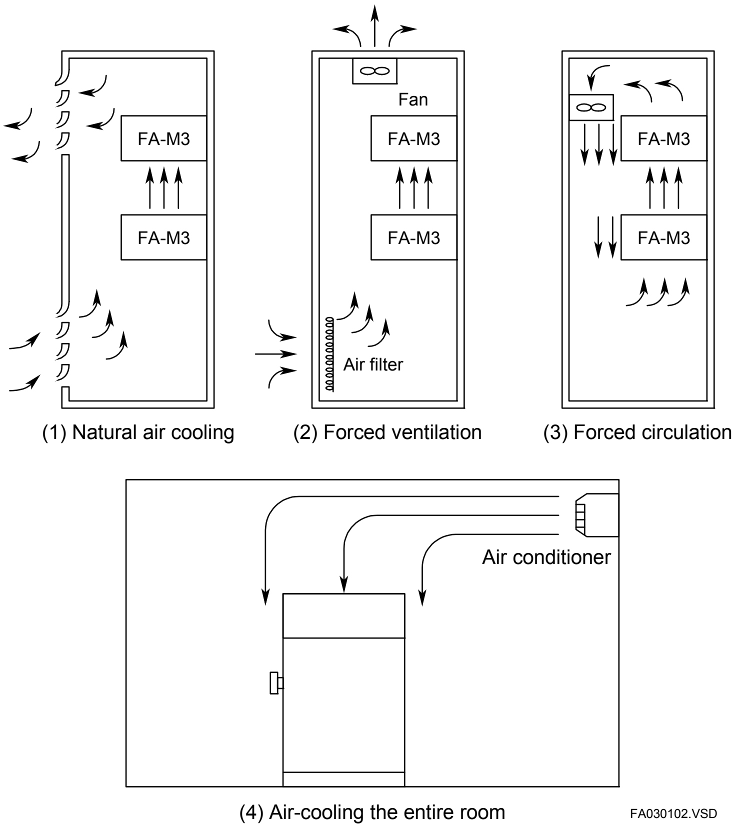
Figure A3.1 Example of a Panel Enclosure Layout



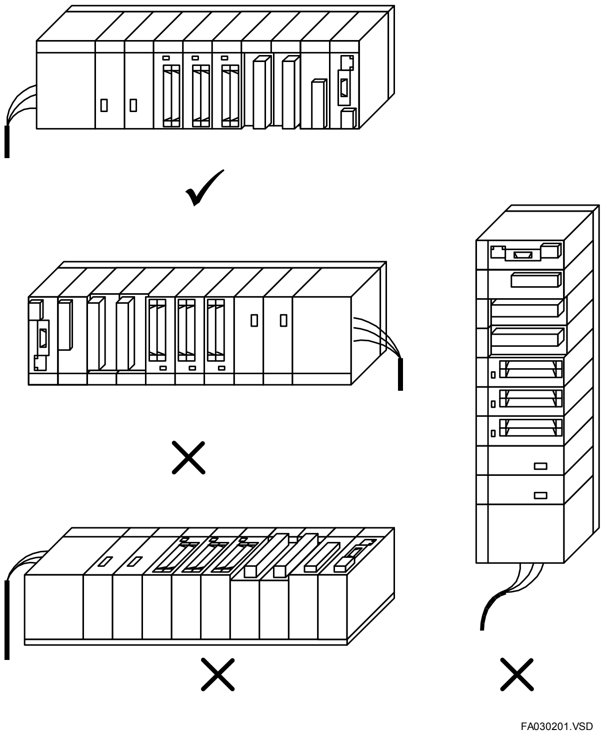
(1) Natural air cooling
(2) Forced ventilation
(3) Forced circulation
(4) Air-cooling the entire room

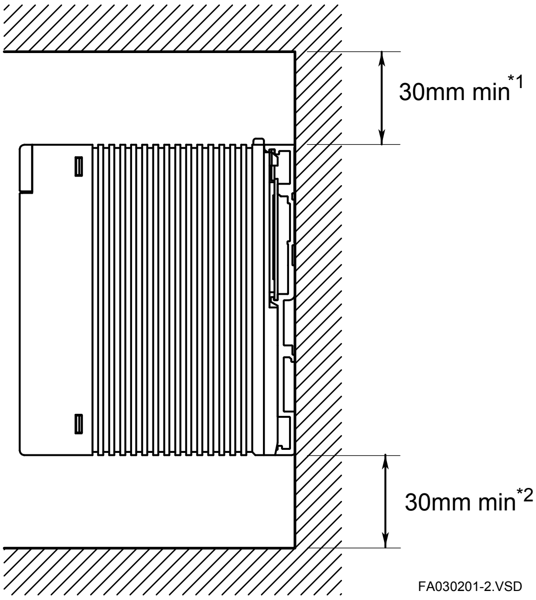
Figure A3.2 Methods for Cooling the Panel Enclosure

A3.2 Methods for Mounting the FA-M3 within a Panel Enclosure

A3.2.1 Mounting Positions

The FA-M3 module is designed with natural air cooling heat design considerations. Install the FA-M3, orientated so that the LED display is at the top and the air outlets are at the top and bottom.



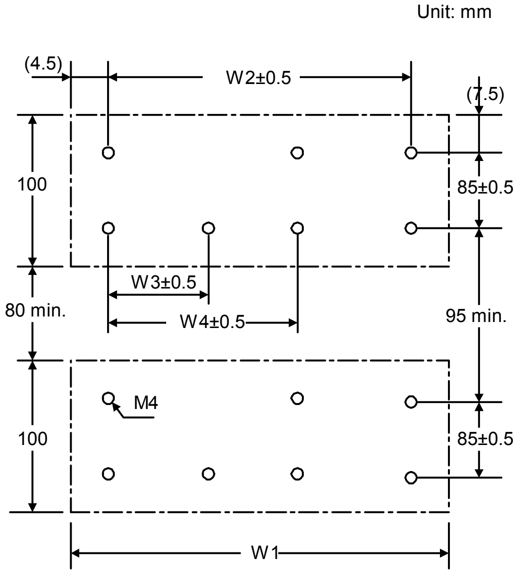


*1: Leave a space in order to attaching/detaching the modules.
*2: When there is the connector wiring from the bottom of the module, see subsection A3.2.5, “Mounting Depth and Space”.

Figure A3.3 Mounting posture and position

A3.2.2 Mounting Dimensions

■ Screw Mounting



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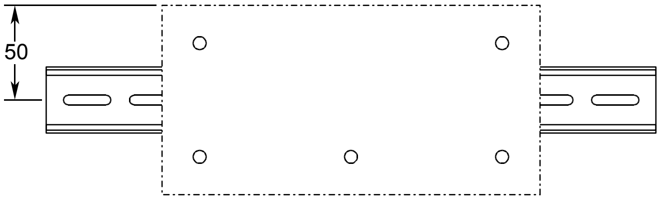
Base Module Model	Full Width W1	Mounting Width		
		W2	W3	W4
F3BU04-0N	147	138	—	—
F3BU06-0N	205	196	—	—
F3BU05-0D	205	196	—	—
F3BU09-0N	322	313	138	—
F3BU13-0N	439	430	196	—
F3BU16-0N	527	517.3	138	313

Note: The FA-M3 does not come with the screws for mounting base modules.
Each base module requires the following number of mounting screws.
F3BU04, F3BU06, F3BU05, F3BU09 and F3BU13: Four
F3BU16: Six
The specifications of the mounting screws are as follows:
M4-size binding-head screw, 12 to 15 mm long (or 14 to 15 mm long, if fitted with a washer)

■ DIN Rail Mounting



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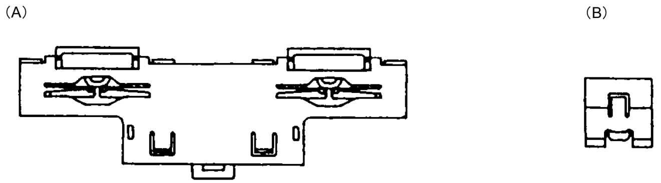
A3.2.3 Mounting on and Removing from a DIN Rail

When mounting the FA-M3 on a DIN rail, attach a rail mount kit to the back of the controller. For the rail mount kit, purchase either Model T9031AP (for F3BU04, F3BU06 and F3BU05 base modules) or Model T9031AQ (for F3BU09 and F3BU13 base modules) separately. Note that F3BU16-0N, F3BU09-2N and F3BU13-2N are not designed for mounting on a DIN rail.

■ Installing a Rail Mount Kit

A rail mount kit comprises two component parts that are used in combination.



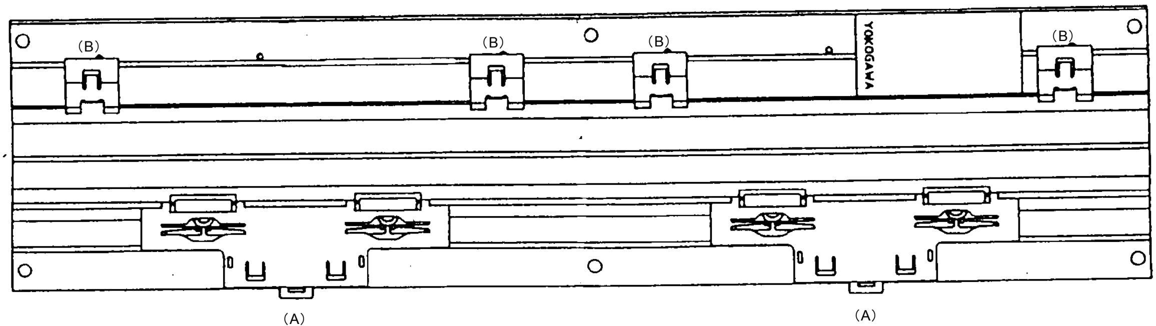
FA030204.VSD

The number of components needed is shown below.

(A) X 1 and (B) × 2 (for F3BU04, F3BU06 and F3BU05 base modules)

(A) X 2 and (B) × 4 (for F3BU09 and F3BU13 base modules)

● Mounting location (Rear of the controller)



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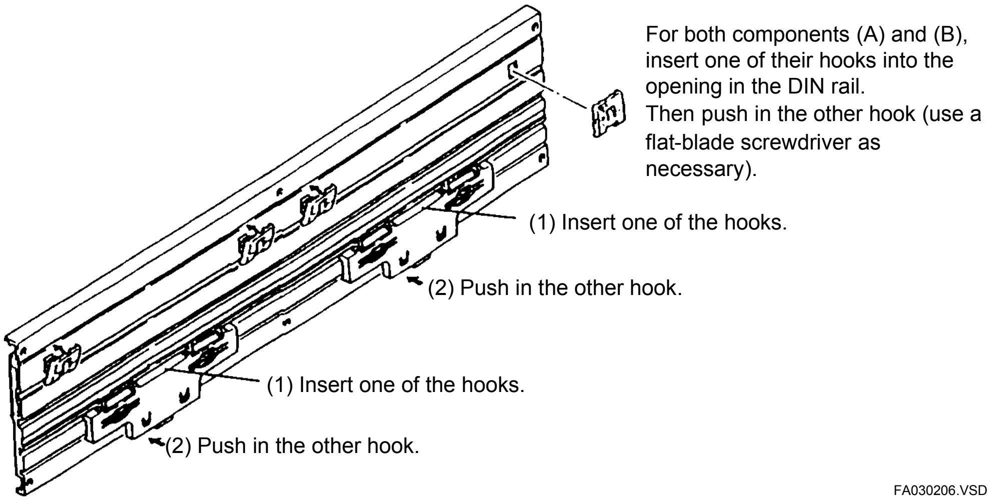
● Mounting procedure



For both components (A) and (B), insert one of their hooks into the opening in the DIN rail.
Then push in the other hook (use a flat-blade screwdriver as necessary).

(1) Insert one of the hooks.

(2) Push in the other hook.

(1) Insert one of the hooks.

(2) Push in the other hook.

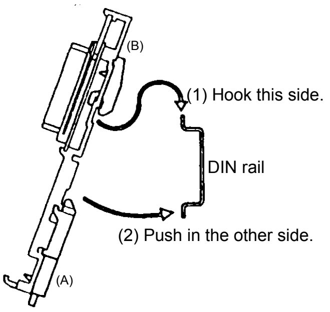
FA030206.VSD

Mounting on the DIN Rail

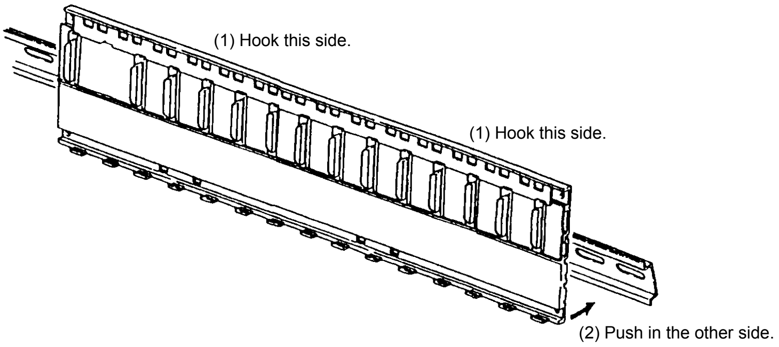
Mount a base module on the DIN rail as follows.

CAUTION

- Ensure that the base module is securely attached to the DIN rail.
- Do not use the DIN rail to install the FA-M3 system in an environment where it would be subjected to excessive vibration, impact or mechanical load as it may fall off the DIN rail.
- Secure both ends of the base module so that it would not slide along the base module.



Viewed from the side of the FA-M3



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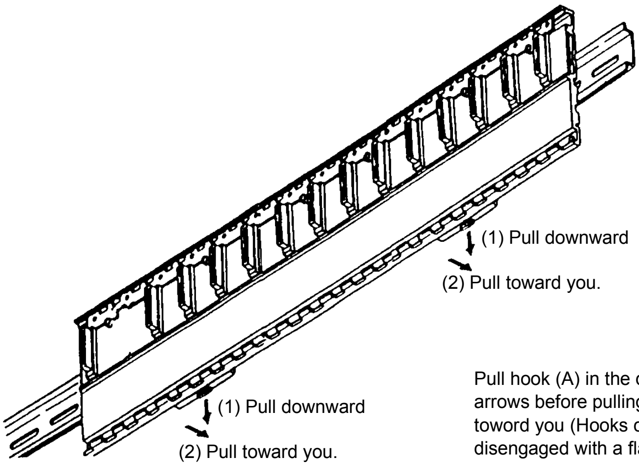
Removing from the DIN Rail



Pull hook (A) in the direction of the arrows before pulling the module toword you (Hooks can be easily disengaged with a flat-blade screwdriver).

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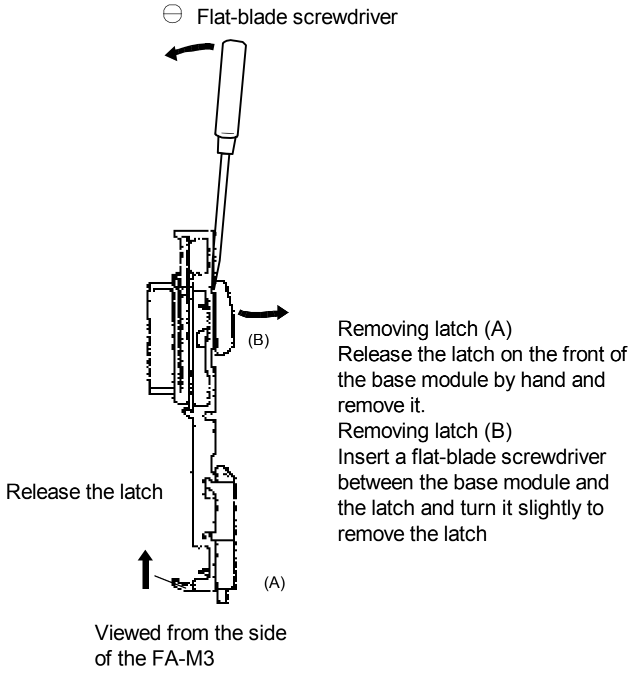
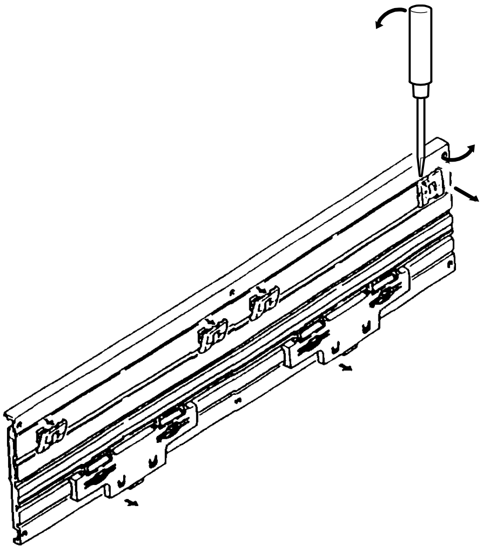
■ Removing the Rail Mount Kit



Removing latch (A)
Release the latch on the front of the base module by hand and remove it.
Removing latch (B)
Insert a flat-blade screwdriver between the base module and the latch and turn it slightly to remove the latch

FA030209.VSD



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A3.2.4 Attaching/Detaching the Module

■ Attaching the Module

Figure A3.4 shows how to attach the module to the base module. First hook the anchor slot at the bottom of the module to be attached onto the anchor pin on the bottom of the base module. Push the top of the module toward the base module until the anchor/release button (yellow button) clicks into place.

CAUTION

Always switch off the power before attaching or detaching the module.

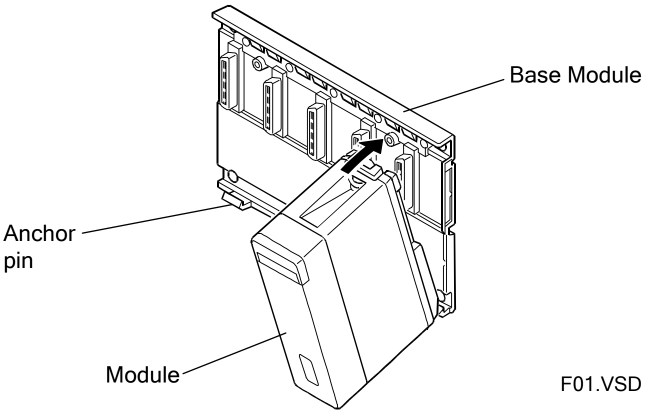


Figure A3.4 Attaching/Detaching the Module

CAUTION

Do not bend the connector on the rear of the module by force during the above operation. If the module is pushed with improper force, the connector may bend causing an error.

■ Detaching the Module

To remove the module from the base module, reverse the above operation.

Press the anchor/release button (yellow button) on the top of this module to unlock it and tilt the module away from the base module.

■ Attaching the Module in Intense Vibration Environments

If the module is used in intense vibration environments, fasten the module with a screw.

Use screws of type listed in the table below.

Insert these screws into the screw holes on top of the module and tighten them with a Phillips screwdriver.

Required Screw
Binding head machine screw M4 of 12 to 15 mm long (washer screw of 14-15 mm long)

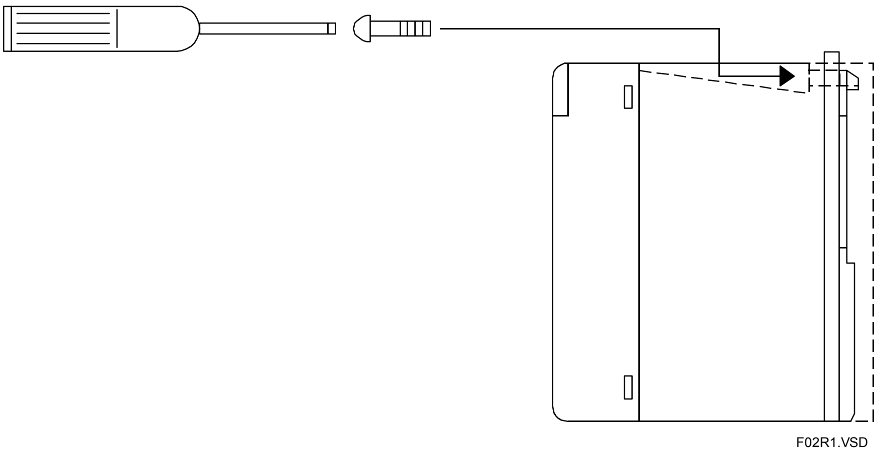
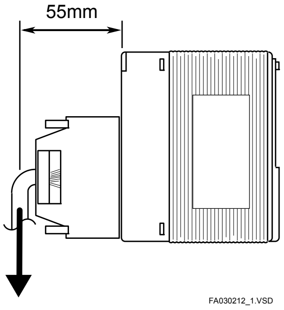


Figure A3.5 Securing Module Using Screws

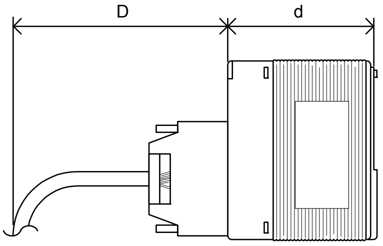
CAUTION

Do not apply excessive load on the module.
Be particularly aware that a downward load of 5 kg or more applied on the connector head (at a position 55 mm from the front side of the module) may cause the module to fall off from the base module.



A3.2.5 Mounting Depth and Space

- The depth of the installed module and the base module together is approximately 90 mm. An additional length should be allowed for cable bending however, if any cable with connectors is attached to the controller.

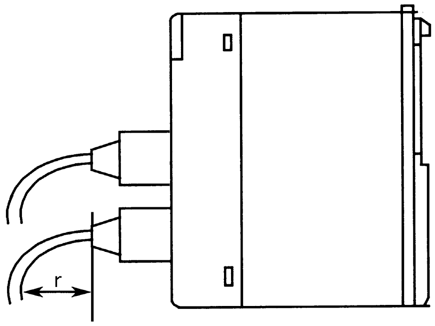


Module	D (mm)	d (mm)
Terminal block type	80 min.	—
Connector type		83.2

FA030212.VSD

Figure A3.6 Mounting Depth

- In the case of fiber-optic FA-bus, fiber-optic FA-bus type 2 and fiber-optic FA link H modules, the mounting depth should allow for the bending radius of their fiber-optic cords or cables.



	Bending Radius r (mm)	
	During cable laying (Temporary)	When secured
Fiber-optic cord	15 min.	50 min.
Fiber-optic cable	50 min.	100 min.

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Figure A3.7 Mounting Depth for Modules with Fiber-optic Cords or Cables

When you lay the fiber-optic cord or cable yourself, follow the instructions given below.

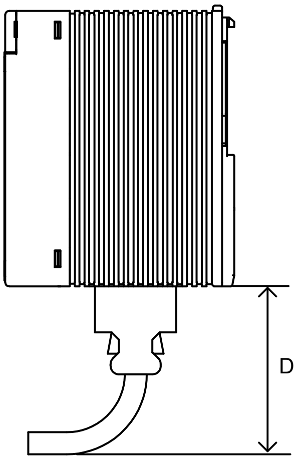
1. The product comes with an instruction manual. The person in charge of wiring should first read the manual thoroughly, and then lay the cord or cable as instructed.
2. Upon delivery, be sure to test the performance of the product by sending light beams through it. The performance of optical fiber can be easily tested by sending sunlight or flashlight beams from one end of the cord or cable and confirming their arrival at the other end.

   Test the performance of the product before installation.

CAUTION

- Before laying cables, customers should check the cables (immediately after delivery) for any defect. In principle, the provided warranty does not cover functional defects (e.g., cable discontinuity) discovered after installation.
- Fiber-optic cables KM61, KM62, KM65, KM67, and KM69 are made-to-order products. Hence, replacement of a defective cable may require a week for KM65 cables, a month for KM61, KM62, and KM67 cables, and two months for KM69 cables.

- In the case of Positioning module(with multi-channel pulse output) F3YP22-0P, F3YP24-0P, F3YP28-0P, this module requires space for the wiring of the connector for counters.



	D(mm)
Min. space	100 min.

FA030214.VSD

Figuer A3.8 Mounting Space for Positioning module(with multi-channel pulse output)

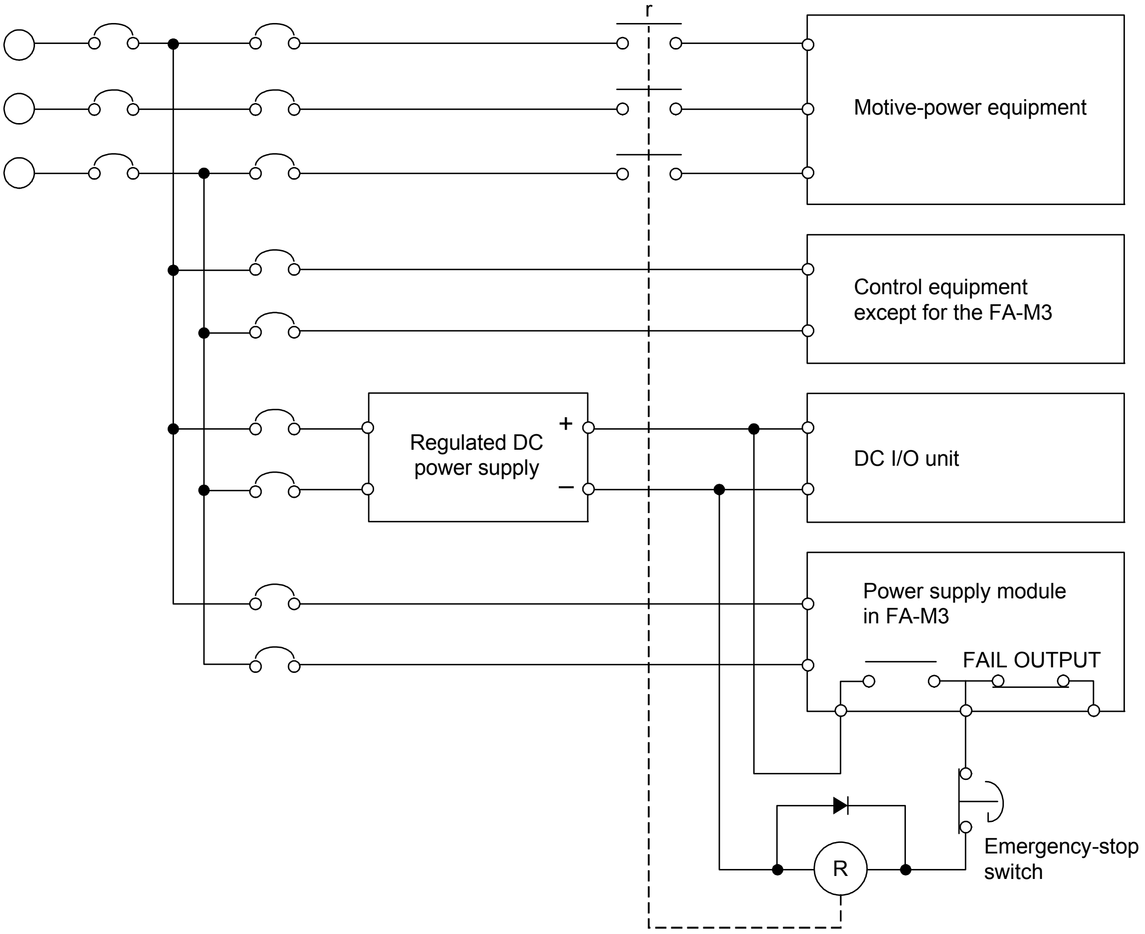
A3.3 System Design Considerations

This section contains the considerations you should take into account when designing a system that incorporates the FA-M3.

A3.3.1 Power Line Wiring and Emergency-stop Circuit

The power lines can roughly be divided into three groups: one for motive-power equipment, one for control equipment except for the FA-M3 and one for the FA-M3 itself. The power line for the FA-M3 is further divided into one for the power supply module and one for I/O units. All these power lines must be equipped with separate circuit breakers or switches and wired separately.

Use the FAIL OUTPUT terminal on the power supply module of the FA-M3 in combination with your external relay circuit to configure an emergency-stop circuit. The adoption of this strategy is essential to prevent erroneous operation of the entire system or any possible failure or malfunction in the FA-M3.


r
Motive-power equipment
Control equipment except for the FA-M3
Regulated DC power supply
+
−
DC I/O unit
Power supply module in FA-M3
FAIL OUTPUT
R
Emergency-stop switch

The FAIL OUTPUT terminal comes in two types: one that turns on if the FA-M3 fails and one that turns off if the FA-M3 fails. Normally, a system should be designed so that the terminal turns off if the FA-M3 fails.

FA030301.VSD

Figure A3.9 Circuit Diagram of Power Lines and Example of Emergency-stop Circuit

WARNING

If there is a risk that the system could cause injury or death of personnel, be sure to take appropriate security measures, such as power shutdown to the motive-power circuit in the case of an emergency, as shown in Figure A3.9.

A3.3.2 Grounding Lines

When considering the grounding system in your panel enclosure, take into account the following:

- To increase noise immunity, connect the signal ground (the GND terminal for the 5 V output of the power supply module) to the metal chassis of the base module. This defines the signal ground as the point of reference potential. To stabilize the reference potential, directly fix the base module onto a grounded metal plate installed inside the panel enclosure. It is advisable that you use a plated metal material with excellent conductivity as the metal plate.
- For grounding lines connecting to the FG terminal and LG terminal of the power supply module, use thick wiring of at least 2 mm^2. Connect to the Protective earth (Comply with the regulation of each country.) , and route the line through the shortest path possible.

  For compliance to CE Marking, use braided wires for the system configured with this module for low impedance even at high frequency.
- It is anticipated that a system failure due to stray current or for other reasons may occur, though this is very rare, if both the base module and other equipment are directly fixed onto the metal plate inside the panel enclosure. In such situations, electrically isolate the base module or the other equipment from the metal plate. When isolating the base module or other equipment from the plate, connect the grounding lines of the base module and the other equipment separately to their respective grounding points. Depending on the cause of system failure, such measures as disconnecting the SHIELD terminal of each I/O module may be required.

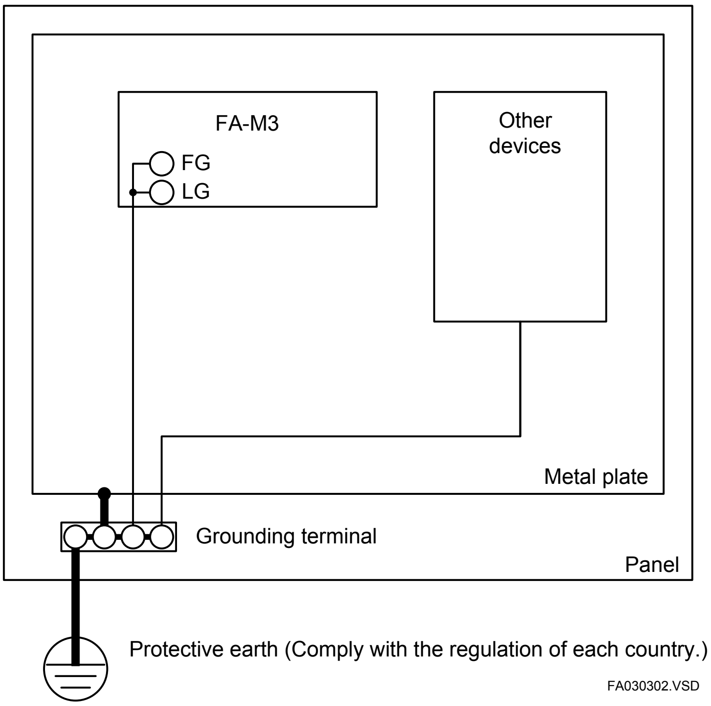


Figure A3.10 Grounding System Diagram

A3.3.3 Relay Circuits

The input/output points of the FA-M3 are normally connected directly to external devices. Relays, however, should be placed between the input/output points of the controller and the external devices in the following cases:

- The controller is far away from the external devices and is susceptible to noise interferences in the field.
- The controller is to be connected to devices that will generate high-voltage noise.
- There is a need to clarify the relationship between other control lines with regards to the responsibility of handling respective signals.
- A manually operated circuit needs to be included as a backup against failure of the I/O equipment.

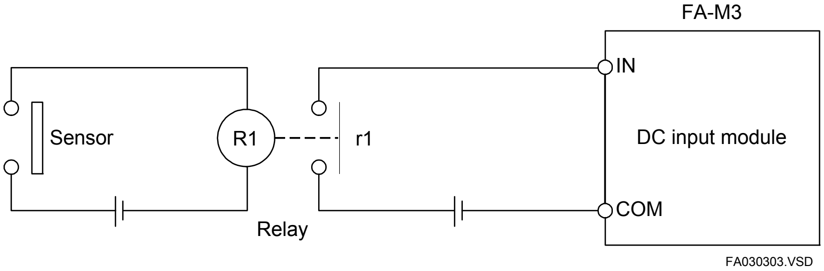


Figure A3.11 Example of Use of Relay

A3.3.4 Protection against Output Short-circuit

If any of the loads connected to the output terminals of the FA-M3 are short-circuited, an excess short-circuit current flows and there is the possibility that the external wiring will burn or there will be a generation of abnormal heat. It is therefore common practice to install fuses in the output circuits to ensure safety in the case of short-circuited loads and minimize damage to the FA-M3. Use of external fuses is recommended, especially for output modules that do not have built-in fuses or short-circuit protectors.

Figure A3.12 is an example of an FA-M3 that is equipped with output short-circuit protection fuses. Note that these fuses are not intended to protect internal output elements against possible damage. In addition, these fuses may fail to blow in failure modes other than short-circuited loads.

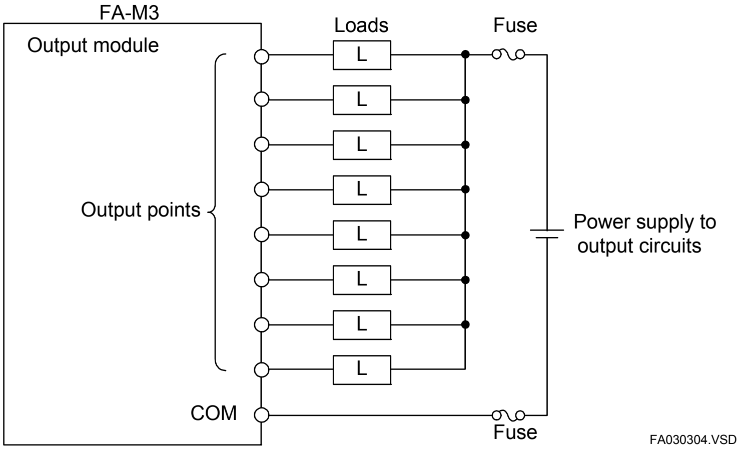


Figure A3.12 Example of Use of Output Short-circuit Protection Fuses

A3.3.5 Interlocking

An interlock circuit is required when you handle particular outputs, such as those for the forward and reverse rotation of a motor that must not turn on at the same time. In such a case, installing an external interlock circuit allows one of the “b” contacts of the two relay coils to cut off the other when energized. Figure A3.13 shows an example of an interlock circuit.

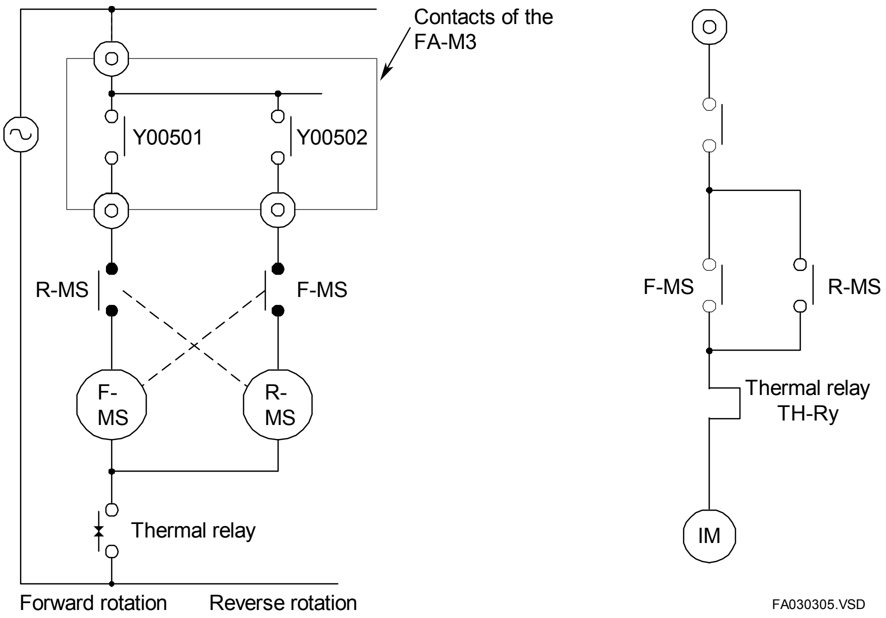


Figure A3.13 Example of an Interlock Circuit

A3.3.6 Measures against Power Failure

The power supply block of the FA-M3 incorporates a built-in power sequence circuit which prevents the system from malfunctioning when a momentary power failure or voltage reduction occurs. This system has two modes of detecting power failures; one is the standard mode and the other is the immediate detection mode. There are restrictions on the use of the immediate detection mode, as summarized in the table given below, according to the type of power supply module or CPU module used. The default (factory setting) mode is the standard mode.

Mode	**Available Power Supply Module**	**Available CPU Module**
Standard	All types	All types
Immediate detection*	F3PU10-0N F3PU10-0S F3PU16-0N F3PU20-0N F3PU20-0S F3PU26-0N F3PU30-0N F3PU30-0S F3PU36-0N F3PU36-0S	F3SP2x-xx F3SP3x-xx F3SP5x-xx F3SP6x-xx F3SP7x-xx F3FP36-3N F3BP20-0N F3BP30-0N

*: Select the immediate detection mode from the “CPU Configuration” menu. For more details, refer to "FA-M3 Programming Tool WideField" (IM 34M06Q14-01E), "FA-M3 Programming Tool WideField2" (IM 34M06Q15-01E) or "FA-M3 Programming Tool WideField3" (IM 34M06Q16- xx E). For details on the modes of detecting power failures supported by the F3BP20, F3BP30 BASIC CPU module, refer to the BASIC CPU Modules and YM-BASIC/FA Programming Language (IM 34M06Q22-01E).

■ Standard Mode (common to all power supply modules)

● Momentary Power Failure Detection

- System operation continues without interruption even if the power fails momentarily for no longer than 20 ms (undetected momentary power failure).
- If a power failure longer than 20 ms occurs, the controller may or may not recognize a momentary power failure condition because an uncertainty is involved. When the controller detects a momentary power failure, it suspends program execution while retaining the current state of its outputs. It also records the date and time at which the momentary power failure occurred into the error log file in the CPU. When power is restored, the controller resumes the execution of the program.

● Power Failure Detection

When the CPU operating voltage (+5V) falls below 95% of the rated voltage, the controller stops operation, turns off its outputs, and then turn on the FAIL contact. (Refer to Section A2.3 for details on how the FAIL contact works).

● Automatic Recovery

The controller resumes normal operation automatically when the power recovers from a momentary power failure condition and the CPU operating voltage (+5V) rises above 95% of the rated voltage. The controller restarts in the reset restart mode after a power failure is detected.

● Power on/off Sequences

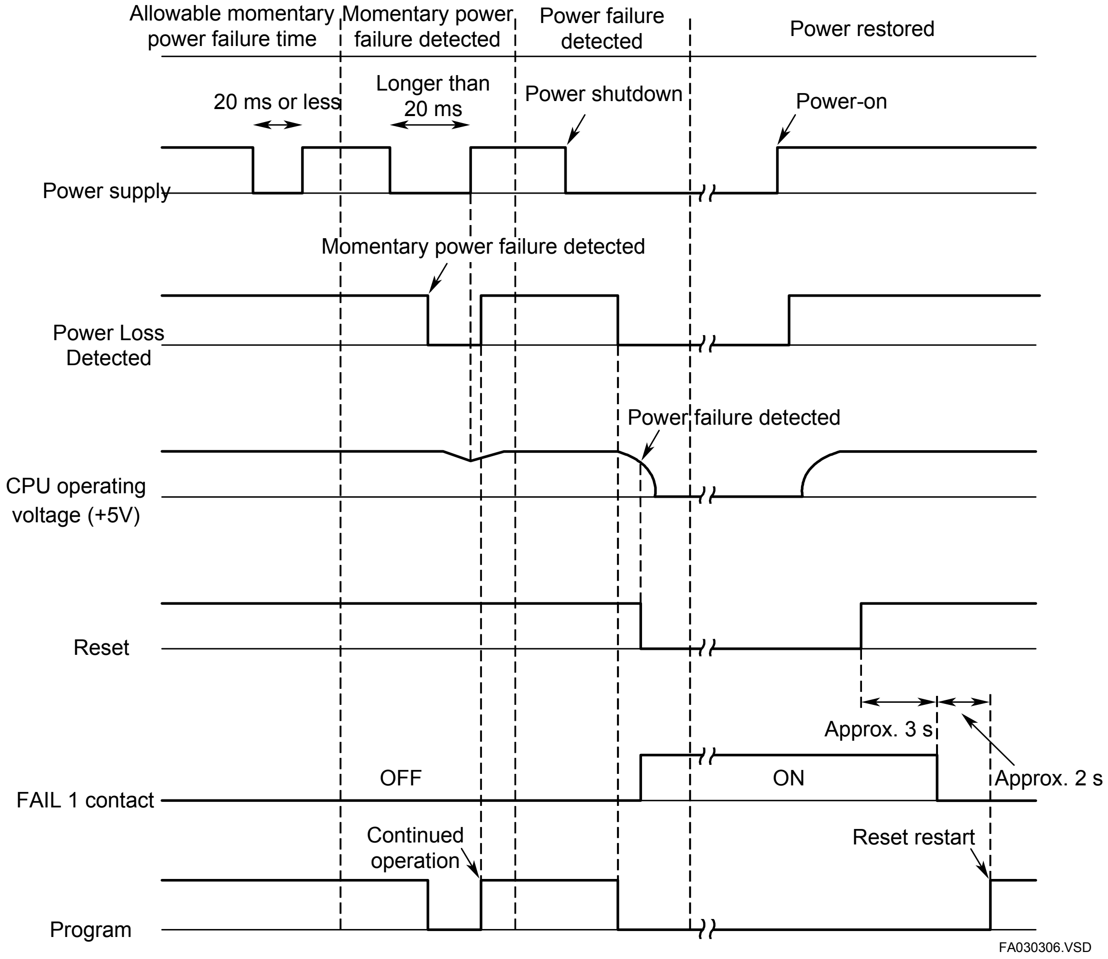


Figure A3.14 Detection of Abnormal Supply Voltage Levels in Standard Mode

■ Immediate Detection Mode
(when F3PU10-0N, F3PU10-0S, F3PU20-0N, F3PU20-0S, F3PU30-0N or F3PU30-0S is used)

● Momentary Power Failure Detection

- System operation continues without interruption even if the power fails momentarily for no longer than 10 ms (undetected momentary power failure).
- If a power failure longer than 10 ms and less than 25 ms occurs, the controller may or may not recognize a momentary power failure condition because an uncertainty is involved. When the controller detects a momentary power failure, it holds or resets its outputs (in accordance with the output set at stop) , it suspends program execution, and then it turns on the FAIL contact. (Refer to Section A2.3 of this manual for details on how the FAIL contact works). It also records the date and time at which the momentary power failure occurred into the error log file in the CPU. The controller restarts in the reset restart mode after a momentary power failure is detected.
- The controller always detects any momentary power loss conditions that are longer than 25 ms.

● Power Failure Detection

The entire functionality of the controller is disabled when the CPU operating voltage (+5V) falls below 95% of the rated voltage.

● Automatic Recovery

The controller resumes normal operation automatically when the power recovers from a momentary power failure condition and the CPU operating voltage (+5V) rises above 95% of the rated voltage. The controller restarts in the reset restart mode following the detection of a power failure condition.

● Power on/off sequences

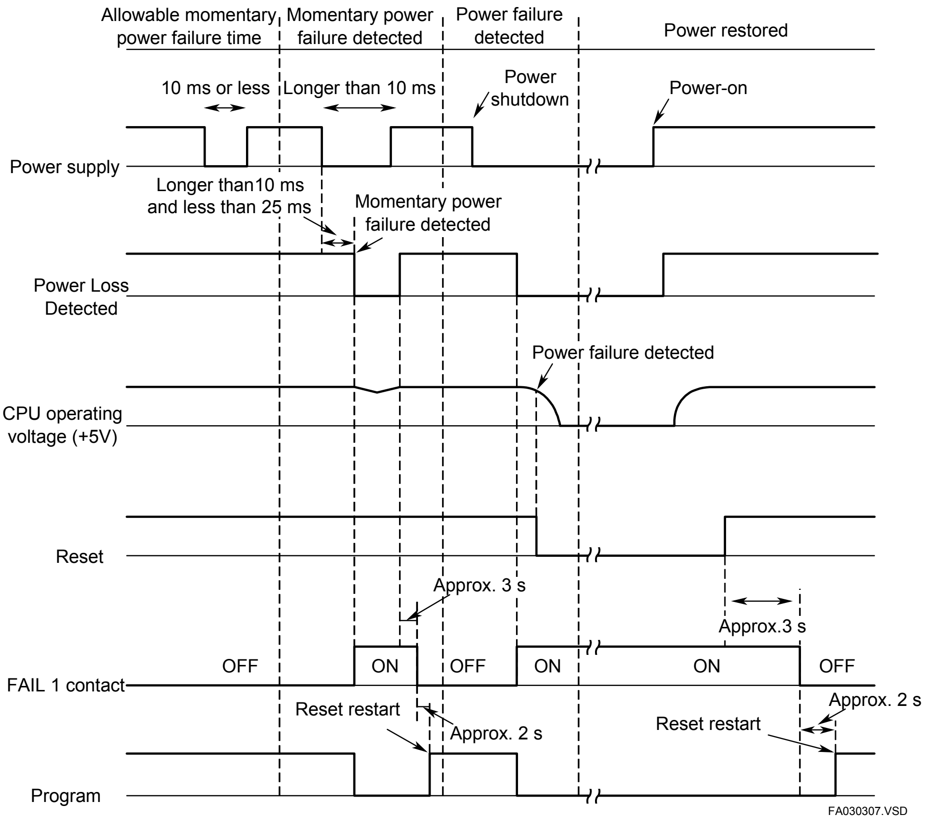


Figure A3.15 Detection of Abnormal Supply Voltage Levels in Immediate Detection Mode (for F3PU10, F3PU20 and F3PU30)

■ Immediate Detection Mode
(when F3PU16-0N, F3PU26-0N, F3PU36-0N or F3PU36-0S is used)

● Momentary Power Failure Detection

- System operation continues without interruption even if the power fails momentarily for no longer than 2 ms (undetected momentary power failure).
- If a power failure longer than 2 ms and less than 10 ms occurs, the controller may or may not recognize a momentary power failure condition because an uncertainty is involved. When the controller detects a momentary power failure, it holds or resets its outputs (in accordance with the output set at stop) , it suspends program execution, and then it turns on the FAIL contact. (Refer to Section A2.3 of this manual for details on how the FAIL contact works). It also records the date and time at which the momentary power failure occurred into the error log file in the CPU. The controller restarts in the reset restart mode after a momentary power failure is detected.
- The controller always detects any momentary power loss conditions that are longer than 10 ms.

● Power Failure Detection

The entire functionality of the controller is disabled when the CPU operating voltage (+5V) falls below 95% of the rated voltage.

● Automatic Recovery

The controller resumes normal operation automatically when the power recovers from a momentary power failure condition and the CPU operating voltage (+5V) rises above 95% of the rated voltage. The controller restarts in the reset restart mode following the detection of a power failure condition.

● Power on/off sequences

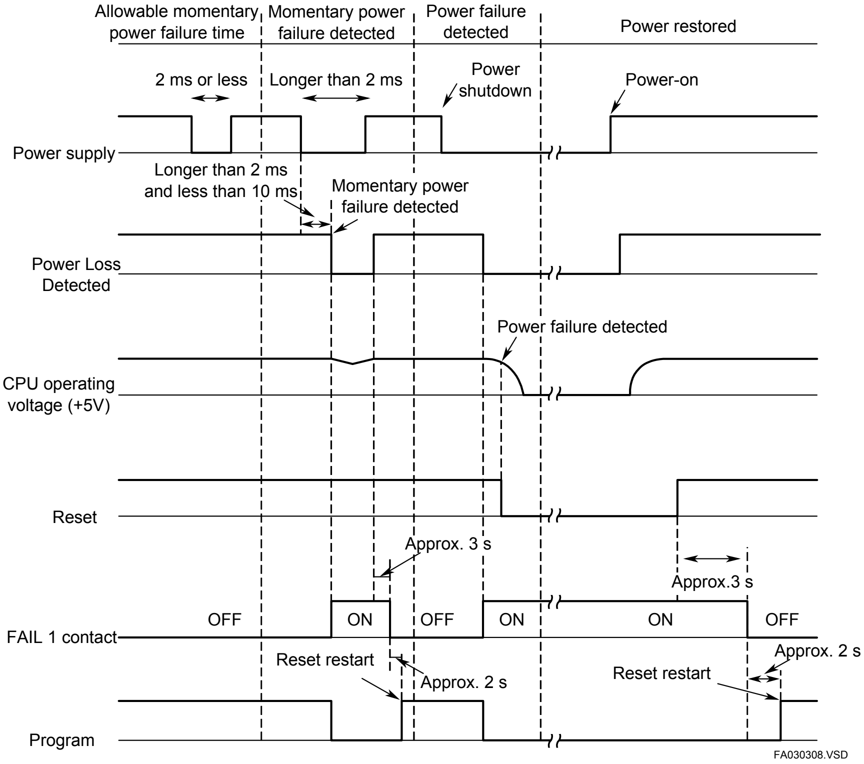


Figure A3.16 Detection of Abnormal Supply Voltage Levels in Immediate Detection Mode (for F3PU16, F3PU26 and F3PU36)

A3.4 Noise Control Considerations

■ Separating Cables from Motive-power Lines

Route motive-power lines so that they are no closer than 20 cm to the FA-M3 and all signal lines connected to the FA-M3. If this is not feasible, route the motive-power lines through a grounded metal conduit.

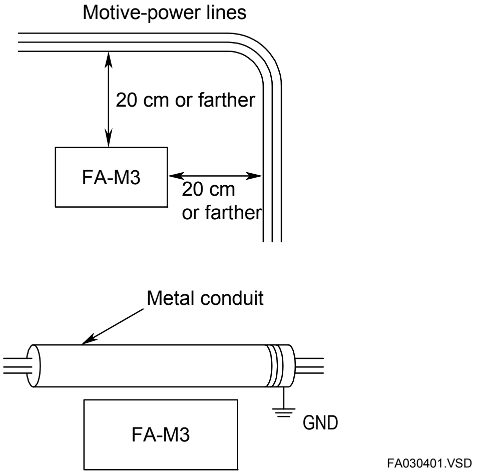


Figure A3.17 Example of Separating Cables from Motive-power Lines

■ Protecting Power Supply Module against Noise

- Form the power line into a twisted pair and route it through the shortest distance possible.
- The power supply module of the FA-M3 contains a noise filter and therefore has a noise immunity level sufficient for noise levels anticipated in general applications. If the module is to be used in an exceptionally noisy environment however, an additional noise filter or a noise cutoff transformer should be located between the power source and the module.

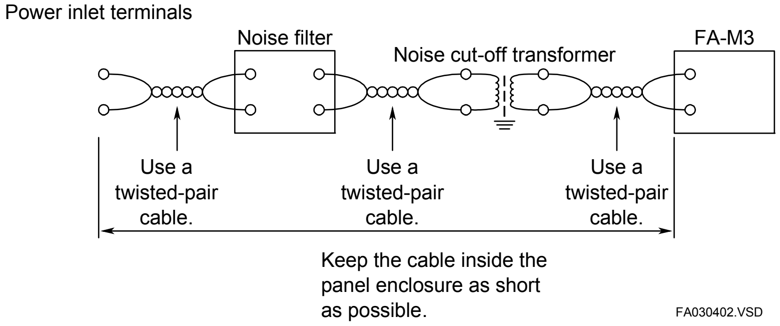

Power inlet terminals
Noise filter
Noise cut-off transformer
FA-M3
Use a twisted-pair cable.
Use a twisted-pair cable.
Use a twisted-pair cable.
Keep the cable inside the panel enclosure as short as possible.
FA030402.VSD

Figure A3.18 Example of Power Supply Circuit Noise Control

■ Protecting Special Modules against Noise

- Analog and communication modules are designed to handle low-level or high-speed signals. Place the lines of these signals at a distance of more than 10 cm away from other I/O signal lines and route them through separate cable ducts.
- It is especially difficult to distinguish analog signals and noise and this will cause errors when an analog signal overlapped by noise is converted into a digital signal. As a precaution, lay the analog signal cables away from noise sources such that noise overlapping will not happen and insert a filter (such as a filter circuit, a filter or software calculation filter) to attenuate noise.
- Always use specified cables only and be especially careful about the way they are routed for grounding and interconnection. For further details, see the instruction manual of each module.

■ Protecting I/O Signals against Noise

- Segregate the AC I/O signal lines from DC I/O signal lines when routing them. If this is not feasible, use collectively shielded lines for each group of these signal lines.
- Segregate signal lines carrying larger current from other signal lines when routing them. If this is not feasible, use shielded lines for signal lines carrying large current.
- If any inductive load is to be connected to an input or output terminal of the FA-M3, install a surge protector or a diode near the load. For further details, see “Inductive Load Countermeasures,” in subsection A3.6.4, “Connecting Input Devices” or “Inductive Load Countermeasures,” in subsection A3.6.5, “Connecting Output Devices.”

CAUTION

Install a protective device, such as a surge arrester, when the FA-M3 is to be used in a district with a high frequency of thunder.

A3.5 Wiring the Power Supply Module

A3.5.1 Re-checking Specifications

WARNING

- Re-check the I/O specifications for the power supply module. Specifically, note that connecting an AC power supply to a power supply module requiring DC input and connecting a 200-240V AC power supply to a power supply module requiring 100-120V AC input will lead to machine failure.
- To avoid electrical shock, turn off the power before wiring.
- Make sure that the ‘+’ , ‘–’ and FG terminals of a DC input power supply module and the L, N and FG terminals of an AC input power supply module are connected correctly.

A3.5.2 Wiring Materials

(1) Wire

Method of External Connection	Compatible Conductor Size	Temperature Rating	Material
Terminal block	AWG22 to 14 (0.33 to 2.1 mm^2)	75°C min	Copper

Use AWG14 (2.1 mm^2) for ground cabling.

(2) Terminal Screws and Crimp-on Terminals

The F3PU□□-0S power supply modules use M4-screw terminal blocks, unlike F3PU□□-0N power supply modules, which use M3.5-screw terminal blocks. The following crimp-on terminals are recommended for connecting to the power supply modules:

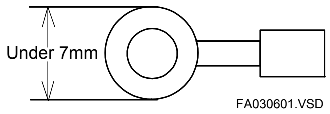


Figure A3.19 Crimp-on Terminals

Vendor	Model	Compatible Conductor	Compatible Modules and Crimping Torque	
			F3PUxx-0N	F3PUxx-0S
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M3	AWG22 to 18 (0.33 to 0.82 mm^2) (Copper wire)	0.8 N·m (7.1 lbf·in)	Cannot be used
Nippon Tanshi Co., Ltd.	RAV1.25-3.5			
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M4			1.2 N·m (10.6 lbf·in)
Japan Solderless Terminal Mfg Co., Ltd.	V2-M4	AWG16 to 14 (1.3 to 2.1 mm^2) (Copper wire)		

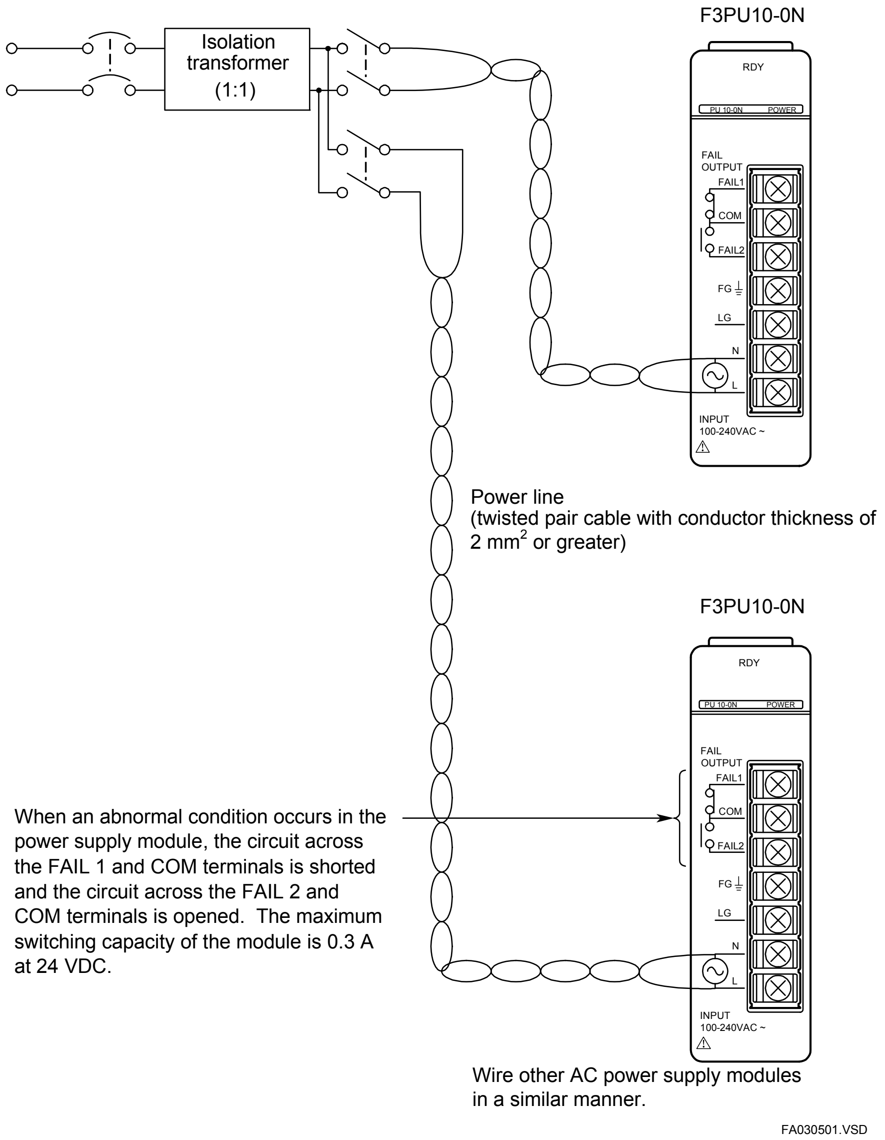
CAUTION

When crimping terminals, be sure only to use the tool specified by each terminal manufacturer.

A3.5.3 Power Supply Wiring

■ AC Power Supply Module

Model	Supply Voltage	Allowable Range of Supply Voltage Change
F3PU10-0N F3PU10-0S	100-240V AC	85 to 264V AC
F3PU20-0N F3PU20-0S		
F3PU30-0N F3PU30-0S		



Power line
(twisted pair cable with conductor thickness of 2 mm^2 or greater)

When an abnormal condition occurs in the power supply module, the circuit across the FAIL 1 and COM terminals is shorted and the circuit across the FAIL 2 and COM terminals is opened. The maximum switching capacity of the module is 0.3 A at 24 VDC.

Wire other AC power supply modules in a similar manner.

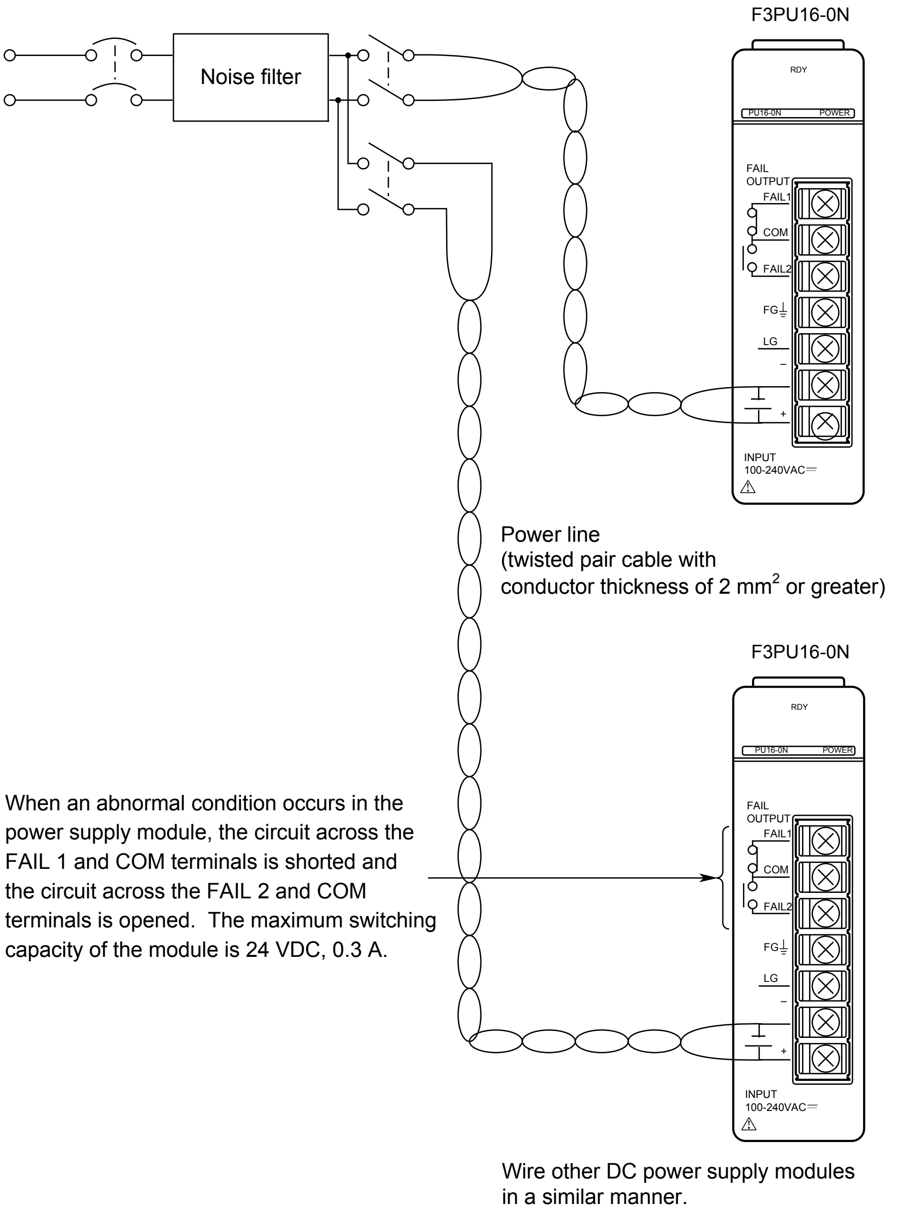
Figure A3.20 Wiring the AC Power Supply Module

DANGER

To avoid electrical shock, turn off the power before wiring.

■ DC Power Supply Module

Model	Supply Voltage	Allowable Range of Supply Voltage Change
F3PU16-0N	24V DC	15.6 to 31.2 V DC
F3PU26-0N		
F3PU36-0N F3PU36-0S		



Power line
(twisted pair cable with
conductor thickness of 2 mm^2 or greater)

When an abnormal condition occurs in the power supply module, the circuit across the FAIL 1 and COM terminals is shorted and the circuit across the FAIL 2 and COM terminals is opened. The maximum switching capacity of the module is 24 VDC, 0.3 A.

Wire other DC power supply modules in a similar manner.

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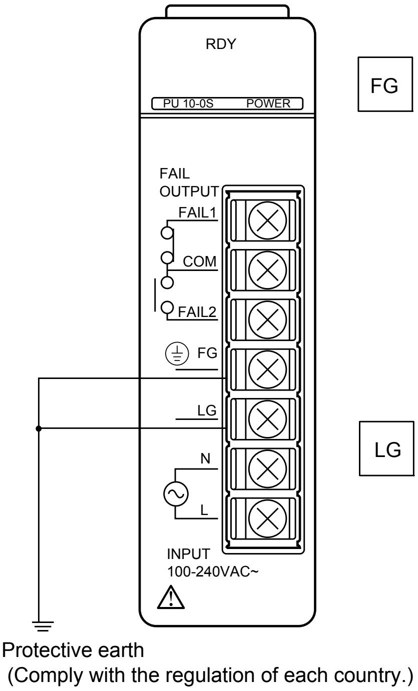
Figure A3.21 Wiring the DC Power Supply Module

DANGER

To avoid electrical shock, turn off the power before wiring.

A3.5.4 Grounding Procedure



FG It is automatically brought into contact with the metal chassis of the base module when the FA-M3 is mounted onto the base module so it shares the same electric potential with the controller's signal potential with the controller's signal ground. Using a wire with a cross-section area of more than 2mm^2, connect to the Protective earth (Comply with the regulation of each country.) by taking the shortest route possible. For details onthe grounding lines of the FA-M3, see subsection A3.3.2,

LG Is connected with the neutral terminal of the noise filter within the power supply module.
Grounding the LG terminal properly attenuates the comon mode noise from the power supply. If the LG terminal is opened, the effect of the noise filter will be reduced.

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Figure A3.22 Ground Wiring

AC power supply module is required protective earth. DC power supply module is required protective earth or functional earth.

When building a system compliant to CE Marking, connect LG terminal to FG terminal and ground these terminals with braided or other wires that ensure low impedance even at high frequencies.

CAUTION

LG terminal has a half potential of the input power supply voltage when LG terminal isn't connected to FG terminal.

A3.6 Wiring I/O Modules

A3.6.1 Re-checking Specifications

WARNING

- Re-check the I/O specifications for the input/output modules. Note that applying a voltage or current that exceeds the maximum permissible input voltage or current of an input module or a voltage or current that exceeds the maximum switching capacity of an output module will lead to machine failure, physical damage or fire hazard.
- To avoid electrical shock, turn off the power before wiring.
- Make sure that the polarity of power terminals is correct.

A3.6.2 Wiring Materials

(1) Wire

Method of External Connection		Compatible Conductor Size	Temperature Rating	Material
Terminal block		AWG22 to 14 (0.33 to 2.1mm^2)	75°C min	Copper
Connector	Soldered	AWG23 or less (0.26mm^2 or less)		
	Crimp-on	AWG28 to 24 (0.08 to 0.20mm^2)		
	Pressure-welded	AWG28 (0.08mm^2); 1.27mm pitch flat cable		

To ensure that a system incorporating this module conforms to the CE Marking, use shielded cables. By properly grounding the shield, noise emission and receipt will be reduced. For more information on shielded cables, see Section A3.9.1 "Cable Routing Considerations".

(2) Terminal Screws and Crimp-on Terminals

The I/O modules have an M3.5-screw terminal block each. The following crimp-on terminals are recommended for connecting to I/O modules:

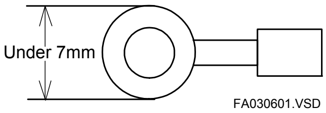

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Figure A3.23 Crimp-on Terminals

Vendor	Model	Compatible Conductor	Crimping Torque
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M3	AWG22 to 18 (0.33 to 0.82 mm^2) (Copper wire)	0.8 N·m (7.1 lbf·in)
Nippon Tanshi Co., Ltd.	RAV1.25-3.5		
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M4		
Japan Solderless Terminal Mfg Co., Ltd.	V2-M4	AWG16 to 14 (1.3 to 2.1 mm^2) (Copper wire)	

CAUTION

When crimping terminals, be sure only to use the tool specified by each terminal manufacturer.

A3.6.3 Terminal Blocks and Connectors

(1) Terminal Block

The input/output modules for the FA-M3 use detachable terminal blocks. When removing the terminal block, loosen the mounting screws located on the top and bottom of the terminal block with a screwdriver as shown in the following figure.

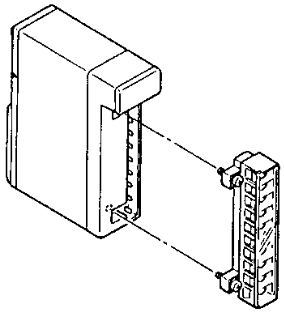


Figure A3.24 Installing and Removing a Terminal Block

(2) Connectors

Connectors are used to wire I/O modules to multiple I/O points. Compatible connector types include soldered, crimp-on and pressure-welded connectors. Separately procure connectors that suit your application purpose.

■ Compatible Connectors

Connection method	Compatible connector
Soldered type	FUJITSU LIMITED: FCN-361J040-AU connector FCN-360C040-B connector cover
Crimp-on type	FUJITSU LIMITED: FCN-363J040 housing FCN-363J-AU contact FCN-360C040-B connector cover
Pressure-welded type	FUJITSU LIMITED: FCN-367J040-AU/FW

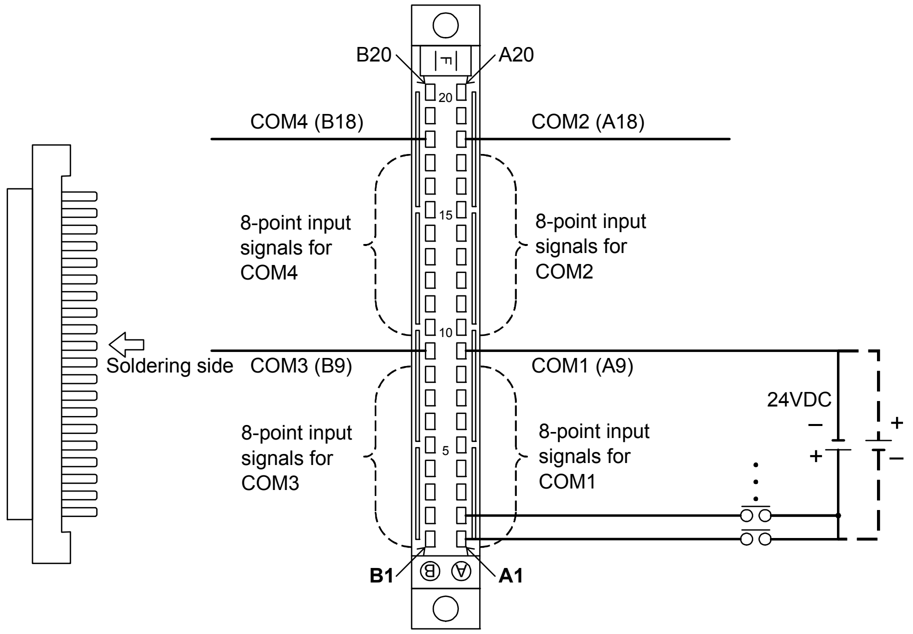
CAUTION

When using crimp-on or pressure-welded connectors, be sure only to use the tool specified by each connector manufacturer.

■ Precautions when Wiring 40-Pin Soldered-type Connectors

When wiring signal lines to an A1451JD 40-pin soldered-type connector, be careful about the orientation of the connector and its pin numbering. The wiring of the input connector (for the input block of F3XDxx-xx and F3WDxx-xx modules) differs from the wiring of the output connector (for the output block of F3YDxx-xx and F3WDxx-xx modules).

● Input Connector



Front view with soldered contacts

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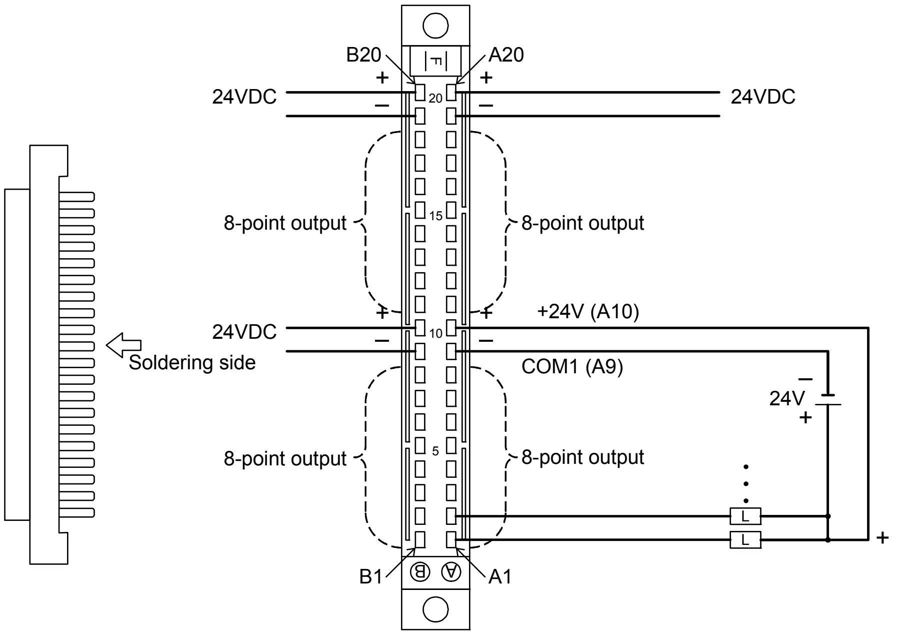
*: The pin layout is the same for the connectors on the F3XD32-□□, F3XD64-□□, and F3WD64□□.

Figure A3.25 40-pole Plug with Soldered Type for Input

● Output Connector



Front view with soldered type

FA030604.VSD

*: The pin layout is the same for the connectors on the F3YD32-□□, F3YD64-□□, and F3WD64-□□.

Figure A3.26 40-pole Plug with Soldered Type for Output

(3) Wiring

Wire I/O modules so that they can be replaced if necessary. Route the cables so that they do not get in the way when viewing the I/O status on the display of an I/O module.

A3.6.4 Connecting Input Devices

Refer to this subsection when selecting or connecting the FA-M3 to input devices.

(1) Examples of Connection to DC Input Devices

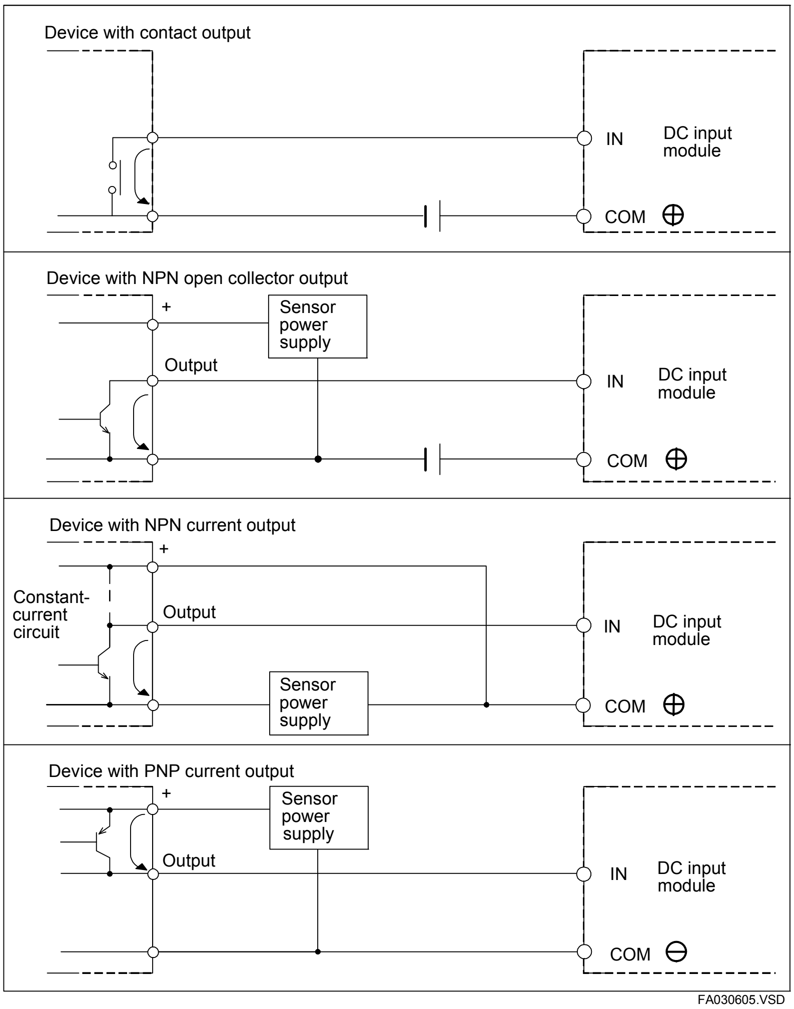


Figure A3.27 Examples of Connection to DC Input Devices

(2) Examples of Connection to AC Input Devices

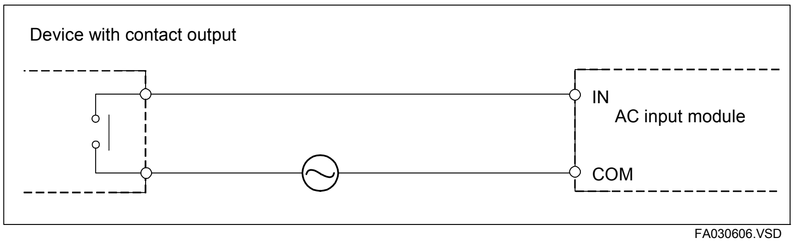
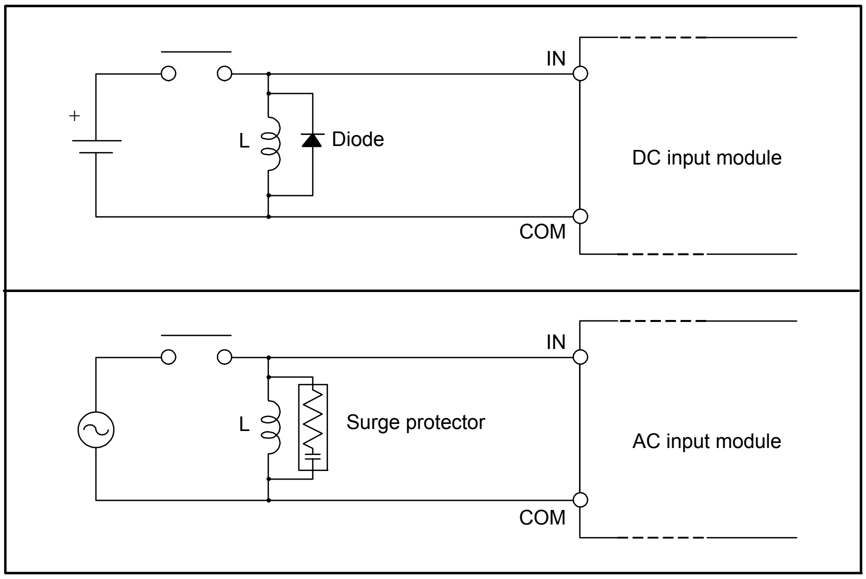


Figure A3.28 Example of Connection to AC Input Devices

(3) Inductive Load Countermeasures

If an inductive load is to be connected to the input block, connect a surge protector or a diode across the load nearby so that the module input voltage will not exceed the specified operating voltage range.



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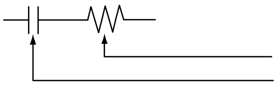
● Surge protector



0.5 to 1 Ω with respect to 1V contact voltage
1 to 0.5 µF, rated voltage or higher,
with respect to 1 A contact current

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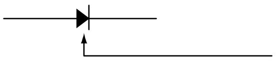
● Diode



The reverse voltage must be at least three times the size of the circuit voltage and the forward current at least twice the size of the current flowing through the inductive load.

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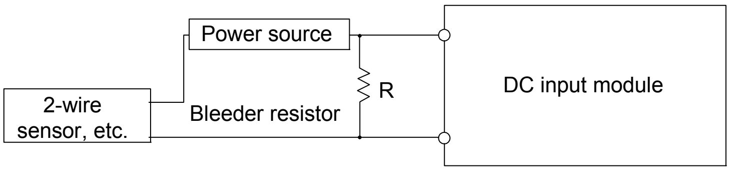
Figure A3.29 Inductive Load Countermeasures for Input Modules

(4) Leakage Current Considerations

There are cases in which a 2-wire sensor (proximity switch, photoelectric switch, etc.) or a limit switch with an LED indicator may cause faulty input signal generation or illumination due to leakage current. There is no problem if the leakage current is smaller than the “off current” that is specified for the module. In situations in which it is likely that the leakage current exceeds the off current, however, add a bleeder resistance as shown in the figure below to lower the input impedance.



$$R \leq \frac{Rin \times VOFF}{Rin \times I - VOFF}$$

where

$$Rin = \frac{Ein}{Iin}$$

$$W \leq \frac{Ein2}{R} \times K \quad [mW]$$

R : bleeder resistor (kO)
Rin : input impedance of the DC input module (kO)
Ein : rated input voltage of the DC input module (V)
Iin : rated input current of the DC input module (mA)
Voff : OFF voltage of the DC input module (V)
I : leakage current of the device (mA)
W : wattage of the bleeder resistor (mW)
K : power margin of the bleeder resistor

Note: Ensure that K ≥ 2.

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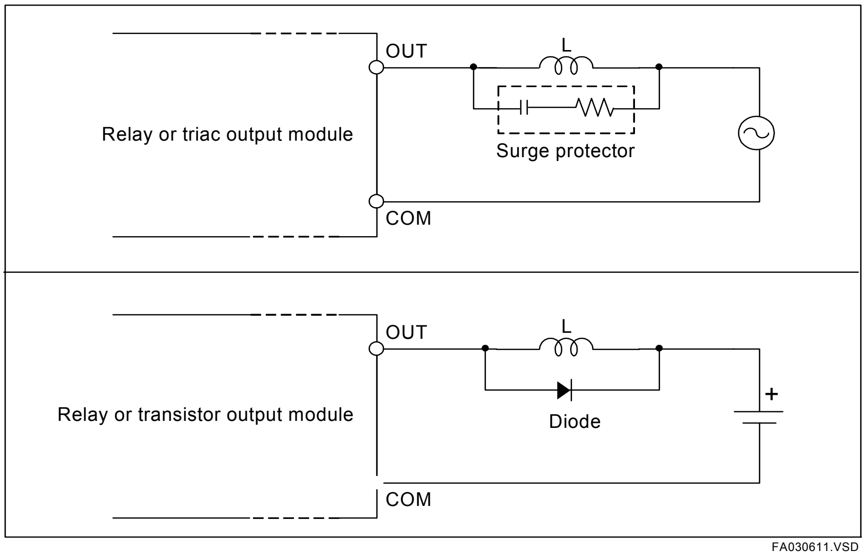
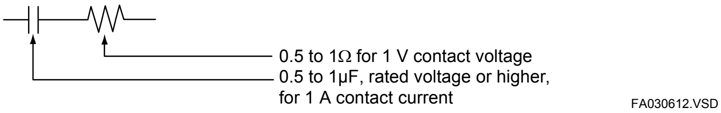
A3.6.5 Connecting Output Devices

Observe the following precautions when connecting the FA-M3 to output devices.

If an inductive load is to be connected to the output block, connect a surge protector or a diode across the load nearby so that the module output terminal voltage will not exceed the specified operating load voltage range.
When connecting a diode, connect its cathode to the positive terminal of the power supply.


OUT
L
Relay or triac output module
Surge protector
COM
OUT
L
Relay or transistor output module
Diode
+
COM
FA030611.VSD

● Surge protector


0.5 to 1Ω for 1 V contact voltage
0.5 to 1μF, rated voltage or higher,
for 1 A contact current
FA030612.VSD

● Diode

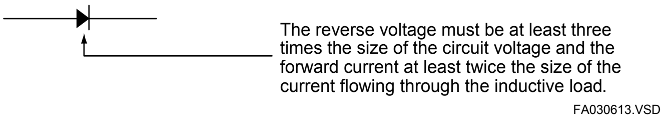

The reverse voltage must be at least three
times the size of the circuit voltage and the
forward current at least twice the size of the
current flowing through the inductive load.
FA030613.VSD

Figure A3.30 Inductive Load Countermeasures for Output Modules

■ Connection of external power supply

In the module with the output signal, connect the external power supply and the load power supply with the same switch; turn on-off the power supply at the same time.

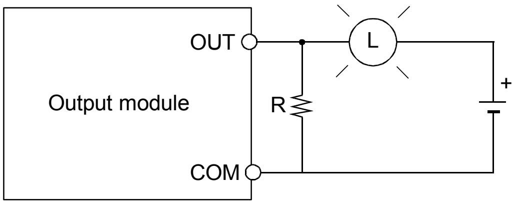
When the external power supply and the load power supply are turned on or off separately, non-intended output may occur.

Inrush Current Countermeasures

When connecting an incandescent lamp or other load that generates large inrush current, it is necessary to take special caution to prevent fatal damage to the output elements. Examples of ways to suppress inrush currents are illustrated below.

Examples

- Flowing dark current at one-third the rated value into the incandescent lamp



- Inserting a current-limiting resistor

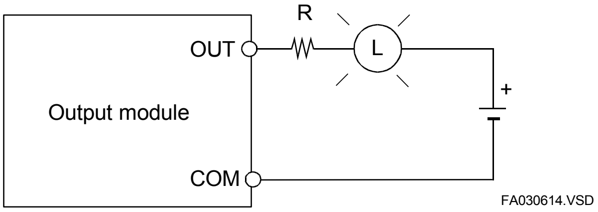


Figure A3.31 Examples of Inrush Current Countermeasures

A3.7 External Cable Routing Requirements

It is especially desirable that the requirements given in this section be satisfied in the routing of the controller's signal cables, power supply cables and power-motive cables of the devices.

● Isolating Cables

When routing cables, segregate by at least 20 cm cables that may become noise sources such as power-motive cables and power supply cables from signal cables that are susceptible to noise, as shown in figures A3.32 and A3.33.

If that is not possible, separate the cables by putting a separator between them as shown in figure A3.34.

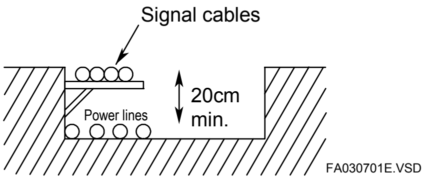


Figure A3.32 Segregation Using Cable Rack

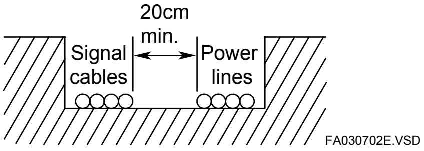


Figure A3.33 Segregation in Parallel Routing

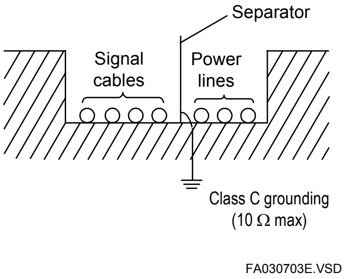


Figure A3.34 Segregation Using Separator

● Perpendicular Crossing of Cables

If the signal cables cross power-motive cables or power supply cables, lay them perpendicular to each other. If no shielded cable is used, it is recommended that a steel plate of at least 1.6 mm thick be placed between the two sets of cables at their intersection as shown by the dotted lines in Figure A3.35.

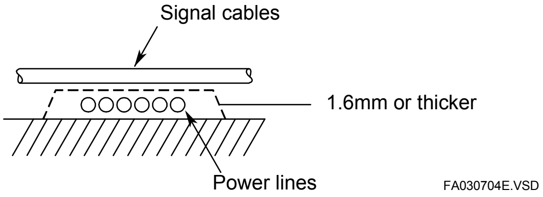


Figure A3.35 Perpendicular Crossing of Cable

A3.8 Calculating Power Consumption

Although the maximum power consumption is shown in item (1) "Common Specifications" in Section A2.1, “Specifications,” it actually differs depending on the number and types of modules installed. Calculate the power consumption according to the formulae shown below after reading Section A2.9, “Module Current Consumption Tables.”

- When using an F3PU10, F3PU20 or F3PU30 power supply module

$$\text{Power Consumption (W)} = \frac{5\ [\text{V}]\text{x}\ \Sigma\ (\text{dissipating currents of individual modules})\ [\text{A}]}{\eta}\ [\text{W}]$$

$$\text{Power Consumption (VA)} = \frac{5\ [\text{V}]\text{x}\ \Sigma\ (\text{dissipating currents of individual modules})\ [\text{A}]}{\eta \times \text{COS}\varphi}\ [\text{VA}]$$

η : Efficiency (approx. 0.65)
COSφ: Power factor (approx.0.4 to 0.5)

- When using an F3PU16, F3PU26 or F3PU36 power supply module

$$\text{Power Consumption (W)} = \frac{5\ [\text{V}]\text{x}\ \Sigma\ (\text{dissipating currents of individual modules})\ [\text{A}]}{\eta}\ [\text{W}]$$

η : Efficiency (approx. 0.65)

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To estimate the temperature increase within the panel enclosure, you need to calculate the total power consumed within the panel enclosure. To do so, you need to add to the power consumption of the power supply module described above, the external power supplied to I/O modules of the FA-M3, as well as the power consumption of peripheral equipment installed within the panel enclosure.

Some examples for calculation of external power supplied to I/O modules of the FA-M3 are given below.

Example 1: Assume that all points of the F3XD32-3F are ON. Rated current input per point is 4.1 mA, so power consumption at the module is:
4.1 [mA] x 24 [V] x 32 [points] = 3148.8 [mW] = 3.15 [W]

Example 2: Assume that 30 points of the F3YD64-1F are ON with a load current of 0.1 A. For this module, power loss at the output transistors must be considered. The ON voltage is 0.5 V max. and the load current per transistor is 0.1 A, so power loss at transistors is:
0.5 [V] x 0.1 [A] x 30 [points] = 1.50 [W]
The external power supply is 24 V/150 mA, so power consumption at external loads is:
24 [V] x 150 [mA] = 3600 [mW] = 3.60 [W]

Example 3: Assume that the F3DA04-1N is used. The external power supply is 24 V/180 mA, so power consumption at external loads is:
24 [V] x 180 [mA] = 4320 [mW] = 4.32 [W]

For power consumption of peripheral equipment installed within the panel enclosure, calculate and total the power consumptions of all pieces of the equipment.

A3.9 CE Marking Conformance

■ About CE Marking

CE Marking aims to integrate the safety regulations existing in countries within the EC community and ensure free circulation (movement) of products guaranteed to be safe. A manufacturer or importing agent is legally obligated to display a CE mark on a product circulated or marketed within the EC community showing conformity to the requirements of EC directives that are applicable to the product.

Each EC directive covers a certain range of equipment; the FA-M3 is required to conform to the EMC directive (2004/108/EC) and the Low Voltage directive (2006/95/EC).

Each directive describes only the essential requirements; an equipment manufacturer is required to test the conformance of equipment to directives applicable to the equipment before displaying the CE Mark on the equipment.

■ Standards Structure

Figure A3.36 shows a conceptual diagram of the CE Marking standards structure.

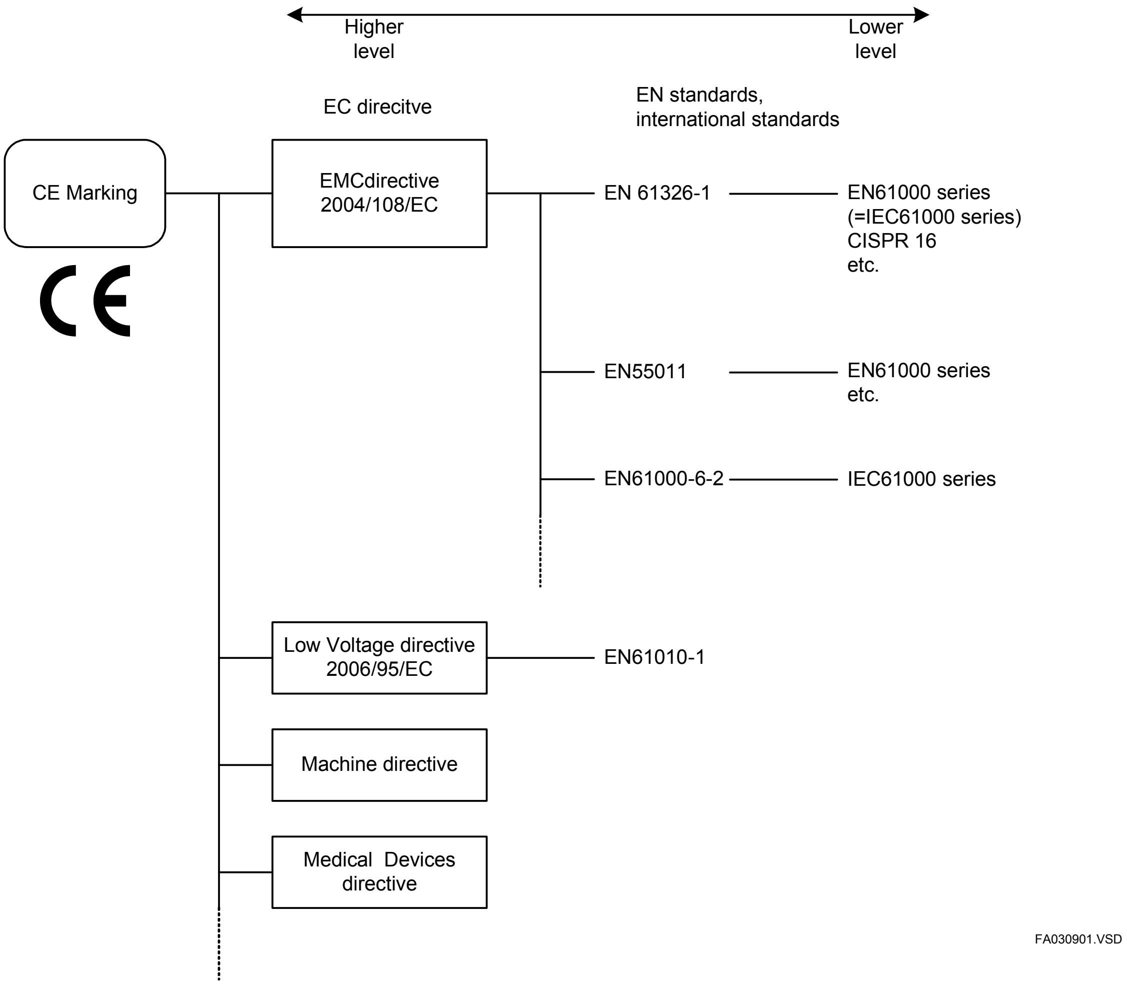


Figure A3.36 Conceptual Diagram of Standards Structure

A3.9.1 EMC Directive

(1) Requirements of EMC Directive

The EMC directive applies to equipment that may emit electromagnetic disturbances or equipment that may be damaged by electromagnetic disturbances.

The EMC directive requires that the electromagnetic disturbances emitted by equipment to not exceed a tolerable level, and that equipment maintains a minimum level of immunity to electromagnetic disturbances. This section summarizes the considerations to ensure that the FA-M3 conforms to the EMC directive. However, the installation manufacturer needs to test and confirm the conformity to the EMC directive of the finished product incorporating the FA-M3.

(2) Applicable Standards of the EMC Directive

The standards applicable to the FA-M3 are given in tables A3.1 and A3.2

Modules declaring conformity to the CE Mark satisfy the specified values and performance criteria displayed in the tables. For details on modules conforming to the CE Marking, see “List of Standard-Approved and Compliant FA-M3 Modules.” (GS 34M06C11-21E)

From the safety viewpoint of the Low Voltage directive, it is necessary to install and use the equipment within a panel enclosure. The EMC directive conformance test is conducted with the equipment installed in a general panel enclosure. The panel enclosure used during the test has an emissive noise attenuation characteristic of 15dB average and 25dB maximum (from 30 to 1000 MHz).

Table A3.1 Applicable Standards of EMC Directive (Emission)

	Applicable Standard	Test Name/ Reference Standards	Test Description*3	Specified Value
Emission	EN 61326-1 EN 61326-2-3*1 EN55011 Class A Group1	Emissive electromagnetic noise CISPR 16-1 CISPR 16-2 CISPR 11	Measures the electric wave disturbance which the equipment emits to the external space	30 to 230MHz: 40dBμV/m (QP*2,10m method) 230 to 1000MHz: 47dBμV/m (QP,10m method)
		Power supply terminal Noise CISPR 16-1 CISPR 16-2 CISPR 11	Measures the noise level which the equipment emits to a power supply line.	0.15 to 0.5MHz: 79dBμV (QP),66dBμV (AV*2) 0.5 to 30MHz: 73dBμV (QP),60dBμV (AV)
	EN61000-3-2	Power supply harmonic EN61000-3-2	Measures the size of the harmonic current generated by the power supply of the equipment.	Class A Equipment: Even 2nd harmonic current: 1.08A or less 4th harmonic current: 0.43A or less 6th harmonic current: 0.30A or less : Odd 3rd harmonic current: 2.30A or less 5th harmonic current: 1.14A or less 7th harmonic current: 0.77A or less : Values specified for up to the 40th harmonic current (description omitted here) The FA-M3 belongs to category A but its input is below 75W and hence it lies outside the applicable scope of the standard.
	EN61000-3-3	Flicker EN61000-3-3	Measures the voltage fluctuation in the power supply system due to fluctuations in the current consumed by the equipment.	Short flicker index: Pst < 1 Long flicker index: Plt < 0.65 Relative steady voltage fluctuation: dc < 3.3% Maximum relative voltage fluctuation: dmax < 4% Voltage fluctuation time: time where voltage fluctuations exceeds 3.3% should be less than 500ms

*1: EN61326-2-3 is applicable only to F3CU04-0S and F3CU04-1S.
*2: QP : Quasi-Peak AV: Average value
*3: USB port on the CPU module is excluded from the EMC test since it is intended for maintenance purposes and not used in actual operation.

Table A3.2 EMC Directive Applicable Standards (Immunity)

	Applicable Standard	Test Name/ Reference Standards	Test Description[*4]	Test Value <Performance Criterion[*2]>
Immunity	EN 61326-1 EN 61326-2-3[*1] EN61000-6-2	Static electricity discharge immunity EN61000-4-2 IEC61000-4-2	Measures the immunity to static electricity discharge	Contact discharge ±4kV (static electricity discharge to the panel enclosure where the FA-M3 system is installed) <Performance criterion B>
		Emissive electric field Immunity EN61000-4-3 /A1 IEC61000-4-3 /A1	Measures the immunity when electric field noise is radiated	10V/m: 80 to 1000MHz, 1.4 to 2GHz 3V/m: 2 to 4GHz (80% AM modulated, 1kHz) <Performance criterion A>
		High speed transient burst immunity EN61000-4-4 IEC61000-4-4	Measures the immunity when burst noise overlaps the power supply line and signal lines	±2kV: power supply line ±1kV: signal line (Tr/Th=5ns/50ns, repeat frequency of 5kHz, pulse width of 15ms and burst cycle of 300ms) <Performance criterion B>
		Surge immunity EN61000-4-5 IEC61000-4-5	Measures the immunity when surge voltages induced by transient phenomena (switching or lightning) overlaps the power supply line or signal lines.	Between the lines ±1kV: power supply line To the ground ±2kV: power supply line, ±1kV: signal line[*3] (Tr/Th=1.2μs/50μs (8μs/20μs)) <Performance criterion B>
		Conductivity immunity EN61000-4-6 IEC61000-4-6	Measures the immunity when external electric field noise overlaps a power supply line or signal line.	10V: 0.15 to 80MHz (80% AM modulated, 1kHz) <Performance criterion A>
		Main power supply frequency magnetic immunity EN61000-4-8 IEC61000-4-8	Measures the immunity when magnetic field caused by power supply frequency is applied	30A/m : except CRT 1A/m : CRT (50/60Hz) <Performance criterion A> This does not apply since currently, no element (component) which is sensitive to magnetic field is used in modules which carry a CE Marking conformance declaration.
		Power supply dip /momentary failure EN61000-4-11 IEC61000-4-11	Tests the operation when the voltage of a power supply dips or when a momentary power supply occurs	30% dip, 25 cycle <Performance criterion C> 60% dip, 10 cycles <Performance criterion C> 100% dip, 1 cycle <Performance criterion B> 100% dip, 250 cycles <Performance criterion C>

*1: EN61326-2-3 is applicable only to F3CU04-0S and F3CU04-1S

*2: The following criteria are used to determine conformity to a standard:

Performance criterion A:	The equipment continues to operate according to specification.
Performance criterion B:	There is a temporary drop in performance but the equipment continues to operate according to specification after the noise disappears.
Performance criterion C:	There is a temporary failure which can be recovered by the self-recovery function or by operator intervention.
Performance criterion D:	Non-recoverable failure due to equipment damage.

The conformance criteria of EN61326-2-3 are, however, applied to F3CU04-0S and F3CU04-1S.

*3: Conforming to the standard, the 24 V DC line of YHLS Slave Units (TAH Series) is treated as a signal line.

*4: USB port on the CPU module is excluded from the EMC test since it is intended for maintenance purposes and not used in actual operation.

WARNING

This product is classified as Class A for use in industrial environments. If used in a residential environment, it may cause electromagnetic interference (EMI). In such situations, it is the user's responsibility to adopt the necessary measures against EMI.

(3) Installation Considerations

From the safety viewpoint of the Low Voltage directive, this equipment should be installed within a panel enclosure. Using a metallic panel enclosure achieves the shield effect from the EMC viewpoint. The EMC directive conformance test is conducted with the equipment installed within a general panel enclosure.

The panel enclosure used during the test has an emissive noise attenuation characteristic of 15dB average and 25dB maximum (from 30 to 1000MHz).

The considerations that should be observed when installing the FA-M3 are summarized below. Figure A3.37 illustrates this graphically.

- Use a metallic panel enclosure and metal plate to install the equipment.
- Ground the panel enclosure and metal plate using braided or other wires to ensure low impedance even at high frequencies.
- Use shielded cables for signal cables leading out of the panel enclosure.
- Secure the base module of this equipment directly onto the metal plate using screws.
- Short the FG terminal and the LG terminal of the power supply module of this equipment and connect it to the metal plate with the shortest wiring possible.
- When coating the metal plate of the panel enclosure, mask the following parts and expose the metallic surface to ensure electrical conductance.
  - the bolts that mounts the FA-M3 to the panel enclosure
  - The contact surface to the aluminum chassis of the base module
  - The connection to the wiring to the FG and LG terminals of the power supply module.
  - The location of the FG clamp for the shielded cable.
- Design the system so that the opening of the panel enclosure is as small as possible to minimize possible leakage of noise generated within the panel enclosure. It is recommended that the diameter of the opening for the cable should be less than 100 mm and that of the opening for ventilation should be less than 125 mm.

TIP

Take the following corrective actions for problems encountered during the installation.

- In case of noise leakage from the opening for the cable, wrap the cables using shield covers, shield tubes, conduit pipes, etc. to prevent noise leakage.

Item	Manufacturer	Product
Shield cover	Nitto Industries, Inc.	SDF-03-04-35ES
Shield tube	Nippon Zipper Tubing, Inc.	OTFX series MTFX series SHX series SHNX series
Conduit pipe	Nitto Industries, Inc.	EMP series

- In case of noise leakage from the ventilation hole, install an electromagnetic shield filter.

Item	Manufacturer	Product
Electromagnetic shield for the ventilation hole	Nitto Industries, Inc.	RSLP series

- In the case of noise leakage from the gap between the panel enclosure and the door, use electromagnetic shield gasket to fill the gap.

Item	Manufacturer	Product
Electromagnetic shield gasket	Kitagawa Industries, Inc.	UC series
	Nippon Zipper Tubing, Inc.	65TS series

- Using a grounding strap to connect the metal plate and the door to the panel enclosure itself may achieve better grounding.

Item	Manufacturer	Product
Grounding strap	Kitagawa Industries, Inc.	FGM series

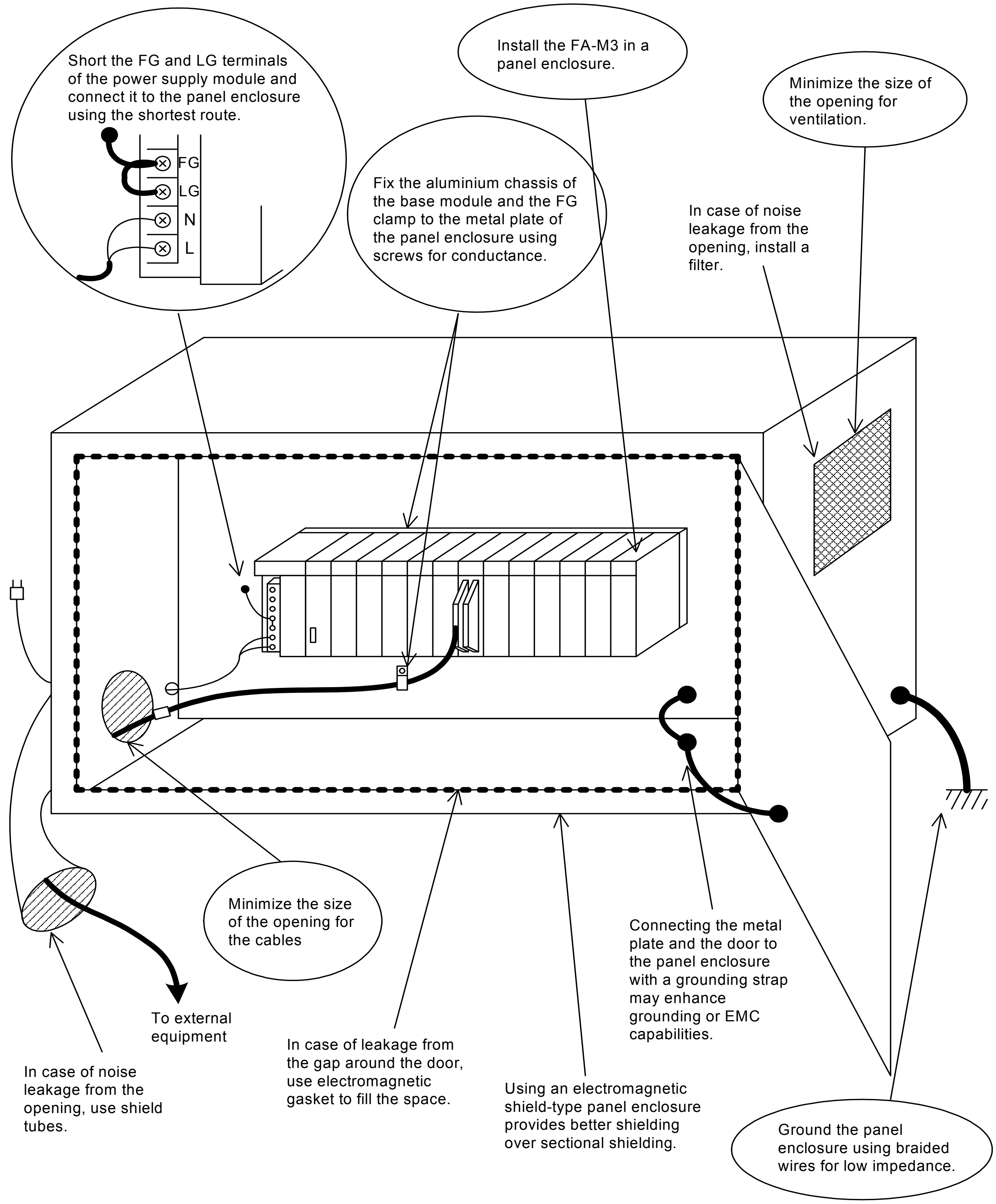

Short the FG and LG terminals of the power supply module and connect it to the panel enclosure using the shortest route.
FG
LG
N
L
Install the FA-M3 in a panel enclosure.
Fix the aluminium chassis of the base module and the FG clamp to the metal plate of the panel enclosure using screws for conductance.
Minimize the size of the opening for ventilation.
In case of noise leakage from the opening, install a filter.
Minimize the size of the opening for the cables
To external equipment
In case of noise leakage from the opening, use shield tubes.
In case of leakage from the gap around the door, use electromagnetic gasket to fill the space.
Using an electromagnetic shield-type panel enclosure provides better shielding over sectional shielding.
Connecting the metal plate and the door to the panel enclosure with a grounding strap may enhance grounding or EMC capabilities.
Ground the panel enclosure using braided wires for low impedance.
FA030902.VSD

Figure A3.37 Example of Installation Measures

(4) Considerations on Cable Routing

Signal cables that are connected to the FA-M3 carry harmonic components. The signal cable acts like an antenna and emits these harmonic components as noise to the external space and at the same time receives the noise from the external space.

Therefore, it is necessary to use shielded signal cables.

The EMC conformance test of the FA-M3 is conducted using shielded cables and FG clamps.

The considerations that should be observed during cable routing are summarized below. Figure A3.38 illustrates this graphically.

- Of the signal cables connected to this equipment, those that lead out of the panel enclosure should be shielded. 10BASE-T and 100BASE-TX cable sections that lead out of the panel enclosure (say, to connect to a HUB) should be shielded.

Item	Manufacturer	Product
Shielded twisted cable	Fuji Cable Industries, Inc.	FKEV series
Shielded flat cable	Oki Cable, Inc.	SFX-S (**)-7/0.127 3030-SV series
	Daichi Electrical Materials, Inc.	FDS series
Shielded 10BASE-T cable Shielded 100BASE-TX cable	Allied Telsis, Inc.	Category V shielded cable
	Sanwa Supply, Inc.	STP cable
	Hitachi Cable, Inc.	HSTP5 4P (without connector)

- Remove part of the shield on a shielded cable to expose the wire and ground it to the metal plate of the panel enclosure with an FG clamp. When connected to the metal plate in a pig-tail way using a drain wire, it cannot ensure low impedance against harmonic noise and cannot provide sufficient grounding effect (noise shield effect).

Item	Manufacturer	Product
FG clamp	Kitagawa Industries, Inc.	FGC series

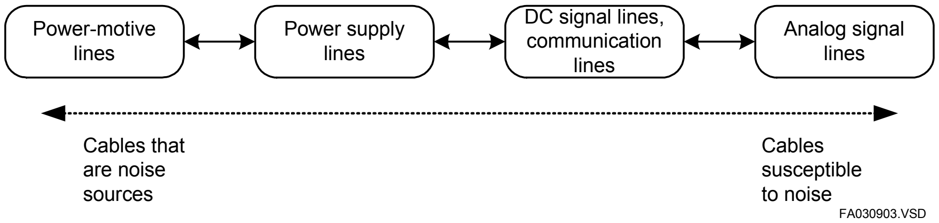
- Power supply cables of power supply modules (F3PU30-0S and F3PU36-0S) and YHLS Slave Units (TAH Series) should be fitted with ferrite cores to prevent interference emission.

Item	Manufacturer	Product
Ferrite core	Kitagawa Industries, Inc.	RFC series
	TDK, Inc.	ZCAT series
	Tokin, Inc.	ESD-SR series

TIP

Adopt the following corrective actions if necessary when routing the cables.

- Make the wiring cable as short as possible. This minimizes noise emission from the cable and noise receipt on the cable.
- Fit a ferrite core around signal cables susceptible to noise to reduce the effect of the noise. Ferrite core should be fitted near the cable outlet of the panel enclosure.
- When routing cables that are susceptible to noise, isolate them from cables that are noise sources.


Power-motive lines
Power supply lines
DC signal lines, communication lines
Analog signal lines
Cables that are noise sources
Cables susceptible to noise
FA030903.VSD

There are several ways to achieve isolation when routing the cables.

- Isolation by distance (Route cables at least 20 cm away from power-motive cables and at least 10 cm away from other cable groups).
- Place a grounded metal plate between the cables.
- Route each cable group through a grounded metal conduit or a shielded tube.

- When inserting a filter on a cable, make sure that wiring before and after the filter is sufficiently far apart. Otherwise, noise may transfer to other cable sections and reduce the effectiveness of the filter.
  Pay special attention to the following areas:
  - Noise filter inserted in the power supply cable
  - Ferrite core fitted around signal cables
  - Noise reduction circuits (surge protector circuit, arrestor circuit, etc.) inserted into signal cables

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(5) Considerations for 24V DC Power Supply to YHLS Slave Units (TAH Series)

- Use a dedicated 24V DC power supply for the TAH series. Avoid sharing power with other equipment.
- The power supply should incorporate an internal noise filter.
- A ferrite core should be fitted on the power cable.

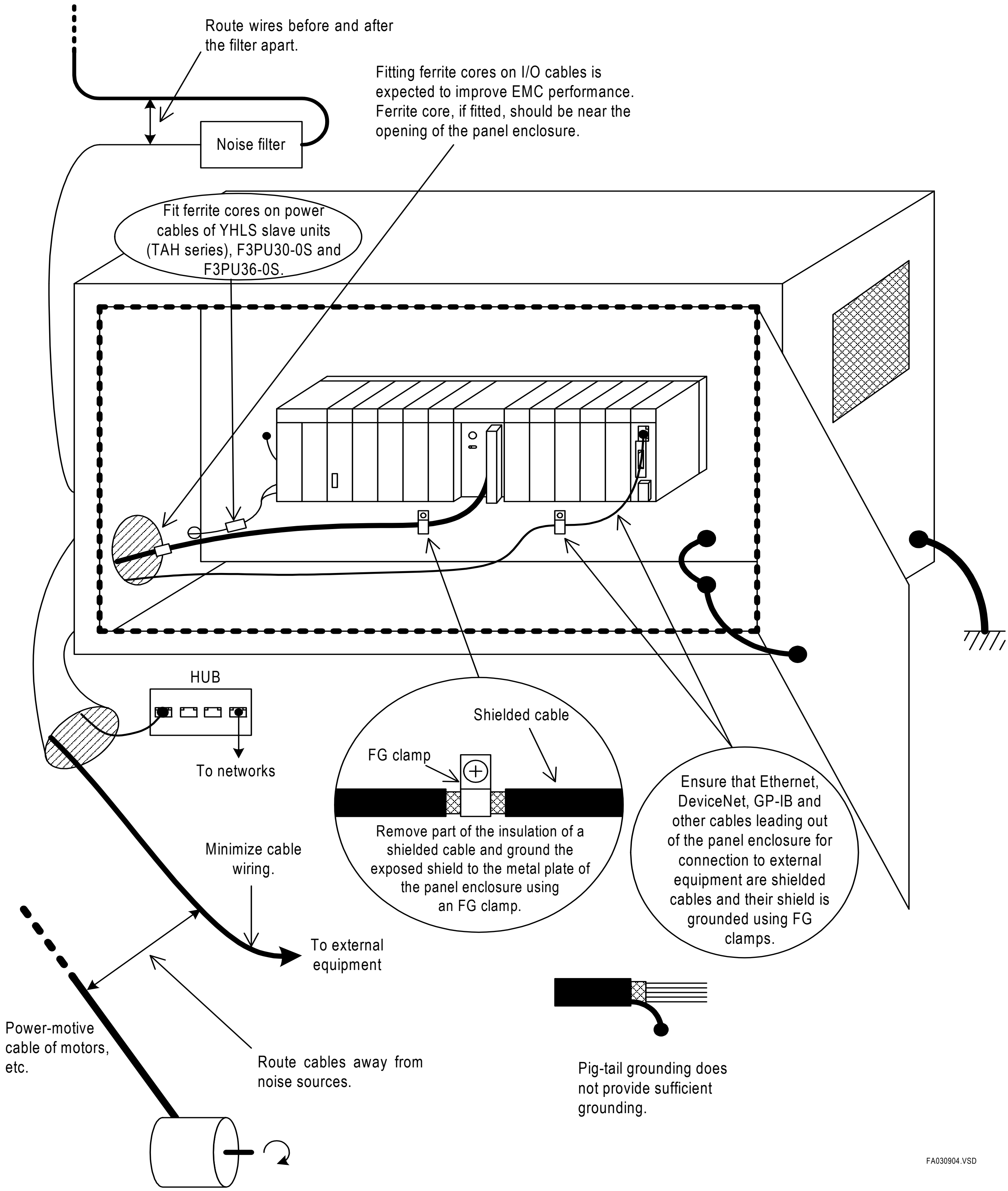

Route wires before and after the filter apart.
Noise filter
Fitting ferrite cores on I/O cables is expected to improve EMC performance. Ferrite core, if fitted, should be near the opening of the panel enclosure.
Fit ferrite cores on power cables of YHLS slave units (TAH series), F3PU30-0S and F3PU36-0S.
HUB
To networks
Shielded cable
FG clamp
Remove part of the insulation of a shielded cable and ground the exposed shield to the metal plate of the panel enclosure using an FG clamp.
Ensure that Ethernet, DeviceNet, GP-IB and other cables leading out of the panel enclosure for connection to external equipment are shielded cables and their shield is grounded using FG clamps.
Minimize cable wiring.
To external equipment
Power-motive cable of motors, etc.
Route cables away from noise sources.
Pig-tail grounding does not provide sufficient grounding.
FA030904.VSD

Figure A3.38 Example of Routing Measures

A3.9.2 Low Voltage Directive

(1) Requirements of Low Voltage Directive

The Low Voltage directive is applicable to equipment that operates with a rated voltage between 50 to 1000V AC or between 75 to 1500V DC. It requires equipment to be manufactured according to safety considerations and not pose risks of injury or death to personnel, livestock, or damage to property when used in applications for which they are designed.

This section summarizes the considerations to ensure that the FA-M3 conforms to the Low Voltage directive. The installation manufacturer needs to test and confirm the conformity to the Low Voltage directive of the finished product incorporating the FA-M3.

(2) Applicable Standards of the Low Voltage Directive

EN61010-1

Safety requirements for electrical equipment for measurement, control and laboratory use

Part 1: General Requirements

EN 61010-2-030

Safety requirements for electrical equipment for measurement, control and laboratory use

Part 2-030: Particular requirements for testing and measuring circuits

The Low Voltage directive is not applicable to modules that operate with a rated voltage of less than 50V AC or less than 75V DC. Modules that bear the CE declaration of conformity and fall within the scope of the Low Voltage directive satisfy the requirements of the above standards.

EN 61010-2-030 should be applicable to measuring circuits of measurement equipment, and is applied only to analog input circuits of FA-M3 series.

The analog input terminals of the FA-M3 have no measurement categories. Therefore it can’t use for measurement on Mains Circuit.

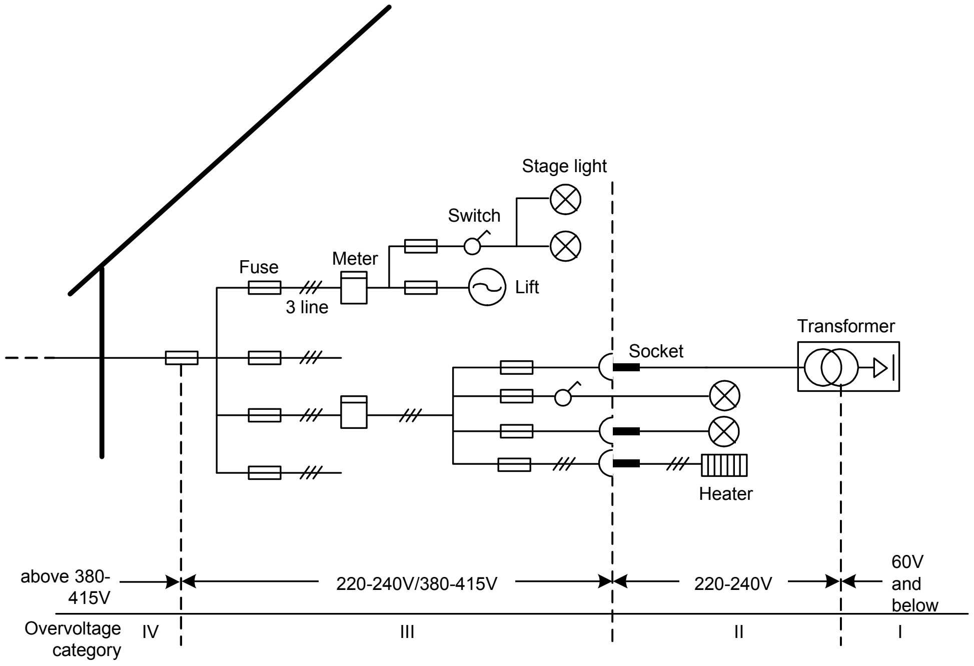
For details on modules that conform to the CE Marking, see “UL-approved, CE marking, C-Tick mark and KC mark - compliant Modules” (GS 34M06C11-21E)

(3) Installation Considerations

- Use the FA-M3 in an Overvoltage Category II environment.

  Overvoltage categories are divided into 4 categories depending on the rate of attenuation of surge voltages induced by lightning.

  Figure A3.39 shows a conceptual diagram for the overvoltage categories.



Overvoltage category I : Applies to signal systems with rated voltage 60V or less.
Special equipment or components of equipment, remote communication, etc.
Overvoltage category II : Applies to station systems with rated voltage 220/230/240V.
Electrical appliances, portable equipment, etc.
Overvoltage category III: Applies to distribution systems with rated voltage 220/230/240V or 380/400/415V.
Fixed installation equipment.
Overvoltage category IV: Single-supply systems with rated voltage 380/400/415 V or more.
Lines and cable systems, etc.

FA030905.VSD

Figure A3.39 Concept of Overvoltage Categories

- Use the FA-M3 in an environment of pollution degree 2 or lower with no condensation.

  The term pollution degree represents the degree of pollution with foreign matter, solid, liquid or gaseous, that may produce a reduction of dielectric strength or surface resistivity in the operating environment of the equipment.

  The EN61010-1 applies to equipment that is used in environment of pollution degree 1 or pollution degree 2; the FA-M3 is designed for use in an environment of pollution degree 2 with no condensation.

  The definitions for the pollution degree levels are given below.

  Pollution degree 1:

  No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.

  Pollution degree 2:

  Normally only non-conductive pollution occurs. Occasionally, temporary conductivity caused by condensation is to be expected.

  Pollution degree 3:

  Conductive pollution occurs, or dry, nonconductive pollution occurs that becomes conductive due to condensation that is to be expected.

Pollution degree 4:

The pollution generates persistent conductivity.

- Install the FA-M3 in a metallic panel enclosure.
  - Use a metallic panel enclosure which complies with the requirement of EN61010-1.
  - Ground the panel enclosure and the metal plate.
  - Connect the FG and LG terminal of the power supply module to the metal plate with the shortest route possible.
  - As a measure to protect against electric shock, design the door of the panel enclosure such that it can only be opened using a key or special tool, and thus only accessible to authorized personnel with adequate electrical knowledge such as system designers or maintenance personnel.
  - When the cable is drawn out of metallic panel enclosure, use a flame-retardant cable of VW-1 class or more.

- Install an external switch or circuit breaker.

  As the power supply module of the FA-M3 does not have a built-in power supply switch, design the system with an external switch or circuit breaker which:
  - Is compliant with EN60947,
  - Can disconnect all current-carrying conductors.
  - Is labeled as the power supply switch for the FA-M3 with its ON and OFF positions clearly marked.
  - Is installed near the FA-M3, within reach of an operator,
  - Is not obstructed by nearby objects such that its operation is hindered, and
  - does not disconnect the grounding wire from the FA-M3.

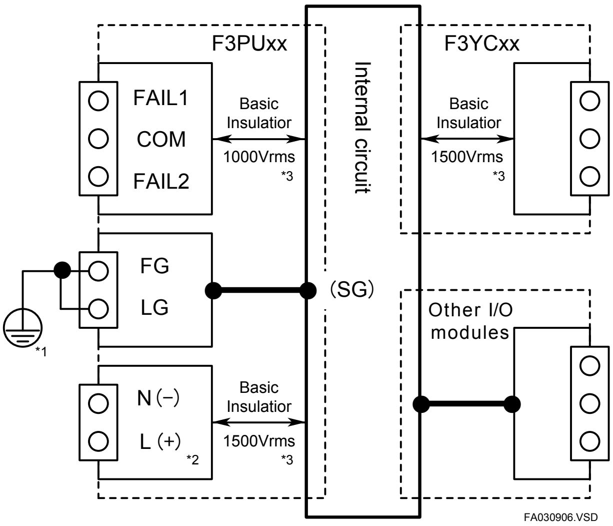
- Use the following external power supply unit to DC power supply modules and I/O modules.
  - Output circuit is insulated by double or reinforced insulation from hazardous voltage.
  - Overcurrent protection device is installed. If not, attach a fuse or a circuit breaker outside.

(4) Precautions in the withstand voltage test

WARNING

Figure A3.40 shows the insulation block diagram of FA-M3.

- FA-M3 provides protection against electric shock from each hazardous voltage by both basic insulation and protective earth.
- Apply the appropriate test voltage to the equipment incorporating the FA-M3 by referring to Fig.A3.40. Don't apply the excessive test voltage. It causes the trouble.
- In the FA-M3 module which doesn't handle hazardous voltage, the insulations between input-output terminals and internal circuits are functional insulations or non-insulations. In terms of safety standards, all of these insulations are treated as non-insulation. Therefore, in the withstand voltage test, don't apply the test voltage between these blocks.



*1: Protective earth for the AC power supply.
Functional earth for the DC power supply.
*2: L/N is for the AC power supply.
(+)/(-) is for the DC power supply.
*3: The numerical values show the withstanding voltages.

Figure A3.40 Insulation block diagram of FA-M3

(5) Precautions about analog input terminal

DANGER

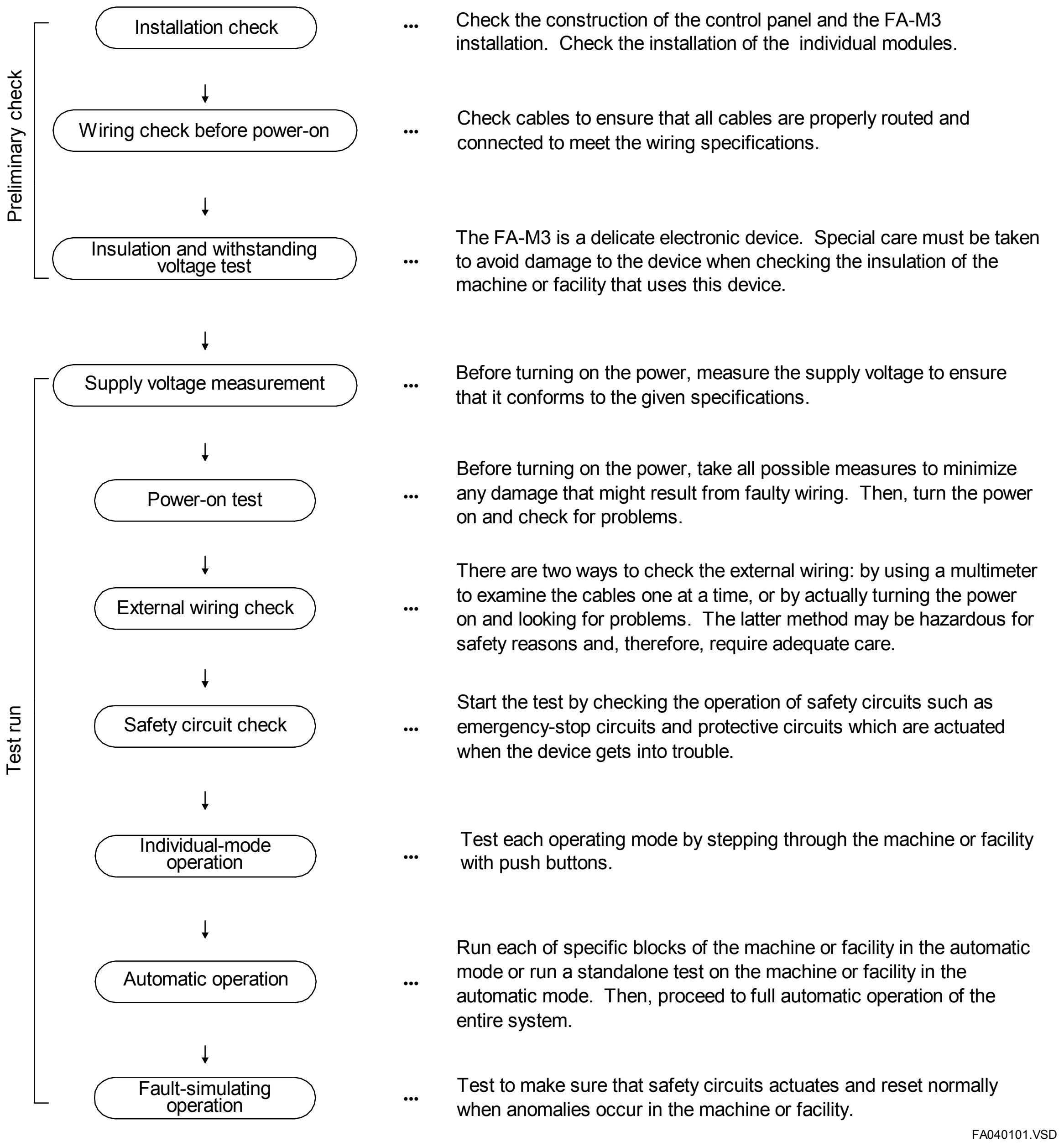
Don’t use analog input terminals of the FA-M3 for measurement on Mains Circuit, since it has no measurement category.

Maximum transient overvoltage that can be applied to the analog input terminal is 1,000 V.

A4. Test Runs and Troubleshooting

A4.1 Test Run Procedure

Figure A4.1 shows the test run flowchart.



Installation check	...	Check the construction of the control panel and the FA-M3 installation. Check the installation of the individual modules.
Wiring check before power-on	...	Check cables to ensure that all cables are properly routed and connected to meet the wiring specifications.
Insulation and withstanding voltage test	...	The FA-M3 is a delicate electronic device. Special care must be taken to avoid damage to the device when checking the insulation of the machine or facility that uses this device.
Supply voltage measurement	...	Before turning on the power, measure the supply voltage to ensure that it conforms to the given specifications.
Power-on test	...	Before turning on the power, take all possible measures to minimize any damage that might result from faulty wiring. Then, turn the power on and check for problems.
External wiring check	...	There are two ways to check the external wiring: by using a multimeter to examine the cables one at a time, or by actually turning the power on and looking for problems. The latter method may be hazardous for safety reasons and, therefore, require adequate care.
Safety circuit check	...	Start the test by checking the operation of safety circuits such as emergency-stop circuits and protective circuits which are actuated when the device gets into trouble.
Individual-mode operation	...	Test each operating mode by stepping through the machine or facility with push buttons.
Automatic operation	...	Run each of specific blocks of the machine or facility in the automatic mode or run a standalone test on the machine or facility in the automatic mode. Then, proceed to full automatic operation of the entire system.
Fault-simulating operation	...	Test to make sure that safety circuits actuates and reset normally when anomalies occur in the machine or facility.

Figure A4.1 Test Run Flowchart

A4.2 Test Run Precautions

■ Attaching and Detaching Connectors and Modules

Be sure to turn off the power before connecting or disconnecting connectors or modules. Removing or replacing connectors or modules with the power on may result in permanent damage to the device.

■ Precautions in Modifying Programs

Make a backup copy of programs after modifying them as they may be altered during a test run.

A4.3 Self-diagnostic Functions

A4.3.1 CPU Module Operation at Power-on

Figure A4.2 shows the flowchart of CPU module operation at power-on time.

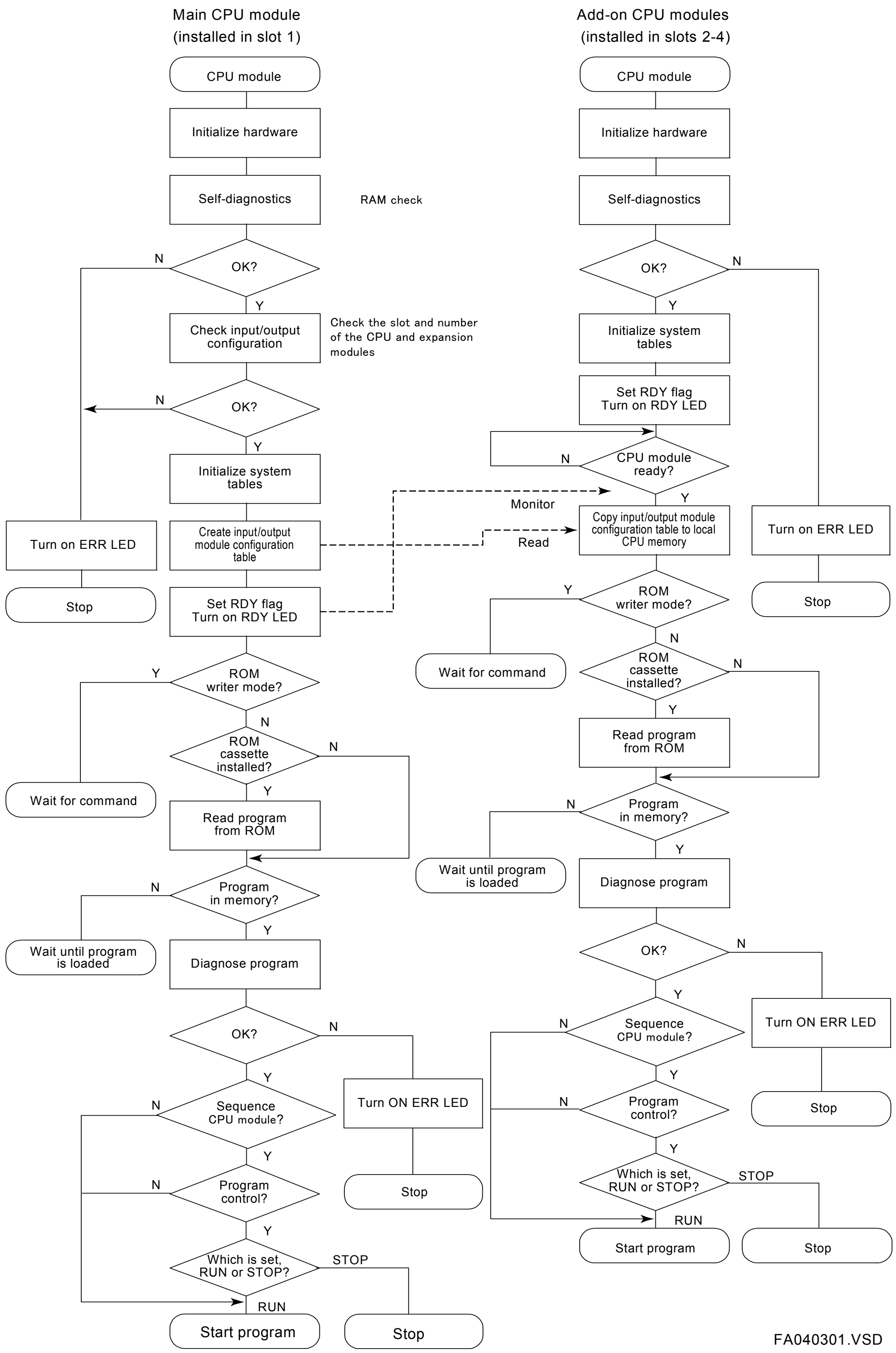


Figure A4.2 CPU Module Operation Flowchart (for CPU modules other than F3SP66-4S, F3SP67-6S, F3SP71-4N/4S and F3SP76-7N/7S)

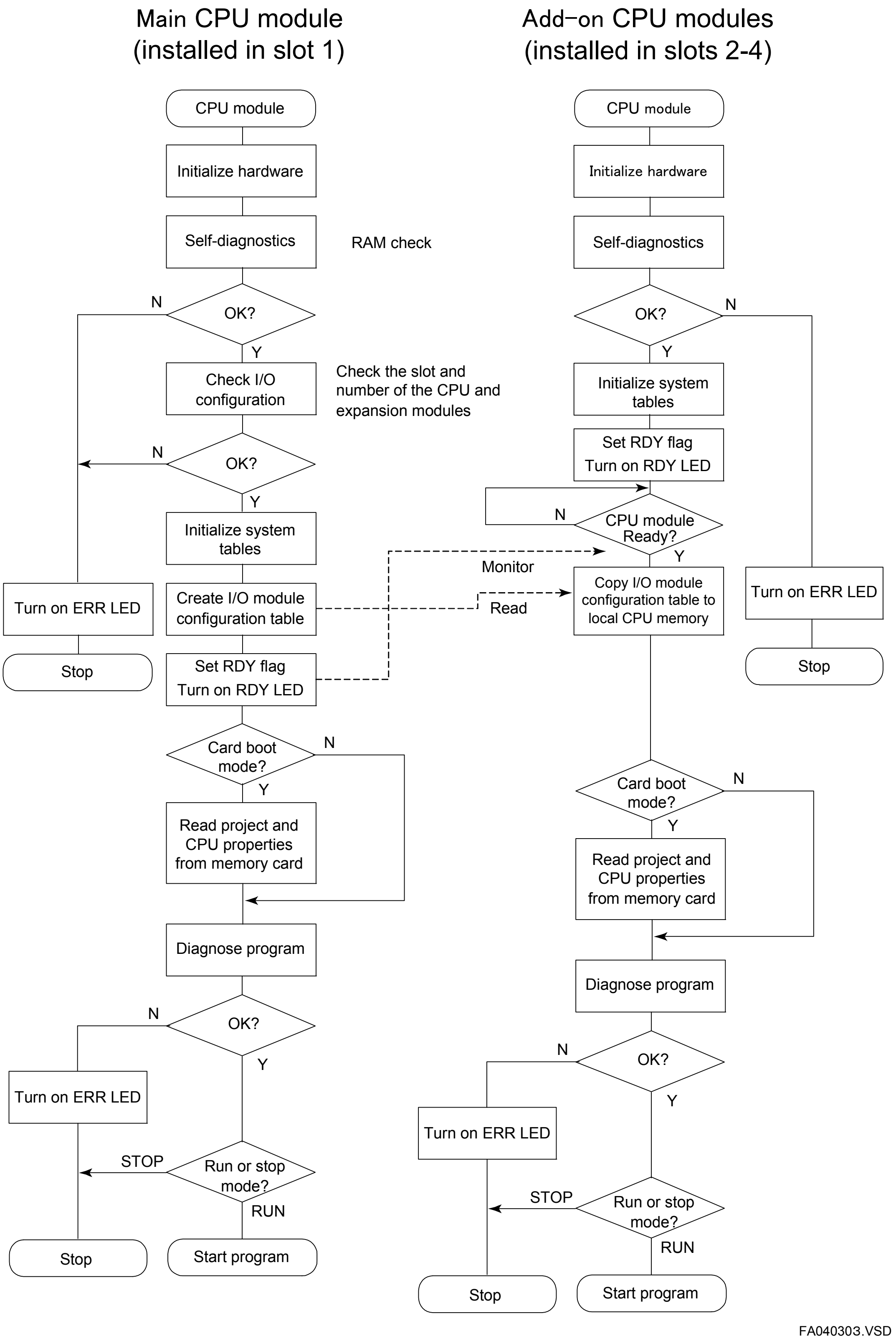


Figure A4.3 CPU Module Operation Flowchart (for F3SP66-4S, F3SP67-6S, F3SP71-4N/4S and F3SP76-7N/7S)

A4.3.2 Fault Identification

The FA-M3 provides means to quickly identify system faults as illustrated in the following figure. This fault identification system is easy to understand because it is hierarchically structured to facilitate fault analysis by checking for faults at each level.

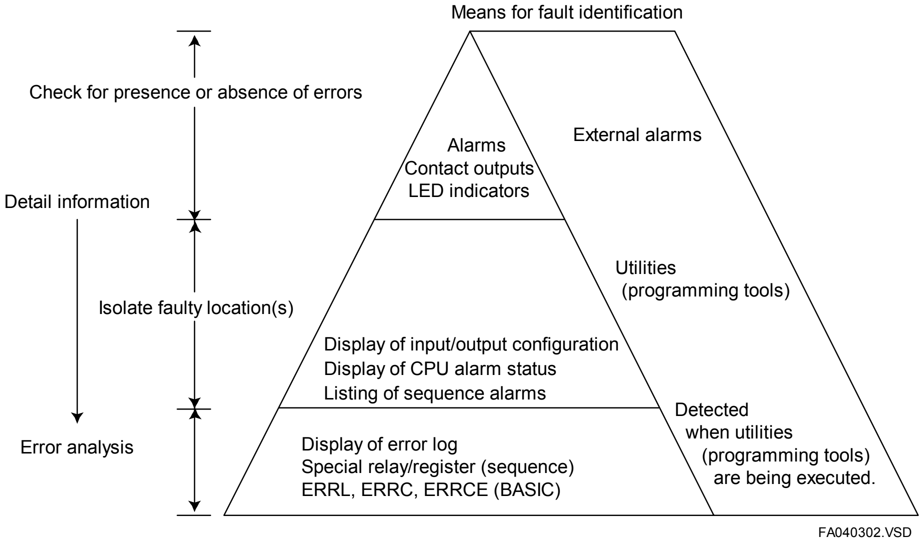

Means for fault identification
Check for presence or absence of errors
Detail information
Isolate faulty location(s)
Error analysis
Alarms
Contact outputs
LED indicators
External alarms
Utilities
(programming tools)
Display of input/output configuration
Display of CPU alarm status
Listing of sequence alarms
Detected
when utilities
(programming tools)
are being executed.
Display of error log
Special relay/register (sequence)
ERRL, ERRC, ERRCE (BASIC)
FA040302.VSD

Figure A4.4 Means of Fault Identification

A4.3.3 Indicating Problem Severity and Status of Output Module

The FA-M3 indicates the presence or absence of failures by the LEDs in the upper section of the CPU module, classifying them into major, moderate and minor failures. Tables A4.1 to A4.3 summarize the failure severity levels and the status of the output module in each case.

See the Fiber-optic FA-bus Module and Fiber-optic FA-bus Type 2 Module, FA-bus Type 2 Module (IM 34M06H45-01E) for details on how the FAIL-signal contact output and output module work if a failure arises in a transmission line, such as a fiber-optic cable, in an application where a fiber-optic FA-bus type 2 module is in use.

Table A4.1 Failure Severity Levels and Status of Output Module (when the CPU module is F3SP21/25/35 or F3FP36)

Severity Level	LED Indication	Effect	Probable Cause	Status of FAIL-signal Contact Output		Status of Output Module	
				Between FAIL1 and COM	Between FAIL2 and COM	Output modules other than F3YD64-1A, F3YD64-1M, F3WD64-xN	F3YD64-1A, F3YD64-1M, F3WD64-xN, Yxxxxx[*4]
Major	Green RDY lamp is off.	The core hardware is disabled.	• CPU error • Memory crash	Shorted	Open	Default: RESET Can be set globally on a module basis.	Setting ignored. The status is always HOLD.
Moderate	Red ERR lamp is lit.	The user program cannot be started or run any further.	• Program error[*1] • I/O comparison error[*1] • I/O module error [*1] • Memory error • SPU error • Instruction error[*1] • Scan timeout[*1] • Startup error • Invalid instruction found • Number of I/O points exceeded • ROM pack error • Subroutine error[*1] • Interrupt error • Subunit communication error[*2]	Shorted	Open	Default: RESET Can be set globally on a module basis.	Default: RESET Can be set globally on a module basis.
Minor	Yellow ALM lamp is lit.	The program can still run In spite of a failure.	• Momentary power failure[*5] • Inter-CPU communication error • Subunit transmitter switching has occurred[*3] • FA link error	Open	Shorted	Operation continues	Operation continues

*1: The severity level of this error item can be set using the Error-time Action field under Operation Control of the Configuration. Setting the field to "Stop" indicates a moderate failure whilst setting it to "Run" indicates a minor failure. The default value is "Stop" (moderate failure).

*2: The severity level of this error item can be set using the Error-time Action field under Operation Control of the Configuration. Setting the field to "Stop" indicates a moderate failure whilst setting it to "Run" indicates a minor failure. The default value is "Run" (minor failure).

*3: When using F3SP21, F3SP25 or F3SP35 CPU modules Rev. 8 or later or F3FP36.

*4: Output relays (Yxxxxx) of the advanced modules.

*5: When supply voltage abnormality is detected, output modules behave differently depending on whether the standard mode or immediate detection mode is selected. Behaviors during momentary power failure in each mode are as follows:

Supply Voltage Abnormality Detection mode	Status of FAIL-signal Contact Output		Status of Output Module	
	Between FAIL1 and COM	Between FAIL2 and COM	Output modules other than F3YD64-1A, F3YD64-1M, F3WD64-xN	F3YD64-1A, F3YD64-1M, F3WD64-xN, Yxxxxx [*4]
Standard mode	Open	Shorted	Hold	Hold
Immediate detection mode	Shorted	Open	Reset	Hold

Table A4.2 Failure Severity Levels and Status of Output Module (when the CPU module is F3SP22/28/38/53/58/59/66/67/71/76)

Severity Level	LED Indication	Effect	Probable Cause	Status of FAIL-signal Contact Output		Status of Output Module	
				Between FAIL1 and COM	Between FAIL2 and COM	Output modules other than F3YD64-1A, F3YD64-1M, F3WD64-xN	F3YD64-1A, F3YD64-1M, F3WD64-xN, Yxxxxx [3]
Major	Green RDY lamp is off.	Core hardware is disabled.	• CPU error • Memory crash	Shorted	Open	Default: RESET Can be set on a 16-point basis.	Setting ignored The status is always HOLD
Moderate	Red ERR lamp is lit.	The user program cannot be started or run any further.	• Program error • I/O comparison error[1] • I/O module error[1] • Memory error • SPU error • Instruction error[1] • Scan timeout[1] • Startup error • Invalid instruction found • Number of I/O points exceeded • ROM pack error • Subroutine error[1] • Interrupt error[1] • Subunit communication error[2] • Sensor CB scan timeout[1]	Shorted	Open	Default: RESET Can be set on a 16-point basis.	Default: RESET Can be set on a 16-point basis.
Minor	Yellow ALM lamp is lit.	The program can still run In spite of a minor failure detected.	• Momentary power failure[4] • Inter-CPU communication error • Subunit transmitter switching has occurred • FA link error	Open	Shorted	Operation continues.	Operation continues.

[1] The severity level of this error item can be set using the Error-time Action field under Operation Control of the Configuration. Setting the field to "Stop" indicates a moderate failure whilst setting it to "Run" indicates a minor failure. The default value is "Stop" (moderate failure).

[2] The severity level of this error item can be set using the Error-time Action field under Operation Control of the Configuration. Setting the field to "Stop" indicates a moderate failure whilst setting it to "Run" indicates a minor failure. The default value is "Run" (minor failure).

[3] Output relays (Yxxxxx) of the advanced modules.

[4] When supply voltage abnormality is detected, output modules behave differently depending on whether the standard mode or immediate detection mode is selected. Behaviors during momentary power failure in each mode are as follows:

Supply Voltage Abnormality Detection mode	Status of FAIL-signal Contact Output		Status of Output Module	
	Between FAIL1 and COM	Between FAIL2 and COM	Output modules other than F3YD64-1A, F3YD64-1M, F3WD64-xN	F3YD64-1A, F3YD64-1M, F3WD64-xN, Yxxxxx [3]
Standard mode	Open	Shorted	Hold	Hold
Immediate detection mode	Shorted	Open	Reset	Hold

CAUTION

- If you want to reset the contacts of an output module in the event of a major or moderate sequence CPU module failure, do the following: Use an output module with 32 or less points and set the Output When Stopped field under "Input/Output Setup" of the Configuration to "RESET". (For F3SP22/28/38/53/58/59/66/67/71/76 modules, F3YD64-1F, F3YD64-1P, F3YD64-1R, F3WD64-xF and F3WD64-xP modules can also be used.)
- If you want to hold the contacts of an output module in the case of a major or moderate sequence CPU module failure, set the Output When Stopped field under "Input/Output Setup" of the Configuration to "HOLD". The behavior is independent of the type of CPU module or output module.

Table A4.3 Failure Severity Levels and LED Indications (when the CPU module is F3BP20 or F3BP30)

Severity Level	LED Indication	Effect	Probable Cause	Status of FAIL-signal Contact Output		Status of Output Module	
				Between FAIL1 and COM	Between FAIL2 and COM	Output modules other than F3YD64-1A, F3YD64-1M, F3WD64-xN	F3YD64-1A, F3YD64-1M, F3WD64-xN, Yxxxxx [*2]
Major	Green RDY lamp if off.	Key hardware is disabled.	• CPU error • Memory crash	Shorted	Open	Default: HOLD Can be set on a 8-point basis. (in a CONTROL statement)	Cannot be set The status is always HOLD
Moderate	Red ERR lamp is lit.	The user program cannot be started or run any further.	• Program error • I/O module error [*1] • BASIC error stop (no ON ERROR) • Startup error • Invalid instruction found • Number of I/O points exceeded • ROM pack error • Subroutine error [*1] • Interrupt error [*1] • Subunit communication error	Open	Shorted	Cannot be set The status is always HOLD	Cannot be set The status is always HOLD
Minor	Yellow ALM [*1] lamp is lit.	The program can still run In spite of a minor failure detected.	• Momentary power failure [*3] • I/O module error (during interrupt processing)	Open	Shorted	Operation continues	Operation continues

*1: The yellow ALM LED is also lit when the FA-M3 is in Debug mode.

*2: Output relays (Yxxxxx) of the advanced modules.

*3: When supply voltage abnormality is detected, output modules behave differently depending on whether the standard mode or immediate detection mode is selected. Behaviors during momentary power failure in each mode are as follows:

Supply Voltage Abnormality Detection mode	Status of FAIL-signal Contact Output		Status of Output Module	
	Between FAIL1 and COM	Between FAIL2 and COM	Output modules other than F3YD64-1A, F3YD64-1M, F3WD64-xN	F3YD64-1A, F3YD64-1M, F3WD64-xN, Yxxxxx [*2]
Standard mode	Open	Shorted	Hold	Hold
Immediate detection mode	Shorted	Open	Reset	Hold

A4.4 Troubleshooting Procedure

If an error condition occurs, take note of the current situation and symptom, then troubleshoot the problem according to the flowchart shown in Figure A4.5 considering the relationship with the other devices and the reproducibility of the error condition.

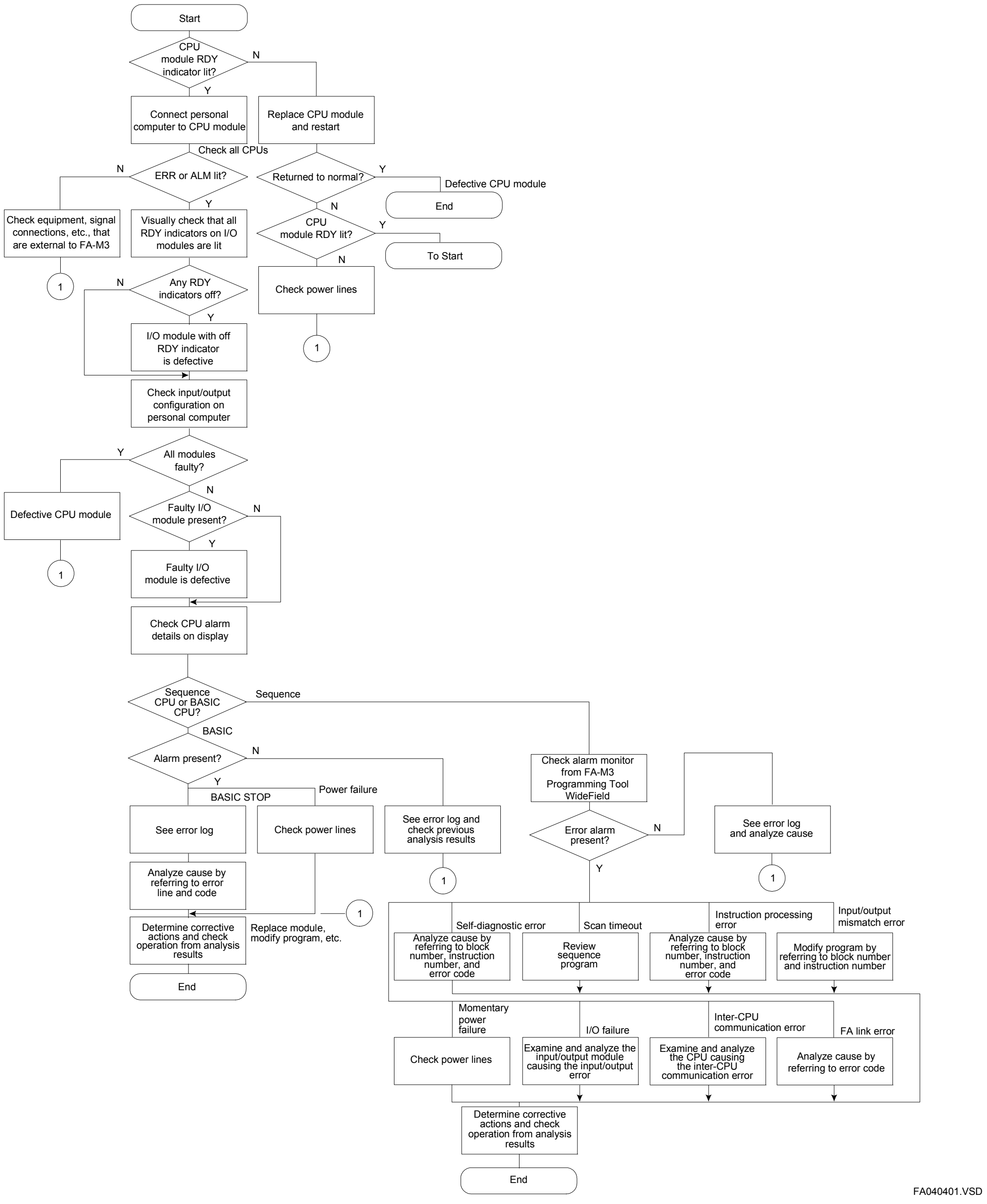

Start
CPU module RDY indicator lit?
N
Y
Connect personal computer to CPU module
Replace CPU module and restart
Check all CPUs
ERR or ALM lit?
N
Y
Returned to normal?
Y
Defective CPU module
End
N
CPU module RDY lit?
Y
To Start
N
Check equipment, signal connections, etc., that are external to FA-M3
Visually check that all RDY indicators on I/O modules are lit
Check power lines
1
N
Any RDY indicators off?
Y
I/O module with off RDY indicator is defective
1
Check input/output configuration on personal computer
Y
All modules faulty?
N
Defective CPU module
Faulty I/O module present?
N
Y
1
Faulty I/O module is defective
Check CPU alarm details on display
Sequence CPU or BASIC CPU?
Sequence
BASIC
Alarm present?
N
Y
BASIC STOP
Power failure
Check alarm monitor from FA-M3 Programming Tool WideField
See error log
Check power lines
See error log and check previous analysis results
Error alarm present?
N
See error log and analyze cause
Y
1
1
Analyze cause by referring to error line and code
1
Determine corrective actions and check operation from analysis results
Replace module, modify program, etc.
End
Self-diagnostic error
Scan timeout
Instruction processing error
Input/output mismatch error
Analyze cause by referring to block number, instruction number, and error code
Review sequence program
Analyze cause by referring to block number, instruction number, and error code
Modify program by referring to block number and instruction number
Momentary power failure
I/O failure
Inter-CPU communication error
FA link error
Check power lines
Examine and analyze the input/output module causing the input/output error
Examine and analyze the CPU causing the inter-CPU communication error
Analyze cause by referring to error code
Determine corrective actions and check operation from analysis results
End
FA040401.VSD

Figure A4.5 Troubleshooting Flowchart

A4.5 CPU Module Reset and Memory Clearance

(1) For the F3SP66, F3SP67, F3SP71 and F3SP76

● Reset

- Using the FA-M3 Programming Tool WideField3:
  Select [Online]–[Extended Functions]–[Reset Start] from the menu bar.
  For details, refer to the FA-M3 Programming Tool WideField3 (IM 34M06Q16-☐☐E).
  The operations can also be carried out using the FA-M3 Programming Tool WideField2 for F3SP66-4S and F3SP67-6S.
- Using the smart access function:
  Execute the Press & Hold operation (with MODE switch value = 0, 1, 2 or 3) of the rotary switch function, or execute a Reset CPU command of the card batch file function.
  For details, refer to the Sequence CPU – Functions (for F3SP66-4S, F3SP67-6S) (IM 34M06P14-01E) or the Sequence CPU Instruction Manual – Functions (for F3SP71-4N/4S, F3SP76-7N/7S) (IM 34M06P15-01E).
- Using the FTP function (for F3SP66/F3SP67, F3SP71-4S and F3SP76-7S only):
  Execute the Reset CPU command of the virtual directory function.
  For details, refer to the Sequence CPU – Network Functions (for F3SP66-4S, F3SP67-6S) (IM 34M06P14-02E) or the Sequence CPU Instruction Manual – Functions (for F3SP71-4N/4S, F3SP76-7N/7S) (IM 34M06P15-01E). F3SP71-4N and F3SP76-7N do not support the virtual directory function.

● Memory clearance

Select [Online]–[Extended Functions]–[Clear Devices] from the menu bar of the FA-M3 Programming Tool WideField3.

For details, refer to the FA-M3 Programming Tool WideField3 (IM 34M06Q16-☐☐E).

The operations can also be carried out using the FA-M3 Programming Tool WideField2 for F3SP66-4S and F3SP67-6S.

● Restoring factory settings

Execute the Press & Hold operation (with MODE switch value = C) of the rotary switch function.

For details, refer to the Sequence CPU – Functions (for F3SP66-4S, F3SP67-6S) (IM 34M06P14-01E) or the Sequence CPU Instruction Manual – Functions (for F3SP71-4N/4S, F3SP76-7N/7S) (IM 34M06P15-01E).

TIP

- Restoring the factory settings when the rotary switch function is disabled by using function removal (for F3SP66/67/71/76)

The Press & Hold operation cannot be used to restore the factory settings when the rotary switch function is disabled by using function removal.

If this situation happens, follow the instructions given below.

Set the rotary switch (MODE switch) to C, install a sequence CPU module in the 5th or higher slot, and turn on the power. After making sure the RDY lamp comes on, turn off the power. This restores the factory settings.

Executing the above-mentioned procedure without setting the rotary switch (MODE switch) to C clears information other than the project and CPU properties information stored in the internal ROM.

(2) For the F3SP22, F3SP28, F3SP38, F3SP53, F3SP58 and F3SP59

Select [Online]–[Extended Functions] from the menu bar of the FA-M3 Programming Tool WideField, WideField2 or WideField3.

For details, refer to the FA-M3 Programming Tool WideField (IM 34M06Q14-01E), the FA-M3 Programming Tool WideField2 (IM 34M06Q15-01E) or the FA-M3 Programming Tool WideField3 (IM 34M06Q16-□□E). F3SP22-0S supports only the FA-M3 Programming Tool WideField3.

(3) For the F3SP21, F3SP25 and F3SP35

Use the Operation Setup menu of the Ladder Diagram Support Program M3.

For details, refer to the Ladder Diagram Support Program M3 (IM 34M06Q13-01E).

The operations can also be carried out using the FA-M3 Programming Tool WideField, WideField2 or WideField3 for F3SP21-0N, F3SP25-2N, and F3SP35-5N modules.

(4) For the F3BP20-0N and F3BP30-0N BASIC CPU

- User area : Initialization using the NEW command.
- Common area : Initialization using the INIT COM statement.
- Own CPU shared register area : Initialization using the INICOMM3 library.

For details on the above-mentioned command, statement and library, refer to the BASIC CPU Modules and YM-BASIC/FA Programming Language (IM 34M06Q22-01E).

TIP

Methods of memory clearance when the FA-M3 Programming Tool WideField3 is not available (for F3SP21/22/25/28/35/38/53/58/59 only)

If you mistakenly configure the baud rate of the CPU port to 19200 bps when running the Ladder Diagram Support Program M3 on an earlier version of the PC98 series of personal computers that does not support that baud rate, the communication link is disabled and the program becomes no longer usable.

If this situation happens, follow the instructions given below.

Install a sequence CPU module in the 5th or higher slot and turn on the power. After making sure the RDY lamp has gone out momentarily and then comes on again, turn off the power. This clears the CPU memory completely, and restores the module to its factory setting.

A5. Maintenance and Inspection

A5.1 Replacing Modules

■ Spare Modules

Always have spare modules on hand for immediate countermeasures against failures in the FA-M3.

■ Procedure for Replacing a Module

Be sure to turn off the power before replacing any module. When replacing a module, do not change the type and location of the module.

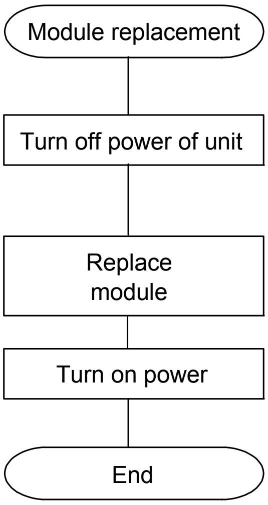


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Figure A5.1 Module Replacement Procedure

■ Note the module replacement

Perform the following checks before replacing a module when there is an error:

- Check whether the load conforms to the specifications.
- Check whether the surge protector, if any, is functioning normally.
- Check for cabling errors such as wrong polarity orientation of a diode.

CAUTION

The FA-M3 will fail again after replacing any module when there is a problem with the external wiring, no surge protector is installed or a diode is connected in the reverse polarity. Be sure to solve problems with the external equipment before replacing the module.

A5.2 Routine Inspection

Routine inspection comprises the minimum level of checks used to determine whether any fault might occur in the day's operation. Observing these procedures properly will enable you to maintain stable FA-M3 operation.

Category	Check item	Criterion		
Power supply	Are the voltage fluctuations within the specified limits when measured at the power supply terminals?	Limits	F3PU10-0N F3PU10-0S F3PU20-0N F3PU20-0S F3PU30-0N F3PU30-0S	85 to 264 V AC
			F3PU16-0N F3PU26-0N F3PU36-0N F3PU36-0S	15.6 to 31.2 V DC
Input/output power supply	Are the voltage fluctuations within the specified limits when measured at the I/O terminal block.	As per the specifications for the individual input/output module.		
Environment	Is the ambient temperature (inside the panel enclosure) normal?	0 to 55°C		
	Is the ambient humidity (inside the panel enclosure) normal?	10 to 90% RH (non-condensing)		
	Is there any accumulation of dust?	Must be free of dust.		
Mounting state	Is each module secured?	Must be secured firmly.		
	Are all cable connectors fully fitted and secured in place?	Must be secured firmly.		
	Are there any loose external cable screws?	Must be secured firmly.		
	Are there any cuts or nicks in the external cables?	Must be free of visible flaws.		

■ Tools Required for Inspection

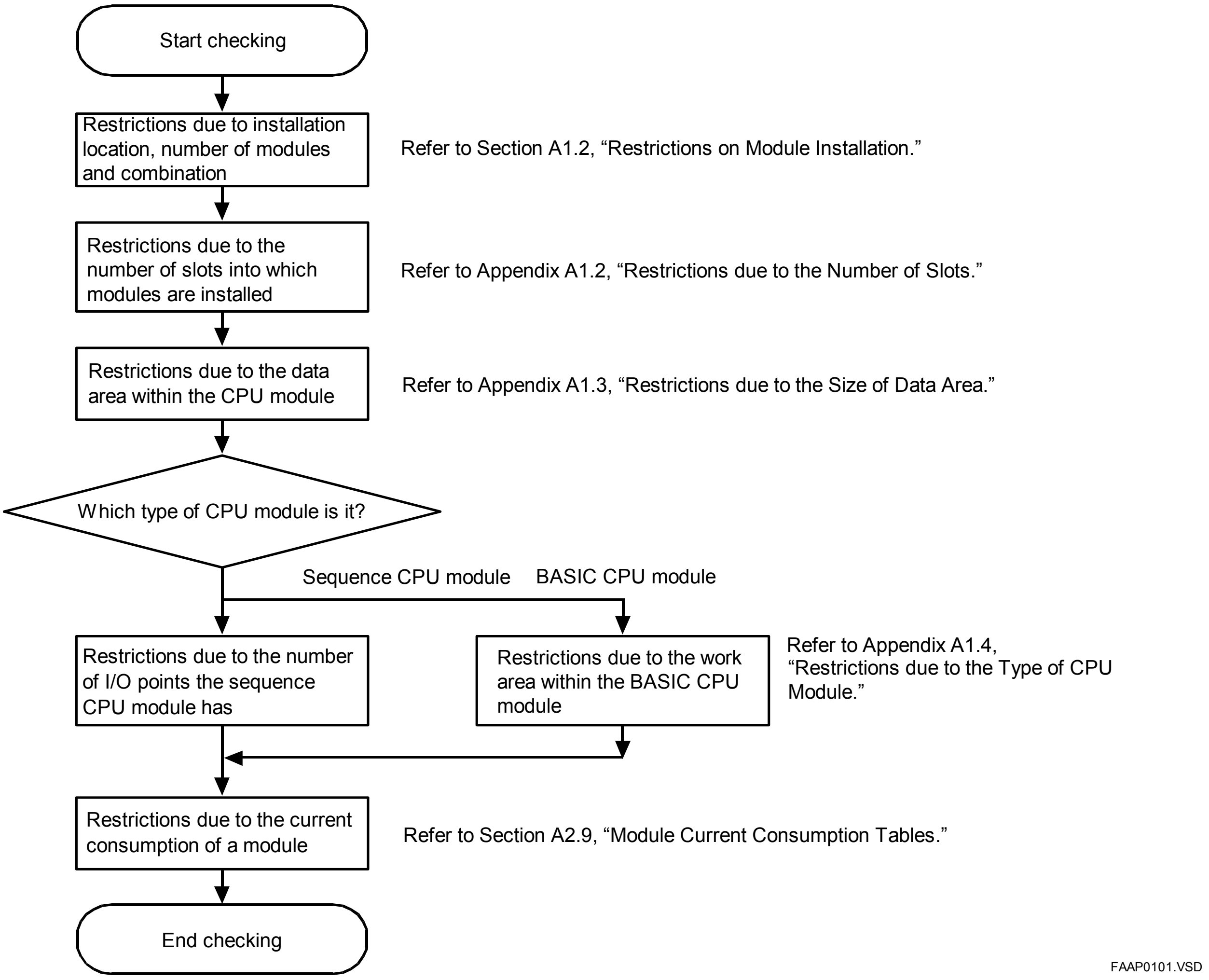
- Philips and flat-blade screwdrivers
- Multi-meter or digital voltmeter
- Thermometer
- Humidity gauge

Appendix A1 System-wide Restrictions on Module Installation

Restrictions on module installation include a limitation on the number of modules that can be installed in the system as a whole, in addition to a limitation on the number of respective CPU and I/O modules that can be installed. This appendix explains how to check whether or not your system complies with system-wide restrictions on module installation.

Appendix A1.1 Checking Compliance with Restrictions on Module Installation

List the CPU and I/O modules you will use and follow the procedure shown in Appendix Figure A1.1 to check whether or not your system complies with each restriction. System operation is not guaranteed unless your system satisfies all of these restrictions.


Start checking
Restrictions due to installation location, number of modules and combination
Refer to Section A1.2, "Restrictions on Module Installation."
Restrictions due to the number of slots into which modules are installed
Refer to Appendix A1.2, "Restrictions due to the Number of Slots."
Restrictions due to the data area within the CPU module
Refer to Appendix A1.3, "Restrictions due to the Size of Data Area."
Which type of CPU module is it?
Sequence CPU module
BASIC CPU module
Restrictions due to the number of I/O points the sequence CPU module has
Restrictions due to the work area within the BASIC CPU module
Refer to Appendix A1.4, "Restrictions due to the Type of CPU Module."
Restrictions due to the current consumption of a module
Refer to Section A2.9, "Module Current Consumption Tables."
End checking
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Appendix Figure A1.1 Flow of Procedure for Checking Restrictions on Module Installation

Refer to Appendix Tables A1.1 and A1.2 when checking each of the restrictions.

Appendix Table A1.1 Number of Slots Occupied and Number of I/O Points Supported by Each CPU Module

Module Description	Model	Number of Slots Occupied	Number of I/O Points Supported
Sequence CPU module	F3SP21-0N	1	2048
	F3SP22-0S	1	4096
	F3SP25-2N	1	4096
	F3SP35-5N	1	8192
	F3SP28-3N	1	4096
	F3SP38-6N	1	8192
	F3SP53-4H	1	4096
	F3SP58-6H	1	8192
	F3SP28-3S	1	4096
	F3SP38-6S	1	8192
	F3SP53-4S	1	4096
	F3SP58-6S	1	8192
	F3SP59-7S	1	8192
	F3SP66-4S	1	4096
	F3SP67-6S	1	8192
	F3SP71-4N	1	4096
	F3SP76-7N	1	8192
	F3SP71-4S	1	4096
	F3SP76-7S	1	8192
	F3FP36-3N	1	4096
BASIC CPU module	F3BP20-0N	1	—
	F3BP30-0N	1	—

Appendix Table A1.2 Number of Slots Occupied and Number of I/O Points Supported by Each I/O Module and its Function Specifications (1/2)

Module Description	Model	Number of Slots ccupied	Number of I/O Points Supported*	Size of Data Area	Size of Basic CPU's Work Area
Memory card module	F3EM01-0N	1	64	0	$110
Input module	F3XA08-□N	1	16	0	$50
	F3XA16-1N	1	16	0	$50
	F3XH04-3N	1	16	0	$50
	F3XC08-0□	1	16	0	$50
	F3XD08-6□	1	16	0	$50
	F3XD16-□□	1	16	0	$50
	F3XD32-□□	1	32	0	$50
	F3XD64-□□	1	64	0	$50
Output module	F3YA08-2N	1	16	0	$50
	F3YC08-0N	1	16	0	$50
	F3YC16-0N	1	16	0	$50
	F3YD04-7N	1	16	0	$50
	F3YD08-□□	1	16	0	$50
	F3YD14-5□	1	16	0	$50
	F3YD32-1□	1	32	0	$50
	F3YD64-1□	1	64	0	$50
I/O module	F3WD64-□□	1	64	0	$50
Analog input module	F3AD04-0□	1	0	2	$110
	F3AD08-□□	1	0	2	$110
Analog output module	F3DA02-□□	1	0	2	$110
	F3DA04-□□	1	0	2	$110
	F3DA08-□□	1	0	2	$110
High-speed data acquisition module	F3HA08-0N	1	64	8	$110
Temperature control/monitoring module	F3CT04-0N	2	64	4	$110
	F3CR04-1N	2	64	4	$110
PID control module	F3CV04-1N	2	64	4	$110
Temperature control and PID module	F3CU04-0□	1	64	2	$110
	F3CU04-1□	2	64	2	$110
Temperature monitoring module	F3CX04-0N	1	64	2	$110
ASi Master module	F3LA01-0N	1	64	2	$110
PROFIBUS-DP Interface module	F3LB01-0N	1	64	4	$110
Personal computer link module	F3LC11-1F	1	64	2	$110
	F3LC11-1N	1	64	2	$110
	F3LC11-2□	1	64	2	$110
	F3LC12-1F	1	64	4	$110
Ethernet interface module	F3LE01-0T	1	64	16	$110
	F3LE01-5T	1	64	16	$110
	F3LE11-0T	1	64	16	$110
	F3LE12-0T	1	64	16	$110
YHLS master module	F3LH02-0N	1	64	4	$110
	F3LH01-1N	1	64	4	$110
	F3LH02-1N	1	64	4	$110
FL-net (OPCN-2) interface module	F3LX02-1N	1	64	16	$110
NX interface module	F3NX01-□N	1	64	16	$110
GP-IB communication module	F3GB01-0N	1	64	8	$110
UT link module	F3LC51-2N	1	64	8	$110
RS-232-C communication module	F3RS22-0N	1	0	2	$110
RS-422-A communication module	F3RS41-0N	1	0	2	$110
Ladder communication module	F3RZ81-0N	1	64	2	0
	F3RZ81-0F	1	64	4	0
	F3RZ82-0F	1	64	4	0
	F3RZ91-0□	1	64	2	0
DeviceNet interface module	F3LD01-0N	1	64	4	$110
FA link H module	F3LP02-0N	1	0	8	0
Fiber-optic FA link H module	F3LP12-0N	1	0	8	0
Fiber-optic FA-bus module	F3LR01-0N	1	0	0	0
Fiber-optic FA-bus type 2 module	F3LR02-0N	1	0	0	0
FA-bus type 2 module	F3LR02-1W	1	0	0	0
High-speed counter module	F3XP01-0H	1	64	0	$50
	F3XP02-0H	1	64	0	$50
Pulse input module	F3XS04-□N	1	64	2	$110

*1: Input and output modules with 4, 8 and 14 points are all regarded as having 16 points.

Appendix Table A1.2 Number of Slots Occupied and Number of I/O Points Supported by Each I/O Module and its Function Specifications (2/2)

Module Description	Model	Number of Slots Occupied	Number of I/O Points Supported*	Size of Data Area	Size of Basic CPU's Work Area
Positioning module (with multi-channel pulse output)	F3YP04-0N	1	64	2	$110
	F3YP08-0N	1	64	2	$110
	F3YP14-0N	1	64	2	$110
	F3YP18-0N	1	64	2	$110
	F3YP22-0P	1	64	4	$110
	F3YP24-0P	1	64	4	$110
	F3YP28-0P	1	64	4	$110
Positioning module (advanced model with pulse output)	F3NC11-0N	1	64	2	$110
	F3NC12-0N	1	64	2	$110
Positioning module (with pulse output)	F3NC32-0N	1	64	4	$110
	F3NC34-0N	1	64	4	$110
Positioning module (with analog voltage output)	F3NC51-0N	1	64	2	$110
	F3NC52-0N	1	64	2	$110
Positioning module (for torque control)	F3NC61-0N	1	64	2	$110
Positioning module (with MECHATROLINK-II interface)	F3NC96-0N	1	64	8	$110
Positioning module (with MECHATROLINK-III interface)	F3NC97-0N	1	64	8	$110

*1: Input and output modules with 4, 8 and 14 points are all regarded as having 16 points.

Appendix A1.2 Restrictions due to the Number of Slots

Determine the total sum W of slots occupied by all modules excluding the power supply, fiber-optic FA-bus, fiber-optic FA-bus type 2, and FA-bus type 2 modules. Then check that the value of W complies with restrictions placed by the maximum number of slots.

The maximum number of slots varies depending on the types of CPU modules used and their combinations.

If F3SP21/22/25/28/35/38/53/58/59/66/67/71/76, F3FP36, F3BP20 and F3BP30 modules are used in combination, a maximum of 7 subunits can be added to the system.

- When F3SP21/22/25/28/35/38/53/58/59/66/67/71/76, F3FP36, F3BP20, and F3BP30, modules are used in combination, the maximum number of slots amounts to 120. This number is only effective however, when 16-slot base modules are used with both the main unit and each subunit, and the seven subunits are connected in a daisy-chain or loop topology through fiber-optic FA-bus type 2 and FA-bus type 2 modules.

TIP

If subunits are divided into groups using fiber-optic FA-bus type 2 modules, the total number of slots may become smaller than the value noted above depending on the mode of such division. For more information on the calculation of the total sum, see the Fiber-optic FA-bus Module and Fiber-optic FA-bus Type 2 Module, FA-bus Type 2 Module (IM 34M06H45-01E).

Appendix A1.3 Restrictions due to the Size of Data Area

Determine the total size M of the data area provided by all I/O modules (i.e., modules excluding the power supply and CPU modules). Then check that the value of M complies with restrictions placed by the maximum size of data area. The total size of data area M varies depending on the order in which I/O modules are installed. Consider system configuration in advance, including the number of subunits, unit number and I/O modules' installation locations, according to your application needs.

● Restrictions due to the size of data area are defined as

$M \leq 112 + 32 \times (4 - n)$, where n = the number of CPU modules.

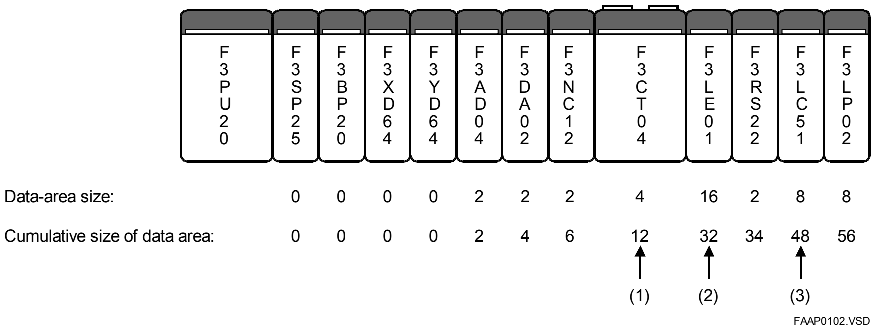
The values 112 and 32 here are the limits due to the function specifications of the CPU modules.

● Calculation Procedure

Sum up the sizes of data areas in sequence for all I/O modules, starting from slot 1 of the main unit up to slot 16 of the 7th subunit to determine the total size M. If there is any I/O module with a data-area size of 4, 8 or 16, then round up the running total for the data area sizes to the nearest multiple of 4, 8 or 16 before you add the size of that I/O module.

Example:

If the system is configured with the following modules, the total data area M is 56.



(1) Calculation for an I/O Module with Data-area Size of 4
Round up the running total for the data-area sizes to the nearest multiple of 4, and then add 4.
In this example, round up 6 to 8, and then add 4 to obtain 12.

(2) Calculation for an I/O Module with Data-area Size of 16
Round up the running total for the data-area sizes to the nearest multiple of 16, and then add 16.
In this example, round up 12 to 16, and then add 16 to obtain 32.

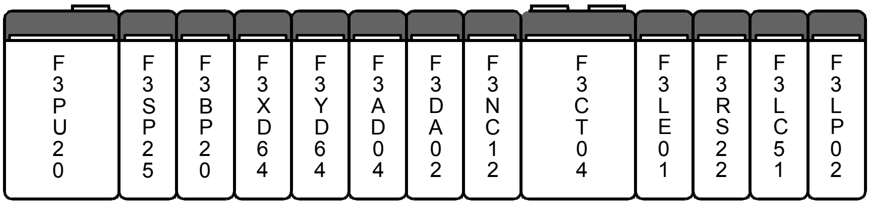
(3) Calculation for an I/O Module with Data-area Size of 8
Round up the running total for the data-area sizes to the nearest multiple of 8, and then add 8.
In this example, round up 34 to 40, and then add 8 to obtain 48.

TIP

The total size of data area M varies depending on the order in which modules are installed. If the initial system configuration fails to comply with any given restriction, try changing the order in which modules are installed by serially installing I/O modules of the same data-area size, for example. This strategy may achieve compliance with the restriction.

Example:

If the system is configured with the following modules, the total size of data area M is 56.



	F3PU20	F3SP25	F3BP20	F3XD64	F3YD64	F3AD04	F3DA02	F3NC12	F3CT04	F3LE01	F3RS22	F3LC51	F3LP02
Data-area size:		0	0	0	0	2	2	2	4	16	2	8	8
Cumulative size of data area:		0	0	0	0	2	4	6	12	32	34	48	56

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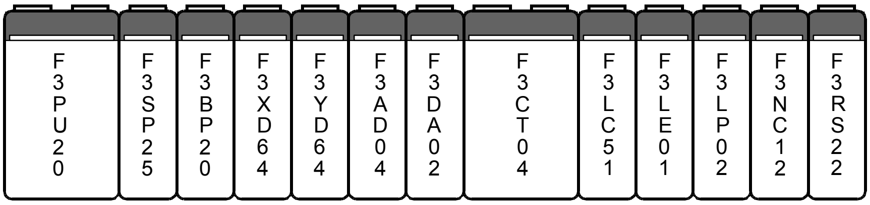
The total size of data area reduces to 44 if you rearrange the I/O modules as shown below.



	F3PU20	F3SP25	F3BP20	F3XD64	F3YD64	F3AD04	F3DA02	F3CT04	F3LC51	F3LE01	F3LP02	F3NC12	F3RS22
Data-area size:		0	0	0	0	2	2	4	8	16	8	2	2
Cumulative size of data area		0	0	0	0	2	4	8	16	32	40	42	44

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Appendix A1.4 Restrictions due to Type of CPU Module

Appendix A1.4.1 For Sequence CPU Module Type

Determine the total sum R of I/O points provided by I/O modules allocated to the sequence CPU module. Then check that the value of R complies with restrictions placed by the maximum number of I/O points. The I/O modules allocated to the CPU module refer to those that are actually installed and set to the Use option of the Configuration menu. If two or more CPU modules are installed, check each of them for compliance.

- **When the CPU module is F3SP21**

  $R \leq 2048$

- **When the CPU module is F3SP22/25/28/53/66/71 or F3FP36**

  $R \leq 4096$

- **When the CPU module is F3SP35/38/58/59/67/76**

  $R \leq 8192$

SEE ALSO

For details on the allocation of I/O modules, see FA-M3 Programming Tool WideField3 (IM 34M06Q16-xxE), FA-M3 Programming Tool WideField2 (IM 34M06Q15-01E), FA-M3 Programming Tool WideField (IM 34M06Q14-01E) or Section 6.6, “Entering Configuration Items,” in the Ladder Diagram Support Program M3 (IM 34M06Q13-01E).

Appendix A1.4.2 For BASIC CPU Module Type

Determine the total sum D of work areas provided by I/O modules for the BASIC CPU module to which the I/O modules are allocated. Then check that the value of D complies with restrictions due to the size of the BASIC CPU's work area. The I/O modules allocated to the CPU module refer to those whose use is declared by the ASSIGN statement in the BASIC program. Be careful when determining the total sum D of the BASIC CPU's work area since the work areas are in hexadecimal.

● When the CPU module is F3BP20 or F3BP30

$D \leq \$2900$

The value $2900 is limited by the function specifications of the CPU module.

SEE ALSO

For details on the allocation of I/O modules, see Section B7.3, "Declaration of Use of I/O Modules" in the "BASIC CPU Modules and YM-BASIC/FA Programming Language" (IM 34M06Q22-01E).

FA-M3

Hardware Manual
Part B FA-M3 Value (F3SC21-1N)

IM 34M06C11-01E   23th Edition

B1. System Configuration

B1.1 System Configuration

■ Basic Configuration

The FA-M3 Value version (F3SC21-1N) consists of the following components.

- F3BU04-0N base module
- F3SP05-0P sequence CPU module with a power supply and memory
- F3WD64-3N I/O module

Should the FA-M3 Value version fail, it can be fixed by replacing the failed module only.

Install the F3SP05-0P sequence CPU module in the leftmost slot of the F3BU04-0N base module and the F3WD64-3N I/O module in slot 2. The remaining slots 3 and 4 are reserved for a variety of I/O modules available for use with the FA-M3 series.

A slot number consists of three digits of which the third digit is the unit number. The unit number 0 is allocated to the main unit.

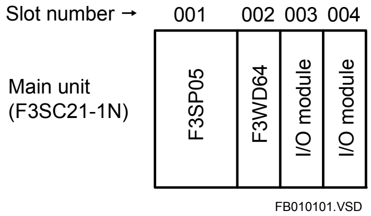


Figure B1.1 Slot Numbering

■ Concept of Unit

● Main Unit

A unit in which the F3SP05-0P sequence CPU module is installed is referred to as a main unit. Consequently, the F3SC21-1N itself serves as the main unit.

● Subunit

Subunits are used to increase the number of I/O ports. A maximum of seven subunits can be added to the Value version of the FA-M3 system to deal with up to 2048 I/O points.

■ Increasing the Number of I/O Points Using Fiber-optic FA-bus Modules

You can install fiber-optic FA-bus or FA-bus type 2 modules in both main and subunits and connect them with fiber-optic cables. This enables the distributed arrangement of remote I/O points, increase in the number of I/O points, and control of I/O modules via high-speed, noise-immune communication. The fiber-optic FA-bus or FA-bus type 2 module may be installed in either slot 3 or slot 4.

TIP

■ Example of increasing the number of I/O points using FA-bus type 2 modules

As with fiber-optic FA-bus type 2 modules, the number of I/O points can be increased using FA-bus type 2 modules.

FA-bus type 2 modules use shielded twisted-pair cables for the connection between subunits.

CAUTION

- F3SP05-0P included in FA-M3 Value (F3SC21-1N) is not CE Marking compliant.
- For compliance to CE Marking of the final product, FA-M3 Value II (F3SC23-xx), which incorporates F3SP08-SP, must be used.

B1.2 Restrictions on Module Installation

B1.2.1 Restrictions on Module Location

In the case of the F3SC21-1N, install the F3SP05-0P in slot 1 and the F3WD64-3N in slot 2. The remaining slots 3 and 4 are reserved for a variety of I/O modules available for use with the FA-M3 series. No CPU module can be installed in slots 3 and 4. For restrictions on the installation of I/O modules, including subunits, refer to Section A1.2, “Restrictions on Module Installation,” as they are equivalent to the restrictions specified for the F3SP21-0N module discussed in that section.

B1.2.2 Restrictions due to Current Consumption

Make sure when designing your system that the total sum of current consumed by modules installed in slots 3 and 4 does not exceed the following calculated value. See section A2.9, "Module Current Consumption Tables".

Current-supply capacity of the F3SP05-0P module = 2000 mA

Current consumption by the CPU of the F3SP05-0P module = 350 mA

Current consumption of the F3BU04-0N module = 50 mA

Current consumption of the F3WD64-3N module = 200 mA

Consequently, the total amount of current available from slots 3 and 4 is

2000 – 350 – 50 – 200 = 1400 mA

B1.3 Peripheral Tools Supporting the Program Development of FA-M3

You can conveniently create and debug your programs on your personal computer.

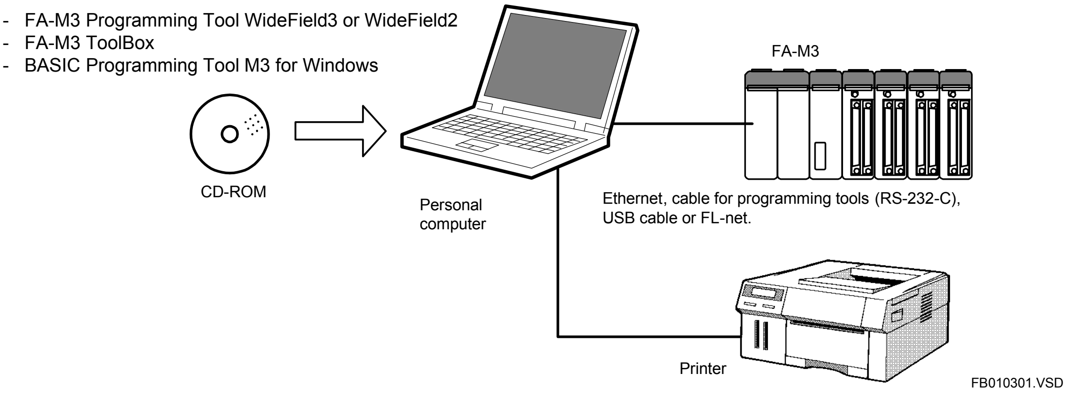

- FA-M3 Programming Tool WideField3 or WideField2
- FA-M3 ToolBox
- BASIC Programming Tool M3 for Windows
CD-ROM
Personal computer
FA-M3
Ethernet, cable for programming tools (RS-232-C), USB cable or FL-net.
Printer
FB010301.VSD

Figure B1.2 Support Tools

B2. Specifications and Configuration

B2.1 Specifications

■ Common Specifications

Item			Specifications
Supply voltage range			100 to 240 VAC, single phase 50/60 Hz
Range of supply voltage change			85 to 264 VAC, 50/60 Hz ± 3 Hz
Power consumption			35 VA
Insulation resistance			5 MΩ min. when tested between a group of external AC terminals and the FG terminal using a 500 VDC insulation resistance tester
Withstanding voltage			1500 V AC for one minute between a group of external AC terminals and the FG terminal
FAIL-signal contact output			Located on the front terminal block of power supply module; contact ratings: 24 V DC, 0.3 A (Equipped with both normally-open and normally-closed terminals)
Leakage current			3.5 mA max.
Allowable momentary power failure time			20 ms
Noise immunity			Tested using a noise simulator with a noise voltage of 1500 Vp-p, pulse width of 1 μs, rise time of 1 ns, and repetition frequency of 25 to 60 Hz.
Vibration resistance			Tested in compliance with JIS C0040 under the following conditions: - Frequency ranges: 10 to 57 Hz with an amplitude of 0.075 mm 57 to 150 Hz with an acceleration of 9.8 m/s^2 (1 G) - Direction and sweep cycles: 10 times each in the X, Y, and Z directions
Shock resistance			Tested in compliance with JIS C0041 under the following conditions: - Direction and sweep cycles: 3 times each in the X, Y, and Z directions with an acceleration of 147 m/s^2 (98 m/s^2 with DIN-rail mounting)
Surrounding air temperature range			Operating : 0 to 55°C
			Storage : -20°C to 75°C
Surrounding humidity range			Operating : 10 to 90% RH (non-condensing)
			Storage : 10 to 90% RH (non-condensing)
Surrounding atmosphere			Must be free of corrosive gases, flammable gases or heavy dust.
Grounding			Protective earth (Comply with the regulation of each country.)
Cooling method			Natural-air cooled
Mounting			Direct mounting with 4 M4-size set screws*1 or 35-mm wide DIN-rail mounting
Structure			Designed for mounting inside a panel enclosure
Altitude of installation			Max. of 2000 m above sea level
Compliance with safety and EMC standards *2	UL		UL508 approved, File No.E188707 (Overvoltage Category*3 II, Pollution Degree*4 2)
	CE	EMC Directive	EN 61326-1 Class A, Table 2 (For use in industrial locations) EN 61326-2-3*5 EN 55011 Class A, Group 1 EN 61000-6-2, EN 61000-3-2, EN 61000-3-3 compliance
	C-Tick	EMC Framework	EN 55011 Class A, Group 1 compliance EN 61326-1 Class A, Table 2 (For use in industrial locations) compliance
	KC	EMC Regulations	Korea Electromagnetic Conformity Standard（한국 전자파적합성기준）compliance
Finish color			Light cobalt blue, equivalent to Munsell 6.2PB 4.6/8.8; lampblack, equivalent to Munsell 0.8Y 2.5/0.4
External dimensions			147 (W)× 100 (H)× 88.5 (D)(mm) For more information, see the dimensional figures in Section A2.11, “External Dimensions,” for the case where an F3BU04-0N module is used

*1: For details on the number of mounting screws, see subsection A3.2.2, “Mounting Dimensions”.

*2: For details on conforming modules, see “UL-approved, CE marking, C-Tick mark and KC mark - compliant Modules” (GS 34M06C11-21E) general specification brochure.

*3: The term Overvoltage Category involves prescriptions on resistance to surge voltage reduction due to lightning and has four categories. Overvoltage Category II applies to systems with a rated voltage of 220/230/240 V and applies to electrical appliances, portable devices, etc.

*4: The term Pollution Degree represents the degree of pollution with foreign matter, solid, liquid or gaseous, that may produce a reduction of dielectric strength or surface resistivity in the operating environment of the equipment. Pollution degree 2 refers to an environment where normally only non-conductive pollution occurs but occasionally temporary conductivity caused by condensation is to be expected.

*5: EN61326-2-3 is applicable only to F3CU04-0S and F3CU04-1S.

■ Model and Specification Code

Model	Basic Specification Code	Style Code	Specification Code Suffix	Remarks
F3SC21	-1N	……	……	FA-M3 Value (with base, power supply, sequence CPU, DI/O (F3WD64-3N) modules installed)

Note: F3SC21-1N is no longer available.

B2.2 System Configuration

B2.2.1 Components

The FA-M3 Value version (F3SC21-1N) consists of the following components.

- F3BU04-0N base module
- F3SP05-0P sequence CPU module with a power supply and memory
- F3WD64-3N I/O module

For details on the specifications of the F3BU04-0N and F3WD64-3N modules and other components, see their respective relevant sections.

B2.3 Sequence CPU Module

B2.3.1 Overview

The F3SP05-0P sequence CPU module with a power supply and memory contains a power supply equivalent to the F3PU10-0N power supply module. This section explains the specifications of this built-in power supply block. Details on the sequence CPU block are explained in the "Sequence CPU – Functions (for F3SP21, F3SP25, F3SP35)" (IM 34M06P12-02E).

B2.3.2 Power Supply Block of F3SP05-0P Module

■ Specifications

Item	Specifications
Supply voltage range	100 to 240 V AC, single phase 50/60Hz
Supply voltage fluctuation range	85 to 264 V AC, 50/60 Hz±3 Hz
Current consumption	35 VA
Inrush current	20 A max. (120V AC, Ta=25°C) 45 A max. (240V AC, Ta=25°C)
Fuse	1 A time-lag fuses (Built into the L and N terminals and cannot be replaced.)
Rated output voltage	5 VDC
Rated output current	2.0 A
Insulation resistance	5 MΩ min. when tested between a group of external AC terminals and the FG terminal using a 500 VDC insulation resistance tester
Withstanding voltage	1500 V AC for one minute between a group of external AC terminals and the FG terminal
Leakage current	3.5 mA max.
Allowable momentary power failure time	20 ms
External dimensions	58（W）× 100（H）× 83.2（D）(mm)*
Weight	320 g (including the sequence CPU block)

*: Including the sequence CPU block but excluding protrusions (see the dimensional figures for more information)

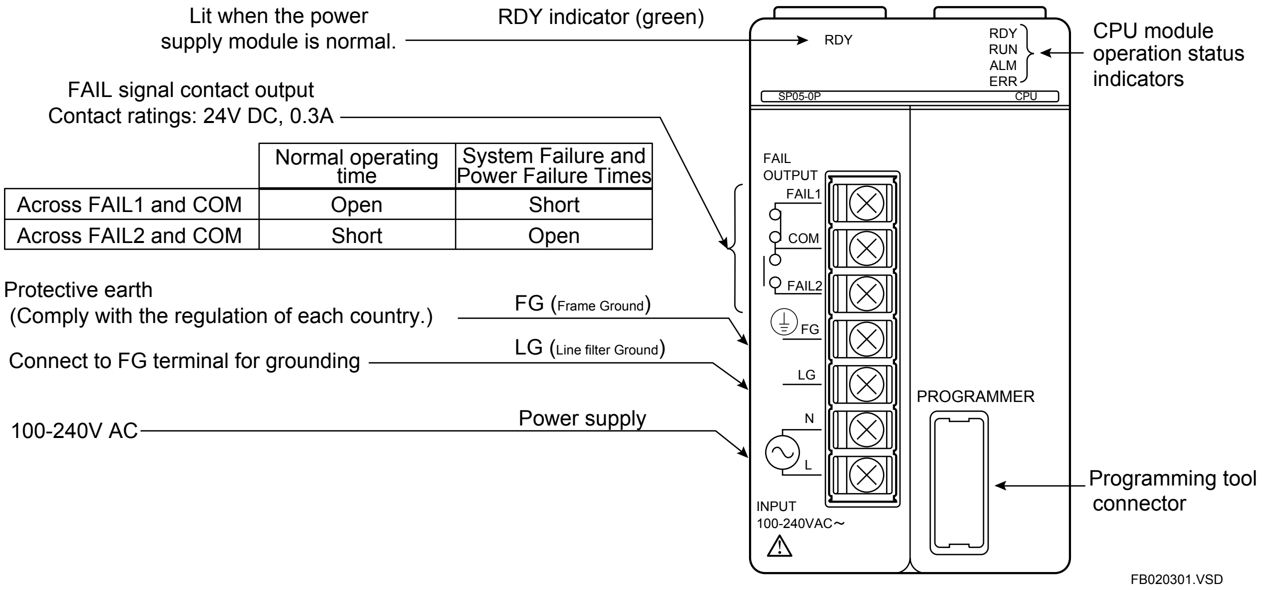
■ Model and Specification Code

Model	Basic Specification Code	Style Code	Specification Code Suffix	Remarks
F3SP05	-0P	……	……	Sequence CPU Module (with power supply and memory modules installed) Memory 5K step

Note: F3SP05-0P is no longer available.

■ Components and Their Functions

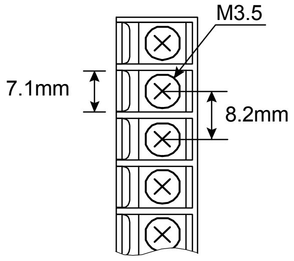
Figure B2.1 shows the power supply block of the F3SP05-0P with its cover removed.


Lit when the power supply module is normal.
RDY indicator (green)
RDY
RDY
RUN
ALM
ERR
CPU module operation status indicators
SP05-0P
CPU
FAIL signal contact output
Contact ratings: 24V DC, 0.3A
FAIL
OUTPUT
FAIL1
COM
FAIL2
Protective earth
(Comply with the regulation of each country.)
FG (Frame Ground)
FG
Connect to FG terminal for grounding
LG (Line filter Ground)
LG
100-240V AC
Power supply
N
L
INPUT
100-240VAC~
PROGRAMMER
Programming tool connector
FB020301.VSD

	Normal operating time	System Failure and Power Failure Times
Across FAIL1 and COM	Open	Short
Across FAIL2 and COM	Short	Open

Figure B2.1 F3SP05-0P Sequence CPU Module

● Terminal dimensions (all values in mm)



FB020302.VSD

● Adaptable crimp-on terminal

Vendor	Model	Compatible Conductor	Crimping Torque
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M3	AWG22 to 18 (0.33 to 0.82 mm^2) (Copper wire)	0.8 N·m (7.1 lbf·in)
Nippon Tanshi Co., Ltd.	RAV1.25-3.5		
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M4		
Japan Solderless Terminal Mfg Co., Ltd.	V2-M4	AWG16 to 14 (1.3 to 2.1 mm^2) (Copper wire)	

CAUTION

When crimping terminals, be sure only to use the tool specified by each terminal manufacturer.

DANGER

To avoid electrical shock, turn off the power before wiring.

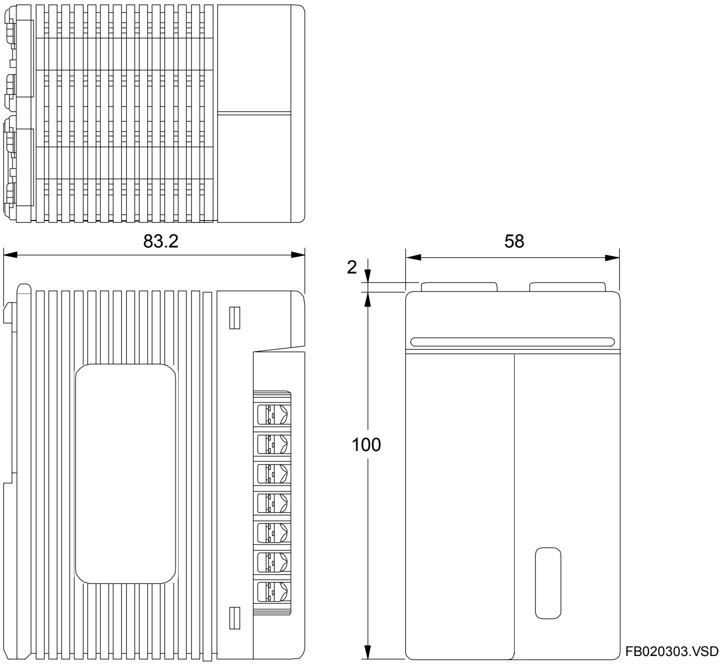
CAUTION

LG terminal has a half potential of the input power supply voltage when LG terminal isn't connected to FG terminal.

B2.3.3 External Dimensions

Unit:mm

F3SP05-0P



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FA-M3

Hardware Manual
Part C FA-M3 Value II (F3SC22-xx, F3SC23-xx)

IM 34M06C11-01E   23th Edition

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C1. System Configuration

C1.1 System Configuration

■ Basic Configuration

The FA-M3 Value II (F3SC22-xx, F3SC23- xx) consists of the following components. See Figure C1.1 for the available models with their respective module configurations.

- F3BU04-0N base module
- F3SP08-0P sequence CPU module with power supply (with M3.5 screws) and memory
- F3SP08-SP sequence CPU module with power supply (with M4 screws) and memory
- F3WD32-3F I/O module
- F3WD64-3F I/O module
- F3WD64-3P I/O module
- F3WD64-4P I/O module
- F3XD16-3F input module
- F3YD14-5A output module

Should the FA-M3 Value II fail, it can be fixed by replacing the failed module only.

Install the F3SP08-xP sequence CPU module in the leftmost slot of the F3BU04-0N base module and the other I/O modules in slot 2 (or slots 2 and 3). The remaining slots 3 and 4 (or only slot 4) are reserved for a variety of I/O modules available for use with the FA-M3 series.

A slot number consists of three digits of which the third digit is the unit number. The unit number 0 is allocated to the main unit.

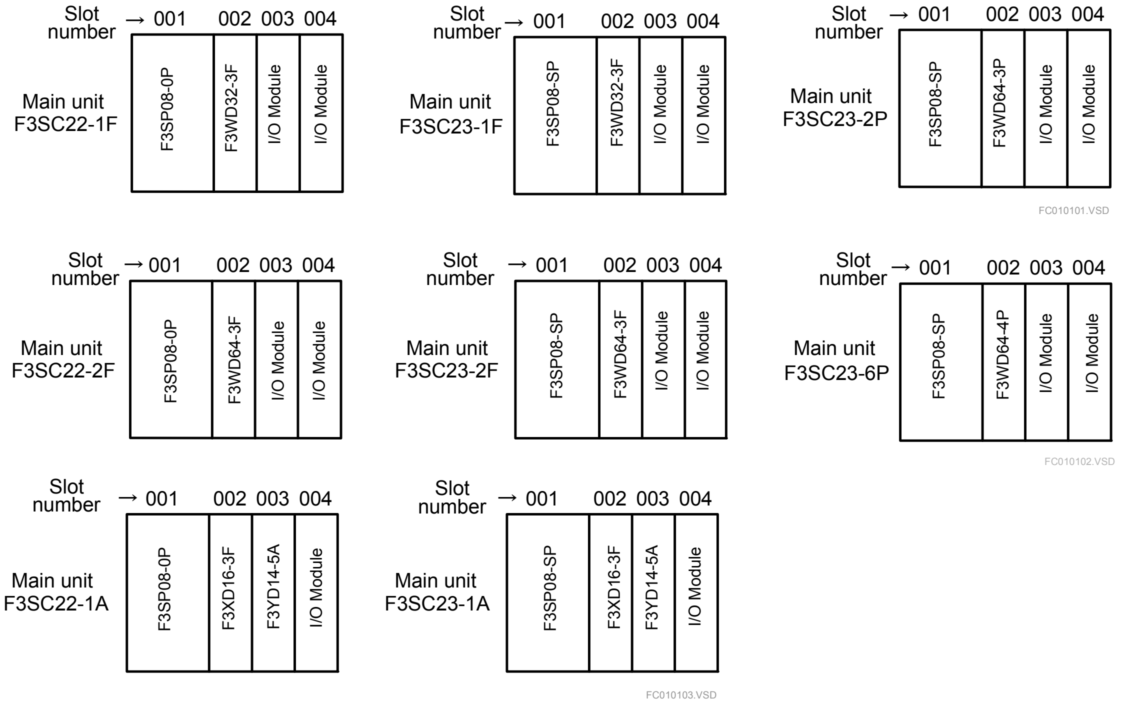


Figure C1.1 Module Configuration and Slot Numbering

■ Concept of Unit

● Main Unit

A unit in which the F3SP08-0P or F3SP08-SP sequence CPU module is installed is referred to as a main unit. Consequently, the F3SC22-xx or F3SC23- xx itself serves as the main unit.

● Subunit

Subunits are used to increase the number of I/O ports. A maximum of seven subunits can be added to the Value II of the FA-M3 system to deal with up to 2048 I/O points.

■ Increasing the Number of I/O Points Using Fiber-optic FA-bus Modules

You can install fiber-optic FA-bus or FA-bus type 2 modules in both main and subunits and connect them with fiber-optic cables. This enables the distributed arrangement of remote I/O points, increase in the number of I/O points, and control of I/O modules via high-speed, noise-immune communication. The fiber-optic FA-bus or FA-bus type 2 module may be installed in either slot 3 or slot 4.

TIP

■ Example of increasing the number of I/O points using FA-bus type 2 modules

As with fiber-optic FA-bus type 2 modules, the number of I/O points can be increased using FA-bus type 2 modules.

FA-bus type 2 modules use shielded twisted-pair cables for the connection between subunits.

C1.2 Restrictions on Module Installation

C1.2.1 Restrictions on Module Location

Install the F3SP08-0P sequence CPU in slot 1 for the F3SC22-xx, and install the F3SP08-SP sequence CPU module in slot 1 for the F3SC23- xx. Install the other specified component modules in slot 2 (or slots 2 and 3). You may install FA-M3 I/O modules in the remaining slots. You may not install a CPU module in the remaining slots.

For restrictions on the installation of I/O modules, including subunits, refer to Section A1.2, “Restrictions on Module Installation,” as they are equivalent to the restrictions specified for the F3SP21-0N module discussed in that section.

C1.2.2 Restrictions due to Current Consumption

Make sure when designing your system that the total sum of current consumed by any modules installed in the remaining slots does not exceed the following calculated value. See section A2.9, "Module Current Consumption Tables".

● Total Amount of Current Available from the Remaining Slots

F3SC22-1F/F3SC23-1F	1500 mA
F3SC22-2F/F3SC23-2F/F3SC23-2P/F3SC23-6P	1400 mA
F3SC22-1A/F3SC23-1A	1415 mA

● Current-supply Capacity, Current Consumption of each Module

F3SP08-0P/F3SP08-SP	Current-supply Capacity of Power Supply Unit	2000 mA
F3SP08-0P/F3SP08-SP	Current Consumption of CPU Unit	350 mA
F3BU04-0N	Current Consumption	50 mA
F3WD32-3F	Current Consumption	100 mA
F3WD64-3F	Current Consumption	200 mA
F3WD64-3P	Current Consumption	170 mA
F3WD64-4P	Current Consumption	170mA
F3XD16-3F	Current Consumption	65 mA
F3YD14-5A	Current Consumption	120 mA

Therefore, the total amount of current available from the remaining slots is the current-supply capacity of the power supply unit (2000 mA) less the current consumption of all pre-installed modules.

C1.3 Peripheral Tools Supporting the Program Development of FA-M3

You can conveniently create and debug your programs on your personal computer.

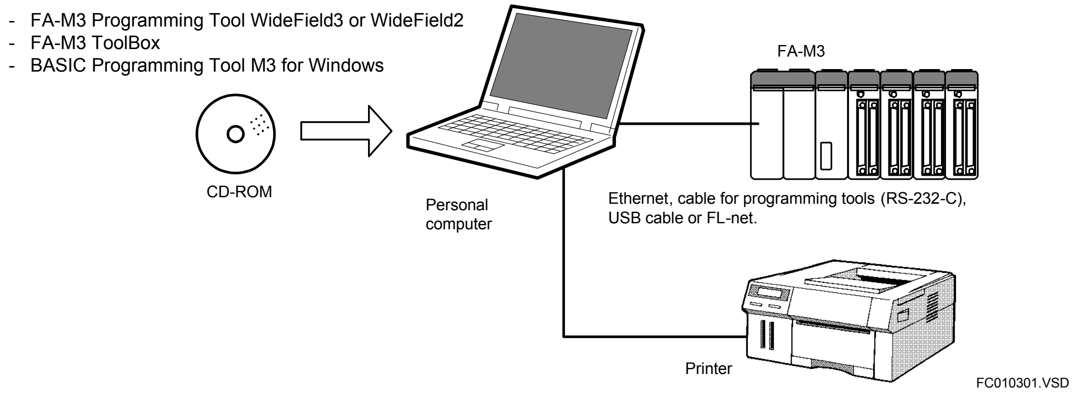

- FA-M3 Programming Tool WideField3 or WideField2
- FA-M3 ToolBox
- BASIC Programming Tool M3 for Windows
CD-ROM
Personal computer
FA-M3
Ethernet, cable for programming tools (RS-232-C), USB cable or FL-net.
Printer
FC010301.VSD

Figure C1.2 Support Tools

CAUTION

Before using F3SP08-SP, you should set the CPU type to F3SP08-0P on the Change CPU Type/Properties screen of the WideField3, WideField2 or ToolBox software.

C2. Specifications and Configuration

C2.1 Specifications

■ Common Specifications

Item			Specifications
Supply voltage range			100 to 240 VAC, single phase 50/60 Hz
Range of supply voltage change			85 to 264 VAC, 50/60 Hz ± 3 Hz
Power consumption			35 VA
Insulation resistance			5 MΩ min. when tested between a group of external AC terminals and the FG terminal using a 500 VDC insulation resistance tester
Withstanding voltage			1500 V AC for one minute between a group of external AC terminals and the FG terminal
FAIL-signal contact output			Located on the front terminal block of power supply module; contact ratings: 24 V DC, 0.3 A (Equipped with both normally-open and normally-closed terminals)
Leakage current			3.5 mA max.
Allowable momentary power failure time			20 ms
Noise immunity			Tested using a noise simulator with a noise voltage of 1500 Vp-p, pulse width of 1 μs, rise time of 1 ns, and repetition frequency of 25 to 60 Hz.
Vibration resistance			Tested in compliance with JIS C0040 under the following conditions: - Frequency ranges: 10 to 57 Hz with an amplitude of 0.075 mm 57 to 150 Hz with an acceleration of 9.8 m/s^2 (1 G) - Direction and sweep cycles: 10 times each in the X, Y, and Z directions
Shock resistance			Tested in compliance with JIS C0041 under the following conditions: - Direction and sweep cycles: 3 times each in the X, Y, and Z directions with an acceleration of 147 m/s^2 (98 m/s^2 with DIN-rail mounting)
Surrounding air temperature range			Operating : 0 to 55°C
			Storage : -20°C to 75°C
Surrounding humidity range			Operating : 10 to 90% RH (non-condensing)
			Storage : 10 to 90% RH (non-condensing)
Surrounding atmosphere			Must be free of corrosive gases, flammable gases or heavy dust.
Grounding			Protective earth (Comply with the regulation of each country.)
Cooling method			Natural-air cooled
Mounting			Direct mounting with 4 M4-size set screws*1 or 35-mm wide DIN-rail mounting
Structure			Designed for mounting inside a panel enclosure
Altitude of installation			Max. of 2000 m above sea level
Compliance with safety and EMC standards *2	UL		UL508 approved File No.E188707 (Overvoltage Category*3 II, Pollution Degree*4 2)
	CE	EMC Directive	EN 61326-1 Class A, Table 2 (For use in industrial locations) EN 61326-2-3*5 EN 55011 Class A, Group 1 EN 61000-6-2, EN 61000-3-2, EN 61000-3-3 compliance
		Low Voltage Directive	EN 61010-1 compliance (only for F3SC23-xx) (Overvoltage Category*3 II, Pollution Degree*4 2)
	C-Tick	EMC Framework	EN 55011 Class A, Group 1 compliance EN 61326-1 Class A, Table 2 (For use in industrial locations) compliance
	KC	EMC Regulations	Korea Electromagnetic Conformity Standard（한국 전자파적합성기준）compliance
Finish color			Light cobalt blue, equivalent to Munsell 6.2PB 4.6/8.8; lampblack, equivalent to Munsell 0.8Y 2.5/0.4
External dimensions			147 (W)× 100 (H)× 88.5 (D)(mm) For more information, see the dimensional figures in Section A2.11, "External Dimensions," for the case where an F3BU04-0N module is used

*1: For details on the number of mounting screws, see subsection A3.2.2, "Mounting Dimensions."

*2: For details on conforming modules, see "UL-approved, CE marking, C-Tick mark and KC mark - compliant Modules" (GS 34M06C11-21E) general specification brochure.

*3: The term Overvoltage Category involves prescriptions on resistance to surge voltage reduction due to lightning and has four categories. Overvoltage Category II applies to systems with a rated voltage of 220/230/240 V and applies to electrical appliances, portable devices, etc.

*4: The term Pollution Degree represents the degree of pollution with foreign matter, solid, liquid or gaseous, that may produce a reduction of dielectric strength or surface resistivity in the operating environment of the equipment. Pollution degree 2 refers to an environment where normally only non-conductive pollution occurs but occasionally temporary conductivity caused by condensation is to be expected.

*5: EN61326-2-3 is applicable only to F3CU04-0S and F3CU04-1S.

■ Model and Specification Code

Model	Basic Specification Code	Style Code	Specification Code Suffix	Remarks
F3SC22	-1A	……	……	FA-M3 Value II (with base, power supply (with M3.5 screws), sequence CPU, DI/O (F3XD16-3F, F3YD14-5A modules installed)
	-1F	……	……	FA-M3 Value II (with base, power supply (with M3.5 screws), sequence CPU, DI/O (F3WD32-3F) modules installed)
	-2F	……	……	FA-M3 Value II (with base, power supply (with M3.5 screws), sequence CPU, DI/O (F3WD64-3F) modules installed)

Note: F3SC22-☐☐ is no longer available.

Model	Basic Specification Code	Style Code	Specification Code Suffix	Remarks
F3SC23	-1A	……	……	FA-M3 Value II (with base, power supply (with M4 screws), sequence CPU, DI/O (F3XD16-3F and F3YD14-5A) modules installed)
	-1F	……	……	FA-M3 Value II (with base, power supply (with M4 screws), sequence CPU, DI/O (F3WD32-3F) modules installed)
	-2F	……	……	FA-M3 Value II (with base, power supply (with M4 screws), sequence CPU, DI/O (F3WD64-3F) modules installed)
	-2P	……	……	FA-M3 Value II (with base, power supply (with M4 screws), sequence CPU, DI/O (F3WD64-3P) modules installed)
	-6P	……	……	FA-M3 Value II (with base, power supply (with M4 screws), sequence CPU, DI/O (F3WD64-4P) modules installed)

Note: F3SC23-2F is no longer available.

C2.2 System Configuration

C2.2.1 Components

The FA-M3 Value II (F3SC22-xx, F3SC23- xx) consists of the following components. See Figure C1.1 for the available models with their respective module configurations.

- F3BU04-0N base module
- F3SP08-0P sequence CPU module with power supply (with M3.5 screws) and memory
- F3SP08-SP sequence CPU module with power supply (with M4 screws) and memory
- F3WD32-3F I/O module
- F3WD64-3F I/O module
- F3WD64-3P I/O module
- F3WD64-4P I/O module
- F3XD16-3F input module
- F3YD14-5A output module

For details on the specifications of the F3BU04-0N, F3WD64- xx, F3XD16-3F, F3YD14-5A modules and other components, see their respective relevant sections.

We describe here the F3SP08-0P, F3SP08-SP and F3WD32-3F modules, which are specific to the FA-M3 Value II (F3SC22- xx, F3SC23- xx).

CAUTION

Before using F3SP08-SP, you should set the CPU type to F3SP08-0P on the Change CPU Type/Properties screen of the FA-M3 WideField3, WideField2 or ToolBox software.

C2.3 Sequence CPU Module

C2.3.1 Overview

The F3SP08-0P (or F3SP08-SP) sequence CPU module with a power supply and memory contains a power supply equivalent to the F3PU10-0N (or F3PU10-0S) power supply module. This section explains the specifications of this built-in power supply block. Details on the sequence CPU block are explained in the instruction manual “Sequence CPU - Functions (for F3SP21, F3SP25 and F3SP35)” (IM 34M06P12-02E).

C2.3.2 Power Supply Block of F3SP08-0P and F3SP08-SP Module

■ Specifications

Item	Specifications
Supply voltage range	100 to 240 V AC, single phase 50/60Hz
Supply voltage fluctuation range	85 to 264 V AC, 50/60 Hz±3 Hz
Current consumption	35 VA
Inrush current	20 A max. (120V AC, Ta=25°C) 45 A max. (240V AC, Ta=25°C)
Fuse	1 A time-lag fuses (Built into the L and N terminals and cannot be replaced.)
Rated output voltage	5 VDC
Rated output current	2.0 A
Insulation resistance	5 MΩ min. when tested between a group of external AC terminals and the FG terminal using a 500 VDC insulation resistance tester
Withstanding voltage	1500 V AC for one minute between a group of external AC terminals and the FG terminal
Leakage current	3.5 mA max.
Allowable momentary power failure time	20 ms
External dimensions	58（W）× 100（H）× 83.2（D）(mm)*
Weight	320 g (including the sequence CPU block)

*: Including the sequence CPU block but excluding protrusions (see the dimensional figures for more information)

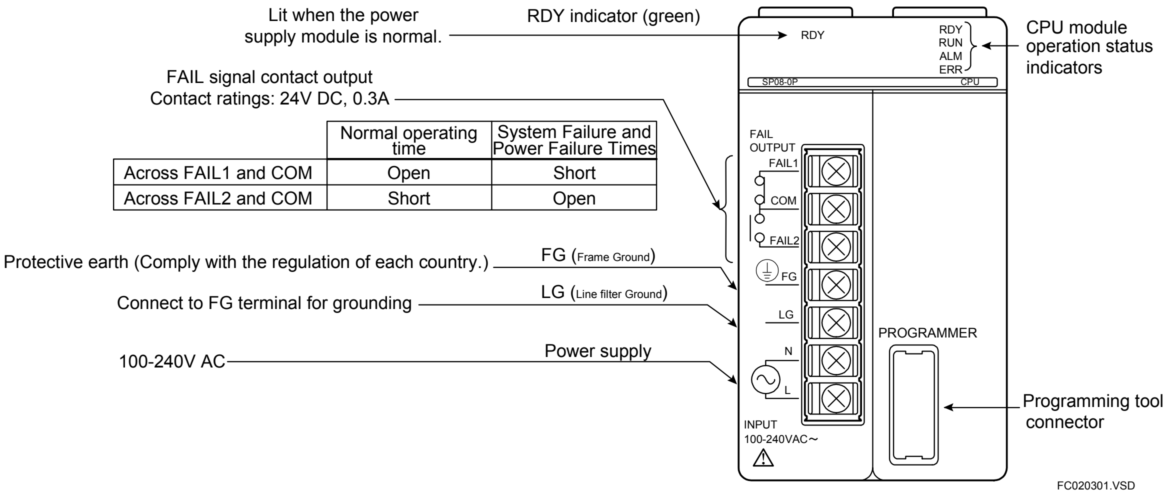
■ Model and Specification Code

Model	Basic Specification Code	Style Code	Specification Code Suffix	Remarks
F3SP08	-0P	……	……	Sequence CPU Module (with power supply and memory modules installed) Memory: 10K step Power supply terminal screw: M3.5
	-SP	……	……	Sequence CPU Module (with power supply and memory modules installed) Memory: 10K step Power supply terminal screw: M4

Note: F3SP08-0P is no longer available.

Components and Their Functions

Figure C2.1 shows the power supply block of the F3SP05-0P with its cover removed.

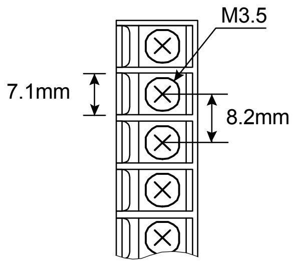

Lit when the power supply module is normal.
RDY indicator (green)
RDY
RDY
RUN
ALM
ERR
CPU module operation status indicators
SP08-0P
CPU
FAIL signal contact output
Contact ratings: 24V DC, 0.3A
FAIL OUTPUT
FAIL1
COM
FAIL2
Protective earth (Comply with the regulation of each country.)
FG (Frame Ground)
FG
Connect to FG terminal for grounding
LG (Line filter Ground)
LG
100-240V AC
Power supply
N
L
INPUT
100-240VAC~
PROGRAMMER
Programming tool connector
FC020301.VSD

	Normal operating time	System Failure and Power Failure Times
Across FAIL1 and COM	Open	Short
Across FAIL2 and COM	Short	Open

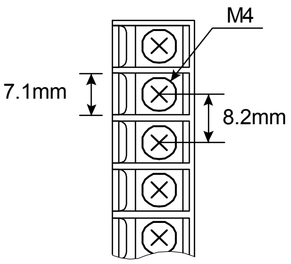
Figure C2.1 F3SP08-0P and F3SP08-SP Sequence CPU Module

Terminal dimensions (all values in mm)

F3SP08-0P



F3SP08-SP



Adaptable crimp-on terminal

Vendor	Model	Compatible Conductor	Compatible Modules and Crimping Torque	
			F3SP08-0P	F3SP08-SP
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M3	AWG22 to 18 (0.33 to 0.82 mm^2) (Copper wire)	0.8 N·m (7.1 lbf·in)	May not be used
Nippon Tanshi Co., Ltd.	RAV1.25-3.5			
Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M4			1.2 N·m (10.6 lbf·in)
Japan Solderless Terminal Mfg Co., Ltd.	V2-M4	AWG16 to 14 (1.3 to 2.1 mm^2) (Copper wire)		

CAUTION

When crimping terminals, be sure only to use the tool specified by each terminal manufacturer.

DANGER

To avoid electrical shock, turn off the power before wiring.

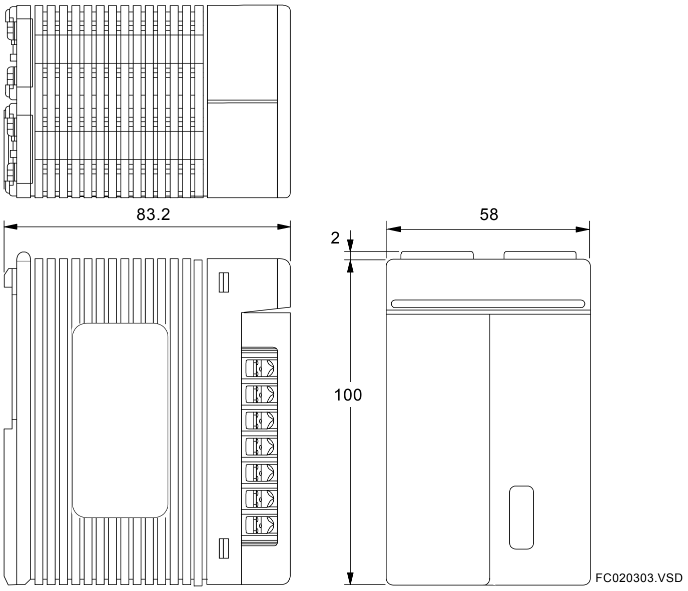
CAUTION

LG terminal has a half potential of the input power supply voltage when LG terminal isn’t connected to FG terminal.

C2.3.3 External Dimensions

Unit: mm

F3SP08-0P/ F3SP08-SP



CAUTION

- F3SP08-0P and F3SP08-SP have exactly the same dimensions, internal circuitry and other characteristics, except that F3SP08-0P uses M3.5-screw terminals while F3SP08-SP uses M4-screw terminals.
- F3SP08-0P is not CE Marking compliant.

  F3SP08-SP is CE Marking compliant.
- For compliance to CE Marking of the final product, FA-M3 Value II (F3SC23-□□), which incorporates F3SP08-SP, must be used.

C2.4 F3WD32-3F Input/Output Module

● Input Block

Item		**Specifications**
		F3WD32-3F
Input type		DC voltage
Number of points		16
Common line type		8 points/common
Isolation method		Photocoupler isolation
Withstanding voltage		1500 V AC for one minute between the group of terminals for external connection and the internal circuit
Rated input voltage		24 V DC
Operating voltage range		20.4 to 26.4 V DC
Rated input current		4.1mA/point (24V DC)
Input impedance		5.9 kΩ
Operating voltage/current	ON	16.0 V DC min 3.2 mA min
	OFF	5.8 V DC max 0.9 mA max
Response time	OFF→ON	can be specified as 2 ms max. or 17 ms
	ON→OFF	can be specified as 3.5 ms max. or 18.5 ms
Interrupt		None
Dissipating current		100 mA (5V DC) (including the output block)
Input display		LED (Lit when inputs are turned on)
External connection		One 40-pin connector (shared with the output block)
Weight		100 g (including the output block)
Maximum ratio of inputs turned on simultaneously		100%

● Output Block

Item		Specifications
		F3WD32-3F
Output type		Transistor contact (sink type)
Number of points		16
Common line type		8 points/common
Isolation method		Photocoupler isolation
Rated load voltage (Operating load voltage range)	DC	24V DC (20.4 to 26.4V DC)
	AC	——
Maximum load current		0.1A/point, 0.4A/common line
Response time	OFF→ON	1ms max.
	ON→OFF	1ms max.
ON voltage		0.5V DC max.
Off-time lead current		0.1mA max.
Service life	Mechanical	——
	Electrical	——
Surge protector[*1]		Zener diode
Fuse		None
Dissipating current		100mA (5V DC) (including the input block)
Output display[*2]		LED (Lit when inputs are turned on) If the selector switch is set to OUT, the output state is displayed.
Output status when the program stops HOLD/RESET[*3]		When a sequence CPU module is used: Default: RESET Can be set globally on a module-by-module basis.
		When a BASIC CPU module is used: No setting function The status is always HOLD
External power supply		24V DC, 30mA
External connection		One 40-pin connector (shared with the input block)
Weight		100 g (including the input block)

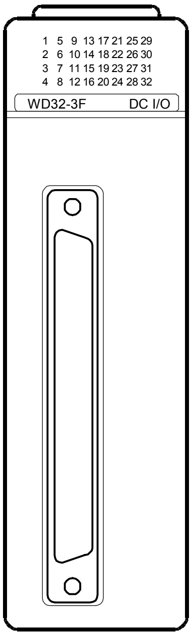
*1: A surge protector is also required on the load side if an inductive load such as a relay is to be connected. See subsection A3.6.5, “Connecting to Output Devices.”

*2: The contact operation of the output block of the circuit and the LED display operate independently and thus may be inconsistent in the event of an error.

*3: For information on the module’s behavior during a CPU failure, see subsection A4.3.3, “Indicating Problem Severity and Status of Output Module.”

Front View

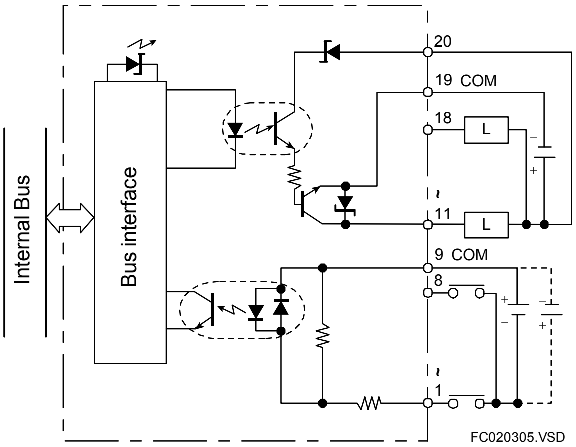
F3WD32-3F



FC020304.VSD

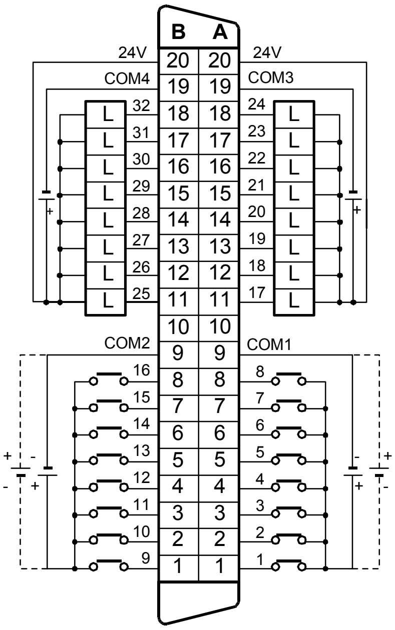
Input/Output Module

Internal Circuit Configuration



FC020305.VSD

External Connection Diagram



Note: Viewed from the front side of the module.
FC020306.vsd

Operating Environment

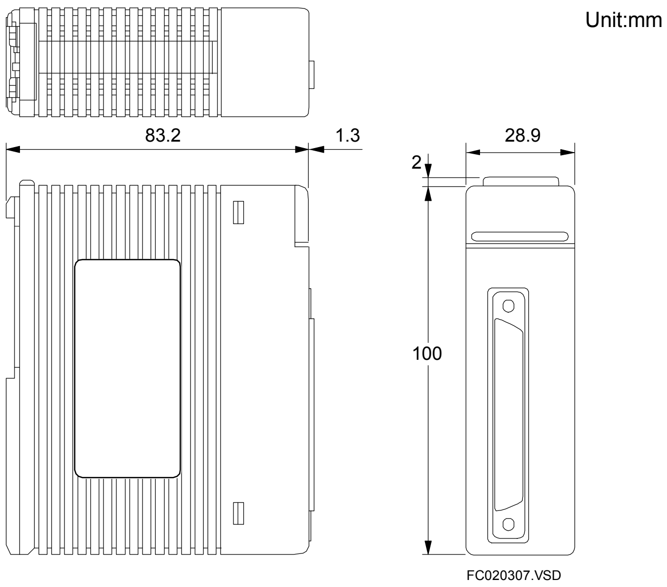
This module can be used with the following CPU modules.

- F3SP08-0P
- F3SP08-SP

Model and Specification Code

Model	Basic Specification Code	Style Code	Specification Code Suffix	Remarks
F3WD32	-3F	……	……	24V DC Input/Output

External Dimensions



FA-M3

Hardware Manual

IM 34M06C11-01E 23th Edition

INDEX

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3rd	Nov. 1994	Addition of modules
4th	Sep.1999	Addition of explanations on support of CE Mark; correction of typographical errors
5th	July 2000	Support of F3SP28, 38,53 and CPUs
6th	May 2001	Additional information and errata on additional modules and CE marking
7th	Oct. 2001	Addition of Part C FA-M3 Value II (F3CS22-☐☐). Change in grounding standard to support revision of clause 10 of the Electrical Equipment Technical Standard. Partial amendment of EMC compliance specifications. Change the vibration resistance and shock resistance standard specification to support new specifications since JIS C0911 and C0912 has been abolished. Correction of errors.
8th	Apr. 2002	Addition of modules
9th	Oct. 2002	Addition of modules. Correction of errors.
10th	Apr. 2003	Addition of KM65 fiber-optic cable. Correction of errors.
11th	July 2003	Addition of modules. Correction of errors.
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