MITSUBISHI ELECTRIC

Programmable Controller

MELSEC-F

FX3S SERIES PROGRAMMABLE CONTROLLERS

USER'S MANUAL

Hardware Edition

Main Unit

AC Power Type

FX3S-□MR/ES

FX3S-□MT/ES

FX3S-□MT/ESS

FX3S-30MR/ES-2AD

FX3S-30MT/ES-2AD

FX3S-30MT/ESS-2AD

DC Power Type

FX3S-□MR/DS

FX3S-□MT/DS

FX3S-□MT/DSS

Display Module

FX3S-5DM

Memory Cassette

FX3G-EEPROM-32L

FX3S

Safety Precautions

(Read these precautions before use.)

Before installation, operation, maintenance or inspection of this product, thoroughly read through and understand this manual and all of the associated manuals. Also, take care to handle the module properly and safely.
If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

This manual classifies the safety precautions into two categories: ⚠WARNING and ⚠CAUTION.

⚠WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Depending on the circumstances, procedures indicated by ⚠CAUTION may also cause severe injury.
It is important to follow all precautions for personal safety.
Store this manual in a safe place so that it can be taken out and read whenever necessary. Always forward it to the end user.

1. DESIGN PRECAUTIONS

⚠WARNING	Reference
• Make sure to have the following safety circuits outside of the PLC to ensure safe system operation even during external power supply problems or PLC failure. Otherwise, malfunctions may cause serious accidents. 1) Most importantly, have the following: an emergency stop circuit, a protection circuit, an interlock circuit for opposite movements (such as normal vs. reverse rotation), and an interlock circuit (to prevent damage to the equipment at the upper and lower positioning limits). 2) Note that when the PLC CPU detects an error, such as a watchdog timer error, during self-diagnosis, all outputs are turned off. Also, when an error that cannot be detected by the PLC CPU occurs in an input/output control block, output control may be disabled. External circuits and mechanisms should be designed to ensure safe machinery operation in such a case. 3) If an overload of the 24 V DC service power supply occurs, the voltage automatically drops, inputs in the PLC are disabled, and all outputs are turned off. External circuits and mechanisms should be designed to ensure safe machinery operation in such a case. 4) Note that when an error occurs in a relay or transistor output device, the output could be held either on or off. For output signals that may lead to serious accidents, external circuits and mechanisms should be designed to ensure safe machinery operation in such a case.	53 66 76 110 120

⚠CAUTION	Reference
• Do not bundle the control line together with or lay it close to the main circuit or power line. As a guideline, lay the control line at least 100 mm (3.94") or more away from the main circuit or power line. Noise may cause malfunctions. • Install module so that excessive force will not be applied to peripheral device connectors. Failure to do so may result in wire damage/breakage or PLC failure.	53 66 76 110 120

2. SECURITY PRECAUTIONS

⚠WARNING	Reference
• To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from unreliable networks and devices via network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.	53 66 76 110 120

3. INSTALLATION PRECAUTIONS

⚠WARNING	Reference
• Make sure to cut off all phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product.	53

⚠CAUTION	Reference
• Use the product within the generic environment specifications described in Section 4.1 of this manual. Never use the product in areas with excessive dust, oily smoke, conductive dusts, corrosive gas (salt air, Cl_2, H_2S, SO_2 or NO_2), flammable gas, vibration or impacts, or expose it to high temperature, condensation, or rain and wind. If the product is used in such conditions, electric shock, fire, malfunctions, deterioration or damage may occur. • Do not touch the conductive parts of the product directly. Doing so may cause device failures or malfunctions. • Install the product securely using a DIN rail or mounting screws. • Install the product on a flat surface. If the mounting surface is rough, undue force will be applied to the PC board, thereby causing nonconformities. • Make sure to affix the expansion board with tapping screws. Tightening torque should follow the specifications in the manual. If the screws are tightened outside of the specified torque range, poor connections may cause malfunctions. • When drilling screw holes or wiring, make sure that cutting and wiring debris do not enter the ventilation slits. Failure to do so may cause fire, equipment failures or malfunctions. • Be sure to remove the dust proof sheet from the PLC's ventilation port when installation work is completed. Failure to do so may cause fire, equipment failures or malfunctions. • Connect the peripheral device cables securely to their designated connectors. Loose connections may cause malfunctions. • Connect the display module, memory cassette and expansion board securely to their designated connectors. Loose connections may cause malfunctions. • Turn off the power to the PLC before attaching or detaching the following devices. Failure to do so may cause device failures or malfunctions. - Peripheral devices, display module, expansion boards, special adapters and memory cassette • Connect the memory cassette securely to the appropriate connector. Loose connections may cause malfunctions. Installing the cassette in a raised or tilted posture can also cause malfunctions.	54

4. WIRING PRECAUTIONS

⚠WARNING	Reference
• Make sure to cut off all phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product. • Make sure to attach the terminal cover, offered as an accessory, before turning on the power or initiating operation after installation or wiring work. Failure to do so may cause electric shock. • The temperature rating of the cable should be 80°C or more.	54 67 77 100 111 121

⚠CAUTION	Reference
• Do not supply power to the [24V] terminal (24 V DC service power supply) on the main unit. Doing so may cause damage to the product. • Perform class D grounding (grounding resistance: 100 Ω or less) to the grounding terminal on the main unit with a wire 2 mm^2 or thicker. Do not use common grounding with heavy electrical systems (refer to Section 8.3). • Connect the AC power supply wiring to the dedicated terminals described in this manual. If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out. • Noise resistance may be lower when the L and N wires of an AC power supply are not wired correctly. Please wire using the correct polarity. • Connect the DC power supply wiring to the dedicated terminals described in this manual. If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out. • Do not wire vacant terminals externally. Doing so may damage the product. • When drilling screw holes or wiring, make sure cutting or wire debris does not enter the ventilation slits. Failure to do so may cause fire, equipment failures or malfunctions. • Make sure to observe the following precautions in order to prevent any damage to the machinery or accidents due to abnormal data written to the PLC under the influence of noise: 1) Do not bundle the power line or shield of the analog input/output cable together with or lay it close to the main circuit, high-voltage line, or load line. Otherwise, noise disturbance and/or surge induction are likely to take place. As a guideline, lay the control line at least 100 mm (3.94") or more away from the main circuit, high-voltage line, or load line. 2) Ground the shield of the analog input/output cable at one point on the signal receiving side. However, do not use common grounding with heavy electrical systems. • Make sure to properly wire to the main unit in accordance with the following precautions. Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product. - Make sure to properly wire to the main unit in accordance with the rated voltage, current, and frequency of each terminal. - The disposal size of the cable end should follow the dimensions described in the manual. - Tightening torque should follow the specifications in the manual. - Tighten the screws using a Phillips-head screwdriver No.2 (shaft diameter 6mm (0.24”) or less). Make sure that the screwdriver does not touch the partition part of the terminal block. • Make sure to properly wire to the terminal block (European type) in accordance with the following precautions. Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product. - The disposal size of the cable end should follow the dimensions described in the manual. - Tightening torque should follow the specifications in the manual. - Twist the end of strand wire and make sure that there are no loose wires. - Do not solder-plate the electric wire ends. - Do not connect more than the specified number of wires or electric wires of unspecified size. - Affix the electric wires so that neither the terminal block nor the connected parts are directly stressed.	54 67 77 100 111 114 118 119 121

5. STARTUP AND MAINTENANCE PRECAUTIONS

⚠WARNING	Reference
• Do not touch any terminal while the PLC's power is on. Doing so may cause electric shock or malfunctions. • Before cleaning or retightening terminals, cut off all phases of the power supply externally. Failure to do so may cause electric shock. • Before modifying or disrupting the program in operation or running the PLC, carefully read through this manual and the associated manuals and ensure the safety of the operation. An operation error may damage the machinery or cause accidents. • Do not change the program in the PLC from two or more peripheral equipment devices at the same time. (i.e. from a programming tool and a GOT) Doing so may cause destruction or malfunction of the PLC program.	127 154

⚠CAUTION	Reference
• Turn off the power to the PLC before attaching or detaching the memory cassette. If the memory cassette is attached or detached while the PLC's power is on, the data in the memory may be destroyed, or the memory cassette may be damaged. • Do not disassemble or modify the PLC. Doing so may cause fire, equipment failures, or malfunctions. For repair, contact your local Mitsubishi Electric representative. • Turn off the power to the PLC before connecting or disconnecting any connection cable. Failure to do so may cause equipment failures or malfunctions. • Turn off the power to the PLC before attaching or detaching the following devices. Failure to do so may cause equipment failures or malfunctions. - Peripheral devices, display module, expansion boards, special adapters and memory cassette • Do not use the chemicals for cleaning. • If there is the possibility of touching the PLC inside a control panel in maintenance, make sure to discharge to avoid the influence of static electricity.	127 154 179

6. DISPOSAL PRECAUTIONS

⚠CAUTION	Reference
• Please contact a certified electronic waste disposal company for the environmentally safe recycling and disposal of your device.	127

7. TRANSPORTATION AND STORAGE PRECAUTIONS

⚠CAUTION	Reference
• The PLC is a precision instrument. During transportation, avoid impacts larger than those specified in the general specifications (Section 4.1) using dedicated packaging boxes and shock-absorbing palettes. Failure to do so may cause failures in the PLC. After transportation, verify operation of the product and check for damage of the mounting part, etc.	127

FX3S Series Programmable Controllers

User's Manual [Hardware Edition]

Manual number	JY997D48601
Manual revision	G
Date	12/2021

Foreword

This manual contains text, diagrams and explanations which will guide the reader in the correct installation, safe use and operation of the FX3S Series Programmable Controllers and should be read and understood before attempting to install or use the unit.

And, store this manual in a safe place so that you can take it out and read it whenever necessary. Always forward it to the end user.

Outline Precautions

- This manual provides information for the use of the FX3S Series Programmable Controllers. The manual has been written to be used by trained and competent personnel. The definition of such a person or persons is as follows;
  a) Any engineer who is responsible for the planning, design and construction of automatic equipment using the product associated with this manual should be of a competent nature, trained and qualified to the local and national standards required to fulfill that role. These engineers should be fully aware of all aspects of safety with regards to automated equipment.
  b) Any commissioning or service engineer must be of a competent nature, trained and qualified to the local and national standards required to fulfill that job. These engineers should also be trained in the use and maintenance of the completed product. This includes being completely familiar with all associated documentation for the said product. All maintenance should be carried out in accordance with established safety practices.
  c) All operators of the completed equipment should be trained to use that product in a safe and coordinated manner in compliance to established safety practices. The operators should also be familiar with documentation which is connected with the actual operation of the completed equipment.

  Note: The term 'completed equipment' refers to a third party constructed device which contains or uses the product associated with this manual
- This product has been manufactured as a general-purpose part for general industries, and has not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult with Mitsubishi Electric.
- This product has been manufactured under strict quality control. However when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.
- When combining this product with other products, please confirm the standard and the code, or regulations with which the user should follow. Moreover, please confirm the compatibility of this product to the system, machine, and apparatus with which a user is using.
- If in doubt at any stage during the installation of the product, always consult a professional electrical engineer who is qualified and trained to the local and national standards. If in doubt about the operation or use, please consult your local Mitsubishi Electric representative.
- Since the examples indicated by this manual, technical bulletin, catalog, etc. are used as a reference, please use it after confirming the function and safety of the equipment and system. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- This manual content, specification etc. may be changed without a notice for improvement.
- The information in this manual has been carefully checked and is believed to be accurate; however, if you have noticed a doubtful point, a doubtful error, etc., please contact your local Mitsubishi Electric representative.

Registration

The company names, system names and product names mentioned in this manual are either registered trademarks or trademarks of their respective companies.

In some cases, trademark symbols such as '™' or '®' are not specified in this manual.

Table of Contents

Standards

Certification of UL, cUL standards

FX3S series main units, FX3S series interface adapter and FX3U series special adapters supporting UL, cUL standards are as follows:

UL, cUL file number: E95239
Models: MELSEC FX3S/FX3U series manufactured

FX3S-★★MR/ES	FX3S-★★MT/ES	FX3S-★★MT/ESS	
FX3S-★★MR/DS	FX3S-★★MT/DS	FX3S-★★MT/DSS	
Where ★★ indicates:10, 14, 20, 30			
FX3S-30MR/ES-2AD	FX3S-30MT/ES-2AD	FX3S-30MT/ESS-2AD	
FX3S-CNV-ADP			
FX3U-232ADP(-MB)	FX3U-485ADP(-MB)	FX3U-ENET-ADP	
FX3U-4AD-ADP	FX3U-4DA-ADP	FX3U-3A-ADP	FX3U-4AD-PT-ADP
FX3U-4AD-PTW-ADP	FX3U-4AD-PNK-ADP	FX3U-4AD-TC-ADP	

Compliance with EC directive (CE Marking)

This product complies with EC directive, however, this document does not guarantee that a mechanical system including this product will comply with EC directive.
Compliance to EMC directive and LVD directive of the entire mechanical module should be checked by the user / manufacturer. For more details please contact to the local Mitsubishi Electric sales site.

Requirement for Compliance with EMC directive

The following products have shown compliance through direct testing (of the identified standards below) and design analysis (through the creation of a technical construction file) to the European Directive for Electromagnetic Compatibility (2014/30/EU) when used as directed by the appropriate documentation.

Type: Programmable Controller (Open Type Equipment)

Models: MELSEC FX3S series, FX3G series, FX3U series manufactured

from June 1st, 2005	FX3U-232ADP	FX3U-485ADP		
	FX3U-4AD-ADP	FX3U-4DA-ADP	FX3U-4AD-PT-ADP	FX3U-4AD-TC-ADP
from April 1st, 2007	FX3U-232ADP-MB	FX3U-485ADP-MB		
from December 1st, 2007	FX3U-4AD-PTW-ADP	FX3U-4AD-PNK-ADP		
from November 1st, 2008	FX3G-232-BD	FX3G-422-BD	FX3G-485-BD	
	FX3G-EEPROM-32L			
	FX3G-2AD-BD	FX3G-1DA-BD	FX3G-8AV-BD	
from June 1st, 2009	FX3U-3A-ADP			
from February 1st, 2012	FX3U-ENET-ADP			
from March 1st, 2013	FX3S-★★MR/ES	FX3S-★★MT/ES	FX3S-★★MT/ESS	
	Where ★★ indicates:10, 14, 20, 30			
	FX3S-CNV-ADP			
from September 1st, 2013	FX3S-★★MR/DS	FX3S-★★MT/DS	FX3S-★★MT/DSS	
	Where ★★ indicates:10, 14, 20, 30			
	FX3S-30MR/ES-2AD	FX3S-30MT/ES-2AD	FX3S-30MT/ESS-2AD	
	FX3G-4EX-BD	FX3G-2EYT-BD	FX3G-485-BD-RJ	
from September 1st, 2014	FX3S-5DM			

Standard		Remark
EN61131-2: 2007	Programmable controllers - Equipment requirements and tests	Compliance with all relevant aspects of the standard. EMI • Radiated Emission • Conducted Emission EMS • Radiated electromagnetic field • Fast transient burst • Electrostatic discharge • High-energy surge • Voltage drops and interruptions • Conducted RF • Power frequency magnetic field

Requirement for Compliance with LVD directive

The following products have shown compliance through direct testing (of the identified standards below) and design analysis (through the creation of a technical construction file) to the European Directive for Low Voltage (2014/35/EU) when used as directed by the appropriate documentation.

Type: Programmable Controller (Open Type Equipment)

Models: MELSEC FX3S series manufactured

from March 1st, 2013	FX3S-★★MR/ES	FX3S-★★MT/ES	FX3S-★★MT/ESS
	Where ★★ indicates:10, 14, 20, 30		
from September 1st, 2013	FX3S-★★MR/DS		
	Where ★★ indicates:10, 14, 20, 30		
	FX3S-30MR/ES-2AD	FX3S-30MT/ES-2AD	FX3S-30MT/ESS-2AD

For the products above,
PLCs manufactured before April 30th, 2018 are compliant with EN61131-2: 2007,
PLCs manufactured after May 1st, 2018 are compliant with EN61131-2: 2007 and EN61010-2-201: 2013.*1

*1. For some models, PLCs manufactured in March, 2018 are compliant with LVD directive successively.

Standard		Remark
EN61131-2: 2007	Programmable controllers - Equipment requirements and tests	The equipment has been assessed as a component for fitting in a suitable control box which meets the requirements of EN61131-2: 2007
EN61010-2-201: 2013	Safety of electrical equipment for measurement, control, and test	The equipment has been assessed as a component for fitting in a suitable control box which meets the requirements of EN61010-2-201: 2013

Caution for compliance with EC Directive

- Please use the FX3S Series programmable controllers while installed in conductive shielded control panels under a general industrial environment.
- Programmable controllers are open-type devices that must be installed and used within conductive control panels. Please secure the control panel lid to the control panel (for conduction). Installation within a control panel greatly affects the safety of the system and aids in shielding noise from the programmable controller.
- For the control panel, use the product having sufficient strength, fire protectiveness and shielding property to an installation environment.
- 24 V DC of the power supply must be supplied from the circuit double/reinforced insulated from the main power supply (MAINS).

Caution for compliance with the LVD directive (EN61010-2-201:2013)*1

- To an external connection port other than AC power supply terminal and AC input/output terminal, connect the circuit separated from a dangerous voltage by a double/reinforced insulation.
- Between the commons having the adjacent relay output terminals, if an external power supply is higher than 120 V AC, the insulation is basic.
  Therefore, when using 120 V AC or higher external power supply and 30 V DC/AC or lower external power supply between the adjacent commons, do not handle 30 V DC/AC or lower external power supply as a touchable part, (When handling 30 V DC/AC or lower external power supply as a touchable part, add a basic insulation.)
- Do not wire two or more crimp terminals to one terminal. (If the wiring with two or more wires is needed, take an appropriate action such as adding an external terminal.)
- For crimp terminals to be used for the wiring applied with 30 V AC or higher, use the products with insulating sleeves.
- Cutoff device such as a breaker or a circuit protector should be installed in accordance with the following precautions.
  - Use EN60947-1 or EN60947-3 standards.
  - Use CP30-BA 2P 1-MD 0.5A or the cutoff device having the cutoff performance equivalent to CP30-BA 2P 1-MD 0.5A.
  - Place the cutoff device so that it can be operated easily.
  - Specify that the cutoff device is for this equipment.

*1. For the time of compliance with the LVD directive (EN61010-2-201:2013), refer to Requirement for Compliance with LVD directive.

Caution for Analog Products in use

The analog products have been found to be compliant to the European standards in the aforesaid manual and directive. However, for the very best performance from what are in fact delicate measuring and controlled output devices, Mitsubishi Electric would like to make the following points;
As analog devices are sensitive by nature, their use should be considered carefully. For users of proprietary cables (integral with sensors or actuators), these users should follow those manufacturers' installation requirements.
Mitsubishi Electric recommends that shielded cables be used. If NO other EMC protection is provided, users may experience temporary loss or accuracy between +10% / -10% in very heavy industrial areas.
However, Mitsubishi Electric suggests that if adequate EMC precautions are followed for the users complete control system.

- Sensitive analog cables should not be laid in the same trunking or cable conduit as high voltage cabling. Where possible, users should run analog cables separately.
- Good cable shielding should be used. When terminating the shield at Earth - ensure that no earth loops are accidentally created.
- When reading analog values, EMC accuracy can be improved by averaging the readings. This can be achieved either through functions on the analog product or through a user's program in the FX3S Series PLC main unit.

Compliance with UKCA marking

The requirements for compliance with the UKCA marking are the same as those with the EC Directive (CE marking).

MEMO

1. Introduction

This manual explains the procedures for selecting the system components, main unit specifications and procedures for installing the main unit, and procedures for operating the display module etc. FX3S PLCs can make various kinds of control in combination with the main unit functions and many extension devices (expansion board and special adapters).
The detailed explanation of the sequence instructions, communication control, analog control and positioning control are given in separate manuals.

→ **For information on manual organization, refer to Subsection 1.1.2.**

1.1 Introduction of Manuals

1.1.1 Classification of major components in this manual

1) Main unit (Chapter 1 to Chapter 14)

Division	Outline	Reference
Introduction of manuals	This chapter contains explanations of the procedures for obtaining the manuals and the abbreviations.	Chapter 1
Features and part names	This chapter contains explanations of the product features and the names of the parts.	Chapter 2
Introduction of product	This chapter contains explanations of the structures for model names, extension products.	Chapter 3
Specifications	This chapter contains explanations of the specifications for power supply and input/output, performance specifications, external dimensions and terminal block layout.	Chapter 4
Version information	This chapter contains explanation for upgrading of FX3S PLCs and information for the application of programming tools.	Chapter 5
System configuration	Procedure for determining whether or not a system configuration is possible.	Chapter 6
Installation	This chapter contains explanations for the panel layout and the procedures for installing with DIN rail or screws.	Chapter 7
Power supply wiring	This chapter contains explanations of the procedures for preparing for wiring, power supply wiring and wiring precautions.	Chapter 8
Input wiring	This chapter contains explanations of the input wiring and wiring precautions.	Chapter 9
High-speed counter	This chapter contains explanations of the procedures for using the high-speed counter examples of programming.	Chapter 10
Built-in analog	This chapter contains explanations of the procedures for using the built-in variable analog potentiometer and the built-in analog input and programming examples.	Chapter 11
Output wiring	This chapter contains explanations for the output wiring and wiring precautions.	Chapter 12
Examples of wiring for each use	This chapter contains explanations of the procedures for wiring input/output devices for main uses.	Chapter 13
Test operation, adjustment, maintenance and error check	This chapter contains explanations of the procedures for test operation and adjustment, maintenance and error check items and measures to be taken upon occurrence of error.	Chapter 14

2) Extension devices (Chapter 15)

Division	Outline	Reference
Extension products for special functions, such as communication control and analog.	This chapter contains explanations for the external dimensions and terminal layout (For details, refer to the manual for each extension device).	Chapter 15

3) Optional products (Chapter 16 to Chapter17)

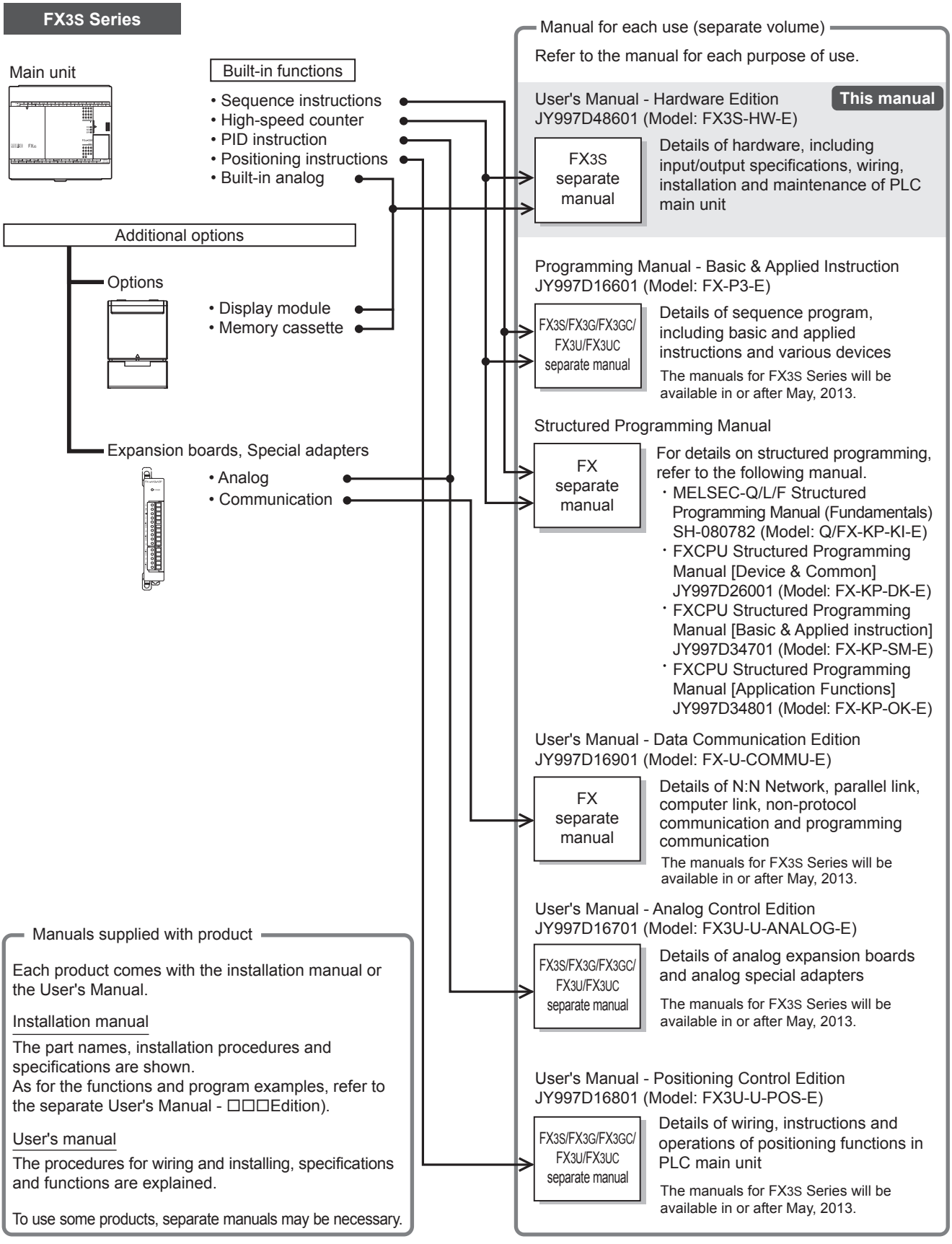
Division	Outline	Reference
Display module	This chapter contains explanation of the specifications, external dimensions, mounting procedures and operating procedures for display modules (FX3S-5DM).	Chapter 16
Memory cassette	This chapter contains explanations of the specifications for the memory cassette and the installation procedures.	Chapter 17

4) Others (Appendix A to Appendix C)

Division	Outline	Reference
List of special devices	This chapter contains an explanation list of the special auxiliary relays (M8000 to M8511) and special data registers (D8000 to D8511). (For details, refer to the programming manual.)	Appendix A
List of instructions	This chapter contains an explanation list of the basic instructions and applied instructions. (For details, refer to the programming manual.)	Appendix B
List of discontinued models	The discontinued MELSEC-F Series PLC models and programming tools described in this manual.	Appendix C

1.1.2 Manual organization and position of this manual

This manual describes detail on the hardware, including the system configuration, installation and wiring. The instructions, communication control, analog control and positioning control are explained in separate manuals. Refer to the manuals as needed.



1.1.3 List of manuals

FX3S Series PLC main units supplied only with the hardware manual.
For the details of the hardware of FX3S Series, refer to this manual.
For instructions for programming and hardware information on special function devices, refer to the relevant manuals.

⊙: Indispensable manuals
✓: Manuals necessary for some purposes
△: Manuals with separate volumes for details

		Manual Name	Manual Number	Contents	Model Code
Manuals for PLC main unit					
■ FX3S PLC main unit					
△	Supplied with product	FX3S Series Hardware Manual	JY997D48301	Extractions of descriptions of input/output specifications, wiring and installation of FX3S Series PLC main unit from FX3S Series User's Manual - Hardware Edition. For the detailed explanation, refer to this manual.	-
△	Supplied with product	FX3S-30M□/E□-2AD Hardware Manual	JY997D51701	Extractions of descriptions of input/output specifications, wiring and installation of FX3S-30M□/E□-2AD PLC main unit from FX3S Series User's Manual - Hardware Edition. For the detailed explanation, refer to this manual.	-
⊙	Additional Manual	FX3S Series User's Manual - Hardware Edition (this manual)	JY997D48601	Details of hardware of FX3S Series PLC main unit, including input/output specifications, wiring, installation and maintenance.	09R535
■ Programming					
⊙	Additional Manual	FX3S/FX3G/FX3GC/FX3U/FX3UC Series Programming Manual - Basic & Applied Instruction Edition	JY997D16601	Details of sequence programming for FX3S Series, including explanation for basic instructions, applied instructions and various devices.	09R517
✓	Additional Manual	MELSEC-Q/L/F Structured Programming Manual (Fundamentals)	SH-080782	Programming methods, specifications, functions, etc. required to create structured programs.	13JW06
✓	Additional Manual	FX CPU Structured Programming Manual [Device & Common]	JY997D26001	Devices, parameters, etc. provided in structured projects of GX Works2.	09R925
✓	Additional Manual	FX CPU Structured Programming Manual [Basic & Applied Instruction]	JY997D34701	Sequence instructions provided in structured projects of GX Works2.	09R926
✓	Additional Manual	FX CPU Structured Programming Manual [Application Functions]	JY997D34801	Application functions provided in structured projects of GX Works2.	09R927
Manuals for communication control					
■ Common					
✓	Additional Manual	FX Series User's Manual - Data Communication Edition	JY997D16901	Details of N:N Network, parallel link, computer link and non-protocol communication (RS instruction and RS2 instruction).	09R715
✓	Additional Manual	FX3S/FX3G/FX3GC/FX3U/FX3UC Series User's Manual - MODBUS Serial Communication Edition	JY997D26201	Details on MODBUS serial communication in FX3S/FX3G/FX3GC/FX3U/FX3UC PLCs.	09R626
■ Ethernet When using each product, refer also to the User's Manual - Hardware Edition for the PLC main unit to be installed.					
△	Supplied with product	FX3U-ENET-ADP Installation Manual	JY997D47401	Describes installation and specifications for the FX3U-ENET-ADP Ethernet communication special adapter extracted from the FX3U-ENET-ADP User's Manual. When using, refer to FX3U-ENET-ADP User's Manual.	-
✓	Additional Manual	FX3U-ENET-ADP User's Manual	JY997D45801	Describes FX3U-ENET-ADP Ethernet communication special adapter details.	09R725

		Manual Name	Manual Number	Contents	Model Code
■ **RS-232C/RS-422/RS-485**					
When using each product, refer also to the User's Manual - Hardware Edition for the PLC main unit to be installed and FX Series User's Manual - Data Communication Edition. For the MODBUS communication, refer to the FX3S/FX3G/FX3GC/FX3U/FX3UC Series User's Manual - MODBUS Serial Communication Edition.					
△	Supplied with product	FX3G-232-BD Installation Manual	JY997D32001	Procedures for handling the RS-232C communication special adapter.	-
△	Supplied with product	FX3U-232ADP-MB Installation Manual	JY997D26401	Procedures for handling the RS-232C communication special adapter.	-
△	Supplied with product	FX3U-232ADP Installation Manual	JY997D13701	Procedures for handling the RS-232C communication special adapter.	-
△	Supplied with product	FX3G-422-BD Installation Manual	JY997D32101	Procedures for handling the RS-422 communication expansion board.	-
△	Supplied with product	FX3G-485-BD Installation Manual	JY997D32201	Procedures for handling the RS-485 communication expansion board.	-
△	Supplied with product	FX3G-485-BD-RJ Installation Manual	JY997D51501	Procedures for handling the RS-485 communication expansion board.	-
△	Supplied with product	FX3U-485ADP-MB Installation Manual	JY997D26301	Procedures for handling the RS-485 communication special adapter.	-
△	Supplied with product	FX3U-485ADP Installation Manual	JY997D13801	Procedures for handling the RS-485 communication special adapter.	-
✓	Supplied with product	FX-485PC-IF Hardware Manual	JY992D81801	Procedures for handling the RS-232C/RS-485 conversion interface.	-
Manuals for analog/temperature control					
■ **Common**					
✓	Additional Manual	FX3S/FX3G/FX3GC/FX3U/FX3UC Series User's Manual - Analog Control Edition	JY997D16701	Details of analog special function block (FX3U-4AD, FX3U-4DA, FX3UC-4AD), analog special adapter (FX3U-***-**-ADP) and analog expansion board (FX3G-***-BD).	09R619
■ **Analog input and temperature input**					
When using each product, refer to the User's Manual - Hardware Edition for the PLC main unit to be installed and FX3S/FX3G/FX3GC/FX3U/FX3UC Series User's Manual - Analog Control Edition.					
△	Supplied with product	FX3G-2AD-BD Installation Manual	JY997D33501	Procedures for handling the 2-ch analog input expansion board.	-
△	Supplied with product	FX3U-4AD-ADP User's Manual	JY997D13901	Procedures for handling the 4-ch analog input special adapter.	-
△	Supplied with product	FX3U-4AD-PT-ADP User's Manual	JY997D14701	Procedures for handling the 4-ch Pt100 temperature sensor input special adapter.	-
△	Supplied with product	FX3U-4AD-PTW-ADP User's Manual	JY997D29101	Procedures for handling the 4-ch Pt100 temperature sensor input special adapter.	-
△	Supplied with product	FX3U-4AD-PNK-ADP User's Manual	JY997D29201	Procedures for handling the 4-ch Pt1000/Ni1000 temperature sensor input special adapter.	-
△	Supplied with product	FX3U-4AD-TC-ADP User's Manual	JY997D14801	Procedures for handling the 4-ch thermocouple input special adapter.	-

		Manual Name	Manual Number	Contents	Model Code
■ Analog output					
When using each product, refer to the User's Manual - Hardware Edition for the PLC main unit to be installed and FX3S/FX3G/FX3GC/FX3U/FX3UC Series User's Manual - Analog Control Edition.					
△	Supplied with product	FX3G-1DA-BD Installation Manual	JY997D33601	Procedures for handling the 1-ch analog output expansion board.	-
△	Supplied with product	FX3U-4DA-ADP User's Manual	JY997D14001	Procedures for handling the 4-ch analog output special adapter.	-
■ Analog input/output					
When using each product, refer to the User's Manual - Hardware Edition for the PLC main unit to be installed and FX3S/FX3G/FX3GC/FX3U/FX3UC Series User's Manual - Analog Control Edition.					
△	Supplied with product	FX3U-3A-ADP User's Manual	JY997D35601	Procedures for handling the 2-ch analog input and 1-ch analog output special adapter.	-
Manuals for positioning control					
■ Common					
✓	Additional Manual	FX3S/FX3G/FX3GC/FX3U/FX3UC Series User's Manual - Positioning Control Edition	JY997D16801	Details of positioning functions of FX3S/FX3G/FX3GC/FX3U/FX3UC Series.	09R620
Manuals for FX-30P					
△	Supplied with product	FX-30P Installation Manual	JY997D34201	Describes FX-30P specification extracted from the FX-30P Operation manual. For details, refer to FX-30P Operation manual.	-
✓	Additional Manual	FX-30P Operation Manual	JY997D34401	Describes Handy Programming Panel FX-30P details.	09R924
Other manuals					
When using each product, refer also to the User's Manual - Hardware Edition for the PLC main unit to be installed.					
■ Input extension					
△	Supplied with product	FX3G-4EX-BD User's Manual	JY997D51301	Procedures for handling the 4 points input expansion board.	-
■ Output extension					
△	Supplied with product	FX3G-2EYT-BD User's Manual	JY997D51401	Procedures for handling the 2 points transistor output expansion board.	-
■ Variable analog potentiometers					
△	Supplied with product	FX3G-8AV-BD Installation Manual	JY997D33701	Procedures for handling the 8-ch variable analog potentiometers expansion board. When using, refer to FX3S/FX3G/FX3GC/FX3U/FX3UC Series Programming Manual -Basic & Applied Instruction Edition.	-
■ Connector conversion					
△	Supplied with product	FX3S-CNV-ADP Installation Manual	JY997D48801	Procedures for handling the conversion function expansion adapter for connectors for connecting communication and analog special adapters.	-
■ Display module					
△	Supplied with product	FX3S-5DM Installation Manual	JY997D51601	Procedures for mounting and handling the display module.	-
■ Memory cassette					
△	Supplied with product	FX3G-EEPROM-32L Installation Manual	JY997D32401	Specifications and operating procedures of the memory cassette.	-

1.2 Generic Names and Abbreviations Used in Manuals

Abbreviation/generic name	Description
PLCs	
FX3S Series	Generic name for FX3S Series PLCs
FX3G Series	Generic name for FX3G Series PLCs
FX3U Series	Generic name for FX3U Series PLCs
FX3S PLCs or main units	Abbreviation of FX3S Series PLC main units
Expansion boards	Generic name for the following models FX3G-4EX-BD, FX3G-2EYT-BD, FX3G-232-BD, FX3G-422-BD, FX3G-485-BD, FX3G-485-BD-RJ, FX3G-2AD-BD, FX3G-1DA-BD, FX3G-8AV-BD
Special adapters	Generic name for communication special adapters and analog special adapters
Communication special adapters	Generic name for the following models FX3U-232ADP(-MB), FX3U-485ADP(-MB), FX3U-ENET-ADP
Analog special adapters	Generic name for the following models FX3U-4AD-ADP, FX3U-4DA-ADP, FX3U-3A-ADP, FX3U-4AD-PT-ADP, FX3U-4AD-PTW-ADP, FX3U-4AD-PNK-ADP, FX3U-4AD-TC-ADP
Display module	Generic name for the following model FX3S-5DM
Memory cassettes	Generic name for the following model FX3G-EEPROM-32L
Peripheral devices	Generic name for programming software, handy programming panel (HPP) and indicator
Programming tool	Generic name for programming software and handy programming panel (HPP)
Programming software	Generic name for GX Works2 and GX Developer
GX Works2	Abbreviation of programming software package SW□DNC-GXW2-E
GX Developer	Abbreviation of programming software package SW□D5C-GPPW-E
Handy programming panels (HPP)	Generic name for the following model FX-30P
RS-232C/RS-422 converters	Generic name for the following model FX-232AWC-H
RS-232C/RS-485 converters	Abbreviation of FX-485PC-IF
Indicators	
GOT1000 Series	Generic name for GT16, GT15, GT14, GT11 and GT10
GOT-900 Series	Generic name for GOT-A900 Series and GOT-F900 Series
GOT-A900 Series	Generic name for GOT-A900 Series
GOT-F900 Series	Generic name for GOT-F900 Series
Manuals	
FX3S Hardware Edition	Abbreviation of FX3S Series User's Manual - Hardware Edition
Programming manual	Abbreviation of FX3S/FX3G/FX3GC/FX3U/FX3UC Series Programming Manual - Basic & Applied Instruction Edition
Data Communication Edition	Abbreviation of FX Series User's Manual - Data Communication Edition
MODBUS Serial Communication Edition	Abbreviation of FX3S/FX3G/FX3GC/FX3U/FX3UC Series User's Manual - MODBUS Serial Communication Edition
Analog Control Edition	Abbreviation of FX3S/FX3G/FX3GC/FX3U/FX3UC Series User's Manual - Analog Control Edition
Positioning Control Edition	Abbreviation of FX3S/FX3G/FX3GC/FX3U/FX3UC Series User's Manual - Positioning Control Edition
ENET-ADP User's Manual	Abbreviation of FX3U-ENET-ADP User's Manual

2. Features and Part Names

2.1 Major Features

1. Basic functions

[Up to 30 input/output points]
Main units are available in models of 10, 14, 20 and 30 total input/output points.

[Memory capacity]
The PLC has a 16 K-step EEPROM memory.
(Program capacity is 4 K-steps.)

[Built-in USB port]
The PLC has a built-in USB port for the programming communication function to enable high-speed communication at 12 Mbps.

[Built-in RUN/STOP switch]
The PLC can be started and stopped with the built-in switch.
RUN and STOP commands can be given to the PLC through a general-purpose input terminal or peripheral device.

[Built-in Variable analog potentiometers]
(except FX3S-30M□/E□-2AD)
The PLC has two built-in variable analog potentiometers available for adjusting the timer set time.
Up to 8 points can be added by using the optional analog potentiometer expansion board.

[Built-in analog inputs]
(only FX3S-30M□/E□-2AD)
The PLC has two built-in analog inputs available for voltage input.
Additional analog input points can be added by using an optional expansion board or special adapter.

[Writing during RUN]
The programming software for personal computer enables you to modify the program while the PLC is running.

[Built-in clock function]
The PLC has a clock function to control the time.

[Programming tool]
Use a version of a programming tool supporting the FX3S.

→ **Refer to Chapter 5.**

[Remote debugging of program]
Programming software enables you to remotely transfer programs and monitor PLC operation through a modem connected to the RS-232C expansion board or the RS-232C communication special adapter.

2. Input/output high-speed processing functions of main unit

[High-speed counter function]

- 1-phase 60 kHz × 2 points + 10 kHz × 4 points
- 2-phase 30 kHz × 1 points + 5 kHz × 1 point

→ **Refer to Chapter 10 and Programming Manual.**

[Pulse catch function]
Signals with short ON width or OFF width can be captured without a complicated program.

→ **Refer to Chapter 9 and Programming Manual.**

Input terminal	Signal ON/OFF width
X000, X001	10 μs
X002 to X005	50 μs

[Input interruption function]
The PLC can process interruption routines with higher priority using external signals whose minimum ON duration or OFF duration is 10 μs (X000, X001) or 50 μs (X002 to X005).
(The timer interruption function is also provided.)

→ **Refer to Chapter 9 and Programming Manual.**

[Pulse output function]
When output terminals in the transistor output type main unit are used, pulses of up to 100 kHz can be output simultaneously to 2 axes (Y000 and Y001).
Using a number of instructions programming is simplified.

→ **Refer to Positioning Control Edition.**

[Various positioning instructions]

Instruction	Description
DSZR	Mechanical zero return instruction with DOG search function.
ABS	Instruction to read the current value from our servo amplifier with absolute position (ABS) detecting function.
DRVI	Positioning (relative positioning) to specify the movement from the current position.
DRVA	Positioning (absolute positioning) to specify the target position based on the current value 0.
PLSV	Instruction to change the pulse train output frequency.

→ **Refer to Positioning Control Edition.**

3. Display functions (display module) (Supported in Ver. 1.20 or later)

FX3S-5DM Display Module (option) can be installed on the PLC.

[Monitor/test function]

Devices can be monitored and tested by operating the buttons on the display module.
The button operations can be inhibited by the user program.

[Other functions]

On the display module, you can set the time and display error codes.

→ **Refer to Chapter 16.**

4. Communication and network functions

The expansion board and special adapter for each communication function can be connected.

→ **Refer to Data Communication Edition.**
→ **Refer to MODBUS Serial Communication Edition.**
→ **Refer to ENET-ADP User's Manual.**

[Kinds of communication functions]

- Programming communication (RS-232C/RS-422/USB)
- N:N Network
- Parallel link
- Computer link
- Inverter communication
- Non-protocol communication (RS-232C/RS-485)
- MODBUS communication
- Ethernet

5. Analog functions

The expansion board and special adapter for each analog function are connected.

→ **Refer to Analog Control Edition.**

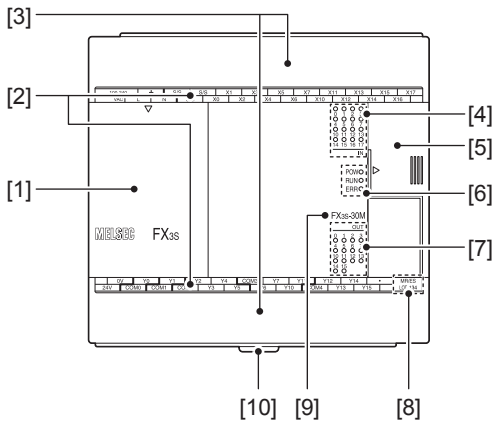
[Kinds of analog functions]

- Voltage/current input
- Voltage/current output
- Temperature sensor input (thermocouple and platinum resistance thermometer sensor)

2.2 Names and Functions of Parts

2.2.1 Front Panel

Factory default configuration (standard)



[1] Top cover
Mount the expansion board, display module and memory cassette under this cover.

[2] Terminal names
The signal names for power supply, input and output terminals are shown.
⏚ shows a function grounding terminal.

[3] Terminal block covers
The covers can be opened for wiring.
Keep the covers closed while the PLC is running (the unit power is on).

[4] Input display LEDs (red)
When an input terminal (X000 or more) is turned on, the corresponding LED lights.

[5] Peripheral device connecting connector cover
The peripheral device connector, variable analog potentiometers, analog inputs and RUN/STOP switch are located under this cover.

[6] Operation status display LEDs
The operation status of the PLC can be checked with the LEDs.
The LEDs turn off, light and flash according to the following table.
→ **For details on the operation status, refer to Section 14.5.**

LED name	Display color	Description
POW	Green	ON while power is on the PLC.
RUN	Green	ON while the PLC is running.
ERR	Red	Flashing when a program error occurs.
	Red	Lights when a CPU error occurs.

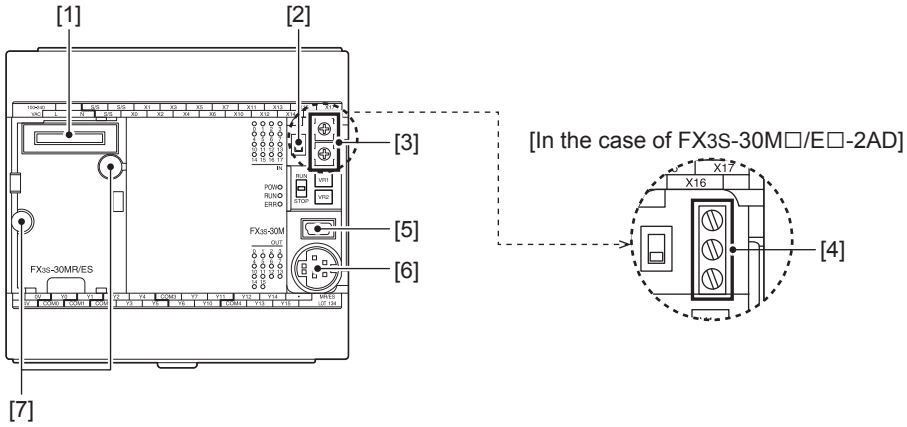
[7] Output display LEDs (red)
When an output terminal (Y000 or more) is turned on, the corresponding LED lights.

[8] The year and month of production
The year and month of production of the main unit is indicated.
→ **For details on the year and month of production, refer to Subsection 5.1.1.**

[9] Model name (abbreviation)
The model name of the main unit is indicated.
Check the nameplate on the right side for the model name.

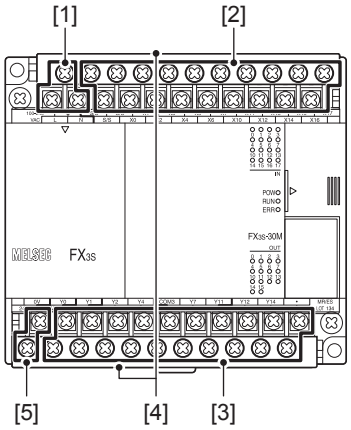
[10] DIN rail mounting hooks
The main unit can be installed on DIN46277 rail (35 mm (1.38") wide).

When the top covers are open



[1] Optional equipment connector	These holes are designed to secure the expansion board, display module and memory cassette with screws.
[2] RUN/STOP switch	To stop writing (batch) of the sequence program or operation, set the switch to STOP (slide it downward). To start operation (run the machine), set it to RUN (slide it upward).
[3] Variable analog potentiometers (except FX3S-30M□/E□-2AD)	Two variable analog potentiometers are built in. Upper side: VR1, Lower side: VR2
[4] Analog input terminal block (only FX3S-30M□/E□-2AD)	Two analog inputs are built in. These terminals are for wiring the analog inputs.
[5] Peripheral device connecting connector (USB)	Connect a programming tool (PC) to program a sequence. → **For details on applicable peripheral devices, refer to Chapter 5.**
[6] Peripheral device connecting connector (RS-422)	Connect a programming tool to program a sequence. → **For details on applicable peripheral devices, refer to Chapter 5.**
[7] Optional equipment connecting screw holes (2 places)	These holes are designed to secure the expansion board and memory cassette with screws.

When the terminal block covers are open

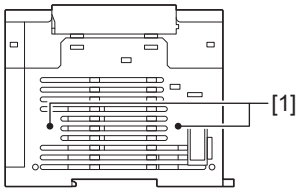


[1] Power supply terminals	Connect the power supply to the main unit.
[2] Input (X) terminals	Wire switches and sensors to the terminals.
[3] Output (Y) terminals	Wire loads (contactors, solenoid valves, etc.) to be driven to the terminals.
[4] Terminal cover	A protective terminal cover (refer to the following drawing) is fitted to the lower stage of each terminal block. The cover prevents fingers from touching terminals, thereby improving safety. 
[5] Service power supply terminals (only AC power type)	Wire sensors or other external equipment to these terminals when the service power supply (24 V DC) is used for such equipment.

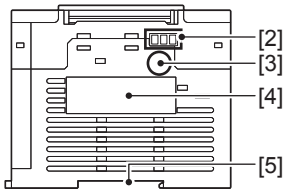
2.2.2 Sides

[AC Power Type]

Left side

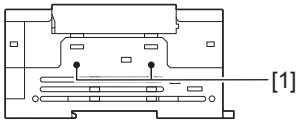


Right side

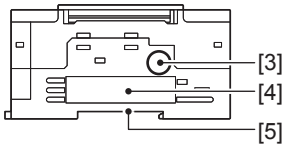


[DC power type]

Left side



Right side

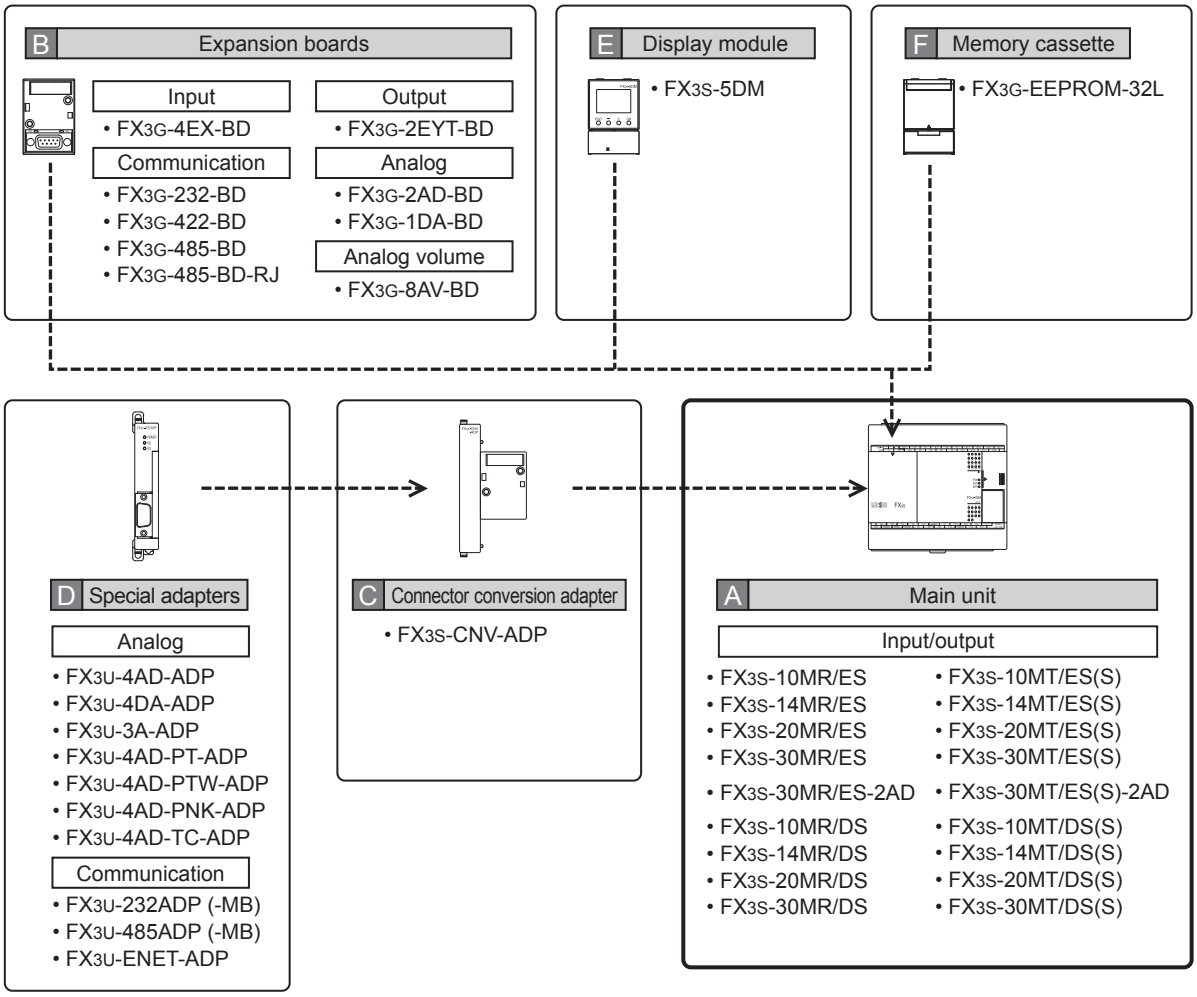


[1] Connector conversion adapter connecting screw holes (2 places)	These holes are designed to secure the connector conversion adapter with screws.
[2] Analog input terminal block (only FX3S-30M□/E□-2AD)	Two analog inputs are built in. These terminals are for wiring the analog inputs.
[3] Label of authenticity	The label of authenticity is affixed to the right side of the product and indicates that the product is genuine. Product without the label or nameplate is not covered by the warranty.
[4] Nameplate	The product model name, serial number and power supply specifications are shown. → **For details on the manufacturer's serial number, refer to Subsection 5.1.1.** ⚠ is a mark that instructs to use the cable with an appropriate temperature rating (80°C or more) for wiring.
[5] DIN rail mounting groove	The unit can be installed on DIN46277 rail (35 mm (1.38") wide).

3. Introduction of Products

3.1 List of Products and Interpretation of Model Names

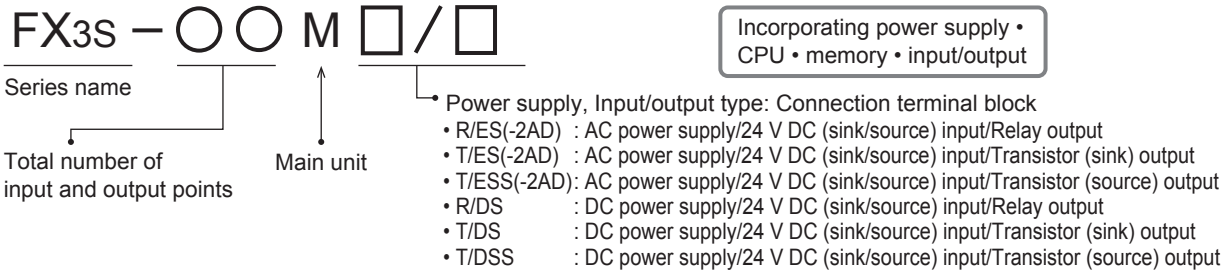
The following system configuration is classified into product groups A to F in the product introduction sections given below.



3.1.1 Main units

A

The main unit incorporates a CPU, memory, input and output terminals and power supply.
To establish a system, at least one main unit is necessary.



Model name	Number of input/output points			Input type	Output type	Connection form
	Total number of points	Number of input points	Number of output points			
AC power supply common to 24 V DC sink and source input						
FX3S-10MR/ES	10	6	4	24 V DC (sink/source)	Relay	Terminal block
FX3S-10MT/ES	10	6	4	24 V DC (sink/source)	Transistor (sink)	Terminal block
FX3S-10MT/ESS	10	6	4	24 V DC (sink/source)	Transistor (source)	Terminal block
FX3S-14MR/ES	14	8	6	24 V DC (sink/source)	Relay	Terminal block
FX3S-14MT/ES	14	8	6	24 V DC (sink/source)	Transistor (sink)	Terminal block
FX3S-14MT/ESS	14	8	6	24 V DC (sink/source)	Transistor (source)	Terminal block
FX3S-20MR/ES	20	12	8	24 V DC (sink/source)	Relay	Terminal block
FX3S-20MT/ES	20	12	8	24 V DC (sink/source)	Transistor (sink)	Terminal block
FX3S-20MT/ESS	20	12	8	24 V DC (sink/source)	Transistor (source)	Terminal block
FX3S-30MR/ES	30	16	14	24 V DC (sink/source)	Relay	Terminal block
FX3S-30MT/ES	30	16	14	24 V DC (sink/source)	Transistor (sink)	Terminal block
FX3S-30MT/ESS	30	16	14	24 V DC (sink/source)	Transistor (source)	Terminal block
FX3S-30MR/ES-2AD	30	16	14	24 V DC (sink/source)	Relay	Terminal block
FX3S-30MT/ES-2AD	30	16	14	24 V DC (sink/source)	Transistor (sink)	Terminal block
FX3S-30MT/ESS-2AD	30	16	14	24 V DC (sink/source)	Transistor (source)	Terminal block
DC power supply common to 24 V DC sink and source input						
FX3S-10MR/DS	10	6	4	24 V DC (sink/source)	Relay	Terminal block
FX3S-10MT/DS	10	6	4	24 V DC (sink/source)	Transistor (sink)	Terminal block
FX3S-10MT/DSS	10	6	4	24 V DC (sink/source)	Transistor (source)	Terminal block
FX3S-14MR/DS	14	8	6	24 V DC (sink/source)	Relay	Terminal block
FX3S-14MT/DS	14	8	6	24 V DC (sink/source)	Transistor (sink)	Terminal block
FX3S-14MT/DSS	14	8	6	24 V DC (sink/source)	Transistor (source)	Terminal block
FX3S-20MR/DS	20	12	8	24 V DC (sink/source)	Relay	Terminal block
FX3S-20MT/DS	20	12	8	24 V DC (sink/source)	Transistor (sink)	Terminal block
FX3S-20MT/DSS	20	12	8	24 V DC (sink/source)	Transistor (source)	Terminal block
FX3S-30MR/DS	30	16	14	24 V DC (sink/source)	Relay	Terminal block
FX3S-30MT/DS	30	16	14	24 V DC (sink/source)	Transistor (sink)	Terminal block
FX3S-30MT/DSS	30	16	14	24 V DC (sink/source)	Transistor (source)	Terminal block

3.1.2 Expansion boards

B

Model name	Description
FX3G-4EX-BD*1	4 points general-purpose input
FX3G-2EYT-BD*1	2 points transistor output
FX3G-232-BD	For RS-232C communication
FX3G-422-BD	For RS-422 communication
FX3G-485-BD	For RS-485 communication (European type)
FX3G-485-BD-RJ	For RS-485 communication (RJ45 connector)
FX3G-8AV-BD	For 8-ch analog volume
FX3G-2AD-BD	2-ch voltage/current input
FX3G-1DA-BD	1-ch voltage/current output

*1. Supported in FX3S PLC Ver. 1.10 or later.

3.1.3 Connector conversion adapter

C

Model name	Description
FX3S-CNV-ADP	Special adapter connection conversion adapter

3.1.4 Special adapters

D

Model name	Description
FX3U-232ADP(-MB)	For RS-232C communication
FX3U-485ADP(-MB)	For RS-485 communication
FX3U-ENET-ADP*1	For Ethernet communication
FX3U-4AD-ADP	4-ch voltage/current input
FX3U-4DA-ADP	4-ch voltage/current output
FX3U-3A-ADP	2-ch voltage/current input 1-ch voltage/current output
FX3U-4AD-PT-ADP	4-ch platinum resistance thermometer sensor input (-50 to +250 °C)
FX3U-4AD-PTW-ADP	4-ch platinum resistance thermometer sensor input (-100 to +600 °C)
FX3U-4AD-PNK-ADP	4-ch Pt1000/Ni1000 resistance thermometer sensor input
FX3U-4AD-TC-ADP	4-ch thermocouple (K, J type) temperature sensor input

*1. The FX3U-ENET-ADP Ver. 1.20 or later is applicable to the FX3S PLC.

3.1.5 Display module

E

Model name	Description
FX3S-5DM*1	Display module that can be installed on FX3S Series main unit

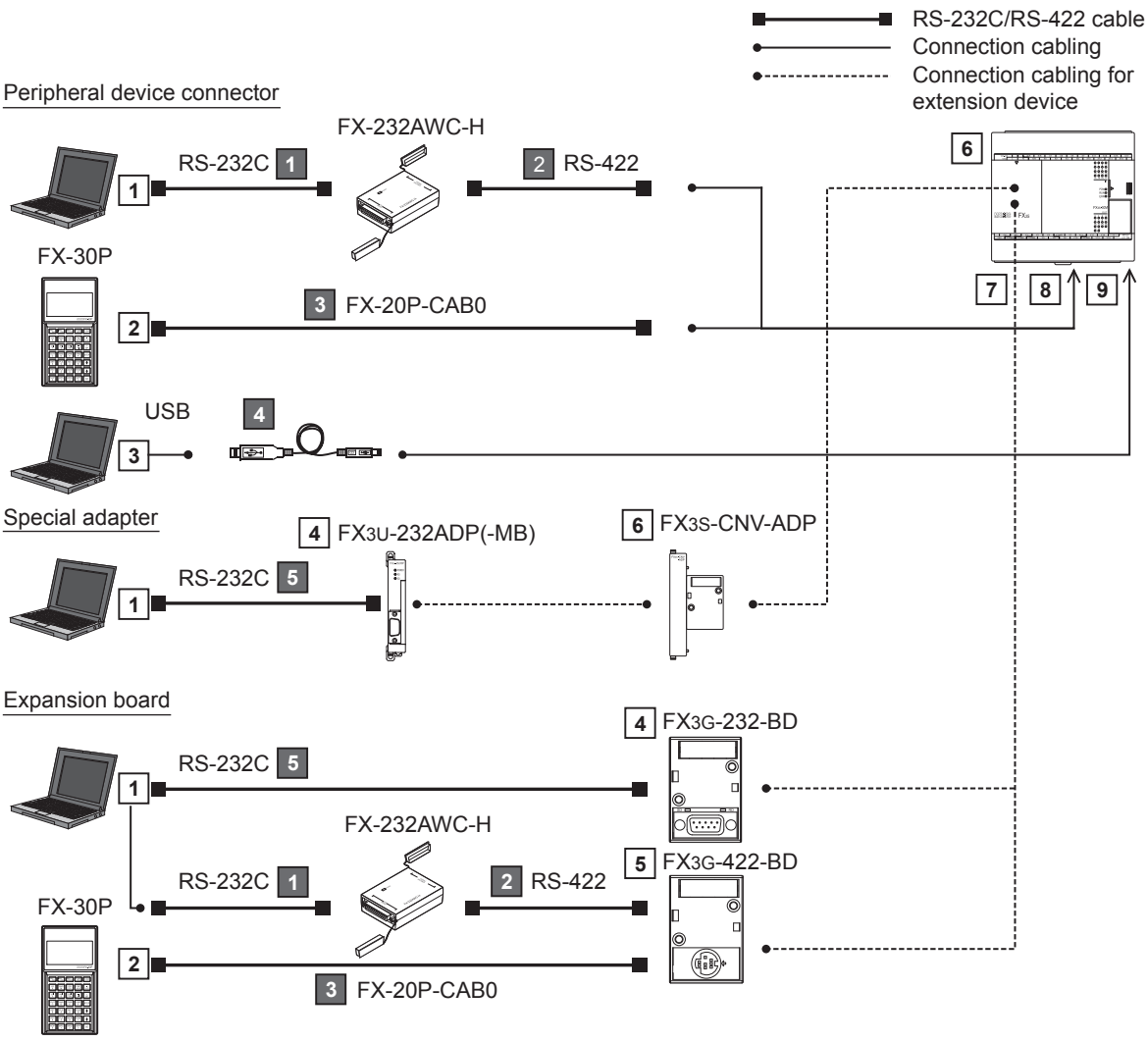
*1. Supported in FX3S PLC Ver. 1.20 or later.

3.1.6 Memory cassette

F

Model name	Description
FX3G-EEPROM-32L	32k-step EEPROM memory (with transfer switch) The FX3S Series PLC can hold 16,000 steps of memory, but user program capacity is limited to 4,000 steps.

3.2 Connector Types and Cables for Program Communication



No.	Shape of connector or combination with cable	
1	D-SUB 9 Pin	2 "FX-422CAB0" + 1 "F2-232CAB-1" + "FX-232AWC-H"
		5 FX-232CAB-1
	Half pitch 14 Pin	2 "FX-422CAB0" + 1 "F2-232CAB-2" + "FX-232AWC-H"
		5 FX-232CAB-2
	D-SUB 25 Pin	2 "FX-422CAB0" + 1 "F2-232CAB" + "FX-232AWC-H"
		5 F2-232CAB-1
2	FX-30P MINI DIN 8 Pin [RS-422]	3 FX-20P-CAB0
3	USB A connector	4 USB cable → **Refer to Subsection 3.2.2.**

No.	Shape of connector or combination with cable
4	FX3G-232-BD D-SUB 9 Pin [RS-232C] FX3U-232ADP(-MB) D-SUB 9 Pin [RS-232C]
5	FX3G-422-BD MINI DIN 8 Pin [RS-422]
6	FX3S-CNV-ADP
7	Expansion board connector
8	Peripheral device connector [RS-422] MINI DIN 8 Pin
9	Peripheral device connector [USB] Mini-B connector [USB 2.0]

3.2.1 Programming tool

The following programming tools support FX3S Series PLCs.

→ **For more information, refer to 5. Version Information and Peripheral Equipment Connectability.**

Model name	Description
GX Works2	Version 1.492N or later of SW□DNC-GXW2-E supports the FX3S.
FX-30P	Version 1.50 or later of FX-30P supports the FX3S.

3.2.2 Communication cables

1
2
3
4
5

Model name		Description
USB cable		
USB cable*1 4	3 m (9'10")	USB A plug <-> USB Mini-B plug For connection between personal computer and FX3S programming port (USB)
RS-232C cable		
F2-232CAB-1 1	3 m (9'10")	D-SUB 9 Pin <-> D-SUB 25 Pin For connection between personal computer and RS-232C/RS-422 converter
F2-232CAB 1	3 m (9'10")	D-SUB 25 Pin <-> D-SUB 25 Pin For connection between personal computer and RS-232C/RS-422 converter
F2-232CAB-2 1	3 m (9'10")	Half-pitch 14 Pin <-> D-SUB 25 Pin For connection between personal computer and RS-232C/RS-422 converter
FX-232CAB-1 5	3 m (9'10")	D-SUB 9 Pin <-> D-SUB 9 Pin For connection between personal computer and RS-232C/RS-422 converter FX3G-232-BD, FX3U-232ADP(-MB)
FX-232CAB-2 5	3 m (9'10")	Half-pitch 14 Pin <-> D-SUB 9 Pin For connection between personal computer and RS-232C/RS-422 converter FX3G-232-BD, FX3U-232ADP(-MB)
RS-422 cable		
FX-422CAB0 2	1.5 m (4'11")	D-SUB 25 Pin <-> MINI DIN 8 Pin For connection between RS-232C/RS-422 converter and FX3S programming port (RS-422), FX3G-422-BD
FX-20P-CAB0 3	1.5 m (4'11")	MINI DIN 8 Pin <-> MINI DIN 8 Pin For connection between FX-30P and FX3S programming port (RS-422), FX3G-422-BD

*1. The following USB cables are applicable.

Model name	Description
MR-J3USBCBL3M	USB cable 3 m (9'10")
GT09-C30USB-5P	USB cable to transfer personal computer data (USB A plug) 3 m (9'10")

3.2.3 Converters and interface

Model name	Description
RS-232C/RS-422 converters	
FX-232AWC-H*2	RS-232C/RS-422 converter Communication speed: Applicable to 9,600 to 115,200 bps.

*2. When the programming software is not applicable to FX3S or FX3G, the converter is applicable only to 9,600 or 19,200 bps.

4. Specifications, External Dimensions and Terminal Layout (Main Units)

This chapter explains the specifications, external dimensions and terminal layout of the main units.

4.1 Generic Specifications

The generic specifications for the main unit are explained below.

Item	Specification				
Ambient temperature	0 to 55 °C (32 to 131 °F) when operating and -25 to 75 °C (-13 to 167 °F) when stored				
Ambient humidity	5 to 95 %RH (no condensation) when operating				
Vibration resistance*1		Frequency (Hz)	Acceleration (m/s^2)	Half amplitude (mm)	
	When installed on DIN rail	10 to 57	-	0.035	Sweep Count for X, Y, Z: 10 times (80 min in each direction)
		57 to 150	4.9	-	
	When installed directly	10 to 57	-	0.075	
		57 to 150	9.8	-	
Shock resistance*1	147 m/s^2 Acceleration, Action time: 11 ms, 3 times by half-sine pulse in each direction X, Y, and Z				
Noise resistance	By noise simulator at noise voltage of 1,000 Vp-p, noise width of 1 μs, rise time of 1 ns and period of 30 to 100 Hz				
Dielectric withstand voltage	1.5 kV AC for 1 min	Between each terminals and ground terminal*2			
	500 V AC for 1 min				
Insulation resistance	5 MΩ or higher by 500 V DC insulation resistance tester				
Grounding	Class D grounding (grounding resistance: 100 Ω or less) <Common grounding with a heavy electrical system is not allowed.>*3				
Working atmosphere	Free from corrosive or flammable gas and excessive conductive dust				
Working altitude	<2000 m*4				
Installation location	Inside a control panel*5				
Overvoltage category	II or less				
Pollution degree	2 or less				

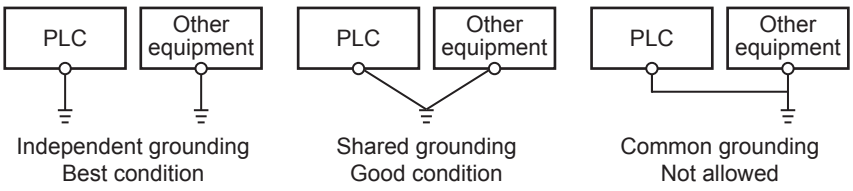
*1. The criterion is shown in IEC61131-2.

*2. For more information on the dielectric withstand voltage test and the insulation resistance test of the terminals of each product, refer to the following.

→ **Refer to Subsection 4.1.1.**

*3. Ground the PLC independently or jointly.

→ **Refer to Section 8.3.**



*4. The PLC cannot be used at a pressure higher than the atmospheric pressure to avoid damage.

*5. The programmable controller is assumed to be installed in an environment equivalent to indoor.

4.1.1 Dielectric withstand voltage test and insulation resistance test

Perform dielectric withstand voltage test and insulation resistance test at the following voltage between each terminals and the main unit ground terminal.

Terminal	Dielectric strength	Insulation resistance	Remark
Terminals of main unit			
Between power supply terminal (AC power) and ground terminal	1.5 kV AC for 1 min	5 MΩ or higher by 500 V DC insulation resistance tester	-
Between power supply terminal (DC power) and ground terminal	500 V AC for 1 min		-
Between input terminal (24 V DC) and ground terminal			-
Between output terminal (relay) and ground terminal	1.5 kV AC for 1 min		-
Between output terminal (transistor) and ground terminal	500 V AC for 1 min		-
Main unit analog input terminal and ground terminal	Not allowed	Not allowed	-
Terminals of expansion boards, special adapters			
Between terminal of expansion board (except FX3G-4EX-BD and FX3G-2EYT-BD) and ground terminal	Not allowed	Not allowed	Since the expansion board and the main unit CPU are not insulated, it is not allowed to perform the dielectric withstand voltage test and insulation resistance test between them.
Between FX3G-4EX-BD input terminal (24 V DC) and ground terminal	500 V AC for 1 min	5 MΩ or higher by 500 V DC insulation resistance tester	-
Between FX3G-2EYT-BD output terminal (transistor) and ground terminal			-
Between terminal of special adapter and ground terminal			-

4.2 Power Supply Specifications

The power supply specifications for the main unit are explained below.

4.2.1 AC power type

Item	Specification			
	FX3S-10M□/E□	FX3S-14M□/E□	FX3S-20M□/E□	FX3S-30M□/E□
Supply voltage	100 to 240 V AC			
Voltage fluctuation range	-15%, +10%			
Rated frequency	50/60 Hz			
Allowable instantaneous power failure time	Operation can be continued upon occurrence of instantaneous power failure for 10 ms or less.			
Power fuse	250 V 1 A			
Rush current	15 A max. 5 ms or less/100 V AC, 28 A max. 5 ms or less/200 V AC			
Power consumption*1	19 W	19 W	20 W	21 W
24 V DC service power supply	400 mA			

*1. This item shows values when all 24 V DC service power supplies are used in the maximum configuration connectable to the main unit, and includes the input current (5 or 7 mA per point).

4.2.2 DC power type

Item	Specification			
	FX3S-10M□/D□	FX3S-14M□/D□	FX3S-20M□/D□	FX3S-30M□/D□
Supply voltage	24 V DC			
Voltage fluctuation range	-15%, +10%			
Allowable instantaneous power failure time	Operation can be continued upon occurrence of instantaneous power failure for 5 ms or less.			
Power fuse	250 V 1.6 A			
Rush current	20 A max. 1 ms or less/24 V DC			
Power consumption*2	6 W	6.5 W	7 W	8.5 W
24 V DC service power supply	-			

*2. There power consumption values are maximum values which include consumption of all expansion equipment and input current (5 or 7 mA per point).

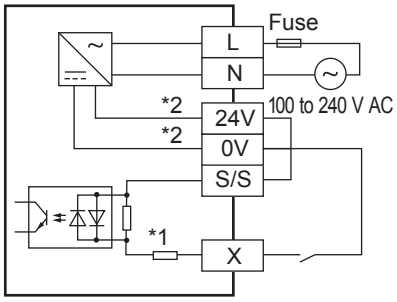
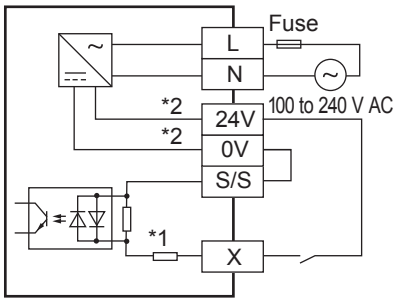
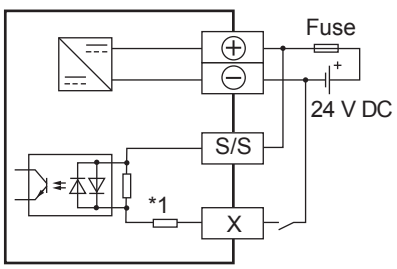
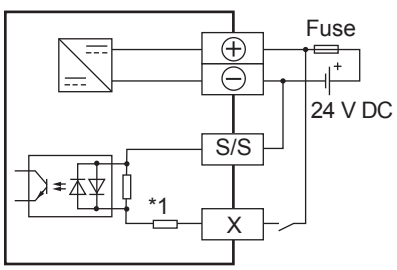
4.3 Input Specifications

The input specifications for the main unit are explained below.

→ **For the specifications of the built-in analog input, refer to Chapter 11.**

4.3.1 24 V DC Input (sink/source)

→ **For details on sink input and source input, refer to Subsection 9.1.1.**

Item		Specification			
		FX3S-10M□	FX3S-14M□	FX3S-20M□	FX3S-30M□
Number of input points		6 points	8 points	12 points	16 points
Input connecting type		Fixed terminal block (M3 screw)			
Input form		Sink/Source			
Input signal voltage		AC power type: 24 V DC ±10 % DC power type: 20.4-26.4 V DC			
Input impedance	X000 to X007	3.3 kΩ			
	X010 to X017	-		4.3 kΩ	
Input signal current	X000 to X007	7 mA/24 V DC			
	X010 to X017	-		5 mA/24 V DC	
ON input sensitivity current	X000 to X007	4.5 mA or more			
	X010 to X017	-		3.5 mA or more	
OFF input sensitivity current		1.5 mA or less			
Input response time		Approx. 10 ms			
Input signal form (Input sensor form)	Sink input	No-voltage contact input NPN open collector transistor			
	Source input	No-voltage contact input PNP open collector transistor			
Input circuit insulation		Photocoupler insulation			
Input operation display		LED on panel lights when photocoupler is driven.			
Input circuit configuration		• AC power type Sink input wiring  Source input wiring  • DC power type Sink input wiring  Source input wiring 			

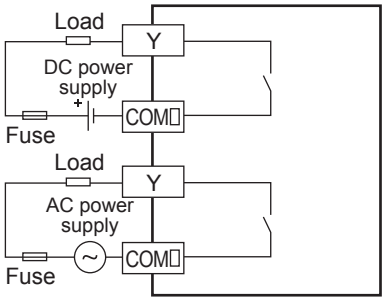
*1. Input impedance.

*2. The "24V" and "0V" terminals are located on the output terminal side.
For details on the terminal layout, refer to Section 4.7.

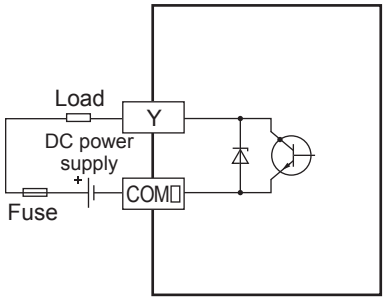
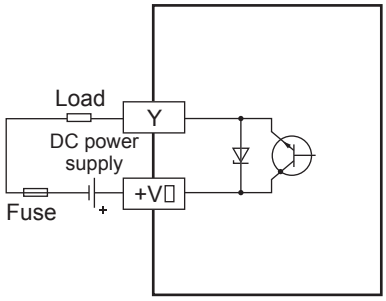
4.4 Output Specifications

The output specifications for the main unit are explained below.

4.4.1 Relay output specifications

Item		Relay output specification			
		FX3S-10MR□	**FX3S-14MR□**	**FX3S-20MR□**	**FX3S-30MR□**
Number of output points		4 points	6 points	8 points	14 points
Output connecting type		Fixed terminal block (M3 screw)			
Output form		Relay			
External power supply		30 V DC or less, 240 V AC or less (250 V AC or less when the unit does not comply with CE, UL or cUL standards.)			
Max. load	Resistance load	2 A/point The total load current of resistance loads per common terminal should be the following value. → **For details on the common terminal for each model, refer to the Section 4.7.** • 1 output point/common terminal: 2 A or less • 4 output points/common terminal: 8 A or less			
	Inductive load	80 VA (UL and cUL standards approved at 120 and 240 V AC.) → **For the product life, refer to Subsection 14.4.2.** → **For cautions on external wiring, refer to Subsection 12.1.3.**			
Min. load		5 V DC, 2 mA (reference value)			
Open circuit leakage current		-			
Response time	OFF→ON ON→OFF	Approx. 10 ms			
Output circuit insulation		Mechanical insulation			
Output operation display		LED on panel lights when power is applied to relay coil.			
Output circuit configuration		 A common number applies to the □ of [COM□].			

4.4.2 Transistor output specifications

Item		Transistor output specification			
		FX3S-10MT□	**FX3S-14MT□**	**FX3S-20MT□**	**FX3S-30MT□**
Number of output points		4 points	6 points	8 points	14 points
Output connecting type		Fixed terminal block (M3 screw)			
Output form		Transistor/sink output (FX3S-□MT/□S, FX3S-30MT/ES-2AD) Transistor/source output (FX3S-□MT/□SS, FX3S-30MT/ESS-2AD)			
External power supply		5-30 V DC			
Max. load	Resistance load	0.5 A/point The total load current of resistance loads per common terminal should be the following value. → **For details on the common terminal for each model, refer to the Section 4.7.** • 1 output point/common terminal: 0.5 A or less • 4 output points/common terminal: 0.8 A or less			
	Inductive load	12 W/24 V DC The total of inductive loads per common terminal should be the following value. → **For details on the common terminal for each model, refer to the Section 4.7.** • 1 output point/common terminal: 12 W or less/24 V DC • 4 output points/common terminal: 19.2 W or less/24 V DC			
Open circuit leakage current		0.1 mA or less/30 V DC			
ON voltage		1.5 V or less			
Response time	OFF→ON ON→OFF	Y000, Y001: 5 μs or less/10 mA or more (5-24 V DC) Y002 to Y015: 0.2 ms or less/200 mA or more (at 24 V DC)			
Output circuit insulation		Photocoupler insulation			
Output operation display		LED on panel lights when photocoupler is driven.			
Output circuit configuration		Sink output wiring  A common number applies to the □ of [COM□]. Source output wiring  A common number applies to the □ of [+V□].			

4.5 Performance Specifications

The performance specifications for the main unit are explained below.

Item		Performance		
Operation control system		Stored program repetitive operation system with interruption function.		
Input/output control system		Batch processing system (when END instruction is executed) Input/output refresh instruction and pulse catch function are provided.		
Programming language		Relay symbol system + step-ladder system (SFC notation possible)		
Program memory	Built-in memory capacity/type	16,000 steps/EEPROM memory (Program capacity is 4000 steps.) Max. allowable write: 20,000 times		
	Memory cassette (Option)	32,000 steps/EEPROM memory (with loader function) The FX3S Series PLC is available only to 16,000 steps. (Program capacity is 4000 steps.) Max. allowable write: 10,000 times		
	Writing function during running	Provided (Program can be modified while the PLC is running.) → **For the writing function during running, refer to Subsection 5.2.5.**		
	Keyword function	With keyword/Customer keyword function		
Real-time clock	Clock function*1	Built-in 1980 to 2079 (with correction for leap year) 2- or 4-digit year, accuracy within 45 seconds/month at 25 °C		
Kinds of instructions	Basic instructions	Sequence instructions: 29 Step-ladder instructions: 2		
	Applied instructions	116 kinds		
Processing speed	Basic instructions	0.21 μs/instruction		
	Applied instructions	0.5 μs to several hundred μs/instruction		
Number of input/ output points	Input points	16 points or less (Extension is impossible.)		
	Output points	14 points or less (Extension is impossible.)		
Input/output relay	Input relay	X000 to X017	The device numbers are octal.	
	Output relay	Y000 to Y015		
Auxiliary relay	For general	M0 to M383	384 points	
	EEPROM keep	M384 to M511	128 points	
	For general	M512 to M1535	1024 points	
	For special	M8000 to M8511	512 points	
State	For initial state (EEPROM keep)	S0 to S9	10 points	
	EEPROM keep	S10 to S127	118 points	
	For general	S128 to S255	128 points	
Timer (on-delay timer)	100 ms	T0 to T31	32 points	0.1 to 3,276.7 sec
	100 ms/10 ms	T32 to T62	31 points	0.1 to 3,276.7 sec/0.01 to 327.67 sec When M8028 is driven ON, timers T32 to T62 (31 points) are changed to 10 ms resolution.
	1 ms	T63 to T127	65 points	0.001 to 32.767 sec
	1 ms accumulating type	T128 to T131	4 points	0.001 to 32.767 sec
	100 ms accumulating type	T132 to T137	6 points	0.1 to 3,276.7 sec
Variable analog potentiometers		Available as analog timers VR1: D8030 VR2: D8031 → **For compatible PLCs, refer to Chapter 11.**		
Analog inputs		Available as voltage inputs ch1: D8270 ch2: D8271 → **For compatible PLCs, refer to Chapter 11.**		
Counter	16 bits up (For general)	C0 to C15	16 points	Counting from 0 to 32,767
	16 bits up (EEPROM keep)	C16 to C31	16 points	Counting from 0 to 32,767
	32 bits up/down (For general)	C200 to C234	35 points	Counting from -2,147,483,648 to +2,147,483,647

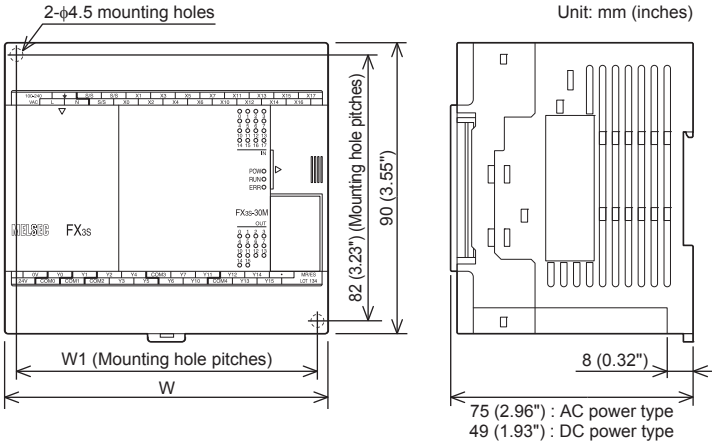
Item		Performance		
High-speed counter	1-phase 1-count input in both directions (32 bits up/down) (EEPROM keep)	C235 to C245	Counting from -2,147,483,648 to +2,147,483,647	
	1-phase 2-count input in both directions (32 bits up/down) (EEPROM keep)	C246 to C250		
	2-phase 2-count input in both directions (32 bits up/down) (EEPROM keep)	C251 to C255		
Data register (32 bits when paired)	For general (16 bits)	D0 to D127	128 points	
	For EEPROM keep (16 bits)	D128 to D255	128 points	
	For general (16 bits)	D256 to D2999	2744 points	
	File register (EEPROM keep)	D1000 to D2999	Max. 2000 points	Can be set as file registers in units of 500 points from D1000 in the program area (EEPROM) using parameters.
	For special (16 bits)	D8000 to D8511	512 points	
	For index (16 bits)	V0 to V7 Z0 to Z7	16 points	
Pointer	For branching of JUMP and CALL	P0 to P255	256 points	For CJ instructions and CALL instructions
	Input interruption	I0□□ to I5□□	6 points	
	Timer interruption	I6□□ to I8□□	3 points	
Nesting	For master control	N0 to N7	8 points	For MC instructions
Constant	Decimal number (K)	16 bits	-32,768 to +32,767	
		32 bits	-2,147,483,648 to +2,147,483,647	
	Hexadecimal number (H)	16 bits	0 to FFFF	
		32 bits	0 to FFFFFFFF	
	Real number (E)	32 bits	-1.0×2^{128} to -1.0×2^{-126}, 0 , 1.0×2^{-126} to 1.0×2^{128} Decimal-point and exponential notations are possible.	

*1. The current time of the clock is backed up by the capacitor built-in the PLC. Supply the power to the PLC for 30 minutes or more to completely charge this large-capacity capacitor.
(The capacitor works for 10 days (atmosphere: 25 °C)

4.6 External Dimensions (Weight/Accessories/Installation)

The external dimensions of the main unit are explained.

4.6.1 Main units



Series	Model name	W: mm (inches)	W1: mm (inches) Direct mounting hole pitches	MASS (Weight): kg (lbs)
FX3S-10M□	FX3S-10MR/ES	60 (2.37”)	52 (2.05”)	Approx. 0.30 (0.66 lbs)
	FX3S-10MT/ES			
	FX3S-10MT/ESS			
	FX3S-10MR/DS			Approx. 0.22 (0.48 lbs)
	FX3S-10MT/DS			
	FX3S-10MT/DSS			
FX3S-14M□	FX3S-14MR/ES	60 (2.37”)	52 (2.05”)	Approx. 0.30 (0.66 lbs)
	FX3S-14MT/ES			
	FX3S-14MT/ESS			
	FX3S-14MR/DS			Approx. 0.22 (0.48 lbs)
	FX3S-14MT/DS			
	FX3S-14MT/DSS			
FX3S-20M□	FX3S-20MR/ES	75 (2.96”)	67 (2.64”)	Approx. 0.40 (0.88 lbs)
	FX3S-20MT/ES			
	FX3S-20MT/ESS			
	FX3S-20MR/DS			Approx. 0.30 (0.66 lbs)
	FX3S-20MT/DS			
	FX3S-20MT/DSS			
FX3S-30M□	FX3S-30MR/ES(-2AD)	100 (3.94”)	92 (3.63”)	Approx. 0.45 (0.99 lbs)
	FX3S-30MT/ES(-2AD)			
	FX3S-30MT/ESS(-2AD)			
	FX3S-30MR/DS			Approx. 0.35 (0.77 lbs)
	FX3S-30MT/DS			
	FX3S-30MT/DSS			

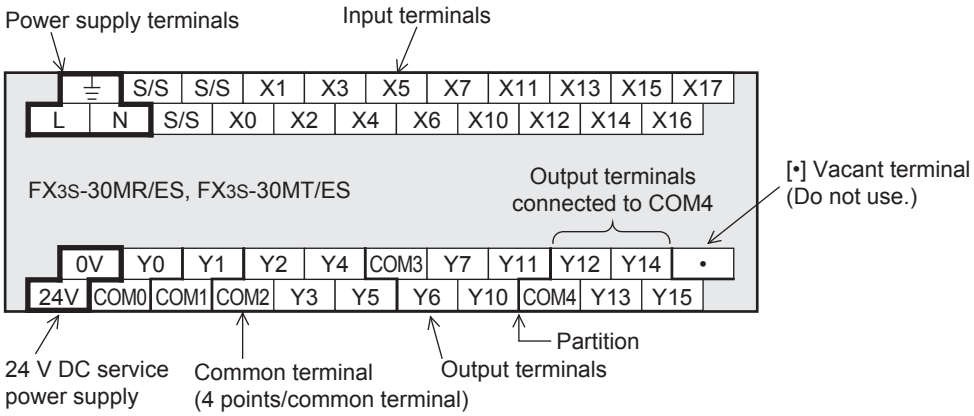
1) Accessories
Dust proof protection sheet
Manual supplied with product

2) Installation
35 mm (1.38") wide DIN rail or Direct installation (with M4 screws)

4.7 Terminal Layout

The terminal layout of the main unit are explained.

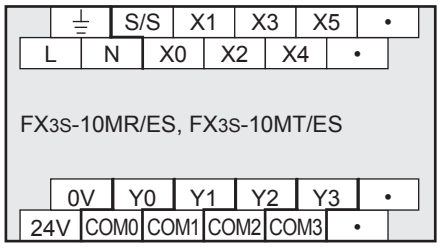
4.7.1 Interpretation of terminal block layout



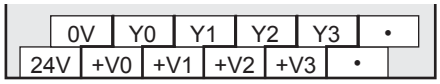
- Indication of power supply terminals
  The AC power supply type has [L] and [N] terminals.
  The DC power supply type has [⊕] and [⊖] terminals.
  For external wiring, make sure to read the power supply wiring described later.
  → **Refer to Chapter 8.**
- Indication of 24 V DC service power supply
  The AC power supply type has [0V] and [24V] terminals, whereas the DC power supply type shows [•] since the DC power supply type does not have the service power supply.
  [•] represents vacant terminals.
  Do not connect with vacant terminals.
  For external wiring, make sure to read the power supply wiring described later.
  → **Refer to Chapter 8.**
- Indication of input terminal
  Both AC and DC power supply type have the same input terminals, however, the external input wiring differs from each other.
  For external wiring, make sure to read the input wiring described later.
  → **Refer to Chapter 9.**
- Indication of output terminals connected to common terminal
  One common terminal covers 1 or 4 output points.
  The output numbers (Y) connected to a common terminal are enclosed with heavy partition lines.
  For transistor output (source) type, [COM☐] is [+V☐].

4.7.2 FX3S-10M□

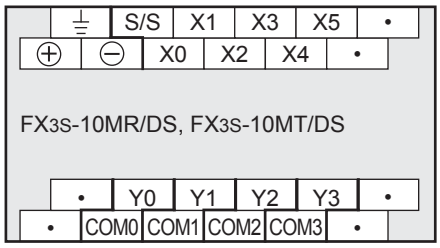
- AC power type



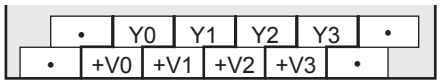
FX3S-10MT/ESS



- DC power type

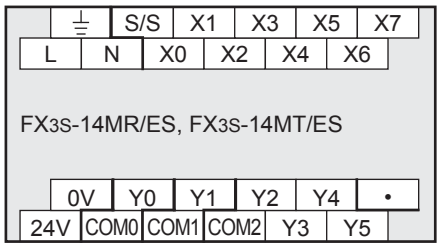


FX3S-10MT/DSS

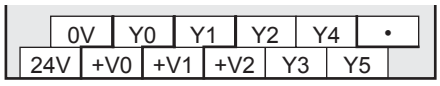


4.7.3 FX3S-14M□

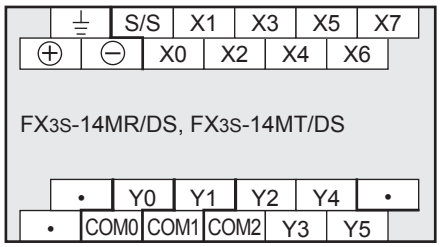
- AC power type



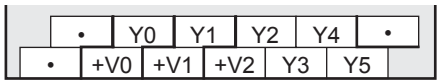
FX3S-14MT/ESS



- DC power type

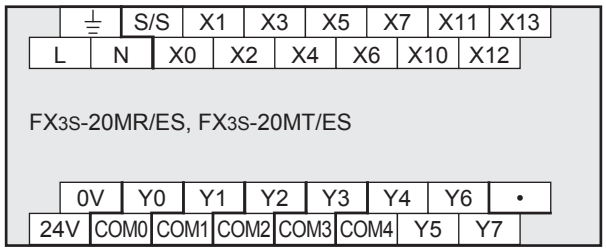


FX3S-14MT/DSS

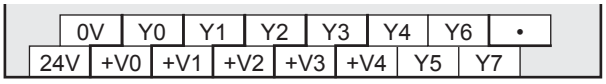


4.7.4 FX3S-20M□

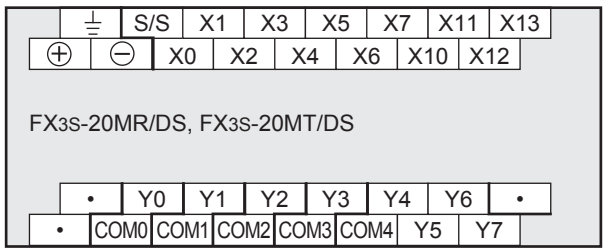
- AC power type



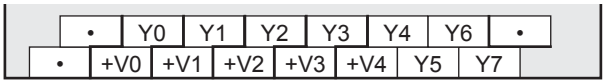
FX3S-20MT/ESS



- DC power type

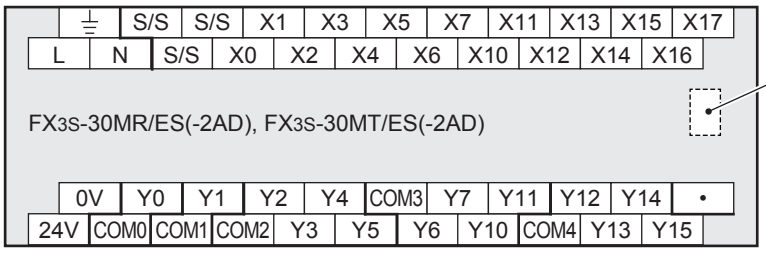


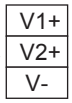
FX3S-20MT/DSS



4.7.5 FX3S-30M□

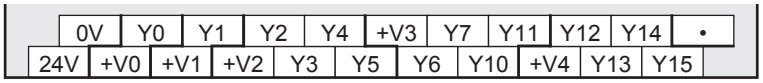
- AC power type



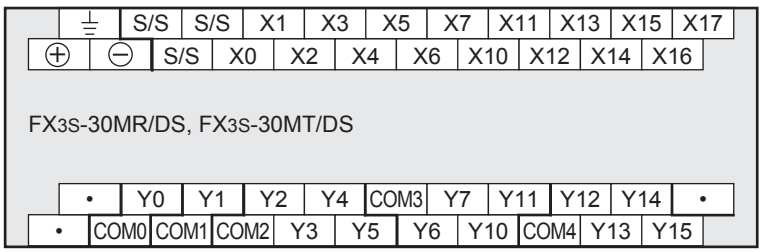


An analog input terminal is built into FX3S-30M□/E□-2AD.

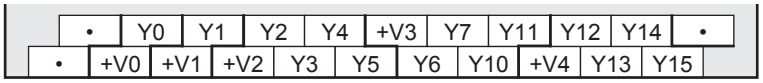
FX3S-30MT/ESS(-2AD)



- DC power type



FX3S-30MT/DSS



5. Version Information and Peripheral Equipment Connectability

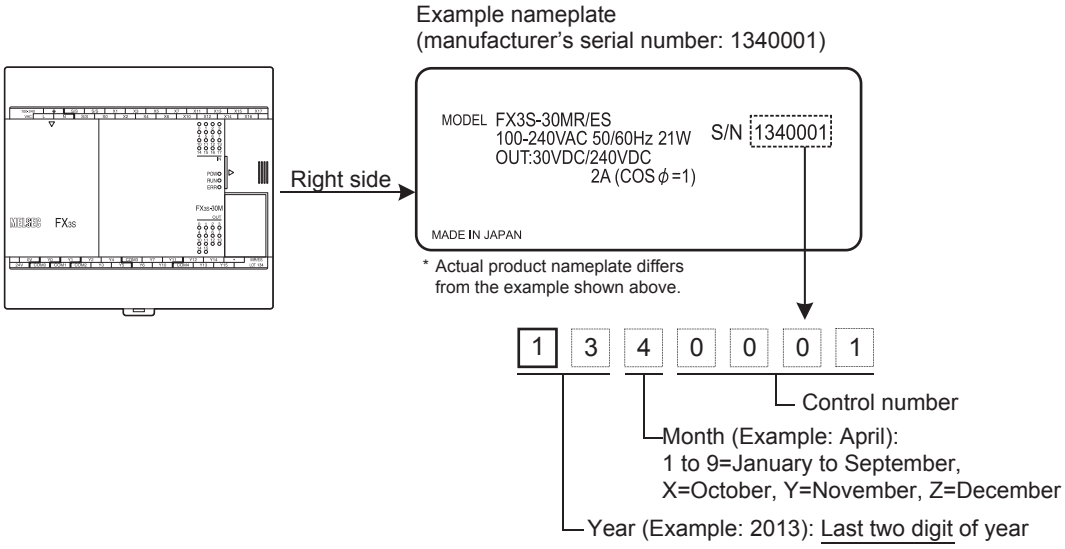
5.1 Version Information

5.1.1 Manufacturer's serial number check method

The year and month of production of the product can be checked on the nameplate, and "LOT" indicated on the front of the product.

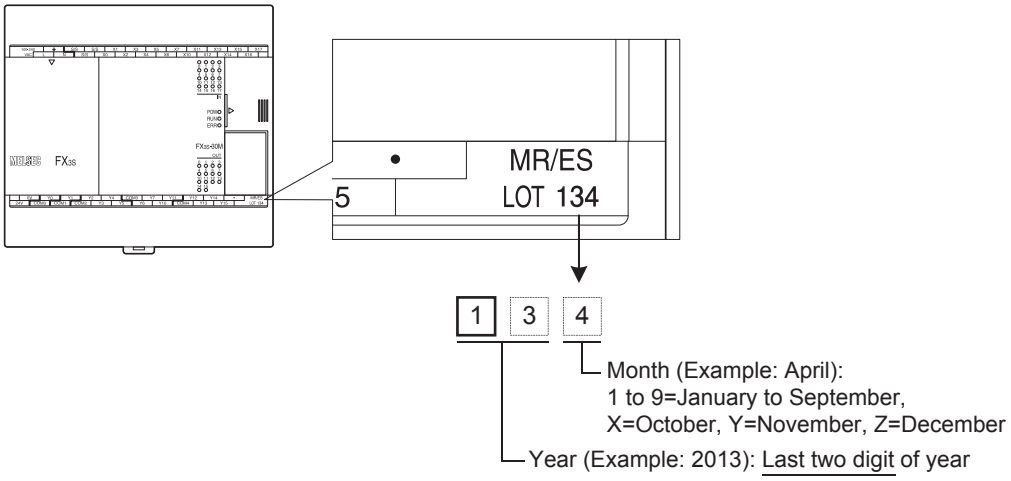
1. Checking the name plate

The year and month of production of the product can be checked from the manufacturer's serial number S/N indicated on the label adhered to the right side of the product.



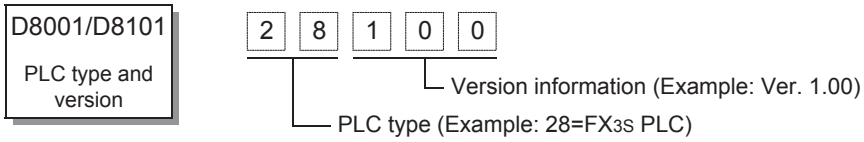
2. Checking the front of the product

The year and month of production of the product can be checked from the manufacturer's serial number "LOT" on the front (at the bottom) of the product.



5.1.2 Version check method

The PLC version number can be checked by reading the last three digits of device D8001/D8101.



5.1.3 Version upgrade history

FX3S Series performed the following upgrade.

Version	Manufacturer's serial number	Contents of version upgrade
Ver. 1.00	133**** (March, 2013)	First product
Ver. 1.10	13X**** (October, 2013)	• FX3S-30M□/E□-2AD (First product) • Supports connection of following expansion boards: FX3G-4EX-BD, FX3G-2EYT-BD
Ver. 1.20	14X**** (October, 2014)	• Supports connection of display module (FX3S-5DM).

5.2 Programming Tool Applicability

5.2.1 Applicable versions of programming tool

1. GX Works2

GX Works2 is applicable to FX3S PLCs from the following versions.

FX3S PLC version	Applicable GX Works2 version
Ver. 1.00	Ver. 1.492N or later

2. FX-30P

FX-30P is applicable to FX3S PLCs from the following version.

FX3S PLC version	Applicable FX-30P version
Ver. 1.00	Ver. 1.50 or later

5.2.2 In the case of programming tool (version) not applicable

Inapplicable programming tools can be used by selecting an alternative PLC model.

1. Alternative model setting

Model to be programmed	Model to be set	Priority High → Low						
FX3S PLC	FX3S	→	FX3G	→	FX1N*1	→	FX2N*1	

*1. "FX2N" is selected when the FX-10P(-E) is used.

2. Contents of restrictions

- Programming is enabled only in the function range such as instructions, device ranges and program sizes available in both the FX3S PLC and the PLC selected as the alternative model.
- When the FX-10P(-E) is used, the function range such as instructions, device ranges and program sizes is limited to that available in both the FX3S PLC and the FX2N PLC.
- Use a programming tool that can select either FX3G to change parameters, i.e. memory capacity, file register capacity, etc.
- Memory capacity must be set to 4000 steps or less.
- Use a programming tool that can select the FX3G model to program using the built-in USB port.

5.2.3 Program transfer speed and programming tools

1. Built-in USB communication

The FX3S PLC has a built-in USB communication port, and performs program writing, program reading and monitoring at high speed (12 Mbps) with a personal computer that supports USB.

1) Supported programming tools*1
GX Works2, GX Developer

2) In programming tools not supporting USB
Communication is performed via RS-422 or RS-232C.

2. RS-422/RS-232C communication

The FX3S PLC can write and read programs and perform monitoring at 115.2 kbps through RS-422/RS-232C communication.

1) 115.2 kbps supported programming tools*1
GX Works2, GX Developer, FX-30P

2) 115.2 kbps supported interfaces
- Standard built-in port (RS-422) or expansion board FX3G-422-BD for RS-422
When the RS-232C/RS-422 converter FX-232AWC-H is connected.
- Expansion board FX3G-232-BD for RS-232C
- Special adapter FX3U-232ADP(-MB) for RS-232C

3) In programming tools not supporting 115.2 kbps
Communication is executed at 9,600 or 19,200 bps.

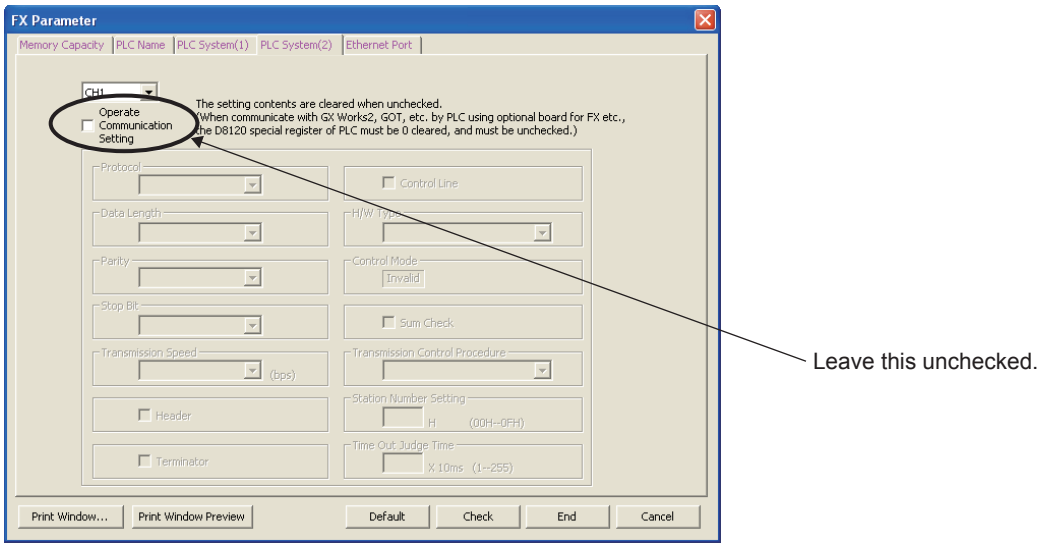
*1. When the currently used programming tool does not support the FX3S PLC, use a programming tool which allows selection of the FX3G PLC as the alternative model.

5.2.4 Cautions on connecting peripheral equipment by way of expansion board or special adapter

When connecting peripheral equipment (programming tool or GOT [CPU direct connection]) by way of the FX3G-232-BD, FX3G-422-BD or FX3U-232ADP(-MB), set as follows. If the setting is not specified with the status below, communication error may occur in the connected peripheral equipment.

→ **For details, refer to the Data Communication Edition.**

- Set to "K0" the special data register (D8120 or D8400) for communication format setting.
- Set the communication parameter "PLC system(2)" of the channel connecting the peripheral equipment to "Not set" (as shown in the window below).



5.2.5 Cautions on write during RUN

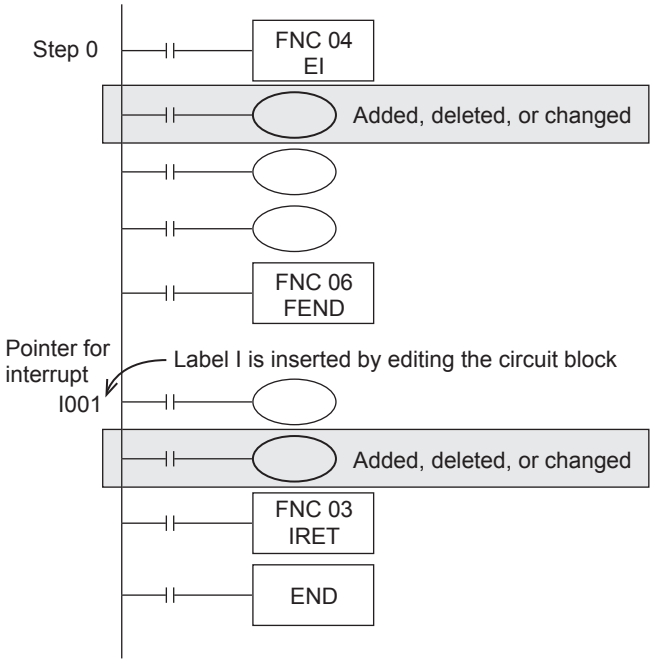
Write during RUN (program changes during RUN) is available in the FX3S PLC when GX Works2 is used. However, list programs and SFC programs cannot be written during RUN.
When programming software not supporting the FX3S PLC is used, write during RUN is available within the function range available in both the FX3S PLC and the PLC selected as the alternative model.

→ **Refer to the manual of the used programming software for the operations for and cautions on write during RUN.**

Cautions on write during RUN

Item	Caution
Program memories which can be written in RUN mode	Built-in EEPROM and optional memory cassette (whose write protect switch is set to OFF)
Number of program steps which can be written for circuit change in RUN mode	256 steps or less after edition (addition/deletion) (including NOP immediately after circuit blocks except final circuit)
Circuit blocks which cannot be written in RUN mode	Circuit blocks*1 in which labels P and I are added, deleted or changed in edited circuits
	Circuit blocks in which 1 ms timers (T63 to T131) are added in edited circuits
	Circuit blocks in which the following instructions are included in edited circuits • Instruction to output high-speed counters C235 to C255 (OUT instruction)

*1. Circuit blocks cannot be edited to insert a label as shown below when written during RUN.



<table>
<tr><th>Item</th><th>Caution</th></tr>
<tr><td rowspan="6">Circuit blocks which require attention on operation after write during RUN</td><td>Avoid write during RUN to a circuit block including the following instructions during execution.
If write during RUN is executed to such a circuit block, the PLC decelerates and stops pulse output.
• DSZR (FNC150), ZRN (FNC156), PLSV (FNC157) instructions [with acceleration/deceleration operation], DRVI (FNC158) and/or DRVA (FNC159) instructions</td></tr>
<tr><td>Avoid write during RUN to a circuit block including the following instruction during execution.
If write during RUN is executed to such a circuit block, the PLC immediately stops pulse output.
• PLSV (FNC157) instruction [without acceleration/deceleration operation]</td></tr>
<tr><td>Avoid write during RUN to a circuit block including the following instructions during execution.
• PLSY (FNC 50), PWM (FNC 58) and/or PLSR (FNC 59) instructions</td></tr>
<tr><td>Avoid write during RUN to a circuit block including the following instructions during execution of communication.
If write during RUN is executed to such a circuit block, the PLC may stop communication after that.
If the PLC stops communication, set the PLC to the STOP mode once, and then set it to the RUN mode again.
• IVCK (FNC270), IVDR (FNC271), IVRD (FNC272), IVWR (FNC273), IVMC (FNC275) and ADPRW (FNC276) instructions</td></tr>
<tr><td>• Instructions for falling edge pulse
When write during RUN is completed for a circuit including an instruction for falling edge pulse (LDF, ANDF, or ORF instruction), the instruction for falling edge pulse is not executed without regard to the ON/OFF status of the target device.
When write during RUN is completed for a circuit including an instruction for falling edge pulse (PLF instruction), the instruction for falling edge pulse is not executed without regard to the ON/OFF status of the device that is set as the operation condition.
It is necessary to set to ON the target device or operation condition device once and then set it to OFF for executing the instruction for falling edge pulse.
• Instructions for rising edge pulse
When write during RUN is completed for a circuit including an instruction for rising edge pulse, the instruction for rising edge pulse is executed if a target device of the instruction for rising edge pulse or the operation condition device is ON.
Target instructions for rising edge pulse: LDP, ANDP, ORP, and pulse operation type applied instructions (such as MOVP)
<table>
<tr><th>Contact ON/OFF status (while write during RUN is executed)</th><th>Instruction for rising edge pulse</th><th>Instruction for falling edge pulse</th></tr>
<tr><td>OFF</td><td>Not executed</td><td>Not executed</td></tr>
<tr><td>ON</td><td>Executed*1</td><td>Not executed</td></tr>
</table>
*1 The PLS instruction is not executed.</td></tr>
<tr><td>Writing in RUN mode to circuit blocks including the following instructions results in the following operation
• MEP instruction (Conversion of operation result to leading edge pulse instruction)
When completing Write during RUN to a circuit including the MEP instruction, the execution result of the MEP instruction turns ON (conducting state) if the operation result up to the MEP instruction is ON.
• MEF instruction (Conversion of operation result to trailing edge pulse instruction)
When completing Write during RUN to a circuit including the MEF instruction, the execution result of the MEF instruction turns OFF (nonconducting state) regardless of the operation result (ON or OFF) up to the MEF instruction.
When the operation result up to the MEF instruction is set to ON once and then set to OFF, the execution result of the MEF instruction turns ON (conducting state)
<table>
<tr><th>Operation result up to MEP/MEF instruction</th><th>MEP instruction</th><th>MEF instruction</th></tr>
<tr><td>OFF</td><td>OFF (nonconducting)</td><td>OFF (nonconducting)</td></tr>
<tr><td>ON</td><td>ON (conducting)</td><td>OFF (nonconducting)</td></tr>
</table></td></tr>
<tr><td>Others</td><td>• When writing during RUN with GX Works2 the program is as follows.
When the number of program steps is reduced by deletion of contacts, coils and applied instructions, the program capacity becomes smaller by as many as the reduced number of steps.
• Errors cannot be detected in write during RUN even in a circuit which causes errors.
Errors are detected after the PLC is stopped once, and then run again.</td></tr>
</table>

5.3 Use of (Built-in USB) Programming Port

Make sure to set the contents described in this section when executing circuit monitor, device monitor, program reading/writing, etc. in the FX3S PLC using the (built-in USB) programming port and GX Works2.

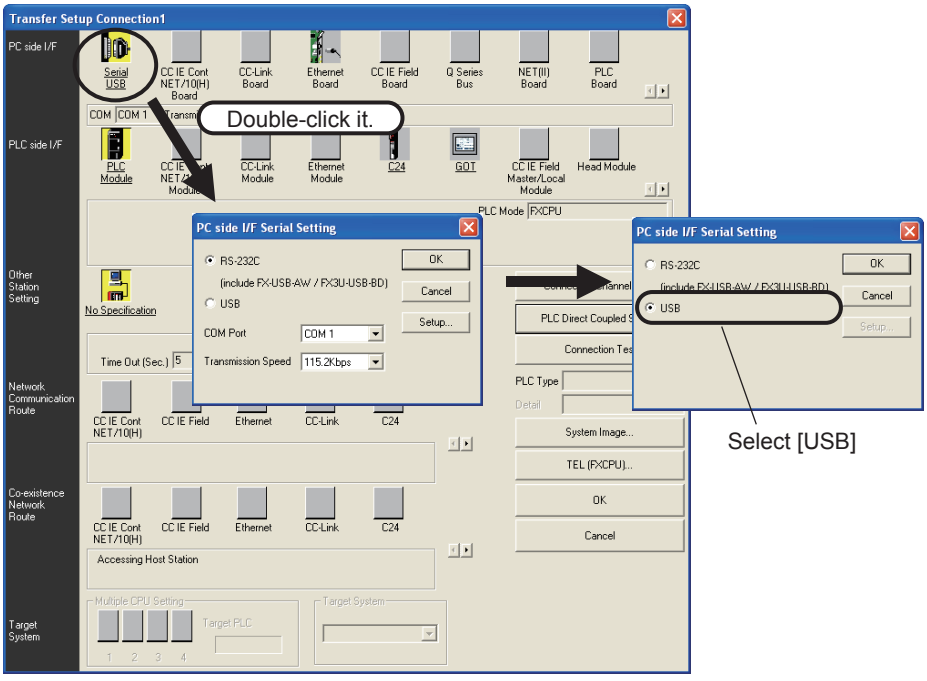
5.3.1 Installation of USB driver

It is necessary to install the USB driver to execute USB communication using the (built-in USB) programming port.
For the USB driver installation method and procedure, refer to the following manual.

→ **Refer to the GX Works2 Version 1 Operating Manual (Common)**

5.3.2 Setting in GX Works2

1. **Double-click the Connection Destination view → [Connection Destination] → [(Connection target data name)] in the Navigation window of GX Works2.**
   The [Transfer Setup Connection1] is displayed.
2. **Double-click [Serial USB] of the PC side I/F to display [PC side I/F Serial Setting].**
3. **Select [USB].**

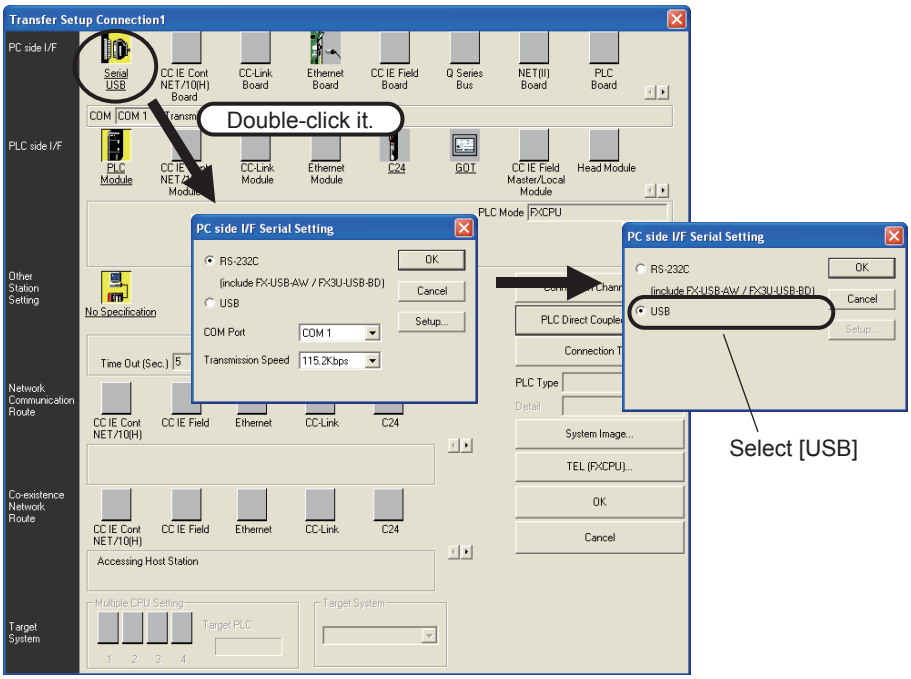


4. **Click the [OK] button to finish the setting.**

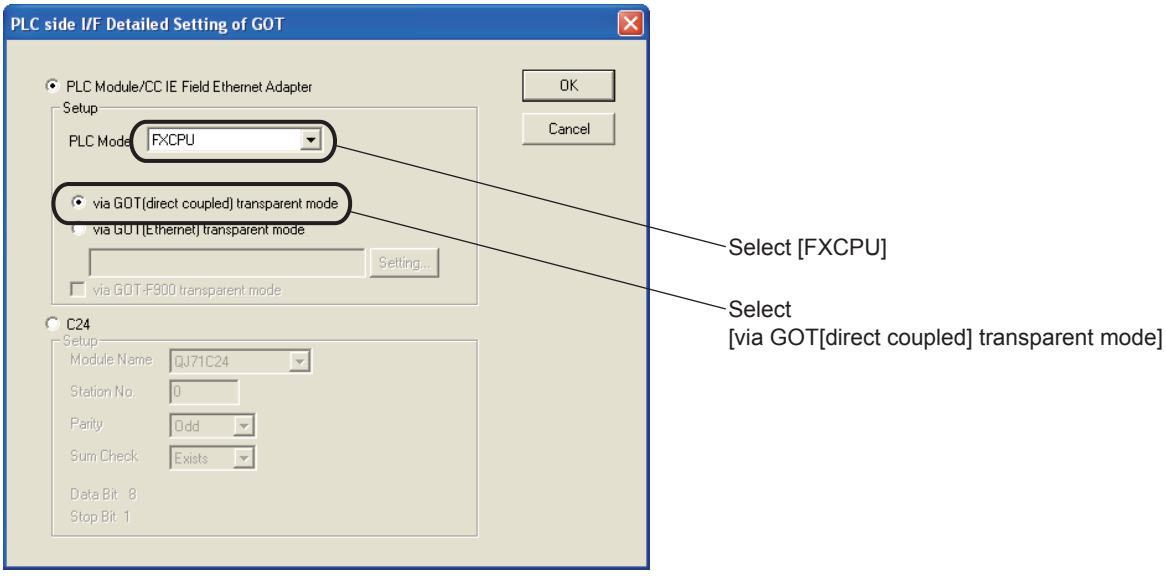
5.4 Cautions on using FA transparent function in GOT1000 Series

When monitoring circuits, device monitor, etc. or reading/writing programs in an FX3GC PLC from GX Works2 using the FA transparent function by way of USB in the GOT1000 Series, make sure to execute the following setting.

1. **Double-click the Connection Destination view → [Connection Destination] → [(Connection target data name)] in the Navigation window of GX Works2.**
   The [Transfer Setup Connection1] is displayed.
2. **Double-click [Serial USB] of the PC side I/F to display [PC side I/F Serial Setting].**
3. **Select [USB].**



4. **Double-click [GOT] of the PLC side I/F to display [PLC side I/F Detailed Setting of GOT].**
5. **Select [FXCPU], [via GOT[direct coupled] transparent mode].**

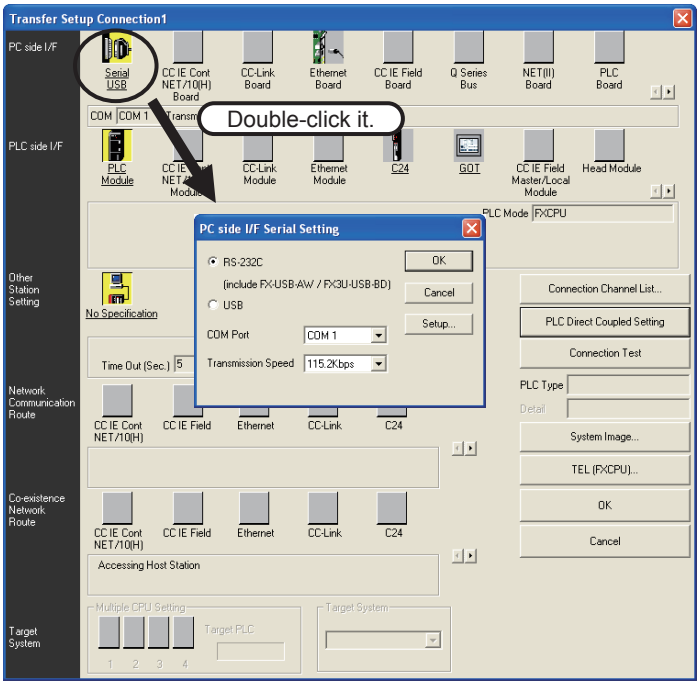


6. **Click the [OK] button to finish the setting.**

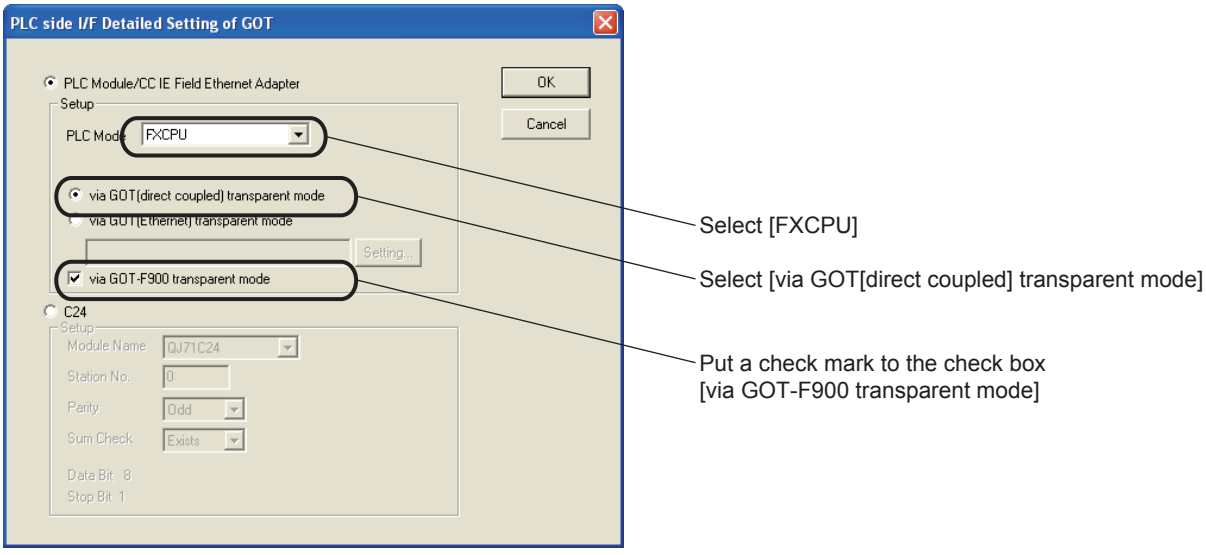
5.5 Cautions on using transparent port (2-port) function of GOT-F900 Series

When monitoring circuits, device monitor, etc. in an FX3S PLC from GX Works2 using the transparent (2-port) function in the GOT-F900 Series, make sure to execute the following setting.

1. **Double-click the Connection Destination view → [Connection Destination] → [(Connection target data name)] in the Navigation window of GX Works2.**
   The [Transfer Setup Connection1] is displayed.
2. **Double-click [Serial USB] of the PC side I/F to display [PC side I/F Serial Setting].**
3. **Select [RS-232C] in setting shown below, and set [COM port] and [Transmission Speed].**



4. **Double-click [GOT] of the PLC side I/F to display [PLC side I/F Detailed Setting of GOT].**
5. **Select [FXCPU], [via GOT[direct coupled] transparent mode] in setting shown below and put a check mark to the check box [via GOT-F900 transparent mode] .**



6. **Click the [OK] button to finish the setting.**

5.6 Other Peripheral Equipment Applicability

5.6.1 Other peripheral equipment applicability

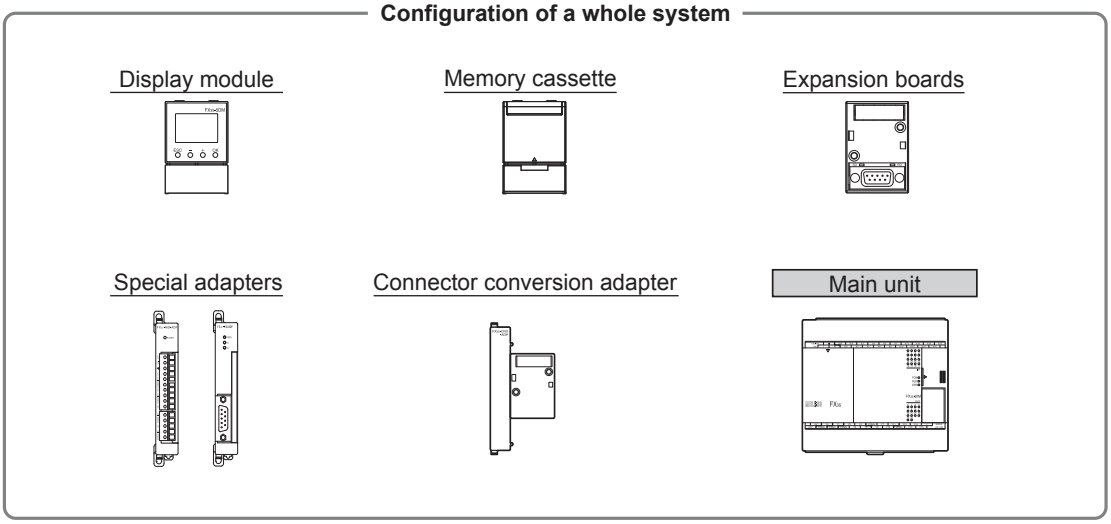
Model name	Applicability	Remarks
GOT1000 Series	Applicable	Standard monitor OS, communication driver and option OS which support the FX3S PLC are required. For details, refer to the GOT manual. This series is subject to the following restrictions when connected using unsupported standard monitor OS, communication driver or option OS. **Contents of restrictions** • When connected using standard monitor OS, communication driver and option OS which support the FX3G PLC - Programming is enabled only in the function range such as instructions, device ranges and program sizes available in both the FX3S PLC and the FX3G PLC. • When connected using standard monitor OS, communication driver and option OS which do not support the FX3G PLC - Programming is enabled only in the function range such as instructions, device ranges and program sizes available in both the FX3S PLC and the FX1N PLC. - The list editor function for MELSEC-FX is not available. When using the list editor function for MELSEC-FX, upgrade the standard monitor OS, communication driver and option OS to the version compatible with the FX3S PLC. Check the applicability of other items in the GOT manual.
GOT-F900 Series	Not available	The following restriction applies when connected. **Contents of restrictions** Programming is enabled only in the function range such as instructions, device ranges and program sizes available in both the FX3S PLC and the FX1N PLC. For applicable models, refer to the GOT manual. For connection using the 2-port interface function, refer to Section 5.5.
FX-10DM(-SET0)	Not available	The following restriction applies when connected. **Contents of restrictions** Programming is enabled only in the function range such as instructions, device ranges and program sizes available in both the FX3S PLC and the FX1N PLC. For supported models and device ranges, refer to the FX-10DM USER'S MANUAL (Manual No. JY992D86401).

6. Examination of System Configuration

6.1 Configuration of a Whole System

The configuration of a whole system is shown below as an example.

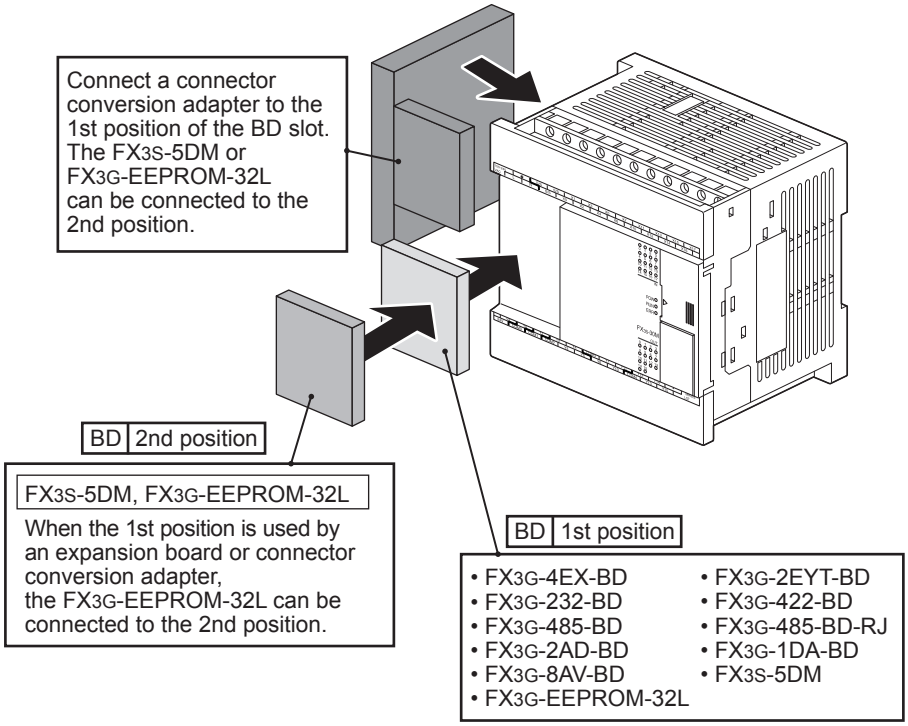
Configuration of a whole system



6.1.1 Expansion board/connector conversion adapter/memory cassette system configuration

One expansion board or connector conversion adapter, and one memory cassette can be connected.
The figure below shows the combination of each product and the available connection positions.

- 1st position: An expansion board, connector conversion adapter, display module or memory cassette can be connected.
- 2nd position: A display module or memory cassette can be connected.



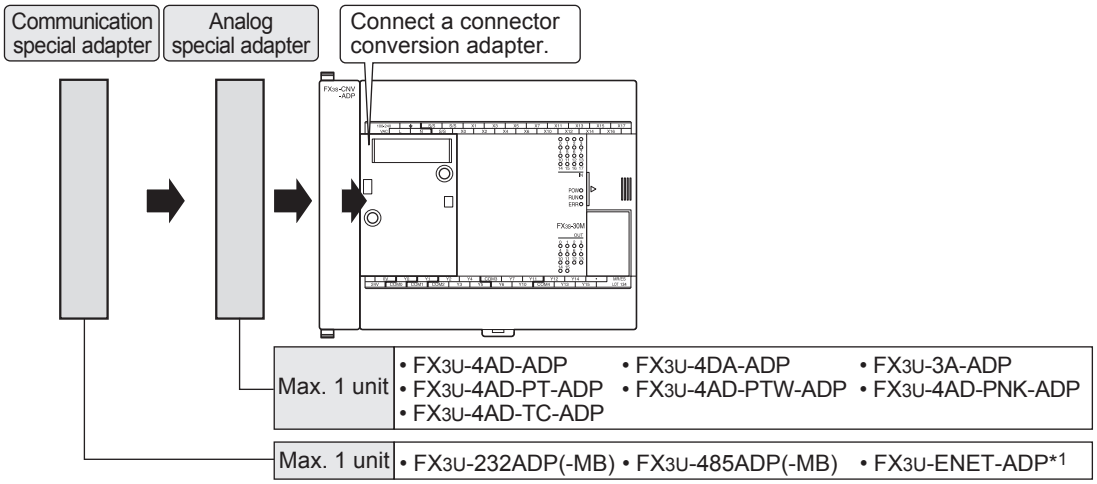
Restrictions in the use of the FX3G-422-BD

When connecting a device (such as GOT) which consumes an internal 5 V DC to each of the RS-422 port built in the main unit and the FX3G-422-BD at the same time, avoid continuous use of either device.
If both devices are used continuously, their life may be shortened due to heat generation.

<Configuration example>
RS-422 port built-in main unit + GT1020LBL (5 V DC type)
FX3G-422-BD + GT1020LBL (5 V DC type)
Avoid continuous use of two GT1020LBL (5 V DC type) units.

6.1.2 Special adapter system configuration

One special communication adapter and one special analog adapter can be connected.
A connector conversion adapter is required to use special adapters.



*1. When using the FX3U-ENET-ADP, connect it to the last adapter position (leftmost position).

7. Installation In Enclosure

DESIGN PRECAUTIONS ⚠ **WARNING**

- Make sure to have the following safety circuits outside of the PLC to ensure safe system operation even during external power supply problems or PLC failure.
  Otherwise, malfunctions may cause serious accidents.
  1) Most importantly, have the following: an emergency stop circuit, a protection circuit, an interlock circuit for opposite movements (such as normal vs. reverse rotation), and an interlock circuit (to prevent damage to the equipment at the upper and lower positioning limits).
  2) Note that when the PLC CPU detects an error, such as a watchdog timer error, during self-diagnosis, all outputs are turned off. Also, when an error that cannot be detected by the PLC CPU occurs in an input/output control block, output control may be disabled.
     External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
  3) If an overload of the 24 V DC service power supply occurs, the voltage automatically drops, inputs in the PLC are disabled, and all outputs are turned off.
     External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
  4) Note that when an error occurs in a relay or transistor output device, the output could be held either on or off.
     For output signals that may lead to serious accidents, external circuits and mechanisms should be designed to ensure safe machinery operation in such a case.

DESIGN PRECAUTIONS ⚠ **CAUTION**

- Do not bundle the control line together with or lay it close to the main circuit or power line. As a guideline, lay the control line at least 100 mm (3.94") or more away from the main circuit or power line.
  Noise may cause malfunctions.
- Install module so that excessive force will not be applied to peripheral device connectors.
  Failure to do so may result in wire damage/breakage or PLC failure.

SECURITY PRECAUTIONS ⚠ **WARNING**

- To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from unreliable networks and devices via network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

INSTALLATION PRECAUTIONS ⚠ **WARNING**

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work.
  Failure to do so may cause electric shock or damage to the product.

INSTALLATION PRECAUTIONS ⚠ **CAUTION**

- Use the product within the generic environment specifications described in Section 4.1 of this manual.
  Never use the product in areas with excessive dust, oily smoke, conductive dusts, corrosive gas (salt air, Cl_2, H_2S, SO_2 or NO_2), flammable gas, vibration or impacts, or expose it to high temperature, condensation, or rain and wind.
  If the product is used in such conditions, electric shock, fire, malfunctions, deterioration or damage may occur.
- Do not touch the conductive parts of the product directly.
  Doing so may cause device failures or malfunctions.
- Install the product securely using a DIN rail or mounting screws.
- Install the product on a flat surface.
  If the mounting surface is rough, undue force will be applied to the PC board, thereby causing nonconformities.
- Make sure to affix the expansion board with tapping screws.
  Tightening torque should follow the specifications in the manual.
  If the screws are tightened outside of the specified torque range, poor connections may cause malfunctions.
- When drilling screw holes or wiring, make sure that cutting and wiring debris do not enter the ventilation slits.
  Failure to do so may cause fire, equipment failures or malfunctions.
- Be sure to remove the dust proof sheet from the PLC's ventilation port when installation work is completed.
  Failure to do so may cause fire, equipment failures or malfunctions.
- Connect the peripheral device cables securely to their designated connectors.
  Loose connections may cause malfunctions.
- Connect the display module, memory cassette and expansion board securely to their designated connectors.
  Loose connections may cause malfunctions.
- Turn off the power to the PLC before attaching or detaching the following devices.
  Failure to do so may cause device failures or malfunctions.
  - Peripheral devices, display module, expansion boards, special adapters and memory cassette
- Connect the memory cassette securely to the appropriate connector.
  Loose connections may cause malfunctions.
  Installing the cassette in a raised or tilted posture can also cause malfunctions.

WIRING PRECAUTIONS ⚠ **WARNING**

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work.
  Failure to do so may cause electric shock or damage to the product.
- Make sure to attach the terminal cover, offered as an accessory, before turning on the power or initiating operation after installation or wiring work.
  Failure to do so may cause electric shock.
- The temperature rating of the cable should be 80°C or more.

WIRING PRECAUTIONS ⚠ **CAUTION**

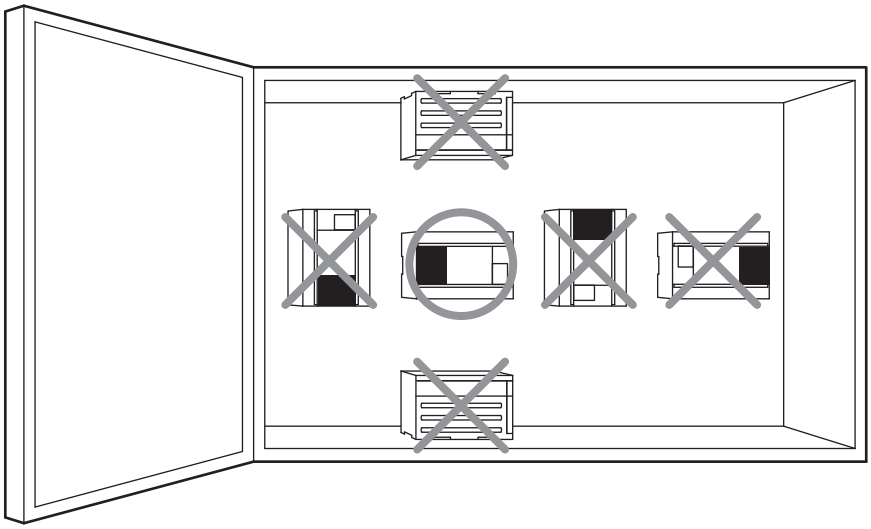
- Do not supply power to the [24V] terminal (24 V DC service power supply) on the main unit.
  Doing so may cause damage to the product.
- Perform class D grounding (grounding resistance: 100 Ω or less) to the grounding terminal on the main unit with a wire 2 mm^2 or thicker.
  Do not use common grounding with heavy electrical systems (refer to Section 8.3).
- Connect the AC power supply wiring to the dedicated terminals described in this manual.
  If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out.
- Noise resistance may be lower when the L and N wires of an AC power supply are not wired correctly.
  Please wire using the correct polarity.
- Connect the DC power supply wiring to the dedicated terminals described in this manual.
  If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out.
- Do not wire vacant terminals externally.
  Doing so may damage the product.
- When drilling screw holes or wiring, make sure cutting or wire debris does not enter the ventilation slits.
  Failure to do so may cause fire, equipment failures or malfunctions.
- Make sure to properly wire to the main unit in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - Make sure to properly wire to the main unit in accordance with the rated voltage, current, and frequency of each terminal.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.
  - Tighten the screws using a Phillips-head screwdriver No.2 (shaft diameter 6mm (0.24”) or less). Make sure that the screwdriver does not touch the partition part of the terminal block.
- Make sure to properly wire to the terminal block (European type) in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.
  - Twist the end of strand wire and make sure that there are no loose wires.
  - Do not solder-plate the electric wire ends.
  - Do not connect more than the specified number of wires or electric wires of unspecified size.
  - Affix the electric wires so that neither the terminal block nor the connected parts are directly stressed.

7.1 Installation location

Use the PLC under the environmental conditions complying with the generic specifications (Section 4.1).

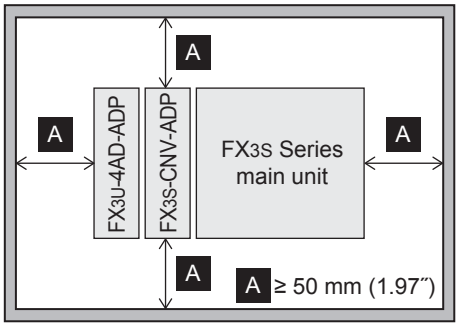
Notes
• Keep a space of 50 mm (1.97") or more between the unit main body and another device or structure. Install the unit as far away as possible from high-voltage lines, high-voltage devices and power equipment. Failure to do so may cause fire, equipment failures or malfunctions. • To prevent temperature rise, do not install the PLC on a floor, a ceiling or a vertical surface. Install it horizontally on a wall as shown in Subsection 7.1.1.

7.1.1 Installation location in enclosure



7.1.2 Space in enclosure

Special adapter can be connected on the left sides of the main unit.
If you intend to add special adapter in the future, keep necessary spaces on the left sides.



7.2 Examination for Installing Method in Enclosure

Examine the installation location of PLC in consideration of the environmental conditions (generic specifications).
The PLC can be installed by the following two methods.

1. **Installing on DIN rail**
   - The PLC can be installed on a DIN46277 rail (35 mm (1.38") wide).
   - The PLC can be easily moved and removed.
   - The PLC is installed higher by the height of the DIN rail.

   → **For details on the procedures on mounting and removing the DIN rail, refer to Section 7.3.**

2. **Direct installing (with screws)**
   - The PLC can be installed directly in the enclosure with M4 screws.

   → **For the mounting hole pitch, refer to Section 7.4.**

7.3 Procedures for Installing on and Detaching from DIN Rail

The main unit can be installed on a DIN46277 rail (35 mm (1.38") wide).

7.3.1 Preparation for installation

1. **Connecting extension devices**
   Some extension devices must be mounted on the main unit before the unit is installed in the enclosure.
   - Mount the special adapter or connector conversion adapter (FX3S-CNV-ADP) on the main unit before installing the main unit to the enclosure.
   - The expansion boards, display module and memory cassette can be fitted to the main unit after it is installed.

2. **Affixing the dust proof sheet**
   The dust proof sheet should be affixed to the ventilation port before beginning the installation and wiring work Be sure to remove the dust proof sheet when the installation and wiring work is completed.

   → **For the affixing procedure, refer to the instructions on the dust proof sheet.**

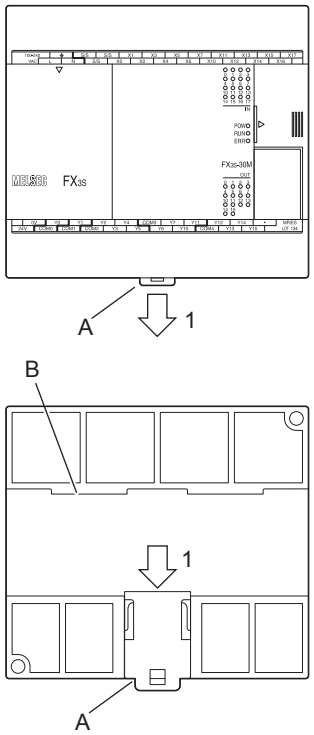
7.3.2 Installation of main unit

The main unit must be installed before installing a special adapter or connector conversion adapter (FX3S-CNV-ADP) on the enclosure.

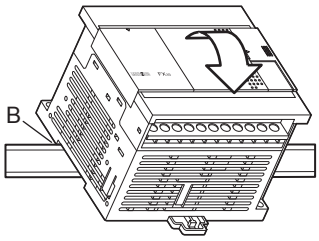
→ **For the connection procedure, refer to Subsection 7.5.3 and Subsection 7.5.4.**

Installation procedure

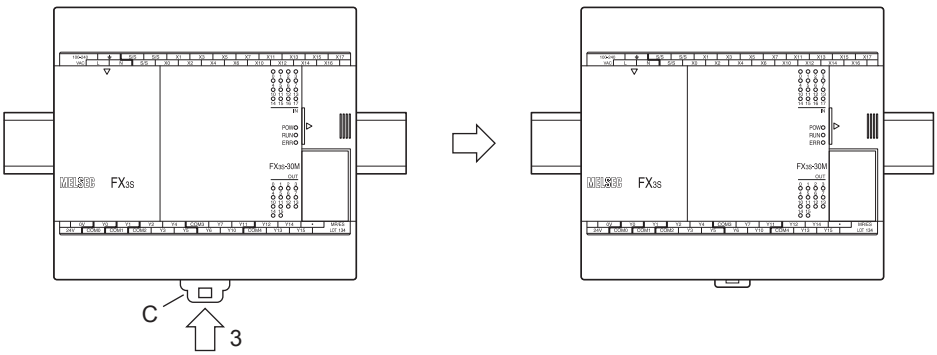
1 **Push out all DIN rail mounting hooks (A in the right figure).**



2 **Fit the upper edge of the DIN rail mounting groove (B in the right figure) onto the DIN rail.**



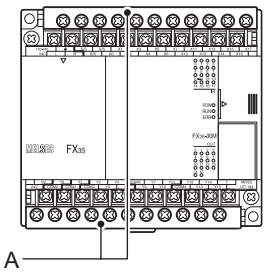
3 **Lock the DIN rail mounting hooks (C in the following figure) while pressing the PLC against the DIN rail.**



7.3.3 Removal of main unit

Removal procedure

1 **Open the terminal block cover, and remove the lower terminal block cover (A in the right figure).**



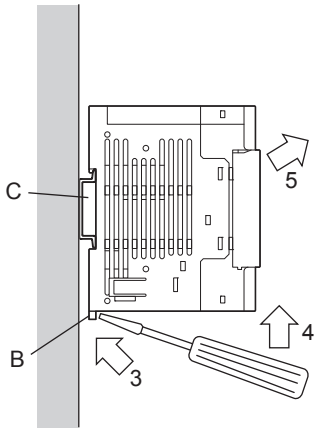
2 **Disconnect the connecting cables (including expansion board and special adapters).**

3 **Insert the tip of a flathead screwdriver into the hole of the DIN rail mounting hook (B in the right figure).**

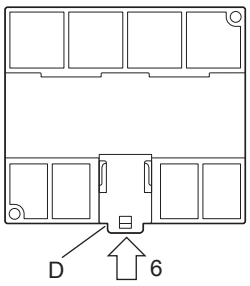
This step also applies for the DIN rail mounting hooks of the special adapters.

4 **Move the flathead screwdriver as shown in the right figure to draw out the DIN rail mounting hooks of all devices.**

5 **Remove the product from the DIN rail (C in the right figure).**



6 **Push in the DIN rail mounting hooks (D in the right figure).**



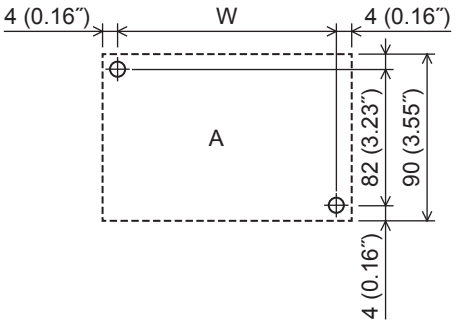
7.4 Procedures for Installing Directly (with M4 screws)

The product can be installed directly in the enclosure (with screws).

7.4.1 Hole pitches for direct mounting

The product mounting hole pitches are shown below.

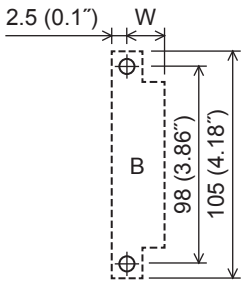
1. Main unit (A)



Unit: mm (inches)

	Model name	Mounting hole pitch (W)
A	FX3S-10MR/ES	52 (2.05")
	FX3S-10MT/ES	
	FX3S-10MT/ESS	
	FX3S-10MR/DS	
	FX3S-10MT/DS	
	FX3S-10MT/DSS	
	FX3S-14MR/ES	
	FX3S-14MT/ES	
	FX3S-14MT/ESS	
	FX3S-14MR/DS	
	FX3S-14MT/DS	
	FX3S-14MT/DSS	
	FX3S-20MR/ES	67 (2.64")
	FX3S-20MT/ES	
	FX3S-20MT/ESS	
	FX3S-20MR/DS	
	FX3S-20MT/DS	
	FX3S-20MT/DSS	
	FX3S-30MR/ES(-2AD)	92 (3.63")
	FX3S-30MT/ES(-2AD)	
	FX3S-30MT/ESS(-2AD)	
	FX3S-30MR/DS	
	FX3S-30MT/DS	
	FX3S-30MT/DSS	

2. Special adapter (B)

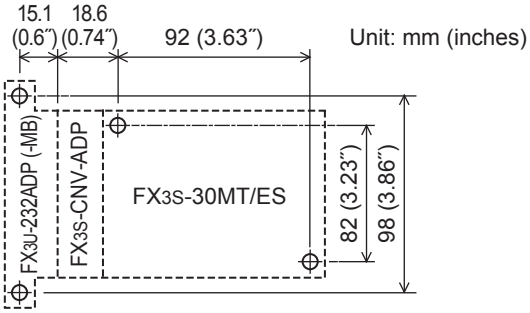


Unit: mm (inches)

	Model name	Mounting hole pitch (W)
B	FX3U-4AD-ADP FX3U-4DA-ADP FX3U-3A-ADP FX3U-4AD-PT-ADP FX3U-4AD-PTW-ADP FX3U-4AD-PNK-ADP FX3U-4AD-TC-ADP FX3U-232ADP(-MB) FX3U-485ADP(-MB)	15.1 (0.6")
	FX3U-ENET-ADP	20.5 (0.81″)

7.4.2 Example of mounting hole pitches

The figure below shows an example when the FX3S-30MT/ES, FX3S-CNV-ADP and FX3U-232ADP(-MB) are used.



7.4.3 Installation of main unit

Mount the special adapters and connector conversion adapter (FX3S-CNV-ADP) on the main unit before installing the unit in the enclosure.

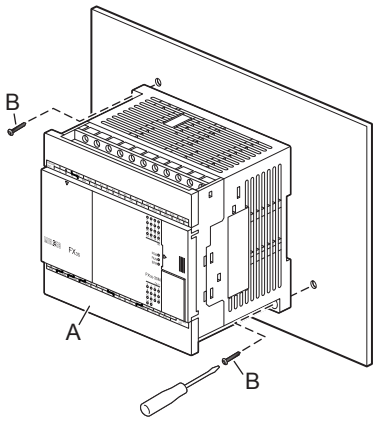
→ **For the connection procedure, refer to Subsection 7.5.3 and Subsection 7.5.4.**

Installation procedure

1 **Make mounting holes in the mounting surface according to the external dimensions diagram.**

2 **Fit the main unit (A in the right figure) based on the holes, and secure it with M4 screws (B in the right figure).**

The positions of screws, refer to Subsection 7.4.1.



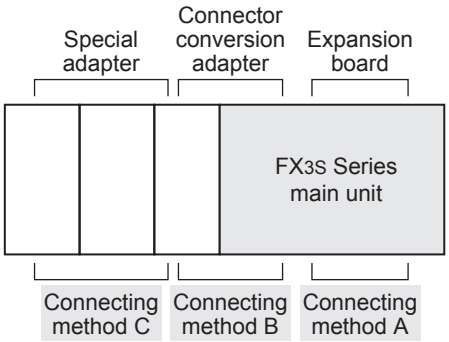
7.5 Connecting Methods for Main Unit and Extension Devices

This section explains the connecting methods for extension devices.

7.5.1 Connection of extension devices

This subsection explains the method for connecting the main unit, expansion board, connector conversion adapter and special adapters using the connection configuration example shown below.

Example of configuration



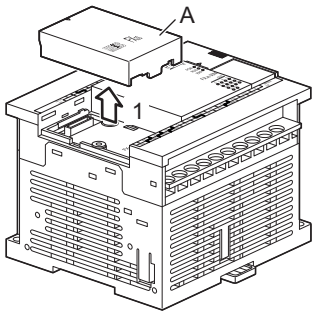
→ **For the connection method A, refer to Subsection 7.5.2.**
→ **For the connection method B, refer to Subsection 7.5.3.**
→ **For the connection method C, refer to Subsection 7.5.4.**

7.5.2 Connecting method A - connection of expansion board

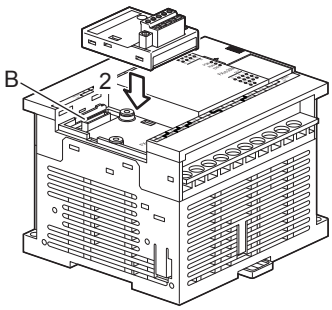
This subsection explains how to connect the expansion board to the main unit.

Connection procedure

1 **Remove the top cover (A in the right figure) from the front face of the main unit.**

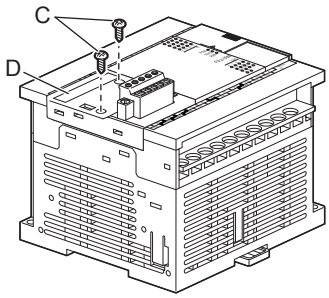


2 **Connect the expansion board to the option connector (B in the right figure).**



3 **Fix the expansion board (D in the right figure) to the main unit with M3 tapping screws (C in the right figure) supplied as accessories of the expansion board.**

- Tightening torque: 0.3 to 0.6 N•m

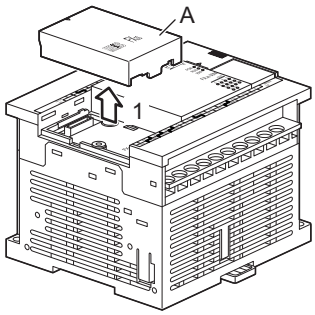


7.5.3 Connecting method B - connection of connector conversion adapter

This subsection explains how to connect the connector conversion adapter to the main unit.

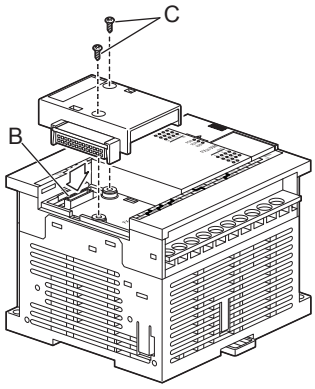
Connection procedure

1 **Remove the top cover (A in the right figure) from the front face of the main unit.**



2 **Connect the connector conversion adapter (board) to the option connector (B in the right figure) as shown in the right figure, and fix it with M3 tapping screws (C in the right figure) supplied as accessories of the connector conversion adapter.**

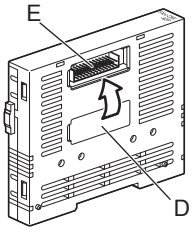
- Tightening torque: 0.3 to 0.6 N•m



→ **Proceed to the step 4 when using the AC power type main unit.**

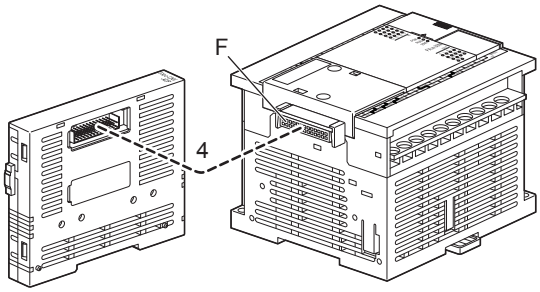
→ **Proceed to the step 3 when using the DC power type main unit.**

3 **Attach the connector cover provided on the DC power type connector (D in the right figure) to the AC power type connector (E in the right figure).**

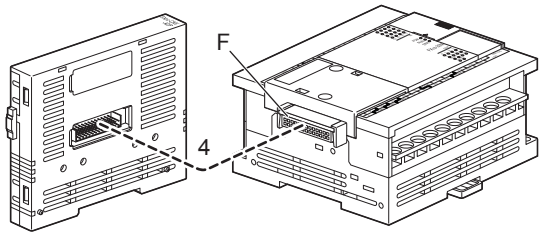


4 **Connect the connector conversion adapter (main body) to the connector (F in the follow figure) provided on the connector conversion adapter (board) as shown in the follow figure.**

[In the case of AC power type main unit]



[In the case of DC power type main unit]



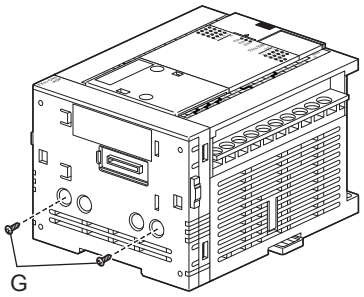
5 **Fix the connector conversion adapter (main body) to the main unit with M3 tapping screws (G in the follow figure) supplied as accessories of the connector conversion adapter.**

- Tightening torque: 0.3 to 0.6 N•m

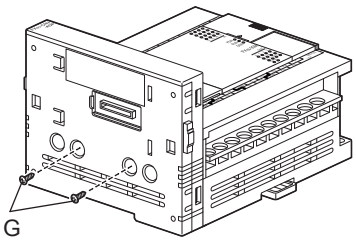
Caution

Mounting holes to be used vary depending on the power type of the main unit.
Make sure to connect the connector conversion adapter (main body) using the proper mounting holes. The main unit may be damaged if the proper mounting holes are not used.

[In the case of AC power type main unit]



[In the case of DC power type main unit]



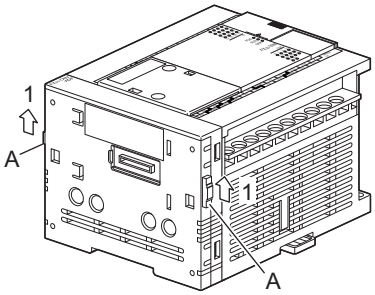
7.5.4 Connecting method C - connection of special adapter

This subsection explains how to connect the special adapter to the main unit.
When connecting the special adapter, it is necessary to attach the connector conversion adapter before the special adapter using the method described in the preceding subsection.

Connection procedure

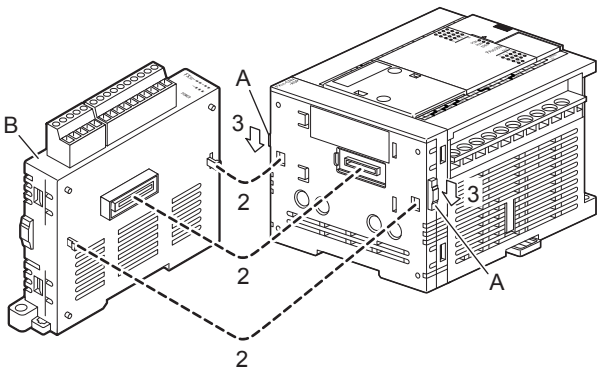
1 **Slide the special adapter connecting hooks (A in the right figure) of the main unit.**

When adding a special adapter to the special adapter that has been connected to the connector conversion adapter, read "connector conversion adapter" as "special adapter." (This applies to the following steps.)



2 **Connect the special adapter (B in the right figure) to the connector conversion adapter as shown in the right figure.**

3 **Slide the special adapter connecting hooks (A in the right figure) of the connector conversion adapter to secure the special adapter (B in the right figure).**

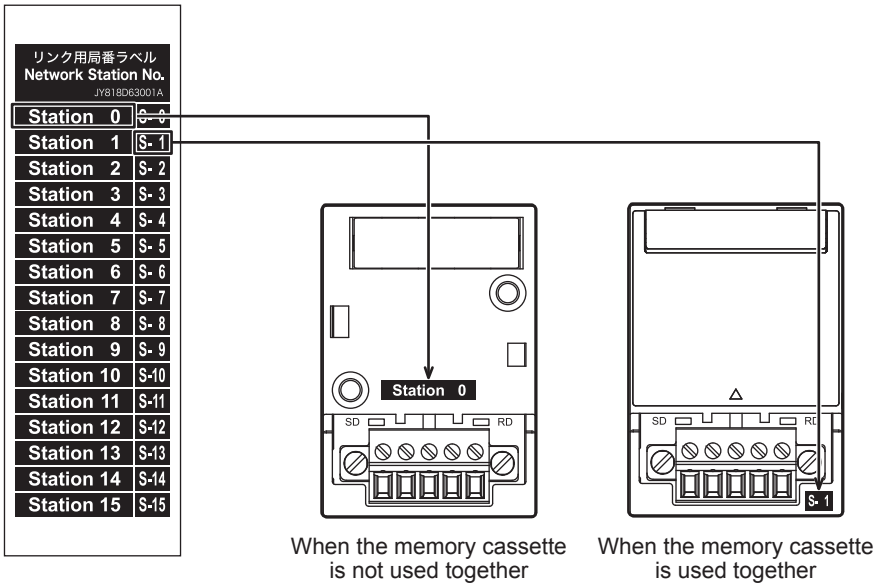


7.6 Application of labels

The label is packed together with the expansion board (FX3G-485-BD, FX3G-485-BD-RJ, FX3G-8AV-BD).
Place it in a position where it can be seen easily for simple reference.

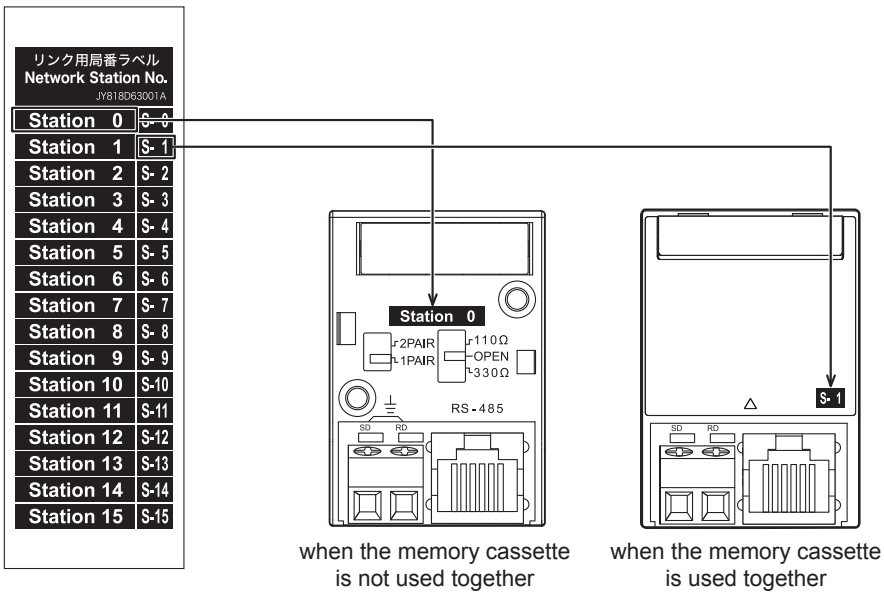
7.6.1 Application of Station No. label (FX3G-485-BD)

The station No. label is packed together with the FX3G-485-BD.
Place it in a position where it can be seen easily for simple reference (as shown in the figure below).



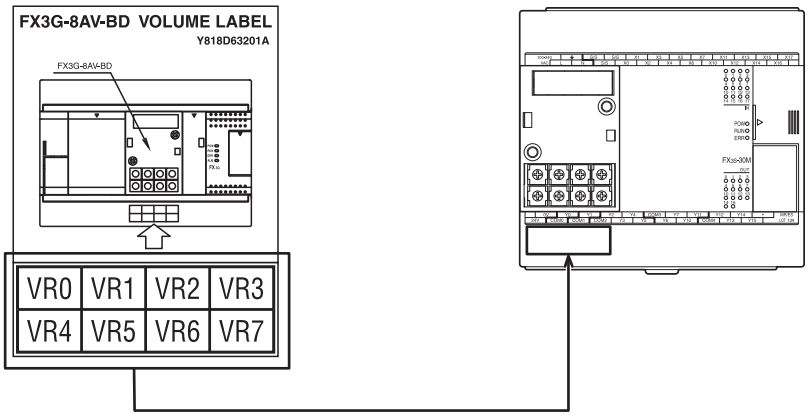
7.6.2 Application of Station No. label (FX3G-485-BD-RJ)

The "station No." label is packed together with the FX3G-485-BD-RJ.
Place it in a position where it can be seen easily for simple reference (as shown in the figure below).



7.6.3 Application of trimmer layout Label (FX3G-8AV-BD)

The trimmer layout label is packed together with the FX3G-8AV-BD.
Adhere it in a position where it can be seen easily for quick reference (as shown in the figure below).



8. Preparation for Wiring and Power Supply Wiring Procedures

DESIGN PRECAUTIONS ⚠ **WARNING**

- Make sure to have the following safety circuits outside of the PLC to ensure safe system operation even during external power supply problems or PLC failure.
  Otherwise, malfunctions may cause serious accidents.
  1) Most importantly, have the following: an emergency stop circuit, a protection circuit, an interlock circuit for opposite movements (such as normal vs. reverse rotation), and an interlock circuit (to prevent damage to the equipment at the upper and lower positioning limits).
  2) Note that when the PLC CPU detects an error, such as a watchdog timer error, during self-diagnosis, all outputs are turned off. Also, when an error that cannot be detected by the PLC CPU occurs in an input/output control block, output control may be disabled.
     External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
  3) If an overload of the 24 V DC service power supply occurs, the voltage automatically drops, inputs in the PLC are disabled, and all outputs are turned off.
     External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
  4) Note that when an error occurs in a relay or transistor output device, the output could be held either on or off.
     For output signals that may lead to serious accidents, external circuits and mechanisms should be designed to ensure safe machinery operation in such a case.

DESIGN PRECAUTIONS ⚠ **CAUTION**

- Do not bundle the control line together with or lay it close to the main circuit or power line. As a guideline, lay the control line at least 100 mm (3.94") or more away from the main circuit or power line.
  Noise may cause malfunctions.
- Install module so that excessive force will not be applied to peripheral device connectors.
  Failure to do so may result in wire damage/breakage or PLC failure.

SECURITY PRECAUTIONS ⚠ **WARNING**

- To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from unreliable networks and devices via network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

WIRING PRECAUTIONS ⚠ **WARNING**

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work.
  Failure to do so may cause electric shock or damage to the product.
- Make sure to attach the terminal cover, offered as an accessory, before turning on the power or initiating operation after installation or wiring work.
  Failure to do so may cause electric shock.
- The temperature rating of the cable should be 80°C or more.

WIRING PRECAUTIONS ⚠ **CAUTION**

- Do not supply power to the [24V] terminal (24 V DC service power supply) on the main unit.
  Doing so may cause damage to the product.
- Perform class D grounding (grounding resistance: 100 Ω or less) to the grounding terminal on the main unit with a wire 2 mm^2 or thicker.
  Do not use common grounding with heavy electrical systems (refer to Section 8.3).
- Connect the AC power supply wiring to the dedicated terminals described in this manual.
  If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out.
- Noise resistance may be lower when the L and N wires of an AC power supply are not wired correctly.
  Please wire using the correct polarity.
- Connect the DC power supply wiring to the dedicated terminals described in this manual.
  If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out.
- Do not wire vacant terminals externally.
  Doing so may damage the product.
- When drilling screw holes or wiring, make sure cutting or wire debris does not enter the ventilation slits.
  Failure to do so may cause fire, equipment failures or malfunctions.
- Make sure to properly wire to the main unit in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - Make sure to properly wire to the main unit in accordance with the rated voltage, current, and frequency of each terminal.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.
  - Tighten the screws using a Phillips-head screwdriver No.2 (shaft diameter 6mm (0.24”) or less). Make sure that the screwdriver does not touch the partition part of the terminal block.
- Make sure to properly wire to the terminal block (European type) in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.
  - Twist the end of strand wire and make sure that there are no loose wires.
  - Do not solder-plate the electric wire ends.
  - Do not connect more than the specified number of wires or electric wires of unspecified size.
  - Affix the electric wires so that neither the terminal block nor the connected parts are directly stressed.

8.1 Preparation for Wiring

8.1.1 Wiring procedures

Before starting wiring work, make sure that the main power is off.

1 Prepare the parts for wiring.

Prepare the solderless terminals and cables necessary for wiring.

→ **For details, refer to Section 8.2.**

2 Wire the power supply terminals.

In the case of AC power type

- Connect the power supply to the terminals [L] and [N].

In the case of DC power type

- Connect the power supply to the terminals [⊕] and [⊖].

Provide the power supply circuit with the protection circuit shown in this subsection.

→ **For details, refer to Section 8.4.**

3 Wire the ground terminal [⏚] at a grounding resistance of 100 Ω or less (Class D).

Connect a class D ground wire to the terminal.

→ **For details, refer to Section 8.3 and Section 8.4.**

4 Wire the input [X] terminals.

For input, select sink or source input by the following connection.

In the case of AC power type

- For sink input, connect the [24V] and [S/S] terminals.
- For source input, connect the [0V] and [S/S] terminals.

In the case of DC power type

- For sink input, connect the [⊕] and [S/S] terminals.
- For source input, connect the [⊖] and [S/S] terminals.

Connect sensors and switches to the terminals.

→ **For details, refer to Chapter 9.**

5 Wire the output [Y] terminals.

Connect loads to the terminals.

→ **For details, refer to Chapter 12.**

8.2 Cable Connecting Procedures

The cable connecting procedures are explained below.

8.2.1 Terminal block [Main unit]

The terminal block of main unit is the M3 screw.

→ **For the terminal block of a built-in analog input, refer to Chapter 11.**

1. Terminal block screw size and tightening torque

The terminal block screw and tightening torque is shown below.

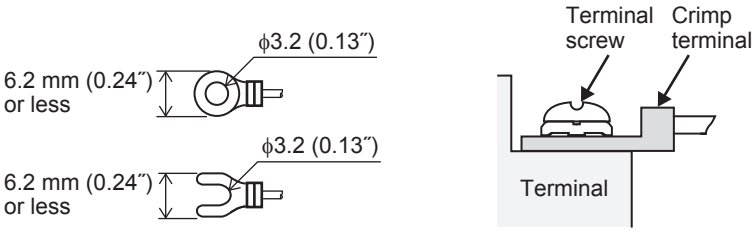
Product	Terminal screw	Tightening torque
Main unit	M3	0.5 to 0.8 N•m

2. Wire end treatment

The solderless terminal size depends on the terminal screw size and wiring method.

- Use solderless terminals of the following size.
- Tighten the terminals to a torque of 0.5 to 0.8 N•m.
  Do not tighten terminal screws with a torque outside the above-mentioned range. Failure to do so may cause equipment failures or malfunctions.

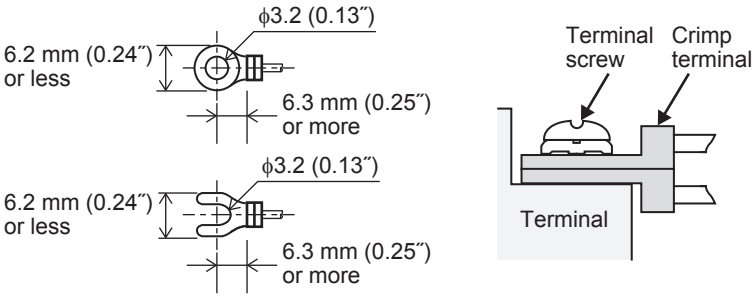
• When one wire is connected to one terminal



<Reference>

Terminal manufacturer	Type No.	Applicable cable	Certification	Pressure bonding tool
J.S.T. Mfg. Co., Ltd.	FV1.25-B3A	AWG22 to 16	UL Listed	YA-1 (J.S.T. Mfg. Co., Ltd.)
	FV2-MS3	AWG16 to 14		

• When two wires are connected to one terminal*1



<Reference>

Terminal manufacturer	Type No.	Applicable cable	Certification	Pressure bonding tool
J.S.T. Mfg. Co., Ltd.	FV1.25-B3A	AWG22 to 16	UL Listed	YA-1 (J.S.T. Mfg. Co., Ltd.)

*1. To adapt the LVD directive (EN61010-2-201:2013) of the EC directive, avoid the wiring with two wires to the built-in terminal, and take an appropriate action such as adding an external terminal.
For the time of compliance with the LVD directive (EN61010-2-201:2013), refer to Requirement for Compliance with LVD directive.

8.2.2 Terminal block (for European) [expansion board and special adapters]

The expansion boards and special adapters of a terminal block type have terminal blocks for European.

1. Applicable products

Classification	Model name
Expansion board	FX3G-4EX-BD, FX3G-2EYT-BD, FX3G-485-BD, FX3G-2AD-BD, FX3G-1DA-BD
Special adapters	FX3U-485ADP(-MB), FX3U-4AD-ADP, FX3U-4DA-ADP, FX3U-3A-ADP, FX3U-4AD-PT-ADP, FX3U-4AD-PTW-ADP, FX3U-4AD-PNK-ADP, FX3U-4AD-TC-ADP

2. Compliant electric wires and tightening torque

	Electric wire size (stranded wire/solid wire)	Tightening torque	End treatment
One electric wire	0.3 to 0.5 mm^2 (AWG 22 to 20)	0.22 to 0.25 N•m	• Remove the coating of the stranded wire, twist the core wires, and connect the wires directly. • Remove the coating from the solid wire, and connect the wire directly.
Two electric wires	0.3 mm^2 (AWG 22)×2		
Bar terminal with insulating sleeve	0.3 to 0.5 mm^2 (AWG 22 to 20) (Refer to the following outline drawing of bar terminal.)		• Bar terminal with insulating sleeve (recommended product) AI 0.5-8WH: Phoenix Contact • Caulking tool CRIMPFOX 6*1: Phoenix Contact (CRIMPFOX 6T-F*2: Phoenix Contact)

*1. Old model name: CRIMPFOX ZA 3

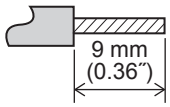
*2. Old model name: CRIMPFOX UD 6

3. Treatment of electric wire ends

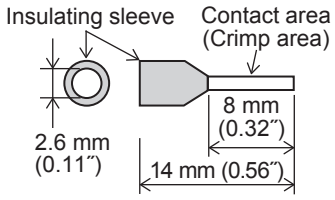
Treat the ends of stranded wires and solid wires without coating or using bar terminals with insulating sleeve. Tighten the terminals to a torque of 0.22 to 0.25 N•m.
Do not tighten terminal screws with a torque outside the above-mentioned range. Failure to do so may cause equipment failures or malfunctions.

- Treatment of stranded wires and solid wires without coating
  - Twist the ends of stranded wires tightly so that loose wires will not stick out.
  - Do not solder-plate the electric wire ends.
- Treatment using bar terminal with insulating sleeve
  It may be difficult to insert the electric wire into the insulating sleeve depending on the thickness of the electric wire sheath. Select the electric wire referring to the outline drawing.

• Stranded wire/solid wire



• Bar terminal with insulating sleeve



<Reference>

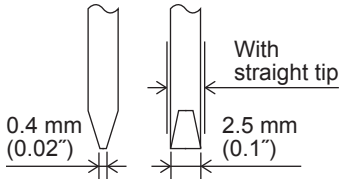
Manufacturer	Model name	Caulking tool
Phoenix Contact Co., Ltd	AI 0.5-8WH	CRIMPFOX 6*3 (or CRIMPFOX 6T-F*4)

*3. Old model name : CRIMPFOX ZA 3

*4. Old model name : CRIMPFOX UD 6

4. Tool

For tightening the terminal, use a commercially available small screwdriver having a straight form that is not widened toward the end as shown right.



Note

If the diameter of screwdriver grip is too small, tightening torque will not be able to be achieved. To achieve the appropriate tightening torque shown in the table above, use the following screwdriver or appropriate replacement (grip diameter: approximately 25 mm (0.98")).

<Reference>

Manufacturer	Model name
Phoenix Contact Co., Ltd	SZS 0.4×2.5

8.2.3 Grounding terminal of the FX3G-485-BD-RJ

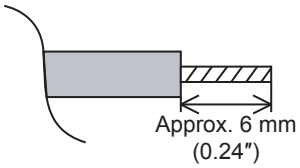
The grounding terminal of the FX3G-485-BD-RJ is a terminal blocks for Europe.

1. Applicable cables

Electric wire size
AWG 20 to 16

2. Treatment of electric wire ends

- When using a stranded cable or solid cable as it is
  - Twist the end of the stranded cable so that loose wires will not stick out.
  - Do not solder-plate the end of the cable.



3. Tightening torque

Set the tightening torque to 0.5 to 0.6 N•m.
Do not tighten terminal screws with a torque outside the above-mentioned range.
Failure to do so may cause equipment failures or malfunctions.

Caution

When tightening a grounding terminal, use a screwdriver suitable for the terminal screw. The screwdriver which does not suit the thread groove is used, tightening torque will not be able to be achieved. To achieve the appropriate tightening torque shown in the above, use the following screwdriver or an appropriate replacement.

<Reference>

Manufacturer	Model name
Phoenix Contact Co., Ltd	SZF 1-0.6×3.5

8.2.4 Grounding terminal of the FX3U-ENET-ADP

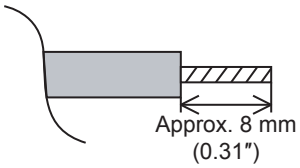
The grounding terminal of the FX3U-ENET-ADP is a M2.5 screw.

1. Applicable cables

Electric wire size
0.5 to 1.5 mm^2 (AWG 20 to 16)

2. Treatment of electric wire ends

- When using a stranded cable or solid cable as it is
  - Twist the end of the stranded cable so that loose wires will not stick out.
  - Do not solder-plate the end of the cable.



3. Tightening torque

Set the tightening torque to 0.4 to 0.5 N•m.
Do not tighten terminal screws with a torque outside the above-mentioned range.
Failure to do so may cause equipment failures or malfunctions.

Caution

When tightening a grounding terminal, use a screwdriver suitable for the terminal screw. The screwdriver which does not suit the thread groove is used, tightening torque will not be able to be achieved. To achieve the appropriate tightening torque shown in the above, use the following screwdriver or an appropriate replacement.

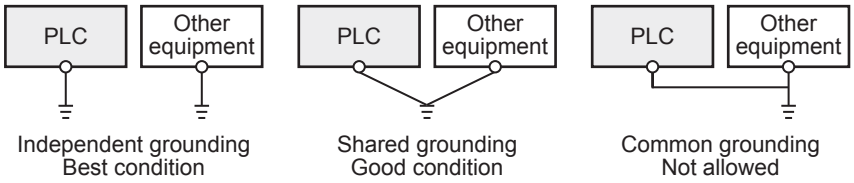
<Reference>

Manufacturer	Model name	Model number
Weidmuller Interface GmbH & Co. KG	SDIK PH0	9008560000
Weidmuller Interface GmbH & Co. KG	SD 0.6×3.5×100	9008330000

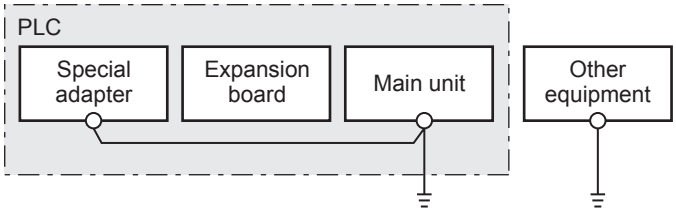
8.3 Grounding

Ground the PLC as stated below.

- Perform class D grounding. (Grounding resistance: 100 Ω or less)
- Ground the PLC independently if possible.
  If it cannot be grounded independently, ground it jointly as shown below.



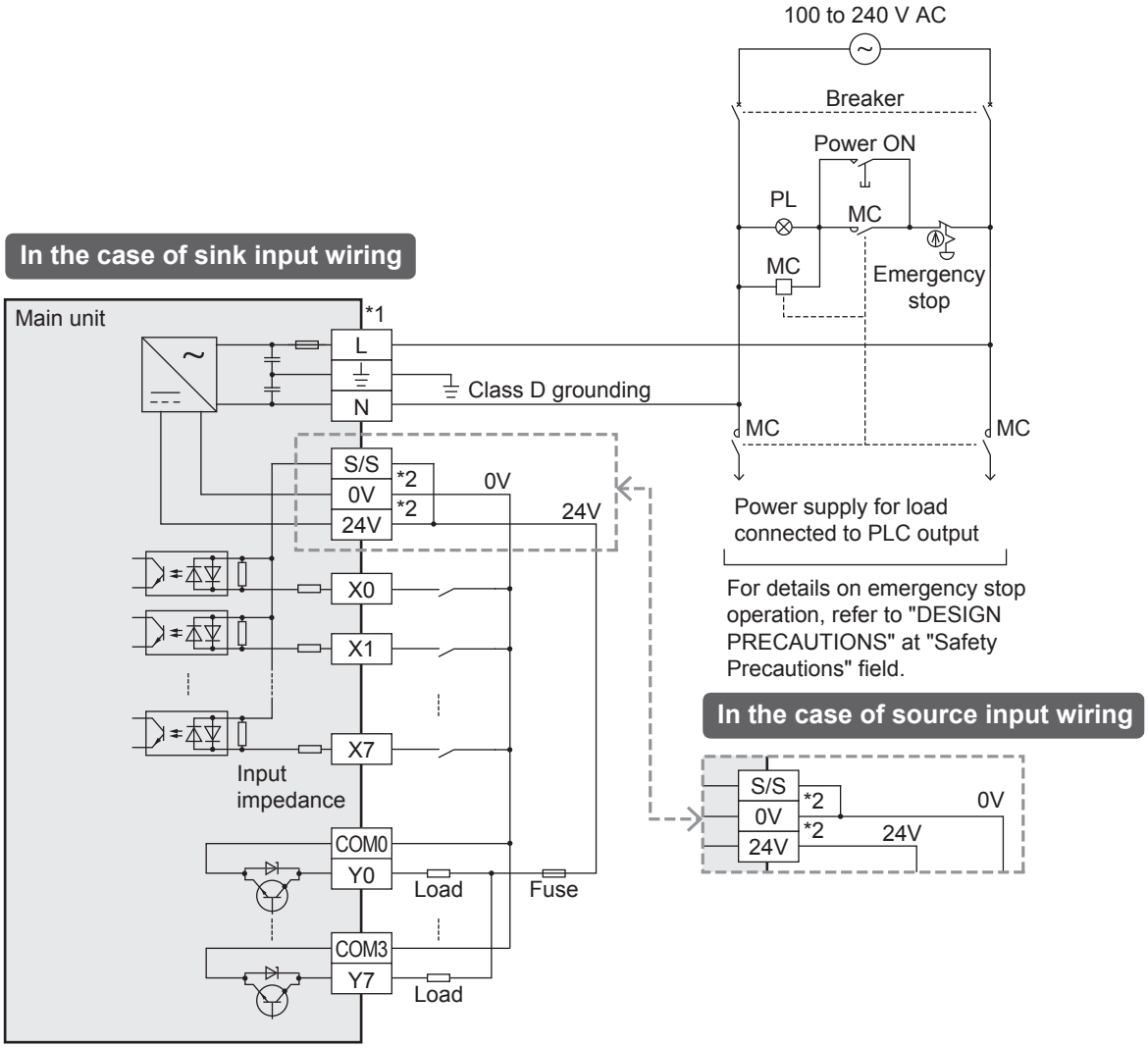
Extension devices of PLC (except expansion board and special adapter)



- Use ground wires thicker than AWG14 (2 mm^2).
- Position the grounding point as close to the PLC as possible to decrease the length of the ground wire.

8.4 Examples of External Wiring [AC power type]

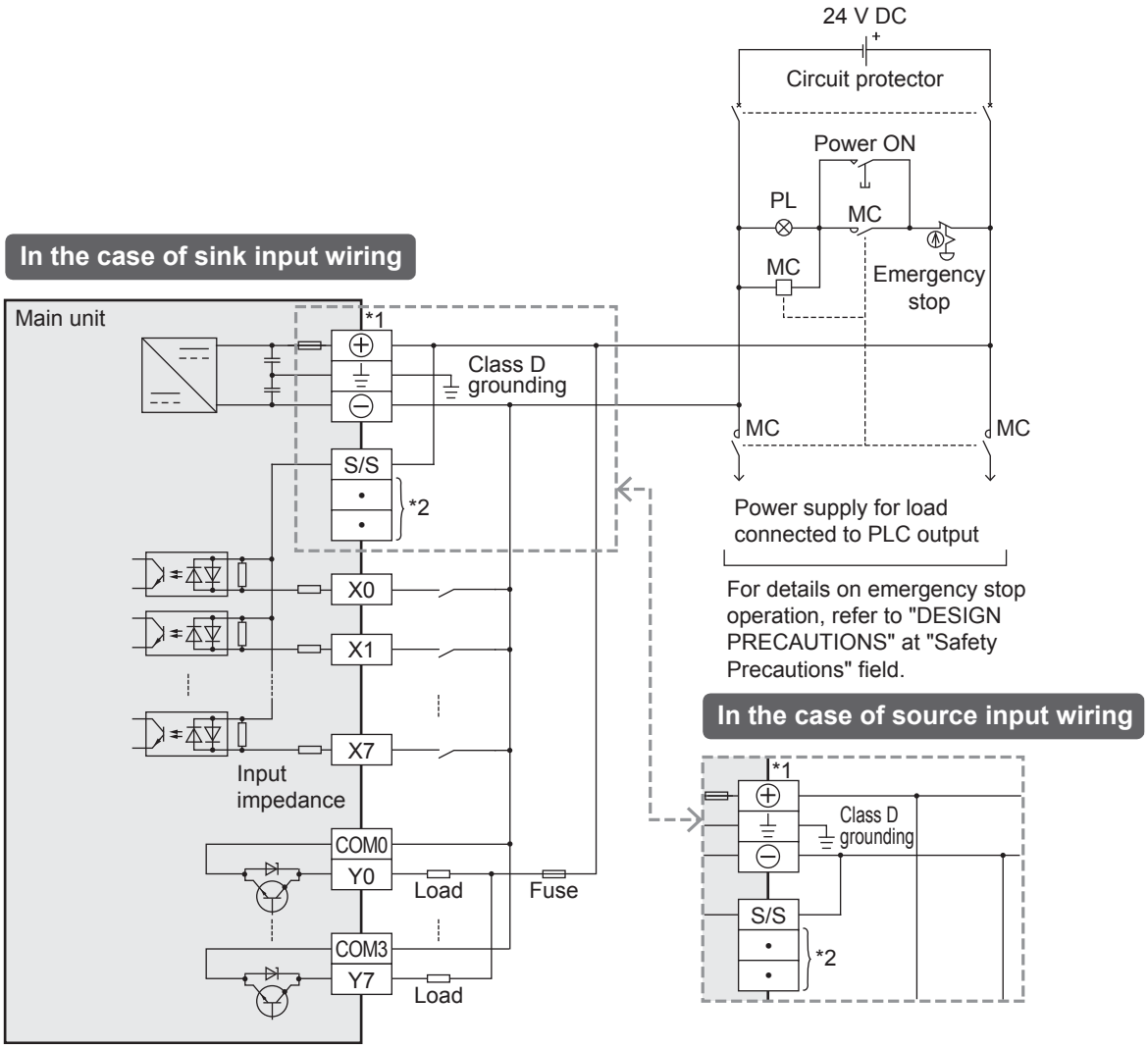
24 V DC service power supply of the main unit can be used as a power supply for loads.



*1. Connect the AC power supply to the L and N terminals (in any case of 100 V AC system and 200 V AC system).
As for the details, see "WIRING PRECAUTIONS" at "Safety Precautions" field.

*2. The "0V" and "24V" terminals are located on the output terminal side.
For details on the terminal layout, refer to Section 4.7.

8.5 Examples of External Wiring [DC power type]



*1. Connect DC power to [+] and [-] terminals.
As for the details, see "WIRING PRECAUTIONS" at "Safety Precautions" field.

*2. Do not connect with vacant terminal.

9. Input Wiring Procedures

DESIGN PRECAUTIONS **⚠WARNING**

- Make sure to have the following safety circuits outside of the PLC to ensure safe system operation even during external power supply problems or PLC failure.
  Otherwise, malfunctions may cause serious accidents.
  1) Most importantly, have the following: an emergency stop circuit, a protection circuit, an interlock circuit for opposite movements (such as normal vs. reverse rotation), and an interlock circuit (to prevent damage to the equipment at the upper and lower positioning limits).
  2) Note that when the PLC CPU detects an error, such as a watchdog timer error, during self-diagnosis, all outputs are turned off. Also, when an error that cannot be detected by the PLC CPU occurs in an input/output control block, output control may be disabled.
     External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
  3) If an overload of the 24 V DC service power supply occurs, the voltage automatically drops, inputs in the PLC are disabled, and all outputs are turned off.
     External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
  4) Note that when an error occurs in a relay or transistor output device, the output could be held either on or off.
     For output signals that may lead to serious accidents, external circuits and mechanisms should be designed to ensure safe machinery operation in such a case.

DESIGN PRECAUTIONS **⚠CAUTION**

- Do not bundle the control line together with or lay it close to the main circuit or power line. As a guideline, lay the control line at least 100 mm (3.94") or more away from the main circuit or power line.
  Noise may cause malfunctions.
- Install module so that excessive force will not be applied to peripheral device connectors.
  Failure to do so may result in wire damage/breakage or PLC failure.

SECURITY PRECAUTIONS **⚠WARNING**

- To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from unreliable networks and devices via network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

WIRING PRECAUTIONS ⚠ **WARNING**

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work.
  Failure to do so may cause electric shock or damage to the product.
- Make sure to attach the terminal cover, offered as an accessory, before turning on the power or initiating operation after installation or wiring work.
  Failure to do so may cause electric shock.
- The temperature rating of the cable should be 80°C or more.

WIRING PRECAUTIONS ⚠ **CAUTION**

- Do not supply power to the [24V] terminal (24 V DC service power supply) on the main unit.
  Doing so may cause damage to the product.
- Perform class D grounding (grounding resistance: 100 Ω or less) to the grounding terminal on the main unit with a wire 2 mm^2 or thicker.
  Do not use common grounding with heavy electrical systems (refer to Section 8.3).
- Connect the AC power supply wiring to the dedicated terminals described in this manual.
  If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out.
- Noise resistance may be lower when the L and N wires of an AC power supply are not wired correctly.
  Please wire using the correct polarity.
- Connect the DC power supply wiring to the dedicated terminals described in this manual.
  If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out.
- Do not wire vacant terminals externally.
  Doing so may damage the product.
- When drilling screw holes or wiring, make sure cutting or wire debris does not enter the ventilation slits.
  Failure to do so may cause fire, equipment failures or malfunctions.
- Make sure to properly wire to the main unit in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - Make sure to properly wire to the main unit in accordance with the rated voltage, current, and frequency of each terminal.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.
  - Tighten the screws using a Phillips-head screwdriver No.2 (shaft diameter 6mm (0.24”) or less). Make sure that the screwdriver does not touch the partition part of the terminal block.
- Make sure to properly wire to the terminal block (European type) in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.
  - Twist the end of strand wire and make sure that there are no loose wires.
  - Do not solder-plate the electric wire ends.
  - Do not connect more than the specified number of wires or electric wires of unspecified size.
  - Affix the electric wires so that neither the terminal block nor the connected parts are directly stressed.

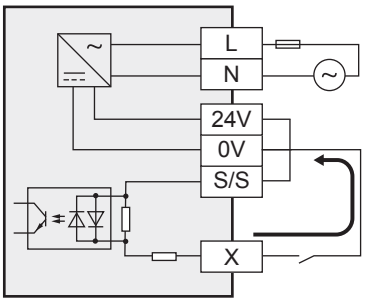
9.1 Before Starting Input Wiring

9.1.1 Sink and source input

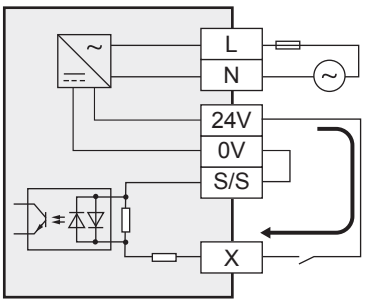
The input terminals (X) of the main unit are common to sink/source input of 24 V DC internal power.

1. Differences between the sink input circuit and the source input circuit

- Sink input [-common]
  Sink input means a DC input signal with current-flow from the input (X) terminal. When a sensor with a transistor output is connected, NPN open collector transistor output can be used.



- Source input [+common]
  Source input means a DC input signal with current-flow into the input (X) terminal. When a sensor with a transistor output is connected, PNP open collector transistor output can be used.



2. Method of switching between sink/source input

To switch the input type to sink or source input, wire the [S/S] terminal to the [0V] or [24V] ([-] or [+]) terminal.

- In the case of AC power type
  - Sink input: [24V] terminal and [S/S] terminal are connected.
  - Source input: [0V] terminal and [S/S] terminal are connected.

→ **For wiring examples, refer to Subsection 9.2.3.**

- In the case of DC power type
  - Sink input: [+] terminal and [S/S] terminal are connected.
  - Source input: [-] terminal and [S/S] terminal are connected.

→ **For wiring examples, refer to Subsection 9.2.4.**

3. Cautions for using

Mixed use of sink/source inputs.
It is possible to set all input terminals (X) of the main unit to either sink input or source input mode. However, a mixture of sink and source input terminals cannot be set within a single unit.

Differences from FX1S PLCs in input specifications (reference)

Sink input type only FX1S PLCs (manuals in Japanese are supplied) and sink/source input type FX1S PLCs (manuals in English are supplied) have different model names.

- For sink input type only FX1S PLCs, the [S/S] terminal and the [24V] terminal are connected internally, unlike in FX3S PLCs.
  When replacing a sink input type only FX1S PLC with a FX3S PLC, short-circuit the [S/S] and [24V] terminals, and use the [0V] terminal of the FX3S as the [COM] terminal of the FX1S for wiring.
- Sink/source input type FX1S PLCs are configured in sink or source input mode using external wiring in the same way as FX3S PLCs.

9.2 24 V DC input (Sink and source input type)

This section explains handling of 24 V DC inputs in the main unit, precautions on input device connection, and external wiring examples.

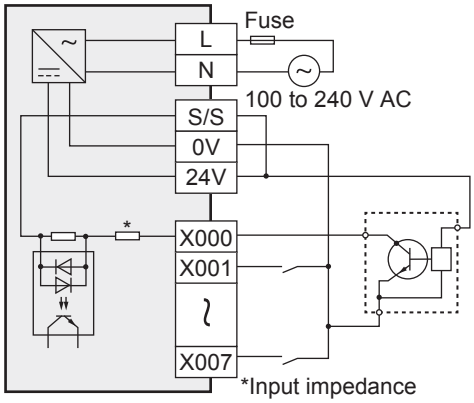
→ **For the input specifications, refer to Section 4.3.**
→ **For specifications and wiring examples of the built-in analog inputs, refer to Chapter 11.**

9.2.1 Handling of 24 V DC input

1. Input terminals

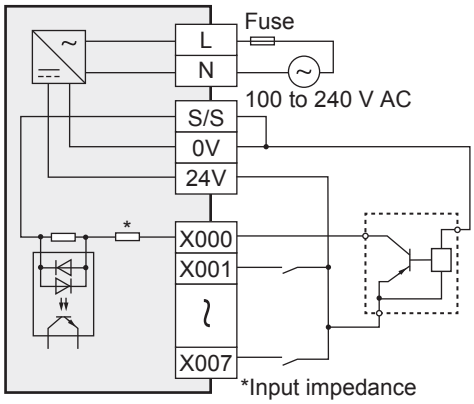
Sink input

When a no-voltage contact or NPN open collector transistor output is connected between an input (X) terminal and the [0V] terminal and the circuit is closed, the input (X) turns on.
Then, the input display LED lights.



Source input

When a no-voltage contact or PNP open collector transistor output is connected between an input (X) terminal and the [24V] terminal and the circuit is closed, the input (X) turns on.
Then, the input display LED lights.



RUN terminal setting

X000 to X017 (up to the largest input number in the main unit[*1]) of the main unit can be used as RUN input terminals by setting parameters.

*1. X000 to X005 in the FX3S-10M□ main unit, X000 to X007 in the FX3S-14M□ main unit and X000 to X013 in the FX3S-20M□ main unit

→ **For the functions of the RUN terminals, refer to Subsection 14.2.1.**

2. Input circuit

Function of input circuit

The primary and secondary circuits for input are insulated with a photocoupler, and the second circuit is provided with a C-R filter.
The C-R filter is designed to prevent malfunctions caused by chattering of the input contact and noise from the input line.
There is a delay of approx. 10 ms in response to input-switching from ON to OFF and from OFF to ON.

Change of filter time

X000 to X017 have digital filters, and the filter time can be changed in increments of 1 ms in the range from 0 to 15 ms through special data register (D8020). When 0 is specified for the time, the input filter values are set as shown in the following table.

Input number	Input filter value when 0 is specified
X000, X001	10 μs
X002 to X007	50 μs
X010 to X017	200 μs

3. Input sensitivity

The PLC input current and input sensitivity are shown in the following table.
When there is a series diode or resistance at the input contact or there is a parallel resistance or leakage current at the input contact, wire the terminals in accordance with the Subsection 9.2.2.

Item		X000 to X007	X010 to X017
Input signal voltage		AC power type: 24 V DC ± 10 % DC power type: 20.4-26.4 V DC	
Input signal current		7 mA	5 mA
Input sensitivity current	ON	4.5 mA or more	3.5 mA or more
	OFF	1.5 mA or less	

9.2.2 Instructions for connecting input devices

1. In the case of no-voltage contact

The input current of this PLC is 7 mA/24 V DC. (5 mA/24 V DC in X010 or later)
Use input devices applicable to this minute current.
If no-voltage contacts (switches) for large current are used, contact failure may occur.

Input number	Input current
X000 to X007	7 mA/24 V DC
X010 to X017	5 mA/24 V DC

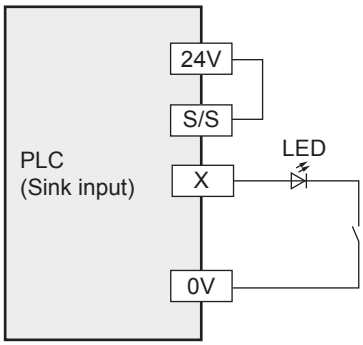
<Example> Products of OMRON

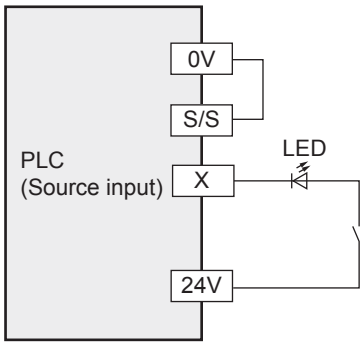
Type	Model name
Microswitch	Models Z, V and D2RV
Proximity switch	Model TL

Type	Model name
Operation switch	Model A3P
Photoelectric switch	Model E3S

2. In the case of input device with built-in series diode

The voltage drop of the series diode should be approx. 4 V or less.
When lead switches with a series LED are used, up to two switches can be connected in series.
Also make sure that the input current is over the input-sensing level while the switches are ON.

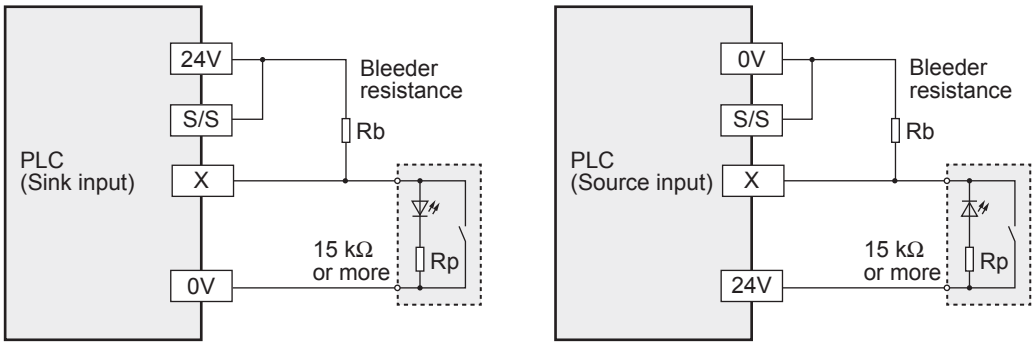




3. In the case of input device with built-in parallel resistance

Use a device having a parallel resistance, Rp, of 15 kΩ or more.
If the resistance is less than 15 kΩ, connect a bleeder resistance, Rb (kΩ), obtained by the following formula as shown in the following figure.

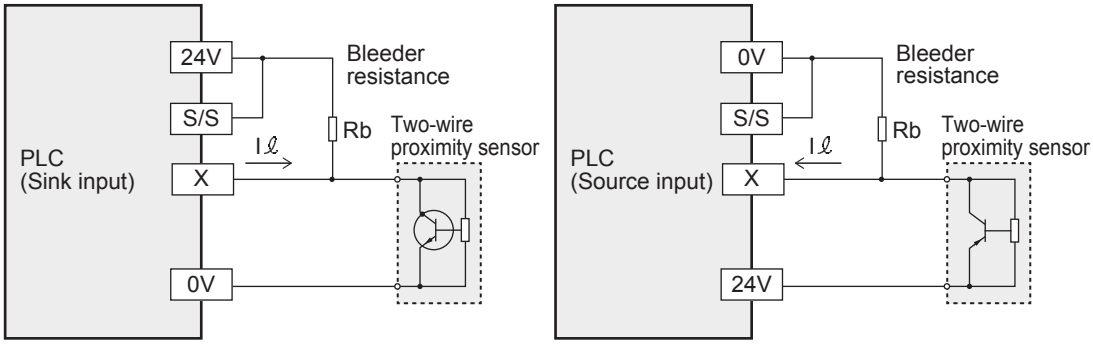
$$Rb\ (k\Omega) \leq \frac{4Rp}{15\text{-}Rp}$$



4. In the case of 2-wire proximity switch

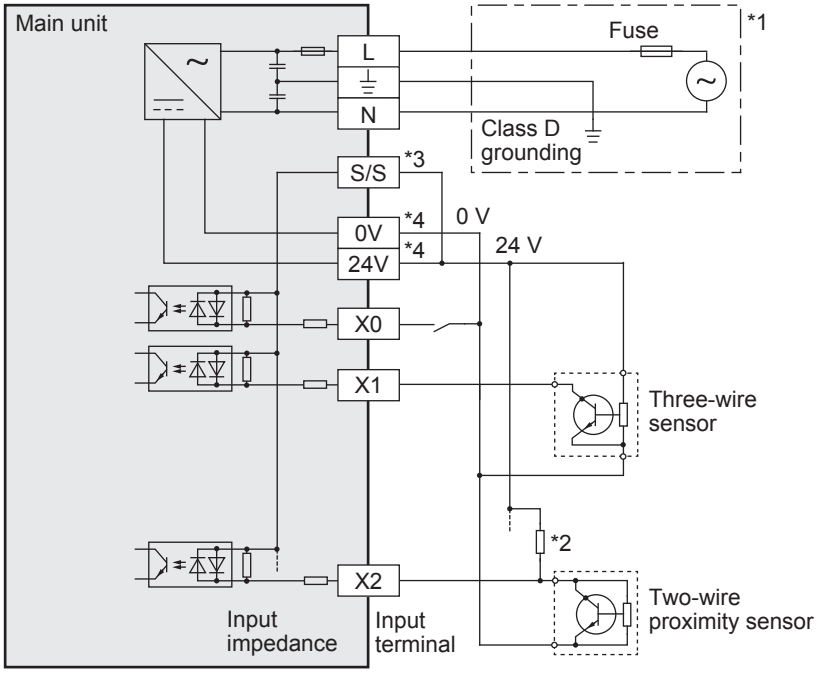
Use a two-wire proximity switch whose leakage current, $I\ell$, is 1.5 mA or less when the switch is off.
When the current is larger than 1.5 mA, connect a bleeder resistance, Rb (kΩ), determined by the following formula.

$$Rb\ (k\Omega) \leq \frac{6}{I\ell\text{-}1.5}$$

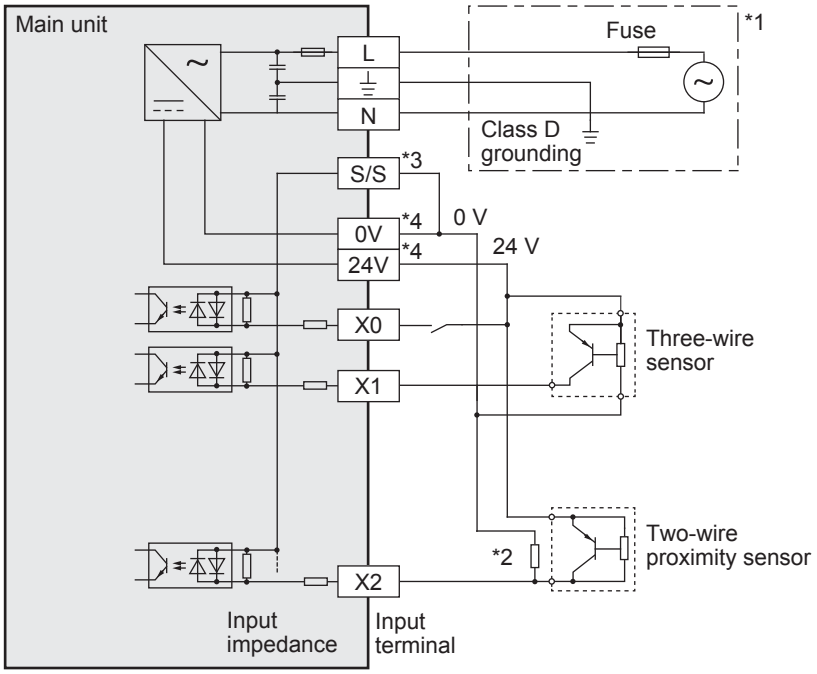


9.2.3 Examples of external wiring [AC power type]

1. Sink input



2. Source input



*1. Handle the power supply circuit correctly in accordance with Chapter 8 "Preparation for Wiring and Power Supply Wiring Procedures."

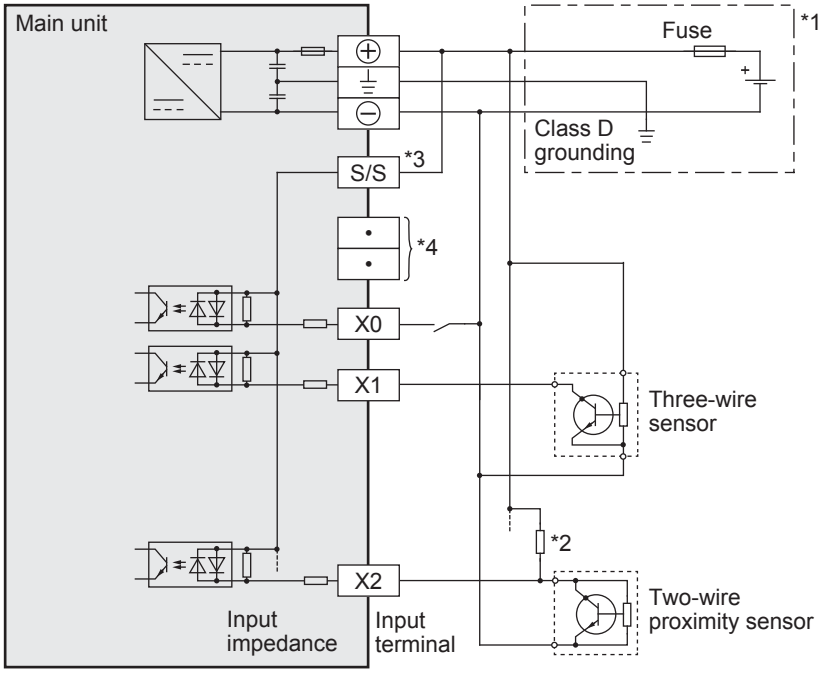
*2. For an input device having a parallel resistance or a two-wire proximity switch, a bleeder resistance may be required.

*3. In the case of sink input wiring, short-circuit the [S/S] terminal and the [24V] terminal of the main unit.
In the case of source input wiring, short-circuit the [S/S] terminal and the [0V] terminal of the main unit.

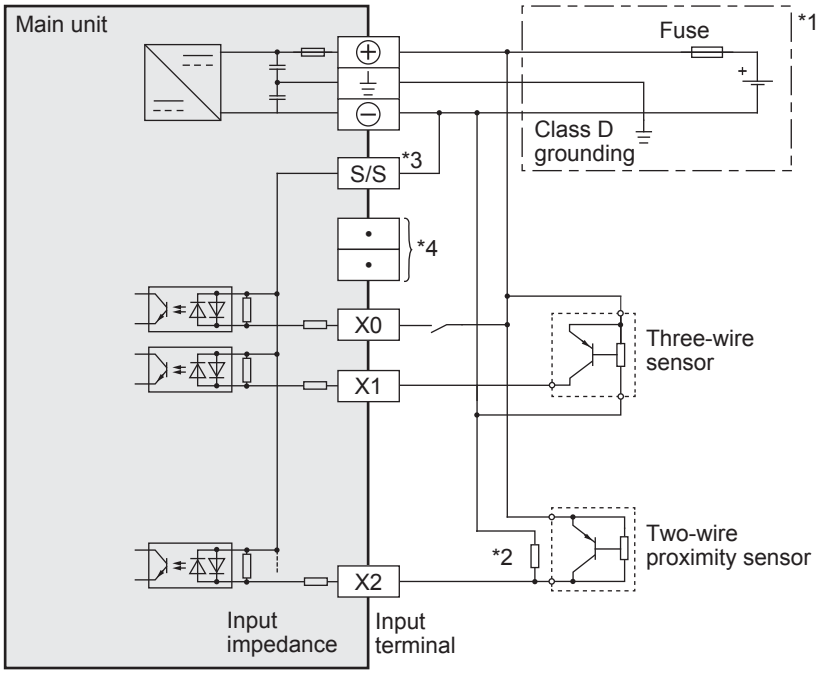
*4. The "0V" and "24V" terminals are located on the output terminal side.
For details on the terminal layout, refer to Section 4.7.

9.2.4 Examples of external wiring [DC power type]

1. Sink input



2. Source input



*1. Handle the power supply circuit correctly in accordance with Chapter 8 "Preparation for Wiring and Power Supply Wiring Procedures."

*2. For an input device having a parallel resistance or a two-wire proximity switch, a bleeder resistance may be required.

*3. In the case of sink input wiring, short-circuit the [S/S] terminal and the [+] terminal of the main unit.
In the case of source input wiring, short-circuit the [S/S] terminal and the [-] terminal of the main unit.

*4. Do not connect with vacant terminal.

9.3 Input Interruption (I00□ to I50□)

The main unit is provided with an input interruption function and has 6 interruption input points.
Make sure that the ON duration or OFF duration of interruption input signals is 10 μs or more (X000, X001) or 50 μs or more (X002 to X005).

→ **For details on programming, refer to the programming manual.**

9.3.1 Allocation of pointers to input numbers (input signal ON/OFF duration)

Input number	Interrupt pointer		Interrupt disable control	ON or OFF duration of input signal
	Interruption on leading edge	Interruption on trailing edge		
X000	I001	I000	M8050	10 μs or more
X001	I101	I100	M8051	
X002	I201	I200	M8052	50 μs or more
X003	I301	I300	M8053	
X004	I401	I400	M8054	
X005	I501	I500	M8055	

9.3.2 Cautions for input interruption

1. Non-overlap of input numbers

The input terminals X000 to X005 can be used for high-speed counter, input interruption, pulse catch, SPD instruction, ZRN instruction, DSZR instruction and general-purpose inputs.
Take care not to overlap the input numbers.

2. Cautions in wiring

It is recommended to use shielded twisted-pair cables for connection cables.

9.3.3 Examples of external wiring

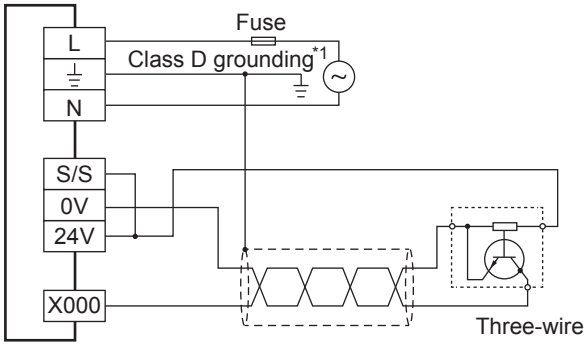
It is recommended to use shielded twisted-pair cables for connection cables.
Ground the shield of each shielded cable only on the PLC side.

1. Examples of input interruption (I000 or I001) wiring using X000

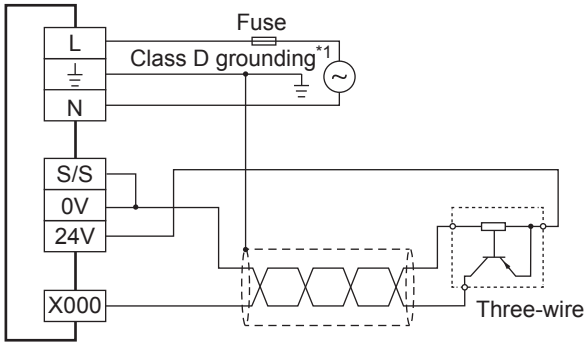
When another input terminal is used, wire it according to the following diagrams.

1) When 24 V DC service power supply is used

Sink wiring

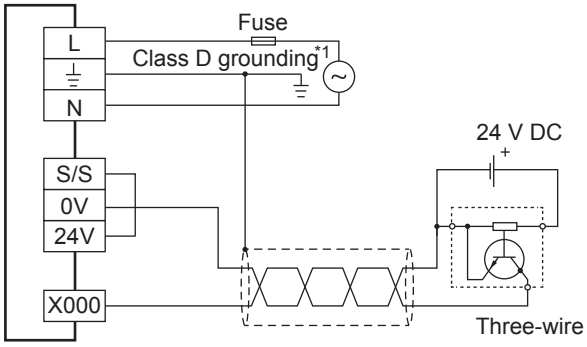


Source wiring

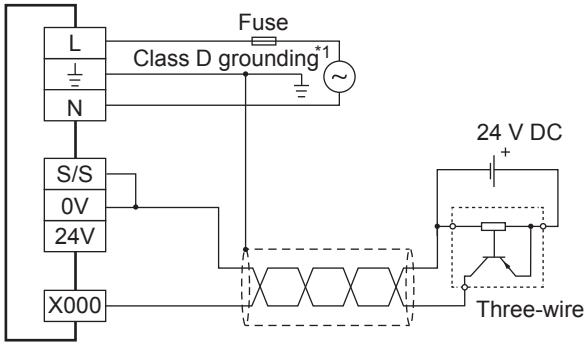


2) When 24 V DC external power supply is used

Sink wiring



Source wiring



*1. The grounding resistance should be 100 Ω or less.

9.4 Pulse Catch (M8170 to M8175)

The main unit is provided with a pulse catch function and has 6 pulse catch input points.

→ **For details on programming, refer to the programming manual.**

9.4.1 Allocation of special memories to input numbers (ON duration of input signals)

Input number	Contact on sequence program	ON duration of input signal
X000	M8170	10 μs or more
X001	M8171	
X002	M8172	50 μs or more
X003	M8173	
X004	M8174	
X005	M8175	

9.4.2 Cautions for pulse catch

1. **Non-overlap of input numbers**
   The input terminals X000 to X005 can be used for high-speed counter, input interruption, pulse catch, SPD instruction, ZRN instruction, DSZR instruction and general-purpose inputs.
   Take care not to overlap the input numbers.

2. **Cautions in wiring**
   It is recommended to use shielded twisted-pair cables for connection cables.

9.4.3 Examples of external wiring

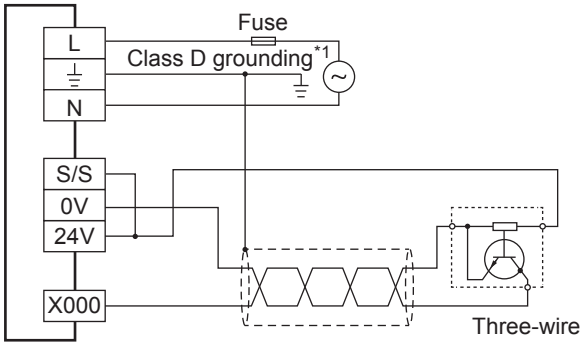
It is recommended to use shielded twisted-pair cables for connection cables.
Ground the shield of each shielded cable only on the PLC side.

1. Examples of pulse catch (M8170) wiring using X000

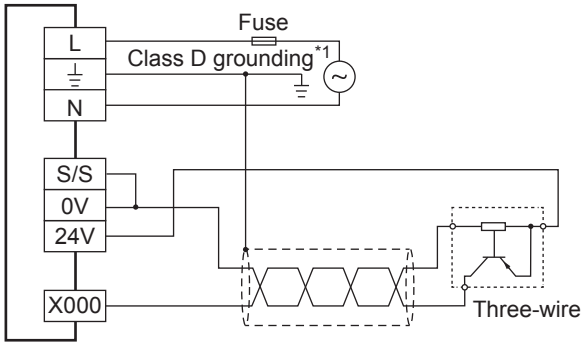
When another input terminal is used, wire it according to the following diagrams.

1) When 24 V DC service power supply is used

Sink wiring

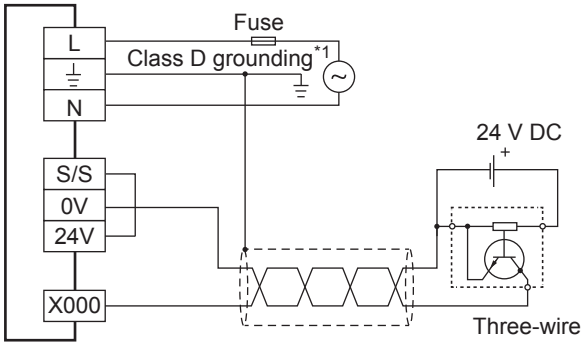


Source wiring

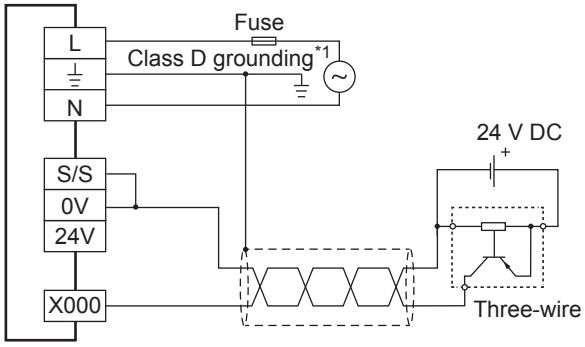


2) When 24 V DC external power supply is used

Sink wiring



Source wiring



*1. The grounding resistance should be 100 Ω or less.

10. Use of High-speed Counters

10.1 Outline

High-speed counters use input terminals (X000 to X007) of the main unit for inputs, and offer counting up to 60 kHz (1-phase).
Input terminals not used for high-speed counters are available for general-purpose inputs.

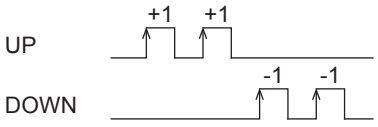
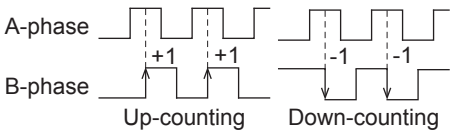
→ **For the input specifications, refer to Section 4.3.**

10.2 Types of Counting and Operations

The main unit has built-in 32-bit high speed bi-directional counters (1-phase 1-count input, 1-phase 2-count input and 2-phase 2-count input).
For some high-speed counters, external reset input terminals or external start input terminals (start of counting) can be selected.

10.2.1 Types and input signal forms

The types and input signals (waveforms) of high-speed counters (1-phase 1-count input, 1-phase 2-count input and 2-phase 2-count input) are shown below.

High-speed counter type	Input signal form	Counting direction
1-phase 1-count input		Down-count or up-count is specified by turning on or off M8235 to M8245. ON : Down-counting OFF: Up-counting
1-phase 2-count input		Up-count or down-count The counting direction can be checked with M8246 to M8250. ON : Down-counting OFF: Up-counting
2-phase 2-count input		Automatic up-count or down-count according to change in input status of phase A/B The counting direction can be checked with M8251 to M8255. ON : Down-counting OFF: Up-counting

10.2.2 High-speed counter device notations

The input terminal assignments for FX3S PLC high-speed counters can be switched when used in combination with a special auxiliary relay. This section classifies these high-speed counter devices under the following notations. Note that an "(OP)" input cannot be programmed.

Standard device numbers	Switched device numbers
C248	C248 (OP)
C253	C253 (OP)

10.2.3 Cautions in connecting mating device

Encoders with the output forms in the following table can be connected to the input terminals. (The encoders may not function correctly depending on electrical compatibility. Check the specifications in advance.)
Voltage output type encoders and absolute encoders cannot be connected to the high-speed counter input terminals.

Terminals for connecting	Output form that can be directly connected
Input terminals of main unit	Open collector transistor output form (applicable to 24 V DC)

10.3 List of Device Numbers and Functions

→ **For details on the high-speed counter number (OP), refer to Subsection 10.2.2.**

High-speed counter type	Device No. (counter)	Response Frequency*1 (kHz)	External reset input terminal	External start input terminal	Data length
1-phase 1-count input	C235	60	None	None	32-bit bi-directional counter
	C236				
	C237	10	None	None	
	C238				
	C239				
	C240				
	C241	60	Provided	None	
	C242	10	Provided	None	
	C243				
	C244	10	Provided	Provided	
	C245				
1-phase 2-count input	C246	60	None	None	32-bit bi-directional counter
	C248 (OP)	10	None	None	
	C247	10	Provided	None	
	C248				
	C249	10	Provided	Provided	
	C250				
2-phase 2-count input	C251	30	None	None	32-bit bi-directional counter
	C253 (OP)	5	None	None	
	C252	5	Provided	None	
	C253				
	C254	5	Provided	Provided	
	C255				

*1. When using multiple high-speed counters, make sure that the sum of used frequency does not exceed the overall frequency.

→ **For details on the overall frequency, refer to Section 10.7.**

10.4 Allocation of Device Numbers to Input Numbers

The high-speed counter numbers are allocated to the input terminals X000 to X007 as shown in the following table. The input terminals not allocated for high-speed counters can be used as general input terminals.

10.4.1 Allocation table

U: Up-count input D: Down-count input A: A-phase input B: B-phase input
R: External reset input S: External start input

High-speed counter type	High-speed counter No.	Input allocation							
		X000	X001	X002	X003	X004	X005	X006	X007
1-phase 1-count input	C235	U/D							
	C236		U/D						
	C237			U/D					
	C238				U/D				
	C239					U/D			
	C240						U/D		
	C241	U/D	R						
	C242			U/D	R				
	C243					U/D	R		
	C244	U/D	R					S	
	C245			U/D	R				S
1-phase 2-count input	C246	U	D						
	C247	U	D	R					
	C248				U	D	R		
	C248 (OP)*1				U	D			
	C249	U	D	R				S	
	C250				U	D	R		S
2-phase 2-count input	C251	A	B						
	C252	A	B	R					
	C253				A	B	R		
	C253 (OP)*1				A	B			
	C254	A	B	R				S	
	C255				A	B	R		S

*1. When a special auxiliary relay is driven in a program, the input terminals and their associated functions are switched.

→ **For the function switching method, refer to Subsection 10.9.2.**

10.4.2 Restriction of redundant use of input numbers

The input terminals X000 to X007 can be used for high-speed counters, input interruption, pulse catch, SPD instruction, ZRN instruction and DSZR instruction and general-purpose inputs.
Take care not to overlap the input numbers.

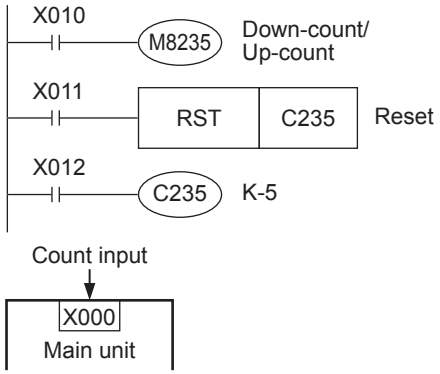
10.5 Handling of High-speed Counters

10.5.1 1-phase 1-count input

These counters are 32-bit up-count/down-count binary counters.

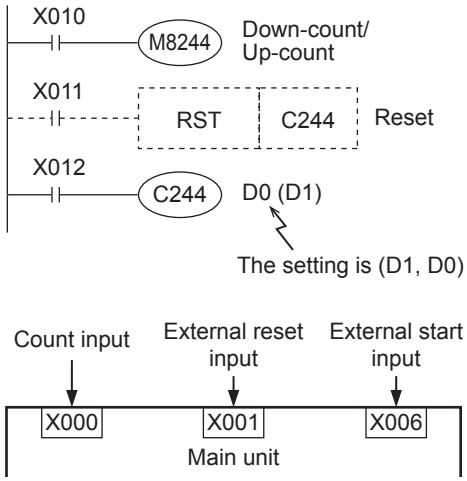
Examples of program

1) For C235



- C235 counts the number of times the input terminal X000 switches from OFF to ON while X012 is on.
- While X011 is on, the counter resets when RST instruction is executed.
- The counters C235 to C245 switch to the down-count or up-count mode by turning on or off M8235 to M8245.

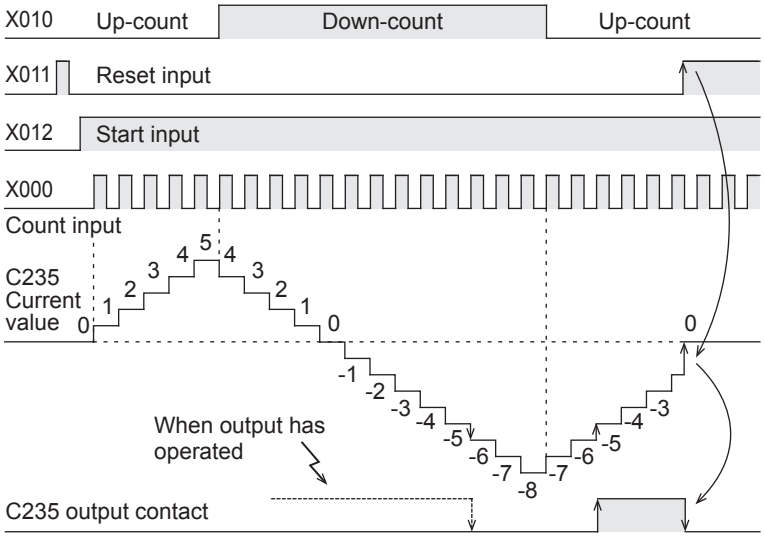
2) For C244



- C244 starts counting immediately when the input terminal X006 turns on while X012 is on. The count input terminal is X000. The setting for this example is the data of the indirectly designated data register (D1, D0).
- C244 can be reset by X011 on the sequence. For C244, X001 is allocated as the external reset input. The counter resets immediately when X001 turns on.
- The counters C235 to C245 switch to the down-count or up-count mode by turning on or off M8235 to M8245.

Example of operation

The above counter C235 operates as shown below.



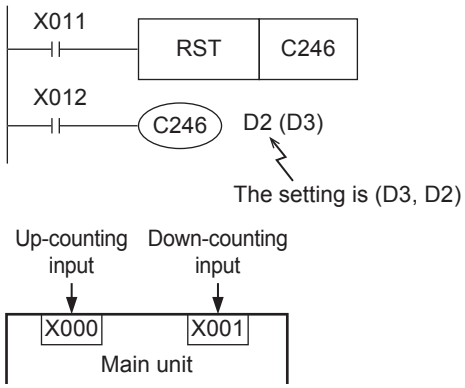
- C235 is set to the up-count or down-count mode through interruption by the count input X000.
- When the current value increases from -6 to -5, the output contact is set, and when the value decreases from -5 to -6, it is reset.
- The current value increases and decreases regardless of the operation of the output contact. However, when the counter's value increments from 2,147,483,647, it changes to -2,147,483,648. In the same manner, when it decrements from -2,147,483,648, it changes to 2,147,483,647. (This type of counter is called a ring counter.)
- When RST instruction is executed after the reset input X011 turns on, the current counter's value resets to 0, and the output contact is restored.
- The current value, output contact operation and reset status of counters are backed up (kept) even if the power is turned off.

10.5.2 1-phase 2-count input

These counters are 32-bit up-count/down-count binary counters.
The operations of the output contact according to the current value are the same as those of the above-mentioned 1-phase 1-count input high-speed counters.

Examples of program

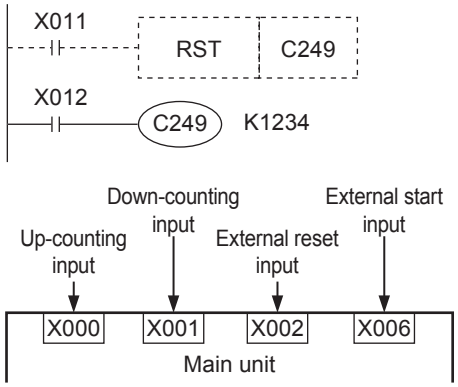
1) For C246



- While X012 is on, C246 increments the value when the input terminal X000 switches from OFF to ON and decrements the value when the input terminal X001 switches from OFF to ON.
- The down-count/up-count operations of C246 to C250 can be monitored through the ON/OFF operations of M8246 to M8250.

  ON : Down-counting
  OFF: Up-counting

2) For C249



- While X012 is on, C249 starts counting immediately when the input terminal X006 turns on. The up-counting input terminal is X000, and the down-counting input terminal is X001.
- C249 can be reset on the sequence by X011. For C249, X002 is allocated as reset input. When X002 turns on, C249 is immediately reset.
- The down-count/up-count operations of C246 to C250 can be monitored through the ON/OFF operations of M8246 to M8250.

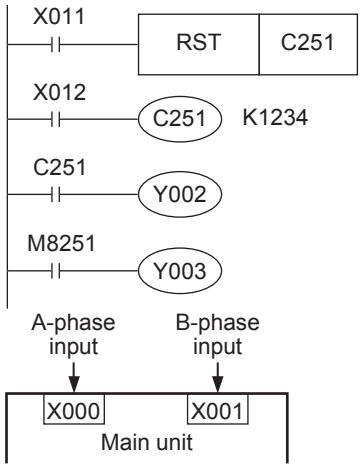
  ON : Down-counting
  OFF: Up-counting

10.5.3 2-phase 2-count input

These counters are 32-bit up-count/down-count binary counters.
The operations of the output contact according to the current value are the same as those of the above-mentioned 1-phase 1-count input high-speed counters.

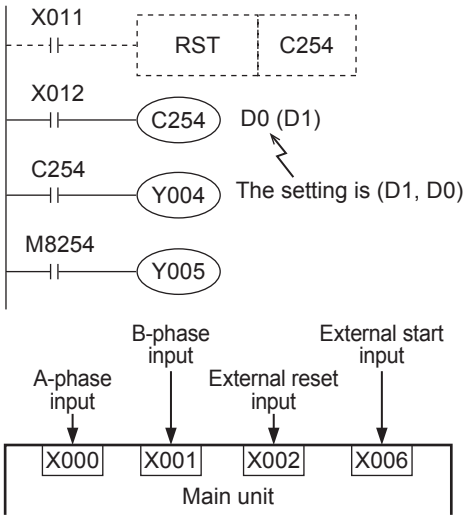
Examples of program

1) For C251



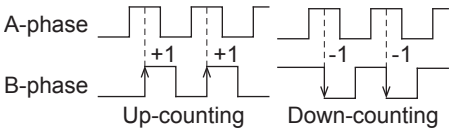
- While X012 is on, C251 counts the operation of the input terminals X000 (A-phase) and X001 (B-phase) through interruption.
- While X011 is turned on, the counter is reset when RST instruction is executed.
- When the current value exceeds the setting, Y002 turns on, and when the current value becomes lower than the setting, Y002 turns off.
- Y003 turns on (down-count) or off (up-count) according to the counting direction.

2) For C254



- C254 starts counting immediately when the input terminal X006 is turned on while X012 is on. The count input terminals are X000 (A-phase) and X001 (B-phase).
- C254 is reset by X011 on the sequence, and it is reset immediately when X002 is turned on.
- When the current value exceeds the setting (D1, D0), Y004 operates, and when the current value becomes lower than the setting, Y004 turns off.
- Y005 turns on (down-count) or off (up-count) according to the counting direction.

- A 2-phase encoder generates A-phase output and B-phase output between which there is a 90 phase difference. The high-speed counter automatically counts up or down according to the output as shown below.



- The down-count/up-count operations of C251 to C255 can be monitored through the ON/OFF operations of M8251 to M8255.
  ON : Down-counting
  OFF: Up-counting

10.6 Timing of Updating of Current Value and Comparison of Current Value

10.6.1 Timing of updating of current value

When pulses are input to an input terminal for a high-speed counter, the high-speed counter executes up-counting or down-counting. The current values of devices are updated when counting is input.

10.6.2 Comparison of current value

To compare and output the current value of a high-speed counter, the following two methods are available.

1. **Use of comparison instruction (CMP instruction), band comparison instruction (ZCP instruction) or contact comparison instruction**
   Use the comparison instruction (CMP instruction), band comparison instruction (ZCP instruction) or contact comparison instruction if the comparison result is necessary at counting. Use these instructions only when high-speed processing is not required because these instructions are processed in the operation cycle of the PLC, and operation delay is generated before the comparison output result is obtained. Use the comparison instructions for high-speed counters (HSCS instruction, HSCR instruction and HSZ instruction) described below if it is necessary to execute comparison and change the output contact (Y) at the same time when the current values of high-speed counters change.

2. **Use of Comparison instruction for high-speed counters (HSCS instruction/HSCR instruction/HSZ instruction)**
   Comparison instructions for high-speed counters (HSCS instruction, HSCR instruction and HSZ instruction) perform comparison and output the comparison results with the relevant high-speed counting operation. These instructions have limitations on the number of simultaneously driven instructions as shown in the following table.
   When the output relay (Y) has been designated for comparison results, the ON/OFF status of the output is affected directly until the END instruction output is refreshed.
   When the PLC is a relay output type, a mechanical delay in operation (approx. 10 ms) is caused.
   Therefore, it is best to use a transistor output type PLC.

Applied instruction	Limitation in number of instructions driven at same time
HSCS instruction*1	6 instructions
HSCR instruction*1	
HSZ instruction*1	

*1. The overall frequency changes when the HSCS instruction, HSCR instruction or HSZ instruction is used.

→ **For details on the overall frequency, refer to Section 10.7.**

10.7 Response Frequency and Overall Frequency

1. Response frequency and overall frequency

When any of the following functions/instructions is used, the overall frequency is restricted without regard to the operand of the instruction.
Consider this restriction when examining the system or creating programs, and observe the specified overall frequency range.

- When two or more high-speed counters are used.
- When the HSCS instruction, HSCR instruction, HSZ instruction, PLSY instruction, PLSR instruction, DSZR instruction, ZRN instruction, PLSV instruction, DRVI instruction or DRVA instruction is used.

High-speed counter type		Response frequency	Overall frequency determined by condition of used instruction	
			When HSCS instruction, HSCR instruction or HSZ instruction is not used	When HSCS instruction, HSCR instruction or HSZ instruction is used
1-phase 1-count input	C235, C236, C241	60 kHz	200 kHz - Number of positioned axes*1 × 40 kHz	60 kHz - Number of positioned axes*1 × 5 kHz
	C237, C238, C239, C240, C242, C243, C244, C245	10 kHz		
1-phase 2-count input	C246	60 kHz		
	C247, C248, C248 (OP), C249, C250	10 kHz		
2-phase 2-count input	C251	30 kHz		
	C252, C253, C253 (OP), C254, C255	5 kHz		

*1. Number of axes used in the following positioning instructions:
PLSY (FNC 57), PLSR (FNC 59), DSZR (FNC150), ZRN (FNC156), PLSV (FNC157), DRVI (FNC158), DRVA (FNC159)

2. Calculation of overall frequency

Obtain the overall frequency using the following expression:
Overall frequency ≥ [(Sum of used frequency of 1-phase counters) + (Sum of used frequency of 2-phase counters)]

3. Example of calculation

Example 1:
When HSCS instruction, HSCR instruction or HSZ instruction is not used, and instructions related to positioning (DRVI instruction [Y000] and DRVA instruction [Y001]) are used
Overall frequency : 200 kHz - (2 axes × 40 kHz) = 120 kHz

<High-speed counter No.>	<Contents of use>
C235 (1-phase 1-count input):	50 kHz is input.
C236 (1-phase 1-count input):	50 kHz is input.
C237 (1-phase 1-count input):	10 kHz is input.
C253 (2-phase 2-count input):	5 kHz is input.
Total	115 k Hz ≤ 120 kHz (Overall frequency)

Example 2:
When HSCS instruction, HSCR instruction or HSZ instruction is used, and instructions related to positioning (DRVI instruction [Y000]) is used
Overall frequency : 60 kHz - (1 axis × 5 kHz) = 55 kHz

<High-speed counter No.>	<Contents of use>
C237 (1-phase 1-count input):	10 kHz is input.
C253 (2-phase 2-count input):	5 kHz is input.
Total	15 k Hz ≤ 55 kHz (Overall frequency)

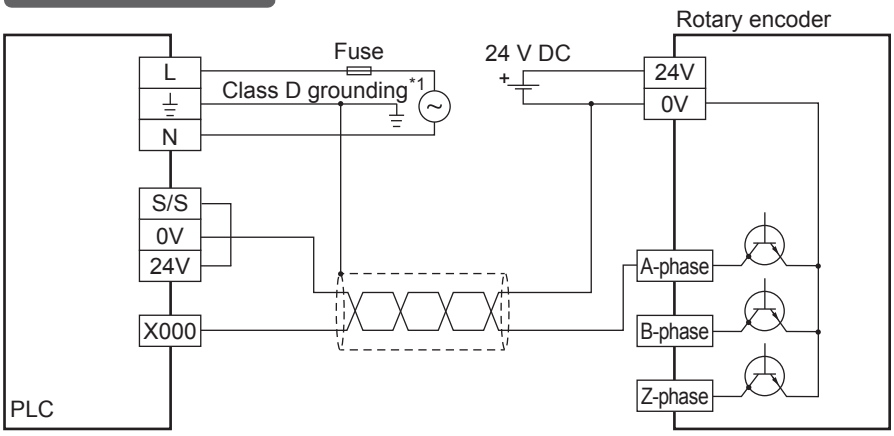
10.8 Examples of External Wiring (Rotary Encoder)

10.8.1 1-phase 1-input [C235 to C245]

The following examples of wiring apply to the cases where C235 is used.
When another high-speed counter number is used, wire the counter referring to the following diagrams.
It is recommended to use shielded twisted-pair cables for connection cables. Ground the shield of each shielded cable only on the PLC side.

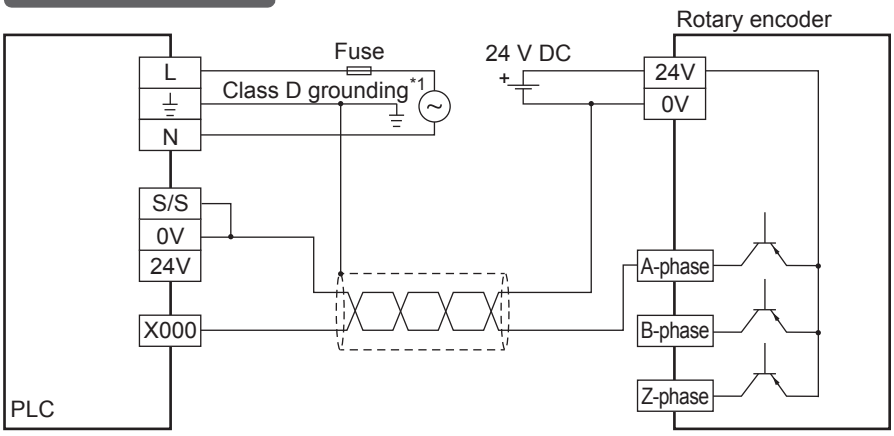
1) NPN open collector transistor output rotary encoder

Sink wiring



2) PNP open collector transistor output rotary encoder

Source wiring



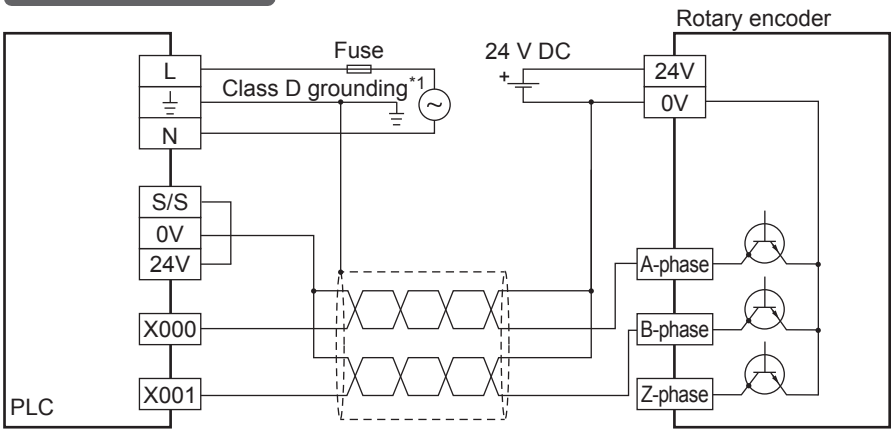
*1. The grounding resistance should be 100 Ω or less.

10.8.2 2-phase 2-input [C251 to C255]

The following examples of wiring apply to the cases where C251 is used.
When another high-speed counter number is used, wire the counter referring to the following diagrams.
It is recommended to use shielded twisted-pair cables for connection cables. Ground the shield of each shielded cable only on the PLC side.

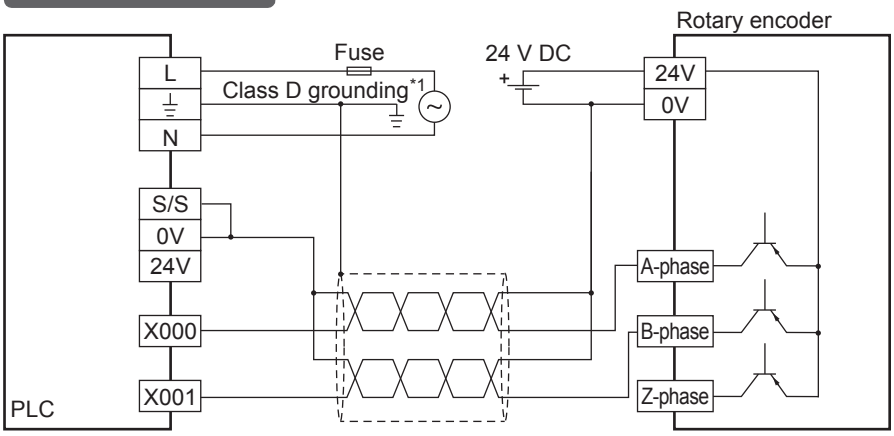
1) NPN open collector transistor output rotary encoder

Sink wiring



2) PNP open collector transistor output rotary encoder

Source wiring



*1. The grounding resistance should be 100 Ω or less.

10.9 Related Devices and Function Switching Procedures

10.9.1 Related devices

1. For switching 1-phase 1-count input counter mode to up-count or down-count

High-speed counter type	High-speed counter No.	Specifying device	Up-counting	Down-counting
1-phase 1-count input	C235	M8235	OFF	ON
	C236	M8236		
	C237	M8237		
	C238	M8238		
	C239	M8239		
	C240	M8240		
	C241	M8241		
	C242	M8242		
	C243	M8243		
	C244	M8244		
	C245	M8245		

2. For monitoring of up-count/down-count counting direction of 1-phase 2-count input and 2-phase 2-count input counters

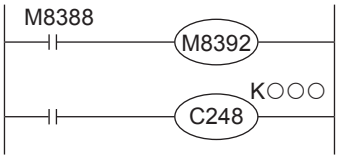
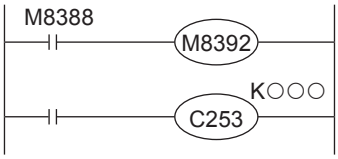
High-speed counter type	High-speed counter No.	Monitoring device	OFF	ON
1-phase 2-count input	C246	M8246	Up-counting	Down-counting
	C247	M8247		
	C248	M8248		
	C249	M8249		
	C250	M8250		
2-phase 2-count input	C251	M8251		
	C252	M8252		
	C253	M8253		
	C254	M8254		
	C255	M8255		

3. For switching high-speed counter function

Device No.	Name	Description	Reference
M8388	Contact for changing high-speed counter function	Changes the function of high-speed counter	-
M8392	Function switching devices	Switches the function of C248 and C253	Subsection 10.9.2

10.9.2 [Function switching] switching of allocation and functions of input terminals

When the counters C248 and C253 are combined with the auxiliary relays (M8388), the allocation of the input terminals and functions are changed.
Program the special auxiliary relays just before the counters.

High-speed counter type	Function switching method	Details of change
C248 (OP)		• Reset input is not given.
C253 (OP)		• Reset input is not given.

10.10 Cautions on Use

→ For programming details, refer to the Programming Manual.

- If the operation of a high-speed counter is triggered by a device such as a switch, the counter may malfunction due to extra noise from switch chattering or contact bounce.
- The input filter of an input terminal for a high-speed counter in the main unit is automatically set to 10 μs (X000, X001) or 50 μs (X002 to X007).
  Accordingly, it is not necessary to use special data register D8020 (input filter adjustment).
  The input filter for input relays not being used for high-speed counters remains at 10 ms (initial value).
- The input terminals X000 to X007 can be used for high-speed counters, input interruption, pulse catch, SPD instruction, ZRN instruction and DSZR instruction and general-purpose inputs.
  Take care not to overlap the input numbers.
- Make sure that the signal speed for high-speed counters does not exceed the response frequency described above. If an input signal exceeds the response frequency, a WDT error may occur, or the communication functions such as a parallel link may malfunction.
- The response frequency changes depending on the number of used counters, but the input filter value is fixed to 10 μs (X000, X001) or 50 μs (X002 to X007). Note that noise above the response frequency may be counted depending on the filter value of the used input.

11. Use of Built-in Analog

WIRING PRECAUTIONS **⚠WARNING**

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work.
  Failure to do so may cause electric shock or damage to the product.
- The temperature rating of the cable should be 80°C or more.

WIRING PRECAUTIONS **⚠CAUTION**

- When drilling screw holes or wiring, make sure cutting or wire debris does not enter the ventilation slits.
  Failure to do so may cause fire, equipment failures or malfunctions.
- Make sure to observe the following precautions in order to prevent any damage to the machinery or accidents due to abnormal data written to the PLC under the influence of noise:
  1) Do not bundle the power line or shield of the analog input/output cable together with or lay it close to the main circuit, high-voltage line, or load line.
     Otherwise, noise disturbance and/or surge induction are likely to take place. As a guideline, lay the control line at least 100 mm (3.94") or more away from the main circuit, high-voltage line, or load line.
  2) Ground the shield of the analog input/output cable at one point on the signal receiving side.
     However, do not use common grounding with heavy electrical systems.
- Make sure to properly wire to the terminal block (European type) in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.
  - Twist the end of strand wire and make sure that there are no loose wires.
  - Do not solder-plate the electric wire ends.
  - Do not connect more than the specified number of wires or electric wires of unspecified size.
  - Affix the electric wires so that neither the terminal block nor the connected parts are directly stressed.

11.1 Outline

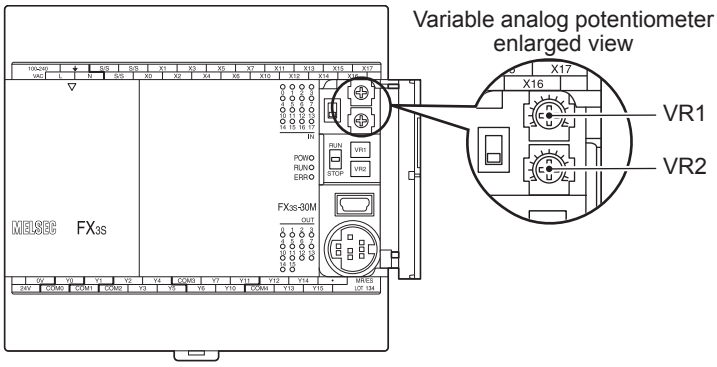
This section explains handling of the built-in variable analog potentiometer and built-in analog input.

→ **For the built-in variable analog potentiometer function, refer to Section 11.2.**
→ **For the built-in analog input function, refer to Section 11.3.**

11.2 Built-in variable analog potentiometer function

11.2.1 Outline of functions

The main unit has two built-in variable analog potentiometers function (shown in the figure below).
The value increases from 0 to 255 when the variable analog potentiometer is turned clockwise, and will be automatically written to a special data register of the PLC.



11.2.2 Applicable PLC

The following models have built-in variable analog potentiometers.

Applicable PLC					
FX3S-10MR/ES	FX3S-10MT/ES	FX3S-10MT/ESS	FX3S-10MR/DS	FX3S-10MT/DS	FX3S-10MT/DSS
FX3S-14MR/ES	FX3S-14MT/ES	FX3S-14MT/ESS	FX3S-14MR/DS	FX3S-14MT/DS	FX3S-14MT/DSS
FX3S-20MR/ES	FX3S-20MT/ES	FX3S-20MT/ESS	FX3S-20MR/DS	FX3S-20MT/DS	FX3S-20MT/DSS
FX3S-30MR/ES	FX3S-30MT/ES	FX3S-30MT/ESS	FX3S-30MR/DS	FX3S-30MT/DS	FX3S-30MT/DSS

11.2.3 Special data register

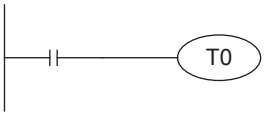
The current value of each variable analog potentiometer is stored in special data registers shown below.

Variable analog potentiometer	Data register to store current value
VR1 (Upper side): Variable analog potentiometer 1	D8030 (Integer from 0 to 255)
VR2 (Lower side): Variable analog potentiometer 2	D8031 (Integer from 0 to 255)

11.2.4 Use example of variable analog potentiometer

1. Example 1

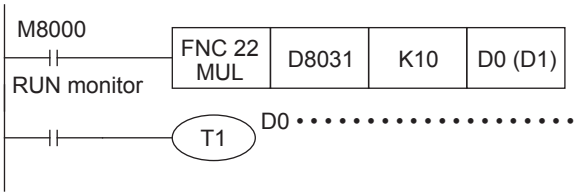
The current value of VR1 is used as the set value of a timer (T0).



D8030 • • • The current value of VR1 is used as the set value of the timer T0.
The setting range in this example using T0 (100 ms timer) in from 0 to 25.5 sec.

2. Example 2

The current value of VR2 multiplied by "10" is used as the set value of a timer (T1).



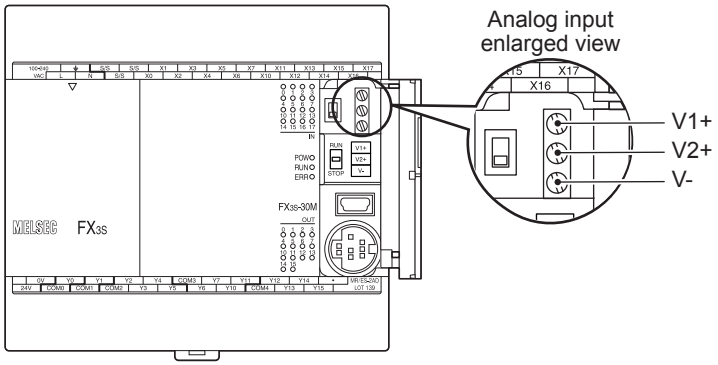
• • • The value of D8031 is multiplied by “10”, and stored in D0 (D1).

D0 • The current value of VR2 multiplied by “10” is used as the set value of the timer T1.
The setting range in this example using T1 (100 ms timer) is from 0 to 255 sec.

11.3 Built-in analog input function

11.3.1 Outline of functions

The main unit has two built-in analog voltage inputs (shown in the figure below).
A/D conversion data will be automatically written to special data registers of the PLC.

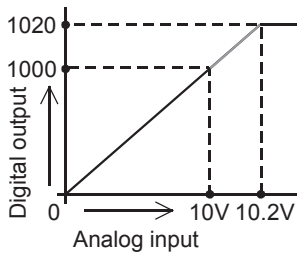


11.3.2 Applicable PLC

The following models have built-in analog inputs.

Applicable PLC		
FX3S-30MR/ES-2AD	FX3S-30MT/ES-2AD	FX3S-30MT/ESS-2AD

11.3.3 Analog input performance specifications

Item	Input specification
Analog input range	0-10 V DC (Input resistance: 115.7 kΩ)
Absolute maximum input	-0.5 V, +15 V
Digital output	10 bits, binary
Device allocation	D8270 (The digital value of CH1 is stored) D8271 (The digital value of CH2 is stored)
Resolution	10 mV (10 V/1000)
Total accuracy	± 1.0 % (± 100 mV) for 10 V full scale (when ambient temperature is 25 °C ± 5 °C) ± 2.0 % (± 200 mV) for 10 V full scale (when ambient temperature is 0 °C to 55 °C)
A/D conversion time	180 µs (The data will be updated at every scan time of the PLC.)
Input characteristics	
Insulation method	No insulation between each channel or the PLC.
Occupied points	0 point (This number is not related to the maximum number of input/output points of the PLC.)

11.3.4 Analog input terminal block

The analog inputs use a European terminal block.
Use the following cables to connect with the counterpart equipment. Terminate the cable ends as shown below.

1. Wire size

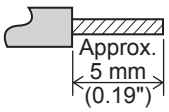
No. of wire per terminal	Wire size		
	Solid wire	Stranded wire	Ferrules with plastic sleeve
1	0.14 to 1.5 mm^2 (AWG26 to 16)	0.14 to 1.0 mm^2 (AWG26 to 16)	0.25 to 0.5 mm^2 (AWG24 to 20)
2	0.14 to 0.5 mm^2 (AWG26 to 20)	0.14 to 0.2 mm^2 (AWG26 to 24)	-

2. Termination of cable end

To terminate the cable, treat the stranded/single-wire directly or use a rod terminal with insulation sleeve.
Tighten the terminals to a torque of 0.22 to 0.25 N•m.
Do not tighten terminal screws with a torque outside the above-mentioned range. Failure to do so may cause equipment failures
or malfunctions.

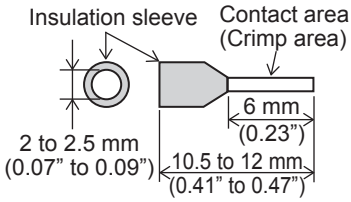
- To directly terminate the end of a stranded/single-wire cable:
  - Twist the end of the stranded cable so that the "barbed wires" cannot protrude.
  - Do not solder-plate the end of the cable.

• Stranded wire/solid wire



- To terminate cable end using a rod terminal with insulation sleeve:
  If the cable cover is too thick, it may be difficult to insert the cable into the insulation sleeve. For this reason, select an appropriate cable while referring to the external view.

• Bar terminal with insulating sleeve



<Reference>

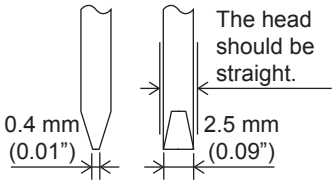
Manufacturer	Model	Caulking tool
Phoenix Contact Co., Ltd.	AI 0.25-6BU (AWG24)	CRIMPFOX 6*1 (or CRIMPFOX 6T-F*2)
	AI 0.34-6TQ (AWG22)	
	AI 0.5-6WH (AWG20)	

*1. Old model name : CRIMPFOX ZA 3

*2. Old model name : CRIMPFOX UD 6

3. Tool

For tightening the terminal, use a commercially available small screwdriver having a straight form that is not widened toward the end as shown right.



Caution

If the diameter of screwdriver grip is too small, tightening torque will not be able to be achieved. To achieve the appropriate tightening torque shown in the table above, use the following screwdriver or appropriate replacement (grip diameter : approximately 25 mm (0.98")).

<Reference>

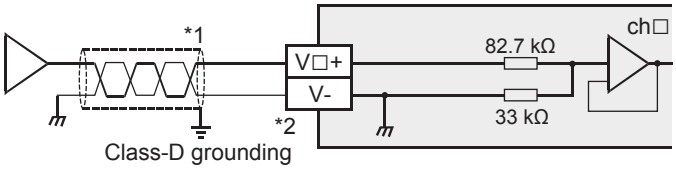
Manufacturer	Model name
Phoenix Contact Co., Ltd.	SZS 0.4×2.5

11.3.5 Terminal layout

Terminal layout is arranged as follows:

V1+	• • • channel 1 analog input
V2+	• • • channel 2 analog input
V-	• • • COM terminal

11.3.6 Analog input line



V□ +, I□ +, ch□ : □ represents the channel number.

*1. Use the 2-core shielded twisted pair cable for the analog input lines, and separate the analog input lines from other power lines or inductive lines.

*2. Make sure to short-circuit the "V□+" and "V-" terminals when ch is not used.

11.3.7 Special data register

The following is a list of associated special devices.

Special data register	Description	Attribute
D8270	Channel-1 input data	R
D8271	Channel-2 input data	R
D8272	Unused (Do not use.)	-
D8273		-
D8274	Averaging time for channel-1 (Setting range: 1 to 4095)	R/W
D8275	Averaging time for channel-2 (Setting range: 1 to 4095)	R/W
D8276	Unused (Do not use.)	-
D8277		-
D8278	Error status	R
D8279	Model code	R

1. Input data

The data converted by the PLC will be stored in special data registers.
The converted A/D immediate data or averaged data (data average conforming to the specified averaging time) will be stored in the above data registers as the input data.
The special data registers that store the input data are shown in the following table:

Special data register	Description
D8270	Channel-1 input data
D8271	Channel-2 input data

Caution regarding input data

Input data is for reading only.
Do not change (rewrite) the input data using sequence program, indicator, or device monitor of the programming tool.

2. Averaging time

If the averaging time is set in the PLC, the averaged data will be stored as the input data.
The averaging time can be set for each channel.
Set the averaging time in the following special data registers:

Special data register	Description
D8274	Averaging time for channel-1
D8275	Averaging time for channel-2

Cautions regarding averaging time setting

- If the averaging time is set to "1", the immediate data is stored to the special data register.
- If the averaging time is set in the range from 2 to 4095, the average value will be calculated to conform to the set averaging time, and the average value obtained will be stored in the special data register.
- After turning the PLC power on, the current data is stored to special data registers until the number of data items reaches the set averaging time. After this, the average data will be stored.
- Set the averaging time in the range from 1 to 4095. If the set value is outside the setting range, an error signal will be output.
- If the averaging time is set to "0" or smaller, the PLC will perform as if the averaging time is set to "1".
  If the averaging time is set to "4096" or larger, the PLC will perform as if the averaging time is set to "4096".
  → **For a detailed description of the error, refer to Subsection 11.3.10.**

3. Error status

If an error is detected in the PLC, the error status data will be stored in the corresponding special data register.
The following table shows the special data registers that store the error status data:

Special data register	Description
D8278	Error status

Check the ON/OFF status of each bit of the error status data register to check the description of the error. Errors are assigned to the bits as shown in the following table. Create a program to detect errors.
→ **For a detailed description of the error status, refer to Subsection 11.3.10.**

Bit	Description
b0	Channel-1 over-scale detection
b1	Channel-2 over-scale detection
b2	Unused
b3	Unused
b4	EEPROM error
b5	Averaging time setting error (common ch1 and ch2)
b6 to b15	Unused

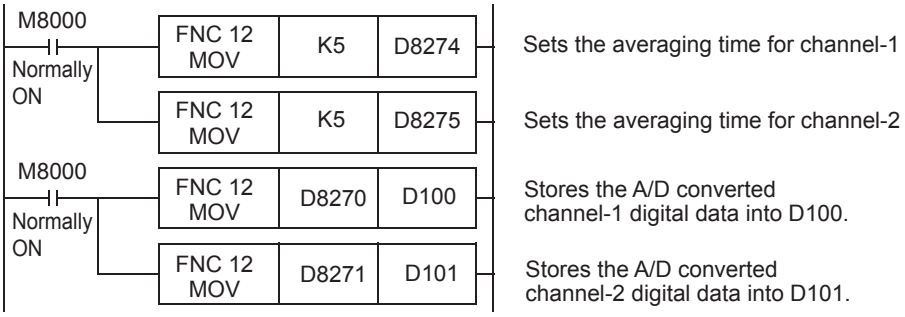
4. Model code

When the analog built-in main unit is connected, model code "5" is stored in the corresponding special data register.
The following table shows the special data registers that store the model code:

Special data register	Description
D8279	Model code

11.3.8 Program example

Create the following program to read out analog conversion (A/D conversion) data.
The following program will store the converted A/D value of channel-1 data into D100 and that of channel-2 data into D101.
Even if the input data is not stored into D100 or D101, the data registers D8270 or D8271 can be directly used as timer/counter setting value or in a PID instruction.

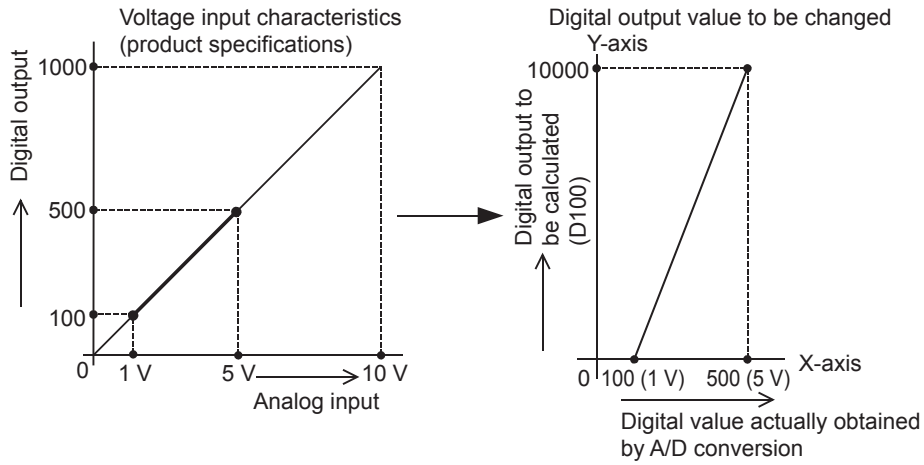


11.3.9 Changing of input characteristics

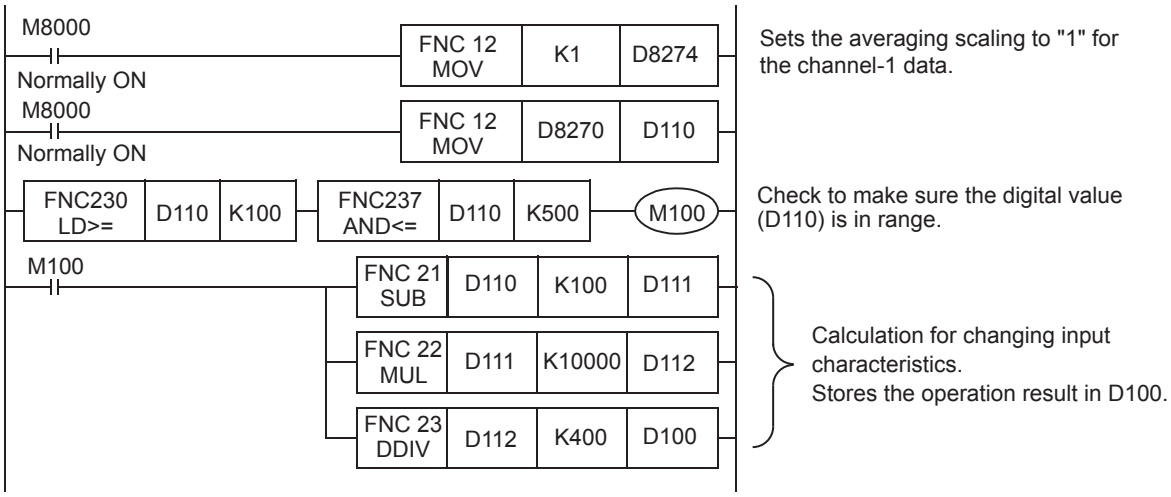
The input characteristics can be changed using a sequence program in the PLC.

Example: Changing of input characteristics
This section describes an example of a program that can change the digital output range of 100 to 500 (when the voltage input is 1 to 5 V) to digital output range of 0 to 10000.

1) Input characteristics



2) Example of program
For example, create the following program to change the digital input data:



11.3.10 Troubleshooting when using built-in analog input

This subsection describes troubleshooting methods and error statuses.
If the A/D conversion data is not input, or if the proper digital value is not input, check the following items:

- Wiring
- Special devices
- Programs

1. Wiring check

Check the following items for wiring:

- Use 2-core twisted shielded pair cable for the analog input line. In addition, be sure to separate the analog input line from other power lines or inductive lines.

→ **For a detailed description of wiring, refer to Subsection 11.3.6.**

2. Special device check

Check whether the special devices for the PLC are being used correctly:

- Input data
  Verify that the special device of the selected channel is correctly selected. This special device should be selected depending on the channel.
- Averaging time
  Check that the set averaging time is within the specified range. The averaging time should be set in the range from 1 to 4095. If the set averaging time is outside the specified range, an error occurs.
- Error status
  Check that no error is detected in the PLC. If an error is detected, check the details of the error, and then check the wiring and programs.

→ **For a detailed description of special devices, refer to Subsection 11.3.7.**

3. Program check

Check the following items for the program:

- Check of storage devices
  Verify that different values are not being stored in the same device by other parts of the program.

4. Error status check

If an error occurs in the PLC, the corresponding bit will turn on.
The bit which is turned ON due to the error status is held ON until overwritten to OFF by the program or the power is cycled.

Bit	Description
b0	Channel-1 over-scale detection
b1	Channel-2 over-scale detection
b2	Unused
b3	Unused
b4	EEPROM error
b5	Averaging time setting error (common ch1 and ch2)
b6 to b15	Unused

To solve the problem, refer to the troubleshooting method described below:

1) Over-scale detection (b0, b1)
   a) Description of error
      The input analog value (voltage value) is outside the specified range.
      The input voltage value is over the specified upper limit of 10.2 V.
   b) Remedy
      Check that the input analog value is within the specified range.
      Also check the wiring.

2) EEPROM error (b4)
   a) Description of error
      The adjustment data which was set in the EEPROM before delivery from our factory cannot be read out properly or has been destroyed.
   b) Remedy
      Please contact your local Mitsubishi Electric representative.
3) Averaging time setting error (b5)
   a) Description of error
      The averaging time set for one of the channels (channels 1 to 2) is outside the specified range: 1 to 4095.
   b) Remedy
      Check that the averaging time is set correctly for each channel.

12. Output Wiring Procedures

DESIGN PRECAUTIONS ⚠ **WARNING**

- Make sure to have the following safety circuits outside of the PLC to ensure safe system operation even during external power supply problems or PLC failure.
  Otherwise, malfunctions may cause serious accidents.
  1) Most importantly, have the following: an emergency stop circuit, a protection circuit, an interlock circuit for opposite movements (such as normal vs. reverse rotation), and an interlock circuit (to prevent damage to the equipment at the upper and lower positioning limits).
  2) Note that when the PLC CPU detects an error, such as a watchdog timer error, during self-diagnosis, all outputs are turned off. Also, when an error that cannot be detected by the PLC CPU occurs in an input/output control block, output control may be disabled.
     External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
  3) If an overload of the 24 V DC service power supply occurs, the voltage automatically drops, inputs in the PLC are disabled, and all outputs are turned off.
     External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
  4) Note that when an error occurs in a relay or transistor output device, the output could be held either on or off.
     For output signals that may lead to serious accidents, external circuits and mechanisms should be designed to ensure safe machinery operation in such a case.

DESIGN PRECAUTIONS ⚠ **CAUTION**

- Do not bundle the control line together with or lay it close to the main circuit or power line. As a guideline, lay the control line at least 100 mm (3.94") or more away from the main circuit or power line.
  Noise may cause malfunctions.
- Install module so that excessive force will not be applied to peripheral device connectors.
  Failure to do so may result in wire damage/breakage or PLC failure.

SECURITY PRECAUTIONS ⚠ **WARNING**

- To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from unreliable networks and devices via network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

WIRING PRECAUTIONS ⚠ **WARNING**

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work.
  Failure to do so may cause electric shock or damage to the product.
- Make sure to attach the terminal cover, offered as an accessory, before turning on the power or initiating operation after installation or wiring work.
  Failure to do so may cause electric shock.
- The temperature rating of the cable should be 80°C or more.

WIRING PRECAUTIONS ⚠ **CAUTION**

- Do not supply power to the [24V] terminal (24 V DC service power supply) on the main unit.
  Doing so may cause damage to the product.
- Perform class D grounding (grounding resistance: 100 Ω or less) to the grounding terminal on the main unit with a wire 2 mm^2 or thicker.
  Do not use common grounding with heavy electrical systems (refer to Section 8.3).
- Connect the AC power supply wiring to the dedicated terminals described in this manual.
  If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out.
- Noise resistance may be lower when the L and N wires of an AC power supply are not wired correctly.
  Please wire using the correct polarity.
- Connect the DC power supply wiring to the dedicated terminals described in this manual.
  If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out.
- Do not wire vacant terminals externally.
  Doing so may damage the product.
- When drilling screw holes or wiring, make sure cutting or wire debris does not enter the ventilation slits.
  Failure to do so may cause fire, equipment failures or malfunctions.
- Make sure to properly wire to the main unit in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - Make sure to properly wire to the main unit in accordance with the rated voltage, current, and frequency of each terminal.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.
  - Tighten the screws using a Phillips-head screwdriver No.2 (shaft diameter 6mm (0.24”) or less). Make sure that the screwdriver does not touch the partition part of the terminal block.
- Make sure to properly wire to the terminal block (European type) in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.
  - Twist the end of strand wire and make sure that there are no loose wires.
  - Do not solder-plate the electric wire ends.
  - Do not connect more than the specified number of wires or electric wires of unspecified size.
  - Affix the electric wires so that neither the terminal block nor the connected parts are directly stressed.

12.1 External Wiring for Relay Output Type

This section explains "handling of relay output", "external wiring precautions" and "example of external wiring".

→ **For the relay output specifications, refer to Subsection 4.4.1.**

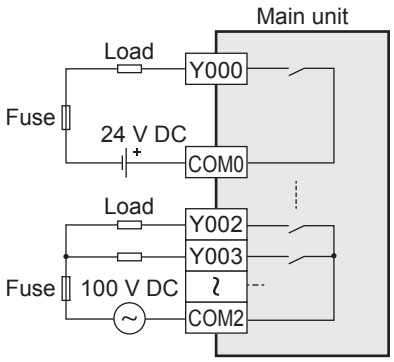
12.1.1 Product life of relay contacts

→ **For product life of relay contacts, refer to Subsection 14.4.2.**

12.1.2 Handling of relay output

1. Output terminal

One common terminal is used for 1 or 4 relay output points.
The common terminal blocks can drive loads of different circuit voltage systems (for example,100 V AC and 24 V DC).



2. External power supply

Use an external power supply of 30 V DC or less or 240 V AC or less[*1] for loads.

3. Circuit insulation

The PLC internal circuit and external load circuits are electrically insulated between the output relay coil and contact. The common terminal blocks are separated from one another.

4. Display of operation

When power is applied to the output relay coil, the LED is lit, and the output contact is turned on.

5. Response time

The response time of the output relay from when the power is applied to the coil until the output contact is turned on and from when the coil is shut off until the output contact is turned off is approx. 10 ms.

6. Output current

At a circuit voltage of 240 V AC or less[*1], a resistance load of 2 A per point or an inductive load of 80 VA or less (100 V AC or 200 V AC[*2]) can be driven.

→ **For the life of the contact for switching an inductive load, refer to Subsection 14.4.2.**

When an inductive load is switched, connect a diode (for commutation) or a surge absorber in parallel with this load.

DC circuit	Diode (for commutation)
AC circuit	Surge absorber

7. Open circuit leakage current

When the output contact is turned off, no current leaks.

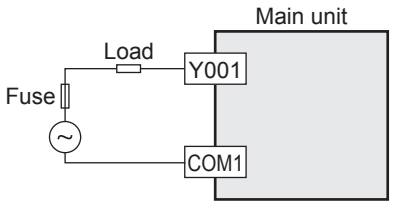
*1. 250 V AC or less when the unit does not comply with CE, UL or cUL standards.

*2. UL and cUL standards approved at 120 and 240 V AC.

12.1.3 External wiring precautions

1. Protection circuit for load short-circuiting

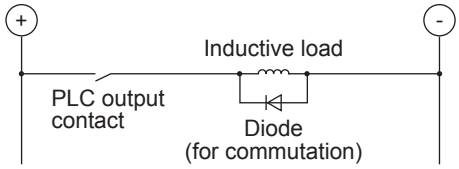
A short-circuit at a load connected to an output terminal could cause burnout at the output element or the PCB. To prevent this, a protection fuse should be inserted at the output.



2. Contact protection circuit for inductive loads

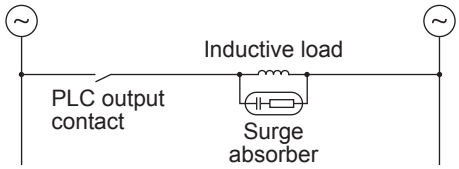
An internal protection circuit for the relays is not provided for the relay output circuit in this product. It is recommended to use inductive loads with built-in protection circuits. When using loads without built-in protection circuits, insert an external contact protection circuit, etc. to reduce noise and extend the product life.

1) DC circuit
Connect a diode in parallel with the load.
The diode (for commutation) must comply with the following specifications.



Item	Guide
Reverse voltage	5 to 10 times the load voltage
Forward current	Load current or more

2) AC circuit
Connect the surge absorber (combined CR components such as a surge killer and spark killer, etc.) parallel to the load. Select the rated voltage of a surge absorber that is suitable for the load being used. Refer to the table below for other specifications.



Item	Guide
Static electricity capacity	Approx. 0.1 μF
Resistance value	Approx. 100 to 200 Ω

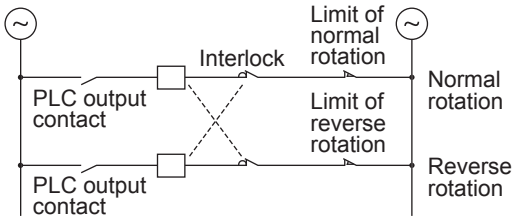
Reference

Manufacturer	Model name
Okaya Electric Industries Co., Ltd.	CR-10201

Manufacturer	Model name
Rubycon Corporation	250MCRA104100M B0325

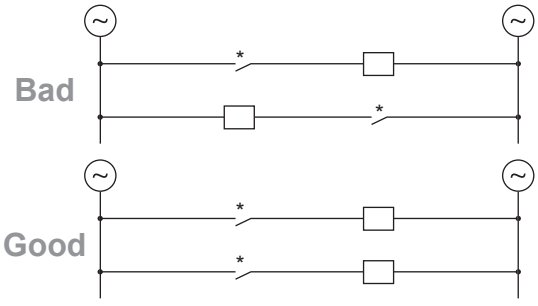
3. Interlock

For loads such as forward/reverse contactors, etc., where a hazardous condition could result if switched ON simultaneously, an external interlock should be provided for interlocking the PLC's internal programs as shown to the right.

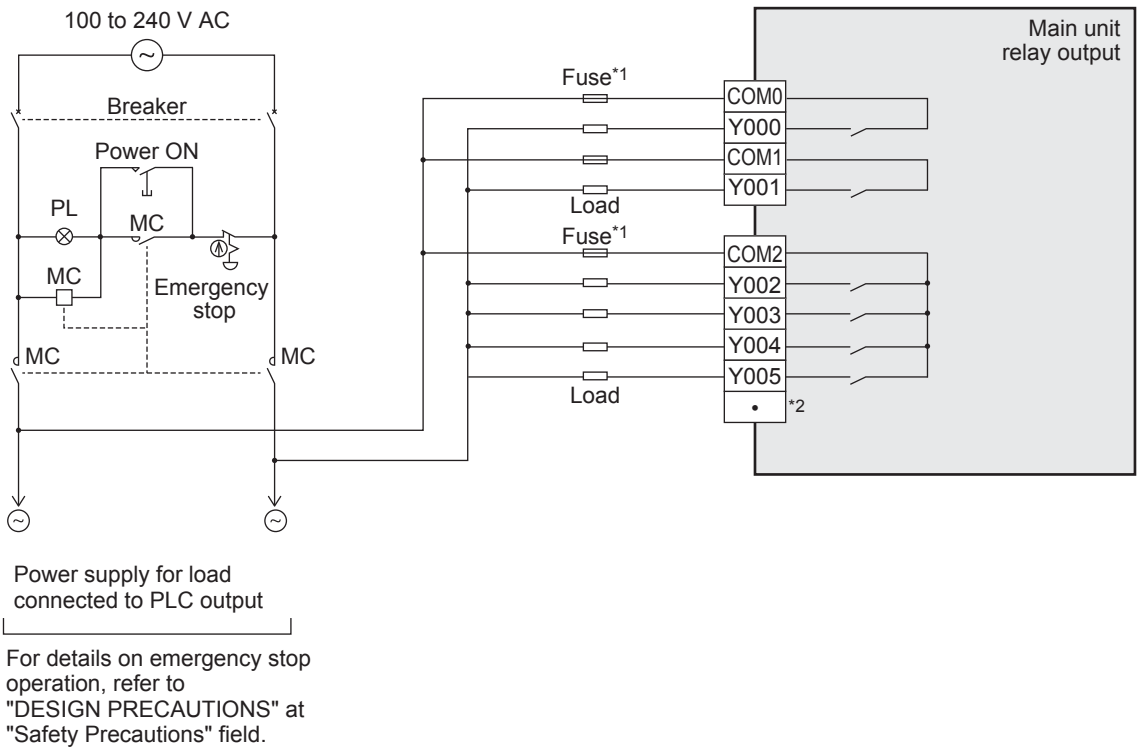


4. In-phase

PLC output contacts (*) should be used in an "in-phase" manner.



12.1.4 Example of external wiring



*1. The output circuit of this PLC does not have a built-in fuse.
Provide a fuse suitable to each load to prevent blowout of the wires on the circuit board caused by output element fracture due to load short-circuiting.
Example) 1 output point/common terminal: 1 A to 2 A
4 output points/common terminal: 5 A to 10 A

*2. "•" represents vacant terminals.

WIRING PRECAUTIONS	⚠**CAUTION**
• Do not wire the vacant terminals externally. Doing so may damage the product.	

12.2 External Wiring of Transistor Output (Sink/Source) Type

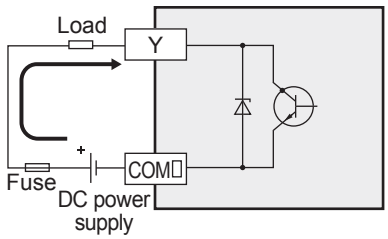
This section explains "handling of transistor output", "external wiring precautions" and "example of external wiring".

→ **For the transistor output specifications, refer to Subsection 4.4.2.**

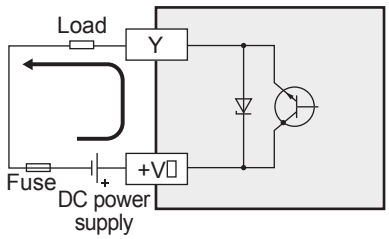
12.2.1 Transistor Output Sink and Source

There is a product of a sink output and source output in the transistor output of the main units.

- Sink output [-common]
  Output to make load current flow into the output (Y) terminal is called sink output.



- Source output [+common]
  Output to make load current flow out of the output (Y) terminal is called source output.



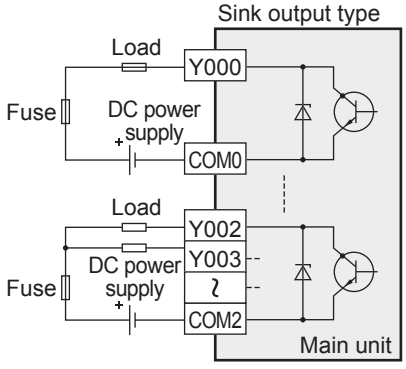
12.2.2 Handling of transistor output

1. Output terminals

One common terminal is used for 1 or 4 transistor output points.

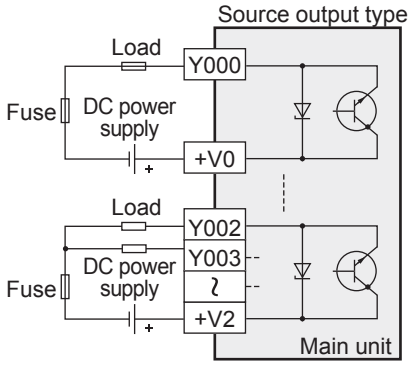
Sink output

Connect each COM☐ (number) terminal to the minus side of the load power supply.
The COM☐ terminals are not connected internally.



Source output

Connect each +V☐ (number) terminal to the plus side of the load power supply.
The +V☐ terminals are not connected internally.



2. External power supply

For driving the load, use a smoothing power supply of 5-30 V DC that can output current two or more times the rated current of the fuse connected to the load circuit.

3. Insulation of circuit

The internal circuit of the PLC and the output transistor are insulated with a photocoupler.
The common blocks are separated from one another.

4. Display of operation

When power is applied to the photocoupler, the LED is lit, and the output transistor is turned on.

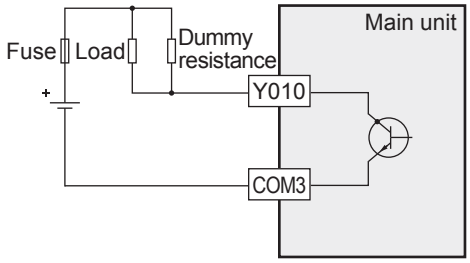
5. Response time

The time from when the PLC drives (or shuts down) the photocoupler until the transistor is turned on (or off) is shown in the following table.

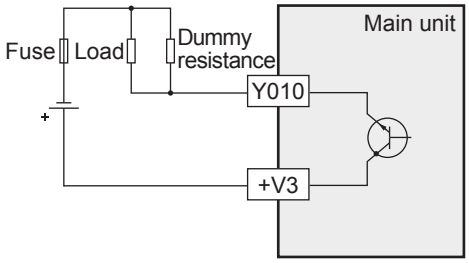
Output number	Response time	Load current	
Y000, Y001	5 μs or less	5-24 V DC 10 mA or more	When using an instruction related to pulse train output or positioning, make sure to set the load current to 10 to 100 mA (5-24 V DC).
Y002 to Y015	0.2 ms or less	24 V DC 200 mA or more*1	

*1. The transistor OFF time is longer under lighter loads. For example, under a load of 24 V DC 40 mA, the response time is approx. 0.3 ms. When response performance is required under light loads, provide a dummy resistor as shown below to increase the load current.

- Sink output type



- Source output type



6. Output current

The maximum resistance loads for the main unit is shown in the following table.
The ON voltage of the output transistor is approx. 1.5 V.
When driving a semiconductor element, carefully check the input voltage characteristics of the applied element.

Output current	Limitation
0.5 A/point	The total load current of resistance loads per common terminal should be the following value. 1 point/common: 0.5 A or less 4 points/common: 0.8 A or less

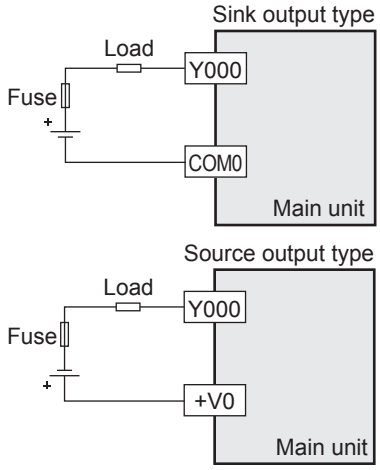
7. Open circuit leakage current

0.1 mA or less.

12.2.3 External wiring precautions

1. Protection circuit for load short-circuits

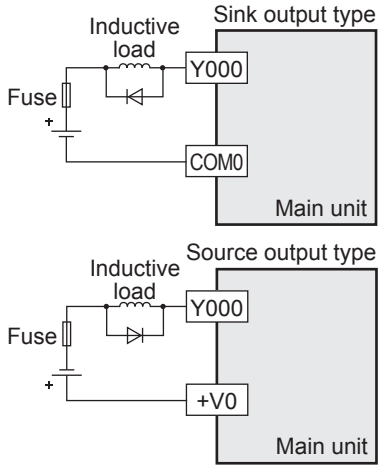
A short-circuit at a load connected to an output terminal could cause burnout at the output element or the PCB. To prevent this, a protection fuse should be inserted at the output.
Use a load power supply capacity that is at least 2 times larger than the total rated fuse capacity.



2. Contact protection circuit for inductive loads

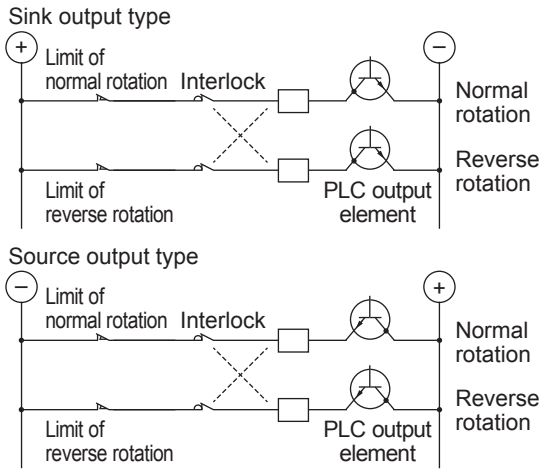
When an inductive load is connected, connect a diode (for commutation) in parallel with the load as necessary. The diode must comply with the following specifications.

Item	Guide
Reverse voltage	5 to 10 times of the load voltage
Forward current	Load current or more



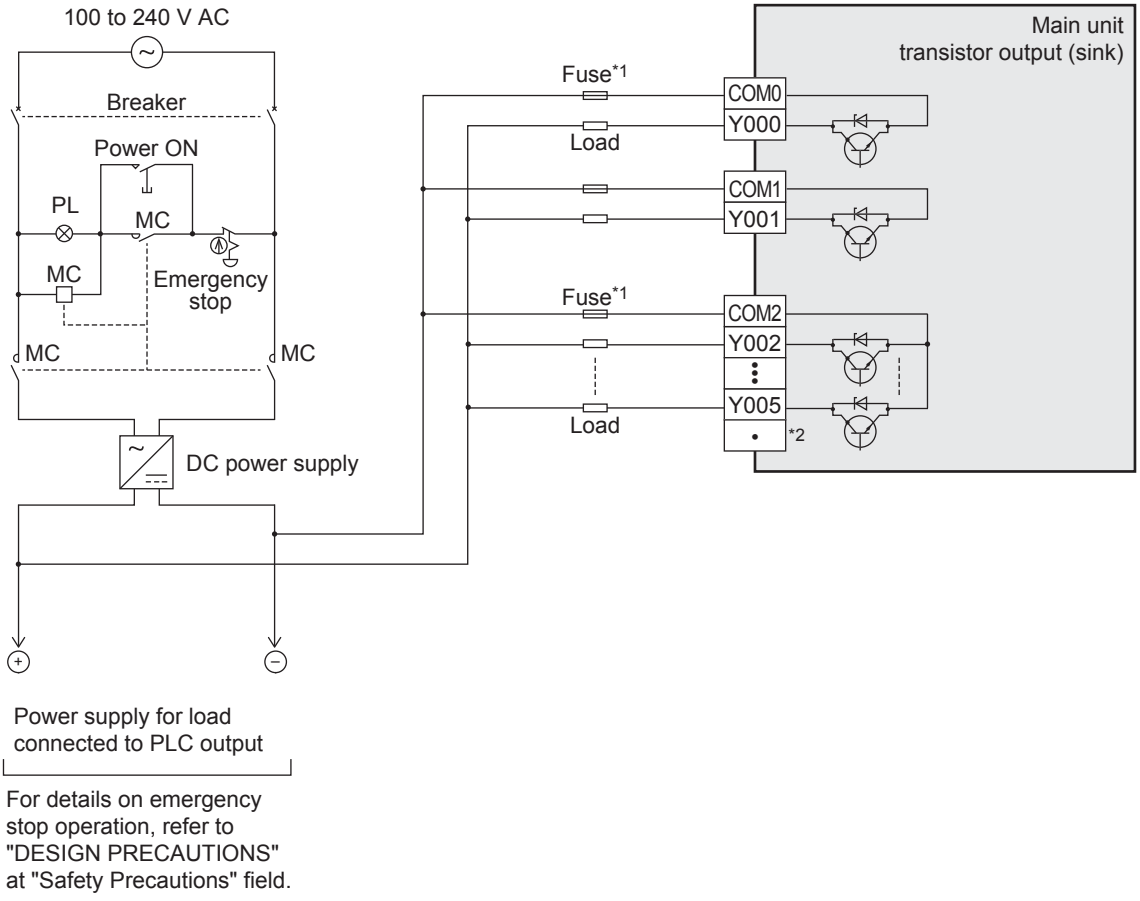
3. Interlock

For loads such as forward/reverse contactors, etc., where a hazardous condition could result if switched ON simultaneously, an external interlock should be provided for interlocking the PLC's internal programs, as shown to the right.



12.2.4 Example of external wiring

1. Transistor output (Sink)



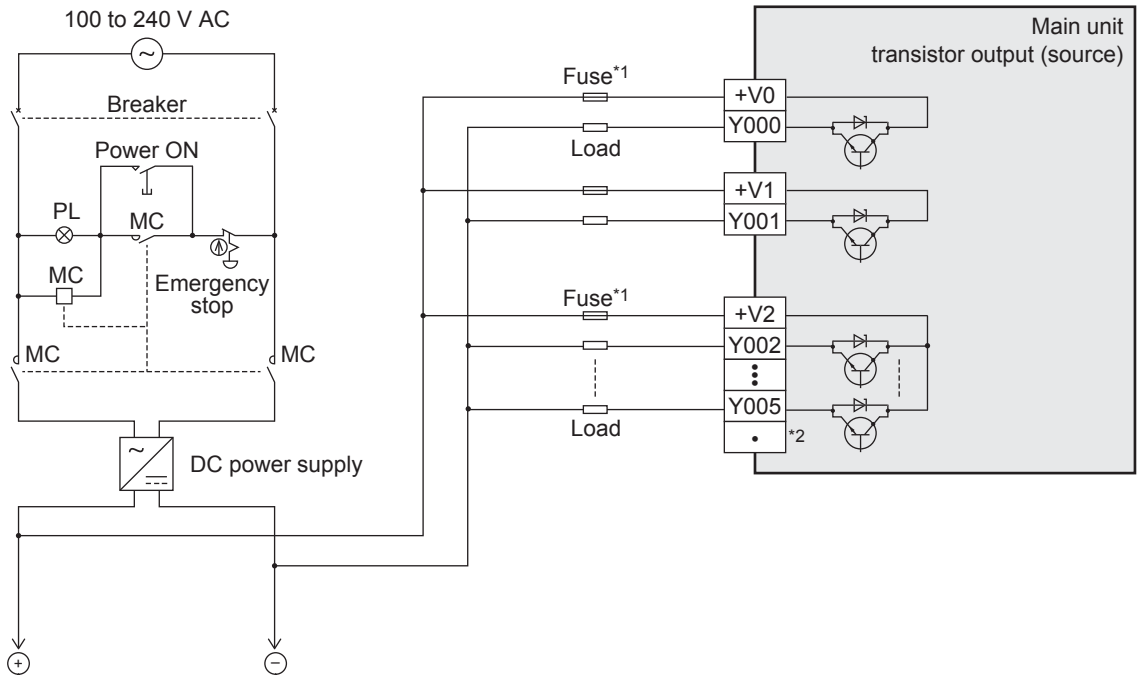
*1. The output circuit of this PLC does not have a built-in fuse.
Provide a fuse suitable to each load to prevent blowout of the wires on the circuit board caused by output element fracture due to load short-circuiting.

*2. "•" represents vacant terminals.

WIRING PRECAUTIONS **⚠CAUTION**

- Do not wire the vacant terminals externally.
  Doing so may damage the product.

2. Transistor output (Source)



For details on emergency stop operation, refer to "DESIGN PRECAUTIONS" at "Safety Precautions" field.

*1. The output circuit of this PLC does not have a built-in fuse.
Provide a fuse suitable to each load to prevent blowout of the wires on the circuit board caused by output element fracture due to load short-circuiting.

*2. "•" represents vacant terminals.

WIRING PRECAUTIONS ⚠**CAUTION**

- Do not wire the vacant terminals externally.
  Doing so may damage the product.

13. Examples of Wiring for Various Uses

DESIGN PRECAUTIONS **⚠WARNING**

- Make sure to have the following safety circuits outside of the PLC to ensure safe system operation even during external power supply problems or PLC failure.
  Otherwise, malfunctions may cause serious accidents.
  1) Most importantly, have the following: an emergency stop circuit, a protection circuit, an interlock circuit for opposite movements (such as normal vs. reverse rotation), and an interlock circuit (to prevent damage to the equipment at the upper and lower positioning limits).
  2) Note that when the PLC CPU detects an error, such as a watchdog timer error, during self-diagnosis, all outputs are turned off. Also, when an error that cannot be detected by the PLC CPU occurs in an input/output control block, output control may be disabled.
     External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
  3) If an overload of the 24 V DC service power supply occurs, the voltage automatically drops, inputs in the PLC are disabled, and all outputs are turned off.
     External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
  4) Note that when an error occurs in a relay or transistor output device, the output could be held either on or off.
     For output signals that may lead to serious accidents, external circuits and mechanisms should be designed to ensure safe machinery operation in such a case.

DESIGN PRECAUTIONS **⚠CAUTION**

- Do not bundle the control line together with or lay it close to the main circuit or power line. As a guideline, lay the control line at least 100 mm (3.94") or more away from the main circuit or power line.
  Noise may cause malfunctions.
- Install module so that excessive force will not be applied to peripheral device connectors.
  Failure to do so may result in wire damage/breakage or PLC failure.

SECURITY PRECAUTIONS **⚠WARNING**

- To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from unreliable networks and devices via network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

WIRING PRECAUTIONS **⚠WARNING**

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work.
  Failure to do so may cause electric shock or damage to the product.
- Make sure to attach the terminal cover, offered as an accessory, before turning on the power or initiating operation after installation or wiring work.
  Failure to do so may cause electric shock.
- The temperature rating of the cable should be 80°C or more.

WIRING PRECAUTIONS **⚠CAUTION**

- Do not supply power to the [24V] terminal (24 V DC service power supply) on the main unit.
  Doing so may cause damage to the product.
- Perform class D grounding (grounding resistance: 100 Ω or less) to the grounding terminal on the main unit with a wire 2 mm^2 or thicker.
  Do not use common grounding with heavy electrical systems (refer to Section 8.3).
- Connect the AC power supply wiring to the dedicated terminals described in this manual.
  If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out.
- Noise resistance may be lower when the L and N wires of an AC power supply are not wired correctly.
  Please wire using the correct polarity.
- Connect the DC power supply wiring to the dedicated terminals described in this manual.
  If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out.
- Do not wire vacant terminals externally.
  Doing so may damage the product.
- When drilling screw holes or wiring, make sure cutting or wire debris does not enter the ventilation slits.
  Failure to do so may cause fire, equipment failures or malfunctions.
- Make sure to properly wire to the main unit in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - Make sure to properly wire to the main unit in accordance with the rated voltage, current, and frequency of each terminal.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.
  - Tighten the screws using a Phillips-head screwdriver No.2 (shaft diameter 6mm (0.24”) or less). Make sure that the screwdriver does not touch the partition part of the terminal block.
- Make sure to properly wire to the terminal block (European type) in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.
  - Twist the end of strand wire and make sure that there are no loose wires.
  - Do not solder-plate the electric wire ends.
  - Do not connect more than the specified number of wires or electric wires of unspecified size.
  - Affix the electric wires so that neither the terminal block nor the connected parts are directly stressed.

13.1 Notes about Examples of Wiring

The examples of wiring are given under the following conditions.

→ **For the example of positioning wiring, refer to the Positioning Control Edition.**

- The input/output numbers are the actual numbers on the program.
  (They may differ from the numbers shown on the product terminals.)
- Product input/output specifications
  Check the product input/output specifications when using any example of wiring.
  - Products for sink output and products for source output are available.
- The examples of programming (applied instructions) are given based on the allocation of the input/output numbers for wiring.

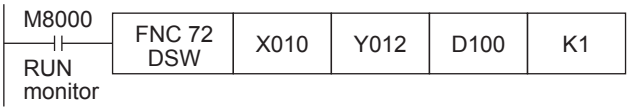
→ **For the applied instructions, refer to the Programming Manual.**

13.2 Digital Switch [DSW Instruction (FNC 72)/BIN Instruction (FNC 19)]

13.2.1 When DSW instruction (FNC 72) is used

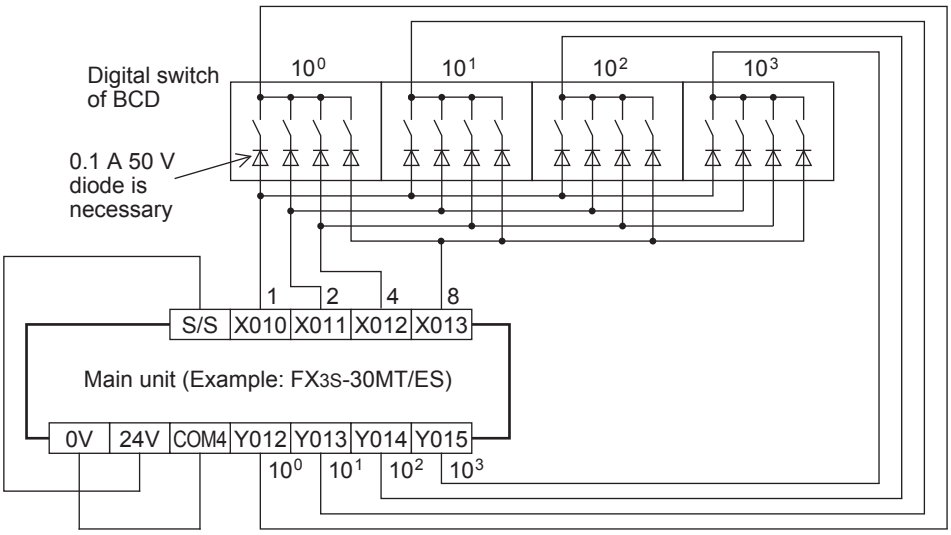
Examples of wiring for capturing values from a 4-digit digital switch to the data register D100 are given below.

Example of program

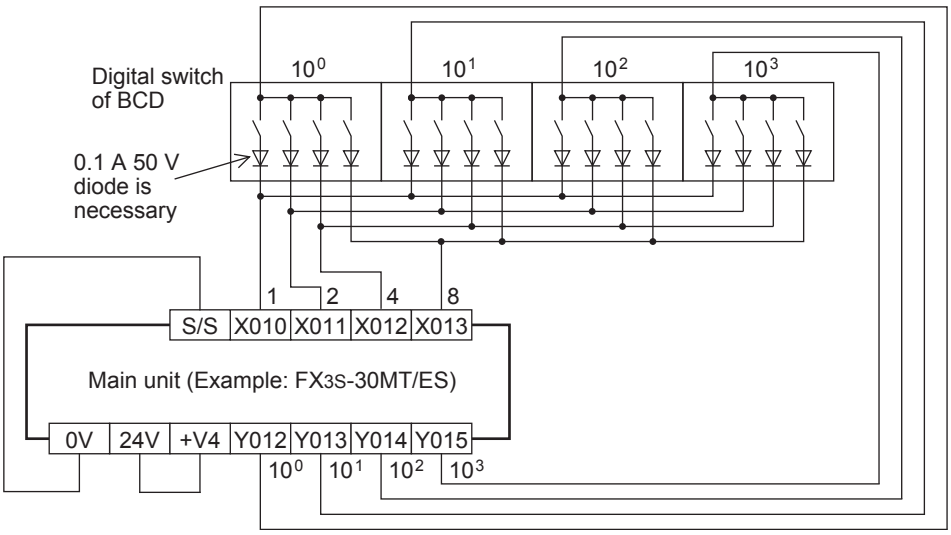


Example of wiring

1) In the case of sink wiring



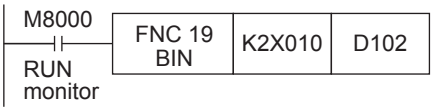
2) In the case of source wiring



13.2.2 When BIN instruction (FNC 19) is used

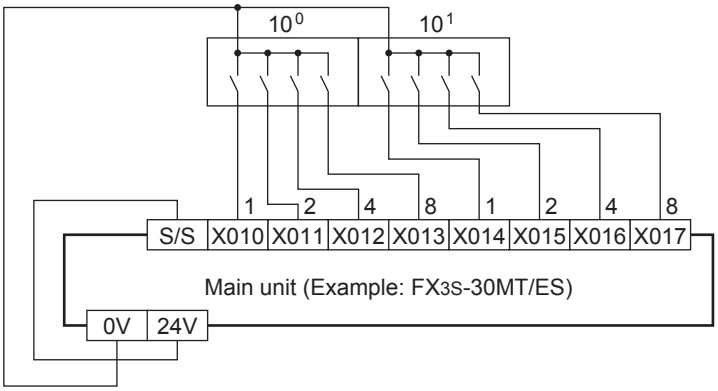
Examples of wiring for capturing values from a 2-digit digital switch to the data register D102 are given below.

Example of program

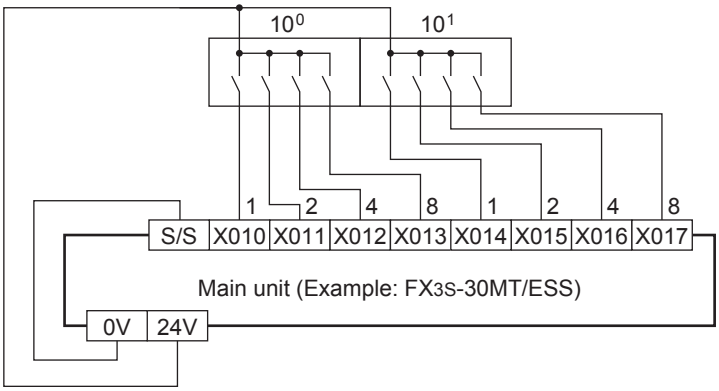


Example of wiring

1) In the case of sink wiring



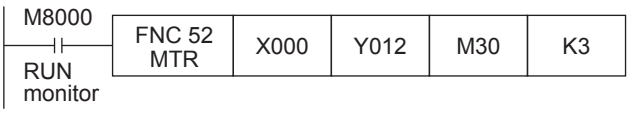
2) In the case of source wiring



13.3 Input Matrix [MTR Instruction (FNC 52)]

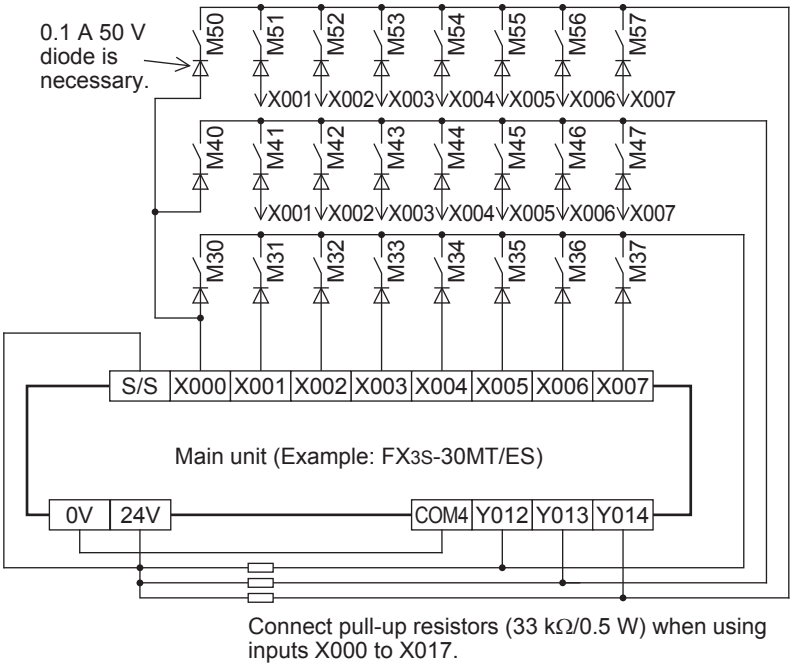
This section gives examples of wiring for capturing the ON/OFF status of 24 switches to M30 to M37, M40 to M47 and M50 to M57 using MTR instruction (FNC 52).

Example of program



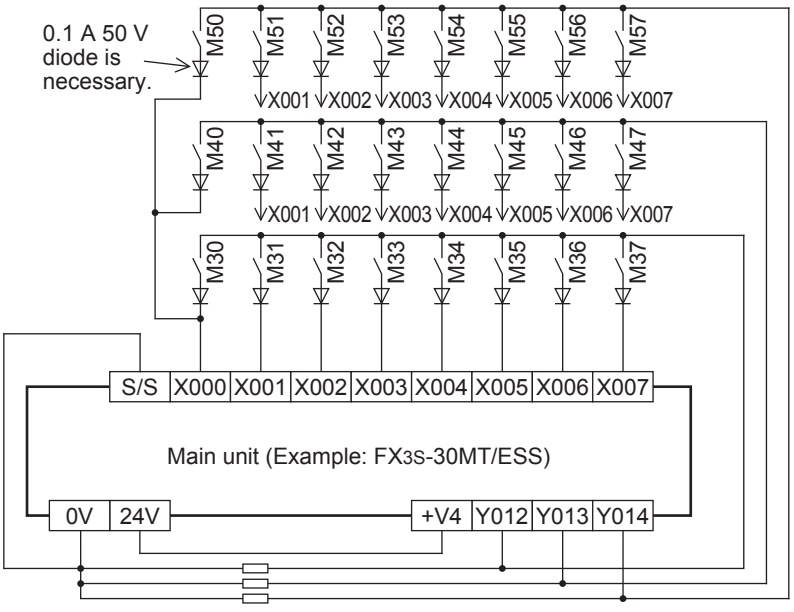
Example of wiring

1) In the case of sink wiring



Connect pull-up resistors (33 kΩ/0.5 W) when using inputs X000 to X017.

2) In the case of source wiring



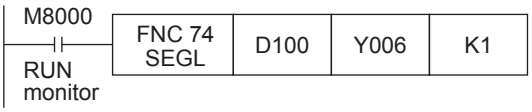
Connect pull-down resistors (3.3 kΩ/0.5 W) when using inputs X000 to X017.

13.4 Seven Segment with Latch [SEGL Instruction (FNC 74)/ BCD Instruction (FNC 18)]

13.4.1 When SEGL instruction (FNC 74) is used

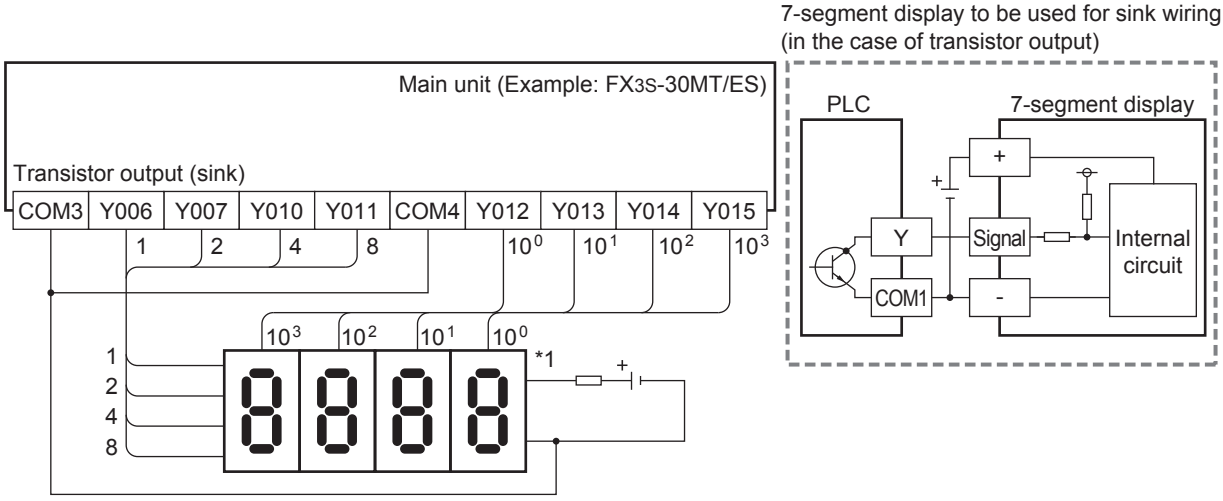
This subsection gives examples of wiring for displaying the current value of D100 on the 4-digit 7-segment display.

Example of program

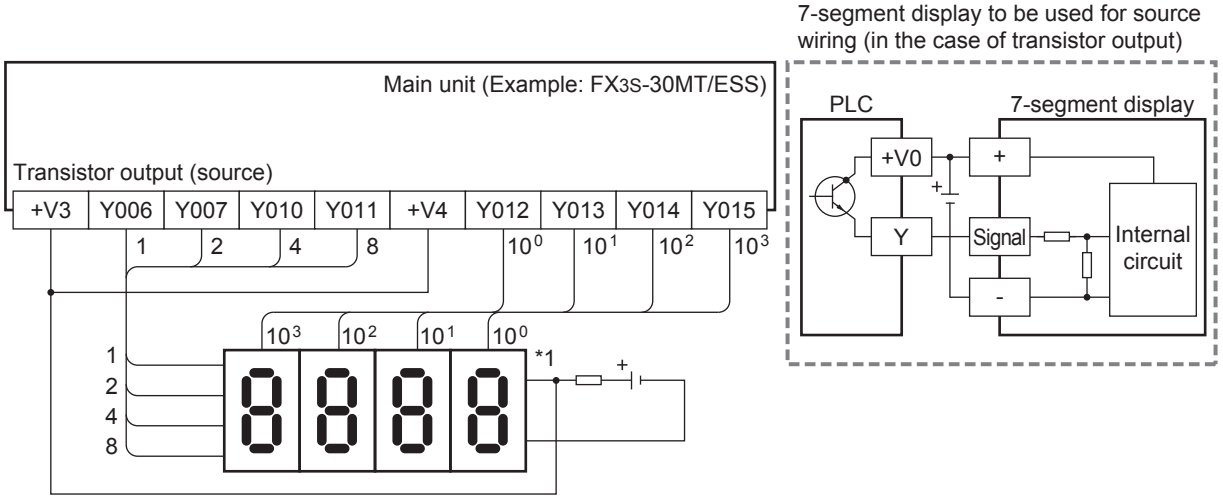


Example of wiring

1) In the case of sink wiring



2) In the case of source wiring

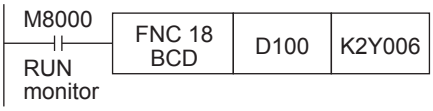


*1. Use a 7-segment display with a latch and a built-in BCD decoder.

13.4.2 When BCD instruction (FNC 18) is used

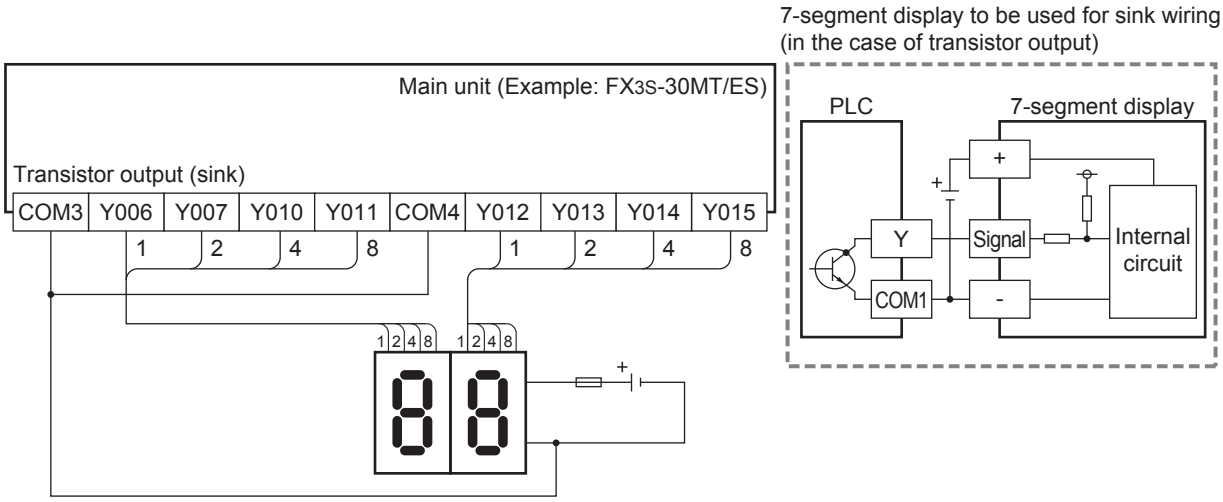
This subsection gives examples of wiring for displaying the current value of D100 on the 2-digit 7-segment display.

Example of program

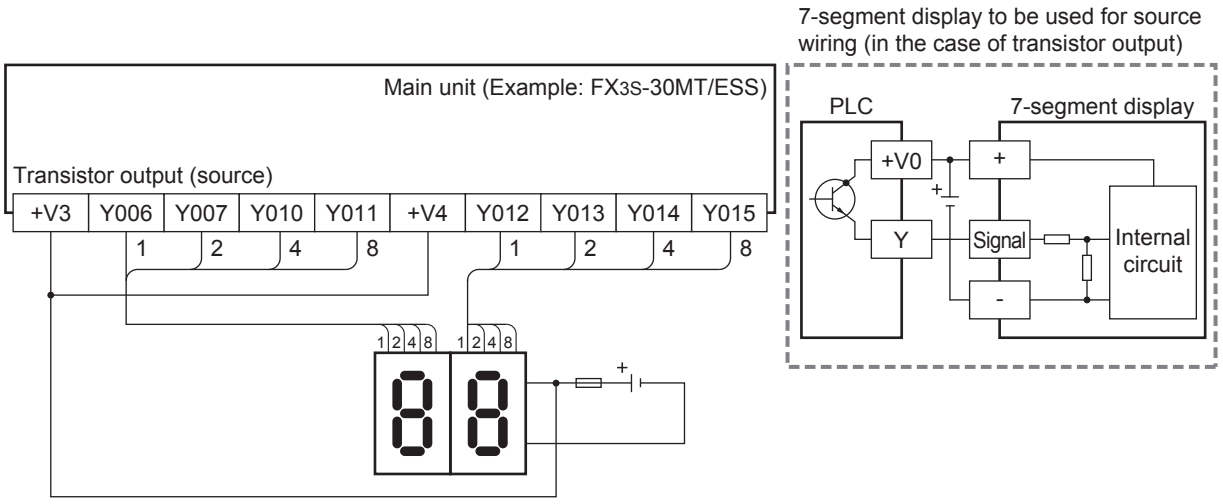


Example of wiring

1) In the case of sink wiring



2) In the case of source wiring



14. Test Operation, Adjustment, Maintenance and Troubleshooting

STARTUP AND MAINTENANCE PRECAUTIONS ⚠ **WARNING**

- Do not touch any terminal while the PLC's power is on.
  Doing so may cause electric shock or malfunctions.
- Before cleaning or retightening terminals, cut off all phases of the power supply externally.
  Failure to do so may cause electric shock.
- Before modifying or disrupting the program in operation or running the PLC, carefully read through this manual and the associated manuals and ensure the safety of the operation.
  An operation error may damage the machinery or cause accidents.
- Do not change the program in the PLC from two or more peripheral equipment devices at the same time. (i.e. from a programming tool and a GOT)
  Doing so may cause destruction or malfunction of the PLC program.

STARTUP AND MAINTENANCE PRECAUTIONS ⚠ **CAUTION**

- Turn off the power to the PLC before attaching or detaching the memory cassette. If the memory cassette is attached or detached while the PLC's power is on, the data in the memory may be destroyed, or the memory cassette may be damaged.
- Do not disassemble or modify the PLC.
  Doing so may cause fire, equipment failures, or malfunctions.
  For repair, contact your local Mitsubishi Electric representative.
- Turn off the power to the PLC before connecting or disconnecting any connection cable.
  Failure to do so may cause equipment failures or malfunctions.
- Turn off the power to the PLC before attaching or detaching the following devices.
  Failure to do so may cause equipment failures or malfunctions.
  - Peripheral devices, display module, expansion boards, special adapters and memory cassette
- Do not use the chemicals for cleaning.
- If there is the possibility of touching the PLC inside a control panel in maintenance, make sure to discharge to avoid the influence of static electricity.

DISPOSAL PRECAUTIONS ⚠ **CAUTION**

- Please contact a certified electronic waste disposal company for the environmentally safe recycling and disposal of your device.

TRANSPORTATION AND STORAGE PRECAUTIONS ⚠ **CAUTION**

- The PLC is a precision instrument. During transportation, avoid impacts larger than those specified in the general specifications (Section 4.1) using dedicated packaging boxes and shock-absorbing palettes. Failure to do so may cause failures in the PLC.
  After transportation, verify operation of the product and check for damage of the mounting part, etc.

14.1 Preparation for Test Operation

14.1.1 Preliminary inspection [power OFF]

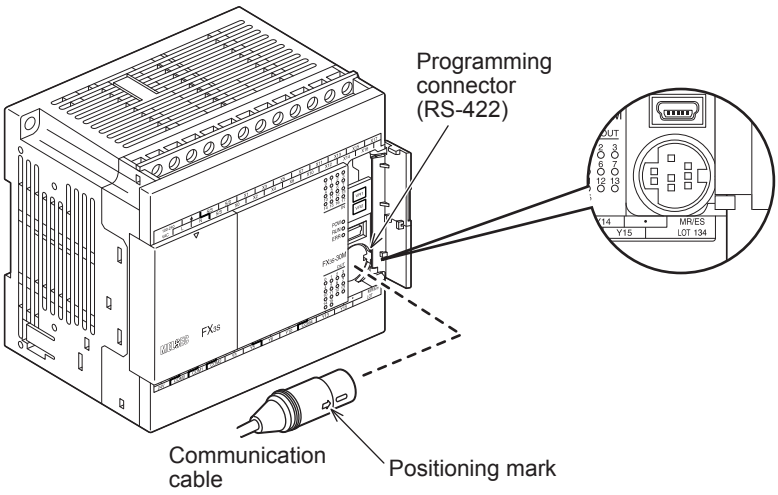
Incorrect connection of the power supply terminal, contact of the DC input wire and power supply wire, or short-circuiting of output wires may result in serious damage.
Before applying power, check that the power supply and ground terminals are connected correctly and input/output devices are wired properly.

Notes
The dielectric withstand voltage and insulation resistance test of the PLC should be measured in accordance with the following procedures. 1) Remove all input/output wires and power supply wires from the PLC. 2) Connect a crossing wire to each of the PLC terminals (power supply terminal, input terminals and output terminals) except the ground terminal. For the dielectric withstand voltage test of each terminal, refer to the generic specifications for the product. (refer to Section 4.1) 3) Measure the dielectric withstand voltage and insulation resistance between each terminal and the ground terminal. Dielectric withstand voltage: 1.5 kV AC or 500 V for 1min (The terminals vary in dielectric withstand voltage.) Insulation resistance: 5 MΩ or higher by 500 V DC insulation resistance tester

14.1.2 Connection to peripheral device connecting connector (RS-422)

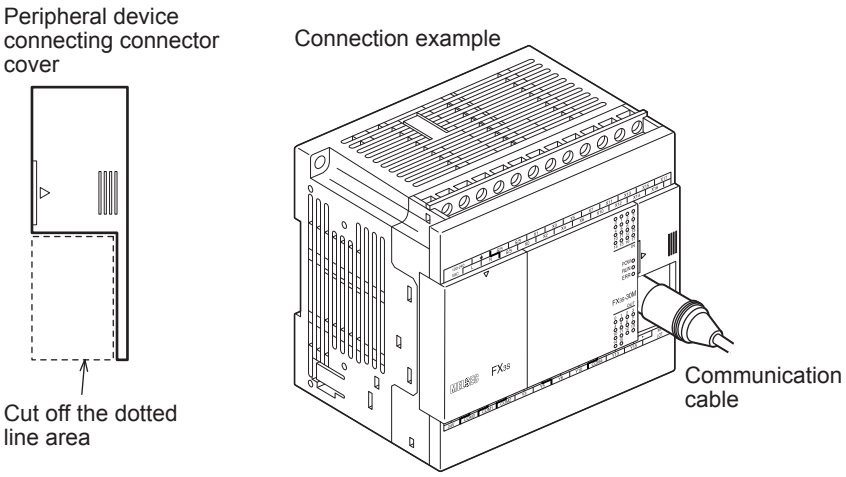
1. When connecting a peripheral device

Connect and disconnect the communication cable for the peripheral device.



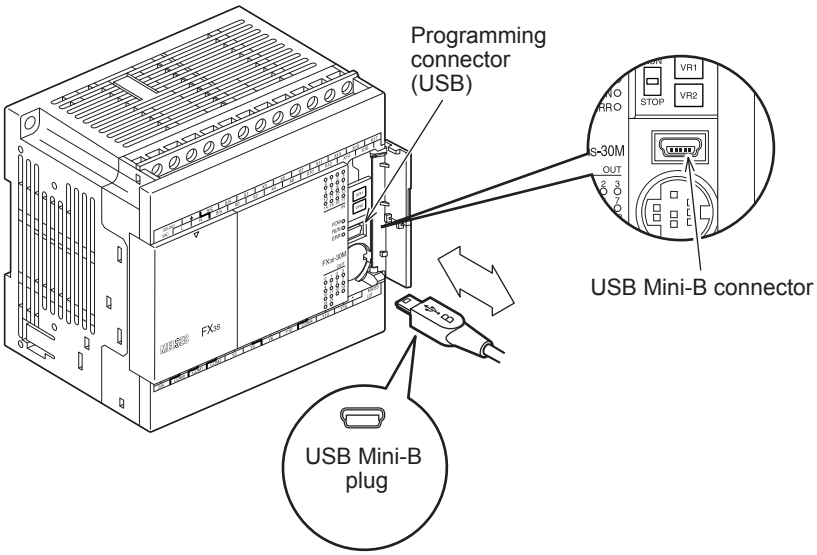
2. For continuous use of a peripheral device (such as GOT)

Cut off the area shown in the left figure below of the peripheral device connector cover (main unit) using a nipper, etc., and connect the peripheral device as shown in the right figure below.



14.1.3 Connection to peripheral device connecting connector (USB)

Connect and disconnect the communication cable for the peripheral device (personal computer).
At connection, confirm the cable and connector shape.



14.1.4 Writing of program and program check [power ON and PLC stopped]

1 **Turn on the PLC power.**

Make sure that the RUN/STOP switch of the PLC is set to STOP, and turn the power on.

2 **Check the program.**

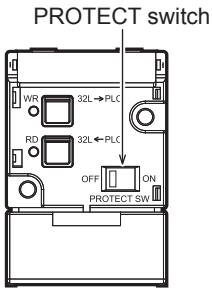
Check for circuit errors and grammatical errors with the program check function of the programming tool.

3 **Transfer the sequence program.**

Write the program to the PLC with the programming tool.

When the memory cassette is used
Make sure to set the PROTECT switch of the memory cassette to OFF (shown right).

→ **For details on the memory cassette, refer to Chapter 17.**



4 **Verify the sequence program.**

Verify that the program has been correctly written to the PLC.

5 **Execute PLC diagnosis.**

Check for errors in the PLC main body with the PLC diagnostic function of the programming tool.

→ **For details on the PLC diagnosis with GX Works2, refer to Section 14.6.**
→ **For details on the PLC diagnosis with FX-30P, refer to FX-30P operation Manual.**

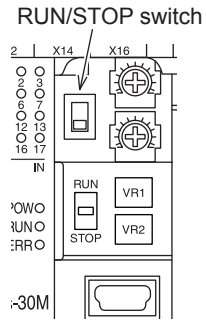
14.2 Running and Stopping Procedures [Power ON]

14.2.1 Methods of running and stopping

FX3S PLCs can be started or stopped by any of the following three methods.
Two of the methods can be combined.
The RUN/STOP switch is located under the peripheral device connector cover.

1. Operation with built-in RUN/STOP switch

Operate the RUN/STOP switch on the front panel of the main unit to start and stop the PLC (refer to the right figure).
Turn the switch to RUN, and the PLC will start. Turn it to STOP, and the PLC will stop.

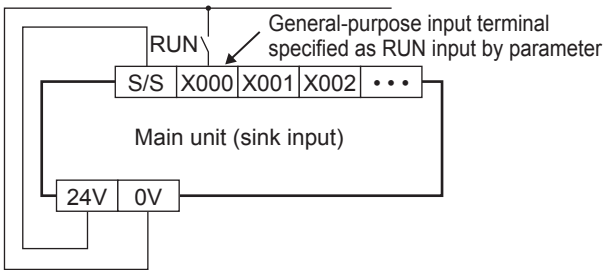


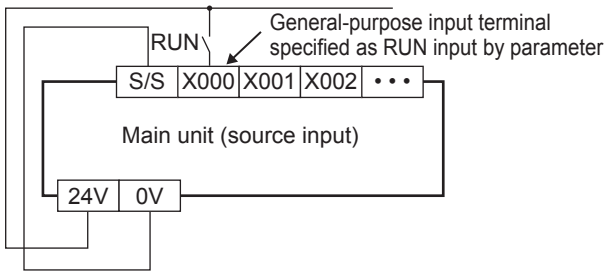
2. Running and stopping with general-purpose input (RUN terminal)

Operation with one switch (RUN)

One of the input terminals X000 to X017[*1] of the main unit can be used as a RUN input terminal by a parameter setting (refer to the figure below).
When the specified input terminal is turned on, the PLC starts. When it is turned off, the PLC is started or stopped depending on the state of the built-in RUN/STOP switch.

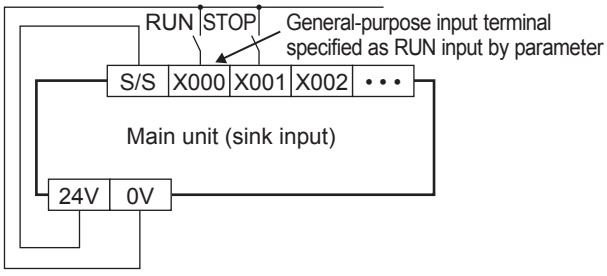
*1. X000 to X005 in FX3S-10M□, X000 to X007 in FX3S-14M□, and X000 to X013 in FX3S-20M□.
→ **For details, refer to "Kinds of Parameters and Settings" in Programming Manual.**

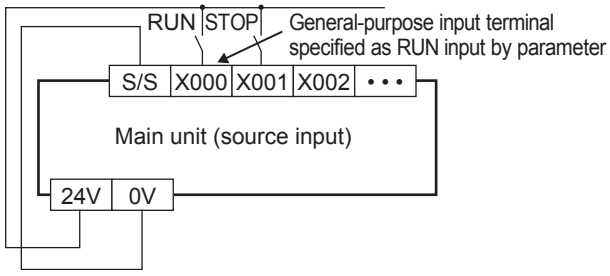




Operation with two switches (RUN and STOP)

The PLC can be started and stopped with individual RUN and STOP pushbutton switches.
For this operation, a sequence program using M8035 to M8037 is necessary.
→ **For details, refer to "Operations of Special Devices" in Programming Manual.**





3. Starting and stopping by remote control from programming tool

The programming tool has a function to forcibly start and stop the PLC by remote control (remote RUN/STOP function).
However, when power is reapplied, the remote RUN/STOP function is disabled. The RUN/STOP status is then determined by the RUN/STOP switch or RUN terminal.
For details on the start and stop procedures with remote control from programming tool, refer to Paragraph 2 of Subsection 14.2.2.

14.2.2 Use of several running/stopping methods

1. When the built-in RUN/STOP switch and the general-purpose RUN terminal are used

(without remote running/stopping operation from the programming tool)
The RUN/STOP status of the PLC is determined by the conditions shown in the following table.

Condition of built-in RUN/STOP switch	Condition of general-purpose input terminal specified as RUN terminal by parameter	Status of PLC
RUN	OFF	RUN
	ON	RUN
STOP	OFF	STOP
	ON	RUN

Use either built-in RUN/STOP switch or the general input specified as RUN terminal.
(When specifying the general-purpose terminal as the RUN terminal, always set the built-in RUN/STOP switch to STOP.)

2. When the remote running/stopping operation from the programming software is performed

For this operation, keep both the built-in RUN/STOP switch and the general-purpose input RUN terminal in the STOP position.
If the stop command is given from the programming tool after the PLC is started by either the built-in RUN/STOP switch or the general-purpose input RUN terminal, the PLC will be restored to the running status by giving the RUN command from the programming tool. This can also be accomplished by setting the built-in RUN/STOP switch or the general-purpose input RUN terminal to STOP and then to RUN.

14.3 Operation and Test [Power ON and PLC Running]

14.3.1 Self-diagnostic function

When the PLC's power is turned on, its self-diagnostic function starts automatically. If there are no problems with the hardware, parameters or program, the PLC will start and the RUN command (refer to Section 14.2) is given (RUN LED is lit). If any problems are found, the "ERR" LED flashes or lights.

14.3.2 Test functions

Functions of the programming tool to turn on/off the PLC devices and change the current values/settings are effective or ineffective depending on the PLC status as shown below.

✓: Effective △: Conditionally effective -: Ineffective

Item		In running status	In stopped status
Forcible ON/OFF*1	Devices used in program	△*1	✓*1
	Devices not in use	✓	✓
Change of current values of timers, counters, data registers and file registers*3	Devices used in program	△*2	✓
	Devices not in use	✓	✓
Change of settings of timers and counters*4	When the program memory is the built-in EEPROM	✓	✓
	When the program memory is in the memory cassette and the PROTECT switch is on	-	-
	When the program memory is in the memory cassette and the PROTECT switch is off	✓	✓

*1. Forcible ON/OFF
- The forcible ON/OFF function is effective on the input relays (X), output relays (Y), auxiliary relays (M), state (S), timers (T) and counters (C).
- The forcible ON/OFF function can turn on or off the devices only for one scan.
  While the PLC is running, the function is substantially effective in clearing the current values of the timers (T), counters (C), data registers (D), index registers (Z and V) and in controlling the SET/RST circuit and self-retaining circuit. (The operation to forcibly turn on timers is effective only when the timers are driven by the program.)
- The results of forcible ON/OFF operation performed while the PLC in the stopped state or performed for devices not used in the program are retained.
  However, the results of the operation performed for the input relays (X) are not retained because the relays refresh input even while the PLC is in the stopped state. (They are updated according to the input terminal conditions.)

*2. Since the current values may be changed according to MOV instruction in the program and the operation results, the most recently obtained values are retained.

*3. The current values of the file registers stored in the program memory cannot be monitored or tested on the display module.

*4. Change of timer and counter settings. The settings of the timers (T) and counters (C) can be changed only when the timers are driven by the program.

14.3.3 Program modification function

The sequence program can be transferred while the PLC is running or in the stopped state as shown below.

✓: Effective -: Ineffective

Item		In running status	In stopped status
Batch writing of file registers (D)		-	✓
Writing of program to PLC	Partial modification of program	✓*1	✓
	Modification of whole program (batch writing)	-	✓
Writing of parameters to PLC		-	✓
Writing of comments to PLC		-	✓

*1. Since the writing function is used during running, the programming tool must support the write during RUN function, such as GX Works2.

→ **For the writing function during running, refer to Subsection 5.2.5.**

14.4 Maintenance and Periodic Inspection

This PLC does not incorporate consumable parts that are factors in the reduction of service life. However, the output relays (points of contact) have a limited life expectancy.

14.4.1 Periodic inspection

Check the following points.

- Check that the temperature in the panel is not abnormally increased by other heat generating bodies or direct sunlight.
- Check that dust or conductive dust has not entered the panel.
- Check for loosening of wiring and other abnormalities.

14.4.2 Maintenance - product life of relay contacts

The product life of relay contacts varies considerably depending on the load type used. Take care that loads generating reverse electromotive force or rush current may cause poor contact or deposition of contacts which may lead to considerable reduction of the contact product life.

1. Inductive load

Inductive loads generate large reverse electromotive force between contacts at shutdown, which may cause arcing. At a fixed current consumption, as the power factor (phase between current and voltage) gets smaller, the arc energy gets larger.
The standard life of contacts used for Inductive loads, such as contactors and solenoid valves, is 500,000 operations at 20 VA.
The following table shows the approximate life of a relay based on the results of an operation life test.

Test condition: 1 sec. ON / 1 sec. OFF

Load capacity		Contact life
20 VA	0.2 A/100 V AC	3,000,000 times
	0.1 A/200 V AC	
35 VA	0.35 A/100 V AC	1,000,000 times
	0.17 A/200 V AC	
80 VA	0.8 A/100 V AC	200,000 times
	0.4 A/200 V AC	

The product life of relay contacts becomes considerably shorter than the above conditions when the rush overcurrent is shut down.
Please refer to the following measures regarding the inductive load.

→ **Refer to Subsection 12.1.3-2.**

Some types of inductive loads generate rush current 5 to 15 times the stationary current at activation.
Make sure that the rush current does not exceed the current corresponding to the maximum specified resistance load.

2. Lamp load

Lamp loads generally generate rush current 10 to 15 times the stationary current. Make sure that the rush current does not exceed the current corresponding to the maximum specified resistance load.

3. Capacitive load

Capacitive loads can generate rush current 20 to 40 times the stationary current. Make sure that the rush current does not exceed the current corresponding to the maximum specified resistance load. Capacitive loads such as capacitors may be present in electronic circuit loads including inverters.

* About the maximum load specifications of the resistance load, refer to the specification for each model.

→ **Refer to Subsection 4.1.1.**

14.5 Troubleshooting with LEDs

When trouble occurs, check the LEDs on the PLC to identify the problem with the PLC.

14.5.1 POW LED [on/flashing/off]

LED Status	PLC Status	Remedies
On	Power of the specified voltage is being correctly supplied to the power supply terminal.	The power supply is normal.
Flashing	One of the following problems may have occurred. • Power of the specified voltage and current is not being supplied to the power supply terminal. • External wiring is incorrect. • Internal error of PLC	• Check the supply voltage. • After disconnecting the cables other than the power cable, re-apply power to the PLC, and check for changes in the state. If the problem persists, consult your local Mitsubishi Electric representative.
Off	One of the following problems may have occurred. • The power supply is off. • External wiring is incorrect. • Power of the specified voltage is not being supplied to the power supply terminal. • The power cable is broken.	• If the power is not off, check the power supply and the power supply route. • If power is being supplied correctly, consult your local Mitsubishi Electric representative. • After disconnecting the cables other than the power cable, re-apply power to the PLC, and check for changes in the state. If the problem persists, consult your local Mitsubishi Electric representative.

14.5.2 ERR LED [on/flashing/off]

LED Status	PLC Status	Action
On	A watchdog timer error may have occurred, or the hardware of the PLC may be damaged.	1) Stop the PLC, and re-apply power. If ERR LED goes off, a watchdog timer error may have occurred. Take any of the following measures. - Review the program. The maximum value (D8012) of the scan time should not exceed the setting (D8000) of the watchdog timer. - Check that the input used for input interruption or pulse catch is not being abnormally turned on and off in one scan. - Check that the frequency of the pulse (duty of 50%) input to the high-speed counter does not exceed the specified range. - Add the WDT instructions. Add some WDT instructions to the program, and reset the watchdog timer several times in one scan. - Change the setting of the watchdog timer. Change the watchdog timer setting (D8000) in the program so that the setting is larger than the maximum value of the scan time (D8012). 2) Remove the PLC and supply power to it from another power supply on a desk. If the ERR LED goes off, noise may have affected the PLC. Take the following measures. - Check the ground wiring, and reexamine the wiring route and installation location. - Fit a noise filter onto the power supply line. 3) If the ERR LED does not go off even after the measures stated in (1) and (2) are taken, consult your local Mitsubishi Electric representative.
Flashing	One of the following errors has occurred in the PLC. • Parameter error • Syntax error • Ladder error	Perform PLC diagnosis and program check with the programming tool. For the remedies, refer to Section 14.6.
Off	No errors that stop the PLC have occurred.	If the operations of the PLC are abnormal, perform PLC diagnosis and program check with the programming tool. A Serial communication error or Operation error may have occurred.

14.6 Judgment by Error Codes and Representation of Error Codes

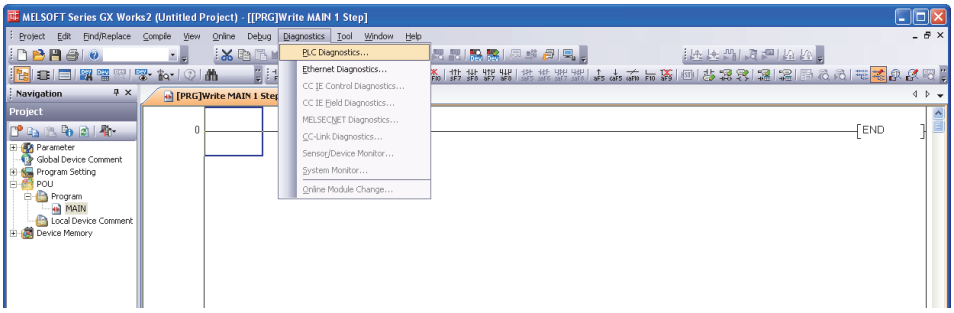
Error codes can be checked with the programming tool.

14.6.1 Operation and check by GX Works2

1 Connect the personal computer and the PLC.

2 Execute the PLC diagnosis.

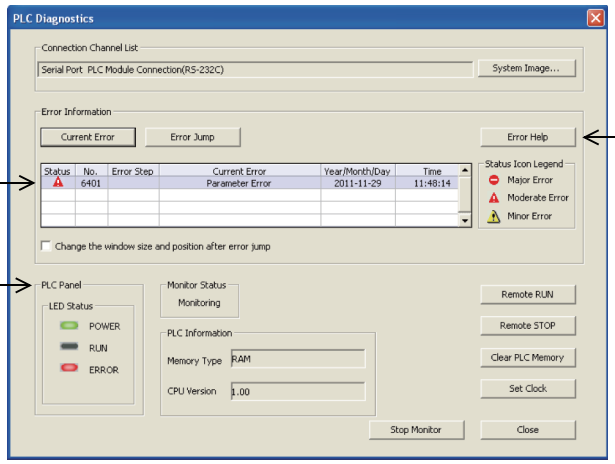
Click [Diagnostics] → [PLC Diagnostics...] on the menu bar, and the diagnosis of PLC will start.



3 Check the results of diagnosis.

Display the following window to check the errors.

Example: one error occurs



The error in PLC is displayed.

The LED status of PLC is displayed.

Open the help window of GX Works2 to check the error details.

14.6.2 Representation of errors

Errors are represented in this manual and GX Works2 as shown in the following table.

This manual	GX Works2
PLC hardware error	PLC Hardware Error
PLC/PP communication error	PLC/PP Communication Error
Serial communication error 1 [ch1]	Link Error
Parameter error	Parameter Error
Syntax error	Syntax Error
Circuit error	Ladder Error
Operation error	Operation Error
USB communication error	USB communication error
Special parameter error	Special Parameter Error

14.6.3 Error Code List and Action

When a program error occurs in the PLC, the error code is stored in special data registers D8061 to D8067, D8487 and D8489. Take action based on the following information.

Error code	PLC operation at error occurrence	Contents of error	Action
PLC hardware error [M8061 (D8061)]			
0000	-	No error	
6101	Stops operation	Memory access error	When the memory cassette is used, check whether it is mounted correctly. If the problem persists or if the memory cassette is not used, something may be malfunctioning inside the PLC. Consult your local Mitsubishi Electric representative.
6105		Watchdog timer error	Check user program. The scan time exceeds the value stored in D8000.
PLC/PP communication error [M8062 (D8062)]			
0000	-	No error	
6201	Continues operation	Parity, overrun or framing error	Check the cable connection between the programming panel (PP) / programming device and the PLC. This error may occur when a cable is disconnected and reconnected during PLC monitoring.
6202		Communication character error	
6203		Communication data sum check error	
6204		Data format error	
6205		Command error	
6230		Memory access error	When the memory cassette is used, check whether it is mounted correctly. If the problem persists or if the memory cassette is not used, something may be malfunctioning inside the PLC. Consult your local Mitsubishi Electric representative.
Serial communication error 1 [M8063 (D8063)]			
0000	-	No error	
6301	Continues operation	Parity, overrun or framing error	• Ethernet communication, Inverter communication, computer link and programming: Ensure that the parameters are correctly set according to their applications. • N:N network, parallel link, MODBUS communication, etc.: Check programs according to applications. • Remote maintenance: Ensure modem power is ON and check the settings of the AT commands. • Wiring: Check the communication cables for correct wiring.
6302		Communication character error	
6303		Communication data sum check error	
6304		Communication data format error	
6305		Command error	
6306		Communication time-out detected	
6307		Modem initialization error	
6308		N:N network parameter error	
6309		N:N Network setting error	
6312		Parallel link character error	
6313		Parallel link sum error	
6314		Parallel link format error	
6320		Inverter communication error	
6321		MODBUS communication error	
6330		Memory access error	When the memory cassette is used, check whether it is mounted correctly. If the problem persists or if the memory cassette is not used, something may be malfunctioning inside the PLC. Consult your local Mitsubishi Electric representative.
6340		Special adapter connection error	Check connection of the special adapter.

Error code	PLC operation at error occurrence	Contents of error	Action
Parameter error [M8064 (D8064)]			
0000	-	No error	
6401	Stops operation	Program sum check error	STOP the PLC, and correctly set the parameters.
6402		Memory capacity setting error	
6404		Comment area setting error	
6405		File register area setting error	
6420		Special parameter sum check error	• STOP the PLC, and correctly set the special parameters. • Set special parameters correctly, turn OFF the power, and then turn ON the power.
6421		Special parameters setting error	• Check the contents of the special parameter error code (D8489), confirm troubleshooting for special adapters/ special blocks, and set special parameters correctly. • Set special parameters correctly, turn OFF the power, and then turn ON the power.
Syntax error [M8065 (D8065)]			
0000	-	No error	
6501	Stops operation	Incorrect combination of instruction, device symbol and device number	During programming, each instruction is checked. If a syntax error is detected, modify the instruction correctly.
6503		• No setting value after OUT T or OUT C. • Insufficient number of operands for an applied instruction.	
6504		• Same label number is used more than once. • Same interrupt input or high-speed counter input is used more than once.	
6505		Device number is out of allowed range.	
6506		Invalid instruction	
6507		Invalid label number [P]	
6508		Invalid interrupt input [I]	
6510		MC nesting number error	
Circuit error [M8066 (D8066)]			
0000	-	No error	
6610	Stops operation	LD, LDI is continuously used 9 times or more.	This error occurs when a combination of instructions is incorrect in the entire circuit block or when the relationship between a pair of instructions is incorrect. Modify the instructions in the program mode so that their mutual relationship becomes correct.
6611		More ANB/ORB instructions than LD/LDI instructions	
6612		Less ANB/ORB instructions than LD/LDI instructions	
6613		MPS is continuously used 12 times or more.	
6614		No MPS instruction	
6615		No MPP instruction	
6616		No coil between MPS, MRD and MPP, or incorrect combination	
6617		Instruction below is not connected to bus line: STL, RET, MCR, P, I, DI, EI, FOR, NEXT, SRET, IRET, FEND or END	
6618		STL, MC or MCR can be used only in main program, but it is used elsewhere (e.g. in interrupt routine or subroutine).	
6619		Invalid instruction is used in FOR-NEXT loop: STL, RET, MC, MCR, I (interrupt pointer) or IRET.	

Error code	PLC operation at error occurrence	Contents of error	Action
Circuit error [M8066 (D8066)]			
6620	Stops operation	FOR-NEXT instruction nesting level exceeded	This error occurs when a combination of instructions is incorrect in the entire circuit block or when the relationship between a pair of instructions is incorrect. Modify the instructions in the program mode so that their mutual relationship becomes correct.
6621		Numbers of FOR and NEXT instructions do not match.	
6622		No NEXT instruction	
6623		No MC instruction	
6624		No MCR instruction	
6625		STL instruction is continuously used 9 times or more.	
6626		Invalid instruction is programmed within STL-RET loop: MC, MCR, I (interrupt pointer), SRET or IRET.	
6627		No STL instruction	
6628		Invalid instruction is used in main program: I (interrupt pointer), SRET or IRET	
6629		No P or I (interrupt pointer)	
6630		No SRET or IRET instruction STL-RET or MC-MCR instructions in subroutine	
6631		SRET programmed in invalid location	
6632		FEND programmed in invalid location	
Operation error [M8067 (D8067)]			
0000	-	No error	
6701	Continues operation	• No jump destination (pointer) for CJ or CALL instruction • Label is undefined or out of P0 to P255 due to indexing. • Label P63 is executed in CALL instruction; cannot be used in CALL instruction as P63 is for jumping to END instruction.	This error occurs in the execution of operation. Review the program and check the contents of the operands used in applied instructions. Even if the syntax or circuit design is correct, an operation error may still occur. For example: "T100Z" itself is not an error. But if Z had a value of 100, the timer T200 would attempt to be accessed. This would cause an operation error since there is no T200 device available.
6702		CALL instruction nesting level is 6 or more	
6704		FOR-NEXT instruction nesting level is 6 or more.	
6705		Operand of applied instruction is inapplicable device.	
6706		Device number range or data value for operand of applied instruction exceeds limit.	
6709		Other (e.g. improper branching)	
6710		Mismatch among parameters	This error occurs when the same device is used within the source and destination in a shift instruction, etc.
6730		Incorrect sampling time (TS) (TS ≤ 0)	<PID instruction is stopped.> This error occurs in the parameter setting value or operation data executing PID instruction. Check the contents of the parameters.
6732		Incompatible input filter constant (α) (α < 0 or 100 ≤ α)	
6733		Incompatible proportional gain (KP) (KP < 0)	
6734		Incompatible integral time (TI) (TI < 0)	
6735		Incompatible derivative gain (KD) (KD < 0 or 201 ≤ KD)	
6736		Incompatible derivative time (TD) (TD < 0)	

Error code	PLC operation at error occurrence	Contents of error	Action
Operation error [M8067 (D8067)]			
6740	Continues operation	Sampling time (TS) ≤ Scan time	<Auto tuning is continued.> The operation is continued in the condition "sampling time (TS) = cyclic time (scan time)".
6742		Variation of measured value exceeds limit. (△PV < -32768 or +32767 < △PV)	<PID operation is continued.> The operation is continued with each parameter set to the maximum or minimum value.
6743		Deviation exceeds limit. (EV < -32768 or +32767 < EV)	
6744		Integral result exceeds limit. (Outside range from -32768 to +32767)	
6745		Derivative value exceeds limit due to derivative gain (KD).	
6746		Derivative result exceeds limit. (Outside range from -32768 to +32767)	
6747		PID operation result exceeds limit. (Outside range from -32768 to +32767)	
6748		PID output upper limit set value < PID output lower limit set value.	<Transpose of output upper limit value and output lower limit value. → PID operation is continued.> Check whether the target setting contents are correct.
6749		Abnormal PID input variation alarm set value or output variation alarm set value (Set value < 0)	<Alarm output is not given. → PID operation is continued.> Check whether the target setting contents are correct.
6750		<Step response method> Improper auto tuning result	<Auto tuning is finished. → PID operation is started.> • The deviation at start of auto tuning is 150 or less. • The deviation at end of auto tuning is 1/3 or more of the deviation at start of auto tuning. Check the measured value and target value, and then execute auto tuning again.
6751		<Step response method> Auto tuning operation direction mismatch	<Auto tuning is forcibly finished. → PID operation is not started.> The operation direction estimated from the measured value at the start of auto tuning was different from the actual operation direction of the output during auto tuning. Correct the relationship among the target value, output value for auto tuning, and the measured value, and then execute auto tuning again.
6752		<Step response method> Improper auto tuning result	<Auto tuning is finished. → PID operation is not started.> Because the set value was fluctuated during auto tuning, auto tuning was not executed correctly. Set the sampling time to a value larger than the output change cycle, or set a larger value for the input filter constant. After changing the setting, execute auto tuning again.
6753		<Limit cycle method> Auto tuning operation direction mismatch	<Auto tuning is forcibly finished. → PID operation is not started.> Check whether the target setting contents are correct.
6754		<Limit cycle method> Abnormal PV threshold (hysteresis) set value for auto tuning (SHPV < 0)	
6755		<Limit cycle method> Abnormal auto tuning transfer status (Data of device controlling transfer status is abnormally overwritten.)	<Auto tuning is forcibly finished. → PID operation is not started.> Ensure that devices occupied by PID instruction are not overwritten in the program.
6756		<Limit cycle method> Abnormal result due to excessive auto tuning measurement time (τon > τ, τon < 0, τ < 0)	<Auto tuning is forcibly finished. → PID operation is not started.> The auto tuning time is longer than necessary. Increase the difference (ULV - LLV) between the upper limit and lower limit of the output value for auto tuning, set a smaller value to the input filter constant (α), or set a smaller value to the PV threshold (SHPV) for auto tuning, and then check the result for improvement.

Error code	PLC operation at error occurrence	Contents of error	Action
Operation error [M8067 (D8067)]			
6757	Continues operation	<Limit cycle method> Auto tuning result exceeds proportional gain. (KP = outside range from 0 to 32767)	<Auto tuning is finished (KP = 32767). → PID operation is started.> The variation of the measured value (PV) is small compared with the output value. Multiply the measured value (PV) by "10" so that the variation of the measured value will increase during auto tuning.
6758		<Limit cycle method> Auto tuning result exceeds integral time. (TI = outside range from 0 to 32767)	<Auto tuning is finished (KP = 32767). → PID operation is started.> The auto tuning time is longer than necessary. Increase the difference (ULV - LLV) between the upper limit and lower limit of the output value for auto tuning, set a smaller value to the input filter constant (α), or set a smaller value to the PV threshold (SHPV) for auto tuning, and then check the result for improvement.
6759		<Limit cycle method> Auto tuning result exceeds derivative time. (TD = outside range from 0 to 32767)	
6760		ABS data read from servo sum check error	Check servo wiring and parameter setting. Also check ABS instruction.
6762		Port specified by inverter communication instruction is already used in another communication.	Check to make sure the port is not specified by another instruction.
6763		Input (X) specified by DSZR or ZRN instruction is already used in another instruction.	Check to make sure the input (X), as specified by DSZR or ZRN instruction, is not being used for the following purposes: - Input interrupt - High-speed counter C235 to C255 - Pulse catch M8170 to M8175 - SPD instruction
6764		Pulse output number is already used in a positioning instruction or pulse output instruction (PLSY, PWM, etc.).	Check to make sure the pulse output destination is not being driven by another positioning instruction.
6770		Memory access error	When the memory cassette is used, check whether it is mounted correctly. If the problem persists or if the memory cassette is not used, something may be malfunctioning inside the PLC. Consult your local Mitsubishi Electric representative.
6772		EEPROM memory cassette is protected against writing.	The write-protect switch of the EEPROM memory cassette was set to ON when data was transferred to the EEPROM memory.
USB communication error [M8487 (D8487)]			
8702	Continues operation	Communication character error	Confirm the cable connection between programming device and the PLC. This error may occur when a cable is disconnected and reconnected during PLC monitoring.
8703		Communication data sum check error	
8704		Data format error	
8705		Command error	
8730		Memory access error	When the memory cassette is used, check whether it is mounted correctly. If the problem persists or if the memory cassette is not used, something may be malfunctioning inside the PLC. Consult your local Mitsubishi Electric representative.
Special parameter error [M8489 (D8489)]			
8101	Continues operation	Special parameter setting time-out error	Turn OFF the power, and check the power supply and connection of special adapters.
8102		Special parameter setting error	Special parameters are set improperly. • Confirm troubleshooting for special adapters and set special parameters correctly. • Set special parameters correctly, turn OFF the power, and then turn ON the power.
8103		Special parameter transfer target unconnected error	Special parameters are set, but special adapters/special blocks are not connected. Check whether special adapters is connected.
8104		Special parameter unsupported function	Check that special parameters with unsupported settings are not set for connected special adapters.

14.7 Troubleshooting

→ **For the procedures on running and stopping the PLC, refer to Section 14.2.**
→ **For the procedures on operating peripheral devices, refer to the manuals for the peripheral devices.**

14.7.1 Output does not operate

1. Output does not turn on.

Stop the PLC, and forcibly turn the inoperable output on then off with a peripheral device to check its operation.
Check for troubles with external wiring.

- When the output operates.
  The output may be turned off unintentionally in the program.
  Reexamine the program. (Duplicate coil or RST instructions)
- When the output does not operate.
  Check the configuration of the connected devices. If the configuration of the external wiring and connected devices are acceptable, the output circuit may be damaged.
  Consult your local Mitsubishi Electric representative.

2. Output does not turn off.

Stop the PLC, and check that the output turns off.
Check for trouble with external wiring.

- When the output turns off
  The output may be turned on unintentionally in the program.
  Check that there are no duplicate coils in the program.
- When the output does not turn off
  The output circuit may be damaged.
  Consult your local Mitsubishi Electric representative.

14.7.2 24 V DC input does not operate

1. Input does not turn on.

Disconnect the external wiring and connect the [S/S] terminal and the [0V] terminal or the [24V] terminal.
Short-circuit the [0V] terminal or [24V] terminal not connected to the [S/S] terminal and the input terminal, then check the input display LED or a peripheral device to confirm that the input turns on.

	Action
When input turns on	Check that the input device does not have a built-in diode or parallel resistance. If so, refer to Subsection 9.2.2.
When input does not turn on	Measure the voltage between the [0V] terminal (or [24V] terminal) not connected to the [S/S] terminal and the input terminal with a tester to confirm that the voltage is 24 V DC. • Check the configuration of the external wiring and connected devices.

2. Input does not turn off.

Check for leakage current from input devices.
If the leakage current is larger than 1.5 mA, it is necessary to connect a bleeder resistance.

→ **For details on the measures, refer to Subsection 9.2.2.**

14.7.3 Cautions in registering keyword

1. **Cautions in registering keyword**
   The keyword limits access to the program prepared by the user from peripheral devices.
   Keep the keyword carefully.
   If you forget the keyword, you cannot operate the PLC online from the programming tool depending on the type of the programming tool and the registered keyword.

2. **Caution on using a peripheral device which does not support the second keyword and customer keyword**
   Sequence programs in which the second keyword and customer keyword are registered cannot be all-cleared using a peripheral device that does not support the second keyword and customer keyword.

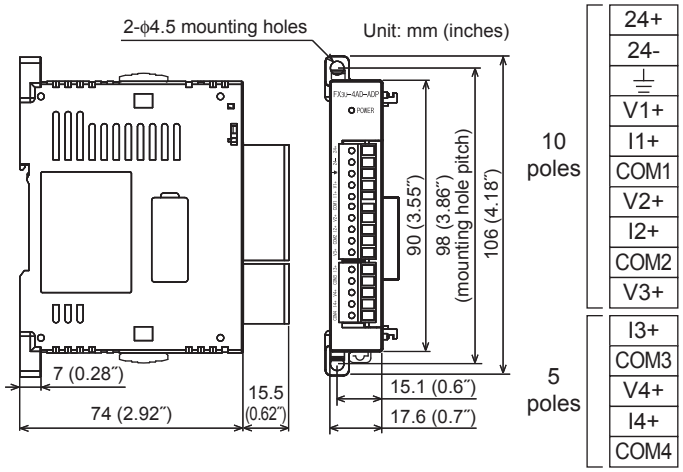
3. **Non-resettable protect function**
   When the non-resettable protect function is set, the protect function cannot be reset.

15. Other Extension Devices and Optional Units (External Dimensions and Terminal Arrangement)

15.1 Special Adapters

15.1.1 FX3U-4AD-ADP

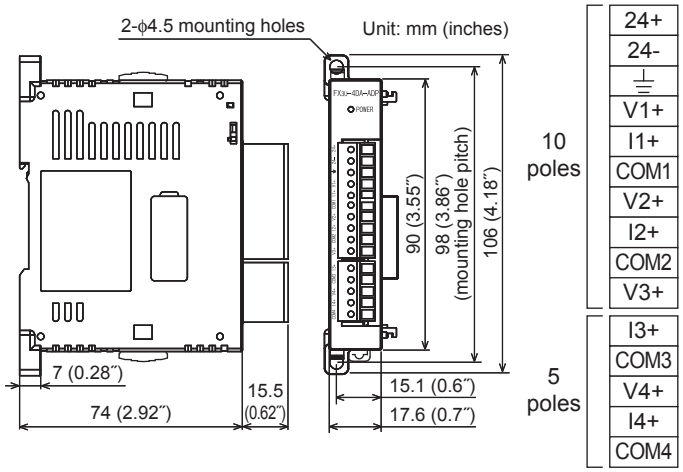
External Dimensions, Terminal Layout



- MASS (Weight): Approx. 0.1 kg (0.22 lbs)
- Installation: DIN rail of 35 mm (1.38") in width or screws
- Accessories: Manual supplied with product
- Terminal block: European type

15.1.2 FX3U-4DA-ADP

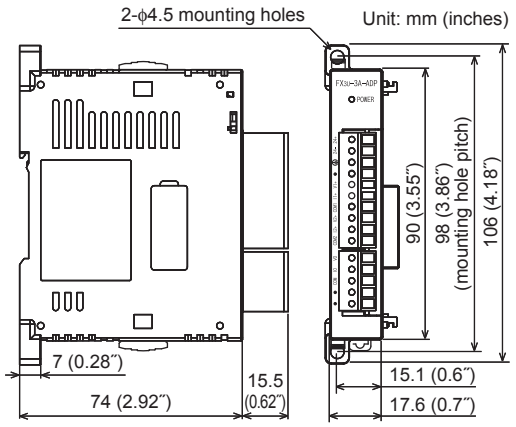
External Dimensions, Terminal Layout



- MASS (Weight): Approx. 0.1 kg (0.22 lbs)
- Installation: DIN rail of 35 mm (1.38") in width or screws
- Accessories: Manual supplied with product
- Terminal block: European type

15.1.3 FX3U-3A-ADP

External Dimensions, Terminal Layout

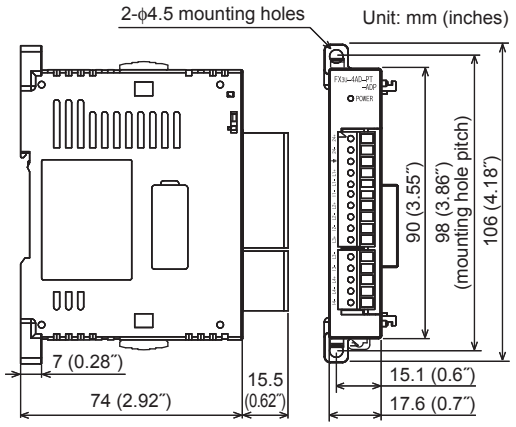


10 poles	24+
	24-
	⏚
	•
	V1+
	I1+
	COM1
	V2+
	I2+
	COM2
5 poles	V0
	I0
	COM
	•
	•

- MASS (Weight): Approx. 0.1 kg (0.22 lbs)
- Installation: DIN rail of 35 mm (1.38") in width or screws
- Accessories: Manual supplied with product
- Terminal block: European type

15.1.4 FX3U-4AD-PT(W)-ADP

External Dimensions, Terminal Layout

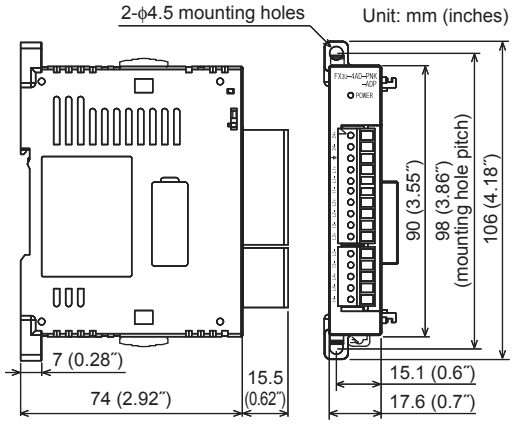


10 poles	24+
	24-
	⏚
	L1+
	L1-
	I1-
	L2+
	L2-
	I2-
	L3+
5 poles	L3-
	I3-
	L4+
	L4-
	I4-

- MASS (Weight): Approx. 0.1 kg (0.22 lbs)
- Installation: DIN rail of 35 mm (1.38") in width or screws
- Accessories: Manual supplied with product
- Terminal block: European type

15.1.5 FX3U-4AD-PNK-ADP

External Dimensions, Terminal Layout

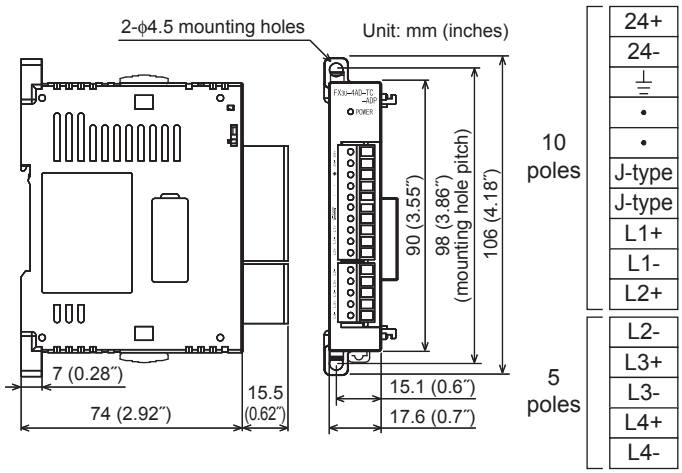


10 poles	24+
	24-
	⏚
	L1+
	L1-
	I1-
	L2+
	L2-
	I2-
	L3+
5 poles	L3-
	I3-
	L4+
	L4-
	I4-

- MASS (Weight): Approx. 0.1 kg (0.22 lbs)
- Installation: DIN rail of 35 mm (1.38") in width or screws
- Accessories: Manual supplied with product
- Terminal block: European type

15.1.6 FX3U-4AD-TC-ADP

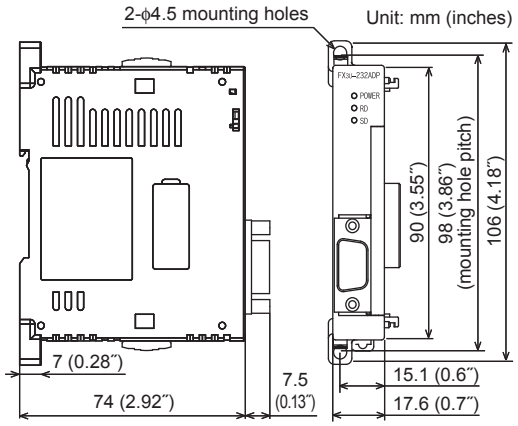
External Dimensions, Terminal Layout



- MASS (Weight): Approx. 0.1 kg (0.22 lbs)
- Installation: DIN rail of 35 mm (1.38") in width or screws
- Accessories: Manual supplied with product
- Terminal block: European type

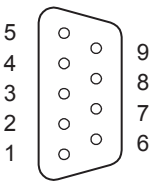
15.1.7 FX3U-232ADP(-MB)

External Dimensions



- MASS (Weight): Approx. 80 g (0.18 lbs)
- Installation: DIN rail of 35 mm (1.38") in width or screws
- Accessories: Manual supplied with product
- Connector: RS-232C (D-SUB 9-pin, male)

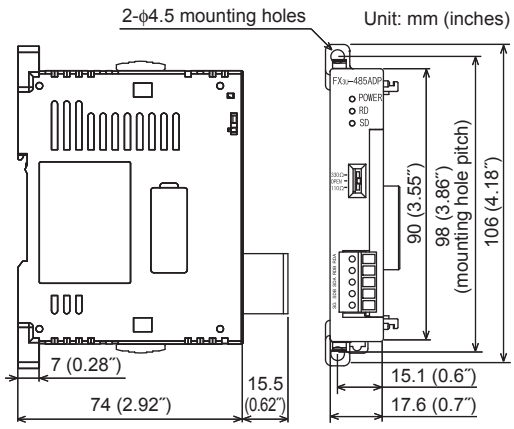
Pin configuration



1	CD (DCD)
2	RD (RXD)
3	SD (TXD)
4	ER (DTR)
5	SG (GND)
6	DR (DSR)
7	Not used
8	Not used
9	Not used

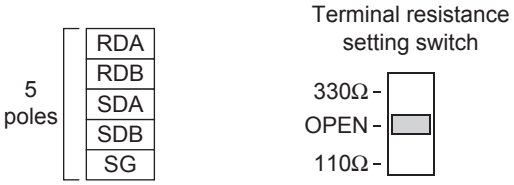
15.1.8 FX3U-485ADP(-MB)

External Dimensions



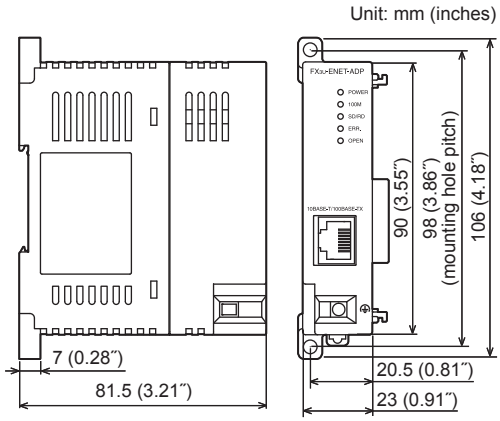
- MASS (Weight): Approx. 80 g (0.18 lbs)
- Installation: DIN rail of 35 mm (1.38") in width or screws
- Accessories: Label for indication of link station number, Manual supplied with product
- Terminal block: European type
- Terminal resistance: 330 Ω/110 Ω, built-in

Terminal Layout



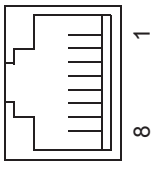
15.1.9 FX3U-ENET-ADP

External Dimensions



- MASS (Weight): Approx. 0.1 kg (0.22 lbs)
- Installation: DIN rail of 35 mm (1.38") in width or screws
- Accessories: Manual supplied with product
- Connector: 10BASE-T/100BASE-TX (RJ45)
- Terminal block: External ground terminal (M2.5 terminal block screw)

Pin configuration

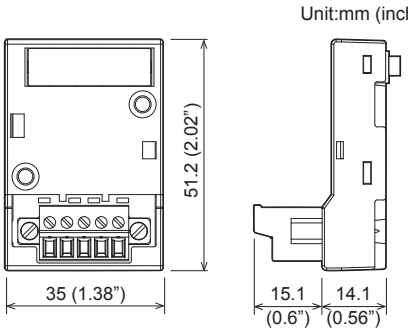


1	TD+
2	TD-
3	RD+
4	Not used
5	Not used
6	RD-
7	Not used
8	Not used

15.2 Expansion Board

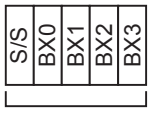
15.2.1 FX3G-4EX-BD

External Dimensions

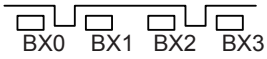


- MASS(Weight): Approx. 20g (0.05lbs)
- Accessories: Two M3×8 tapping screws (for installation of board), Side cover, Manual supplied with product
- Connector: European type

Terminal Layout

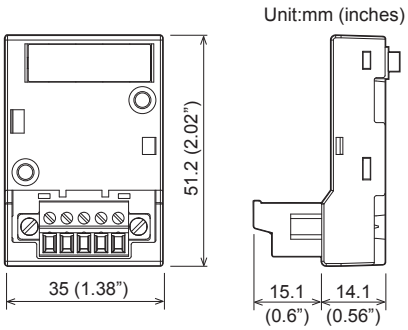


LEDs correspond to each input terminal



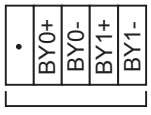
15.2.2 FX3G-2EYT-BD

External Dimensions

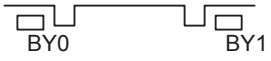


- MASS(Weight): Approx. 20g (0.05lbs)
- Accessories: Two M3×8 tapping screws (for installation of board), Side cover, Manual supplied with product
- Connector: European type

Terminal Layout



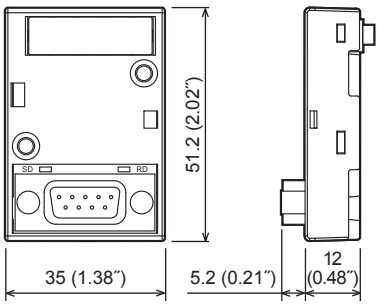
LEDs correspond to each output terminal



15.2.3 FX3G-232-BD

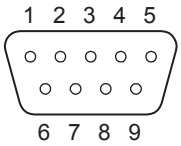
External Dimensions

Unit: mm (inches)



- MASS (Weight): Approx. 20 g (0.05 lbs)
- Accessories: Two M3×8 tapping screws (for installation of board), Side cover, Manual supplied with product
- Connector: RS-232C (D-SUB 9-pin, male)

Pin configuration

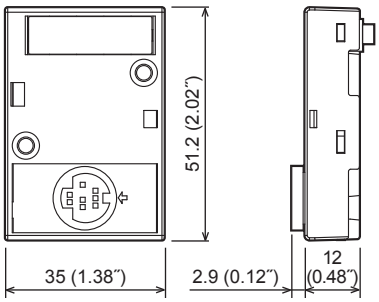


1	CD (DCD)
2	RD (RXD)
3	SD (TXD)
4	ER (DTR)
5	SG (GND)
6	DR (DSR)
7	Not used
8	Not used
9	Not used

15.2.4 FX3G-422-BD

External Dimensions

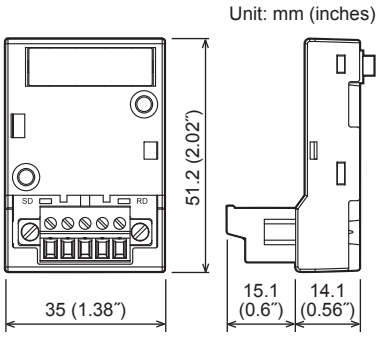
Unit: mm (inches)



- MASS (Weight): Approx. 20 g (0.05 lbs)
- Accessories: Two M3×8 tapping screws (for installation of board), Side cover, Manual supplied with product
- Connector: RS-422 (MINI DIN 8-pin, female)

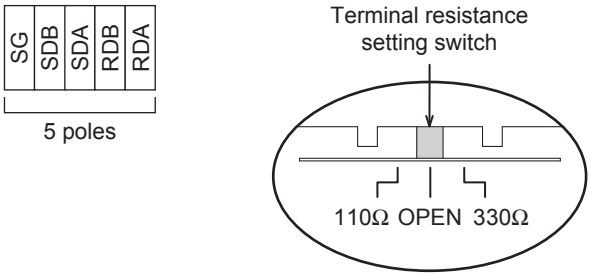
15.2.5 FX3G-485-BD

External Dimensions



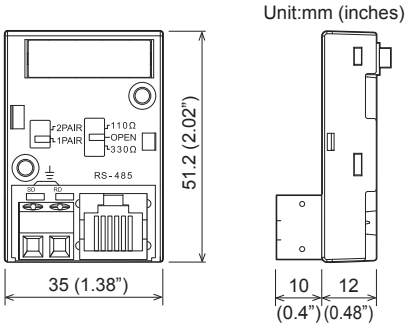
- MASS (Weight): Approx. 20 g (0.05 lbs)
- Accessories: Two M3×8 tapping screws (for installation of board), Side cover, Label for indication of link station number, Manual supplied with product
- Terminal block: European type
- Terminal resistance: 330 Ω/110 Ω, built-in

Terminal Layout



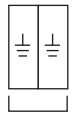
15.2.6 FX3G-485-BD-RJ

External Dimensions

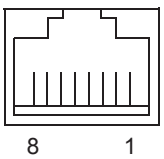


- MASS(Weight): Approx. 20g (0.05lbs)
- Accessories: Two M3×8 tapping screws (for installation of board), Side cover, Label for indication of link station number (2 types), Manual supplied with product
- Terminal block: European type (for grounding)
- Connector: RJ45
- Terminal resistance: 330 Ω/110 Ω, built-in

Terminal Layout

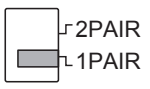


Pin configuration

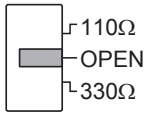


1	SG
2	Not used
3	SDA
4	RDB
5	RDA
6	SDB
7	Not used
8	Not used

Wiring setting switch



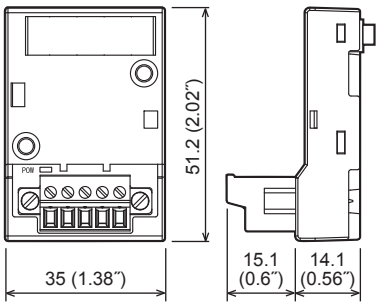
Terminal resistance setting switch



15.2.7 FX3G-2AD-BD

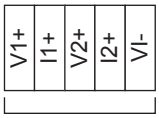
External Dimensions

Unit: mm (inches)



- MASS (Weight): Approx. 20 g (0.05 lbs)
- Accessories: Two M3×8 tapping screws (for installation of board), Side cover, Manual supplied with product
- Terminal block: European type

Terminal Layout

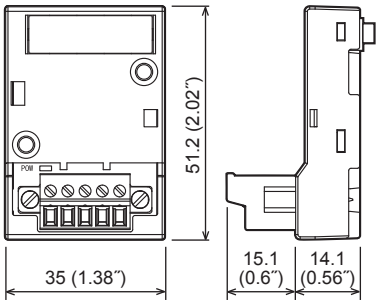


5 poles

15.2.8 FX3G-1DA-BD

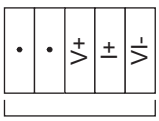
External Dimensions

Unit: mm (inches)



- MASS (Weight): Approx. 20 g (0.05 lbs)
- Accessories: Two M3×8 tapping screws (for installation of board), Side cover, Manual supplied with product
- Terminal block: European type

Terminal Layout

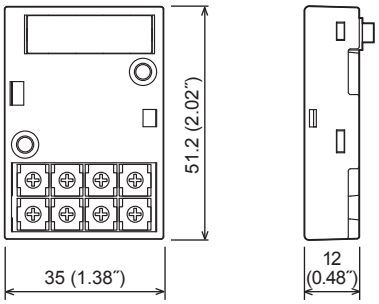


5 poles

15.2.9 FX3G-8AV-BD

External Dimensions

Unit: mm (inches)



- MASS (Weight): Approx. 20 g (0.05 lbs)
- Accessories: Two M3×8 tapping screws (for installation of board), Side cover, Trimmer layout label, Manual supplied with product

Trimmer Layout

VR0	VR1	VR2	VR3
VR4	VR5	VR6	VR7

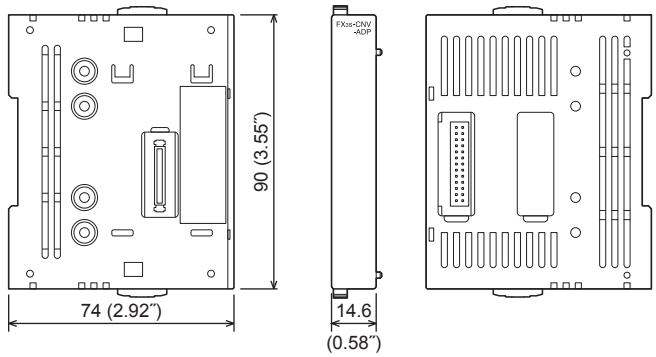
15.3 Connector Conversion Adapter

15.3.1 FX3S-CNV-ADP

External Dimensions

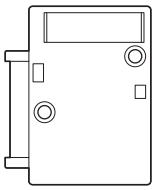
[Connector conversion adapter (main body)]

Unit: mm (inches)



- MASS (Weight): Approx. 0.1 kg (0.22 lbs)
- Accessories: Four M3×8 tapping screws (for installation of adapter), Manual supplied with product

[Connector conversion adapter (board)]

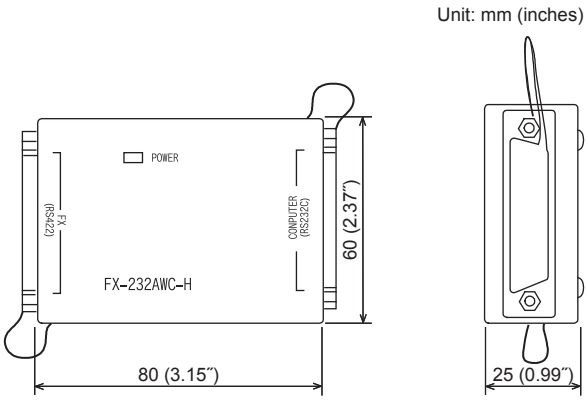


15.4 Interface Module

15.4.1 FX-232AWC-H

External Dimensions

Unit: mm (inches)



- MASS (Weight): Approx. 0.1 kg (0.22 lbs)
- Accessories: Manual supplied with product
- Connector: RS-232C (D-SUB 25-pin, female)
  RS-422 (D-SUB 25-pin, female)
  Screw for securing connector: M2.6 screw

16. Display Module (FX3S-5DM)

STARTUP AND MAINTENANCE PRECAUTIONS **⚠WARNING**

- Before modifying or disrupting the program in operation or running the PLC, carefully read through this manual and the associated manuals and ensure the safety of the operation.
  An operation error may damage the machinery or cause accidents.

STARTUP AND MAINTENANCE PRECAUTIONS **⚠CAUTION**

- Do not disassemble or modify the PLC.
  Doing so may cause fire, equipment failures, or malfunctions.
  For repair, contact your local Mitsubishi Electric representative.
- Turn off the power to the PLC before attaching or detaching the following devices.
  Failure to do so may cause equipment failures or malfunctions.
  - Peripheral devices, display module, expansion boards, and special adapters
  - Battery and memory cassette

16.1 Specifications

16.1.1 Applicable PLC

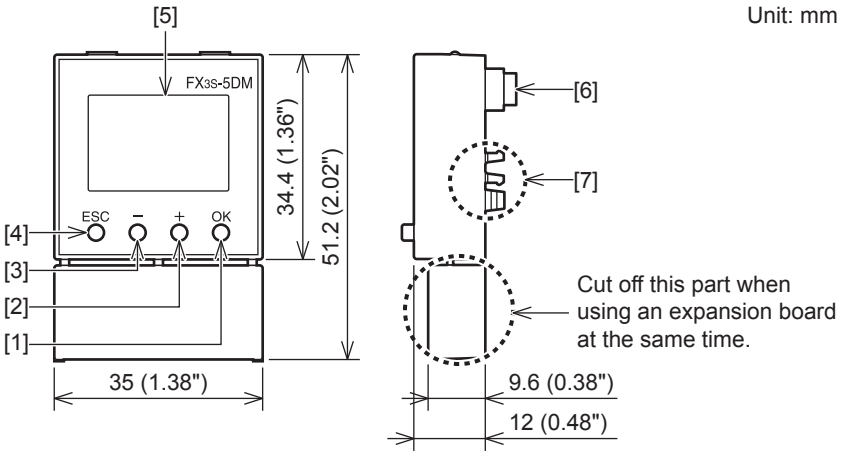
Model name	Applicability
FX3S Series	Ver.1.20 or later

16.1.2 Display Specifications

Item	Specifications
Display device	TN monochrome liquid crystal display
Display character	Seven-segment display + icon display
Backlight	Green LED backlight
Button	4 operation buttons (ESC, -, +, and OK)

16.1.3 External Dimensions and Part Names

Unit: mm (inches)



[1]	[OK] button	[5]	Display
[2]	[+] button	[6]	Connector for PLC
[3]	[-] button	[7]	Display module fixing hook
[4]	[ESC] button		(When used together with an expansion board)

16.2 Installation and Removal

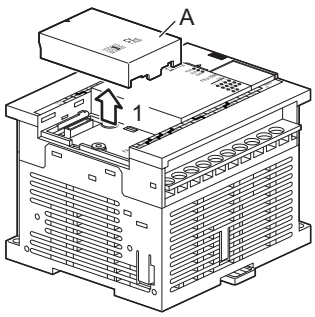
Be sure that the power is OFF when installing the display module.

16.2.1 Installation and Removal (when the expansion board/connector conversion adapter is not used together)

The FX3S-30MT/ES is used as the main unit in this example.

1 **Remove the top cover.**

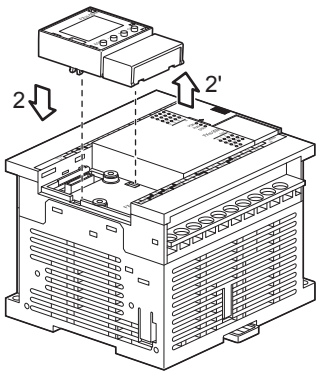
Remove the top cover (A in the figure on the right) as shown in the right figure.



2 **Install/remove the display module.**

Make sure the display module is in parallel with the main unit. Attach the display module to the main unit as shown in the right figure (arrow 2).

Remove the display module as shown in the right figure (arrow 2').



16.2.2 Installation and Removal (when the expansion board/connector conversion adapter is used together)

The FX3S-30MT/ES is used as the main unit and the expansion board is used together in this example.

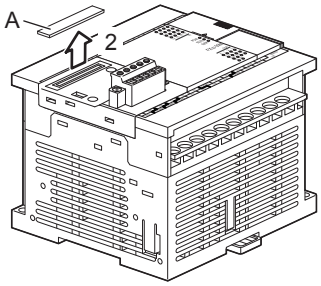
1 **Attach the expansion board/connector conversion adapter to the main unit.**

→ **For the attachment method, refer to Chapter 7.**

Caution

Make sure to attach the expansion board/connector conversion adapter before the display module.

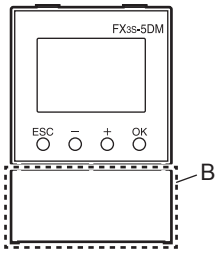
2 **Remove the upper connector cover (A in the right figure).**



3 **Remove part B shown in the right figure using a nipper, etc.**

Caution

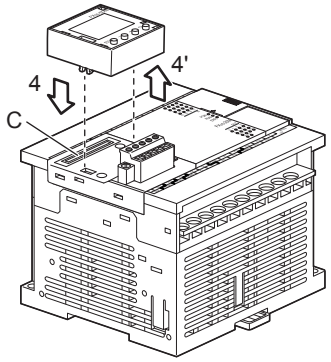
When part B is cut off, the display module can not be installed to the main unit directly.



4 **Attach the display module to the option connector of the expansion board/connector conversion adapter.**

Make sure the display module is in parallel with the main unit. Attach the display module to the option connector (C in the figure on the right) of the expansion board/connector conversion adapter as shown in the right figure (arrow 4).

Remove the display module as shown in the right figure (arrow 4').



16.3 Summary of Functions

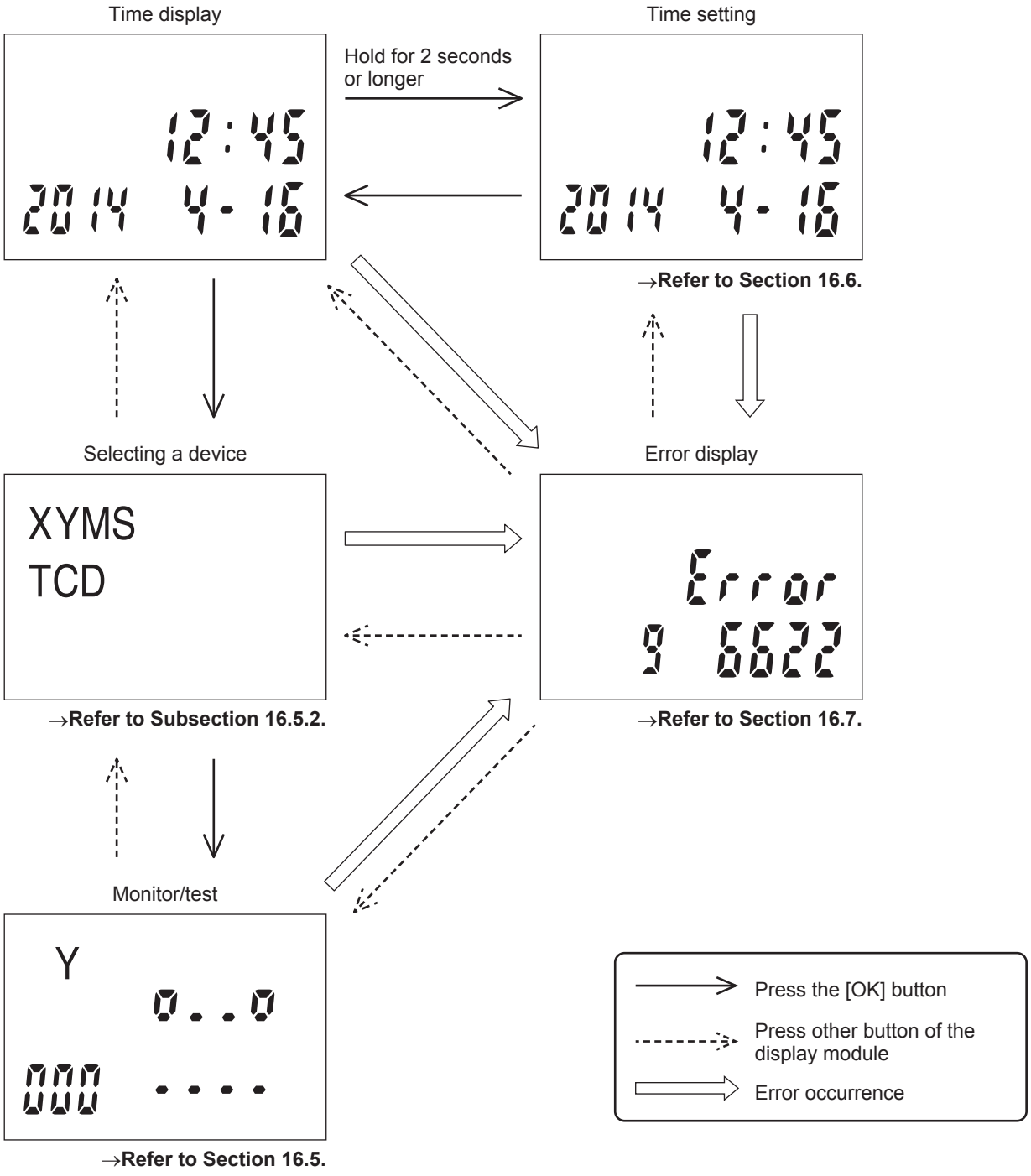
The display module functions are summarized below.
The function to control the display module from programs are called "5DM control functions".

Item	Function	Remarks	Reference
Operator functions			
Monitor/Test	Input (X), output (Y), auxiliary relay (M), state (S), counter (C), timer (T) and data register (D) monitor/test function.	Button operation	Section 16.5
Time display and setting	Display and setting of the current time.	Button operation	Section 16.6
5DM control functions			
Specified device monitor function	Specifies devices displayed on the display module from the PLC.	Requires program	Section 16.9
Back light off function	Sets automatic backlight OFF time.	Requires program	Section 16.10
Display screen protect function	Allows restriction of the operator functions regarding display and setting.	Requires program	Section 16.11
Error display valid/invalid	Allows the selection whether the error display for operation errors, etc. is valid or invalid.	Requires program	Section 16.12
Operation button ON/OFF information	Allows monitoring of operation button ON/OFF status.	Requires program	Section 16.13
Decimal/hexadecimal current value display setting	Allows the display format for monitored values to switch between "decimal" and "hexadecimal".	Requires program	Section 16.14

Caution

- When a keyword is registered in the PLC, only "Time display and setting" and "Error display valid/invalid" are displayed, and other items cannot be displayed.
  If the [OK] button is pressed when a keyword is registered, the error display blinks for 5 seconds.
- A sequence program is required to enable a hexadecimal display of the timer (T), counter (C), and data register (D) [16-bit/32-bit] current values.
- When the scan time is long, the display in the display module is updated at low speed.
  Setting the constant scan mode (M8039 and D8039) can improve the display update timing.
  → **For details on constant scan mode, refer to the Programming Manual.**

16.4 Flowing of the Screen Display



16.5 Monitor/Test

16.5.1 Relevant devices

Monitoring and testing can be performed from the "Monitor/Test" menu for the devices listed below.

✓: Possible ☐: Not possible -: Item not supported by this device

Device	Monitored Items				Test Items		
	Contact	Reset	Current Value	Setting Value	Forced ON/OFF	Current Value Change	Setting Change
Input (X)	✓	-	-	-	-	-	-
Output (Y)	✓	-	-	-	✓*1	-	-
Auxiliary relay (M)	✓	-	-	-	✓*1	-	-
State (S)	✓	-	-	-	✓*1	-	-
Timer (T)	✓	✓	✓	✓	☐	✓	✓
Counter (C)	✓	✓	✓	✓	☐	✓	✓
Data register (D, DD)	-	-	✓	-	-	✓	-
File register (D, DD)	-	-	☐	-	-	☐	-
Index register (V, Z)	-	-	☐	-	-	☐	-

*1. The forced ON/OFF processing for devices (Y, M and S) is executed once by the END instruction executed after the button is pressed.
However, if there are devices (Y, M and S) driven by the OUT instruction in the program, the instruction execution result is reflected.

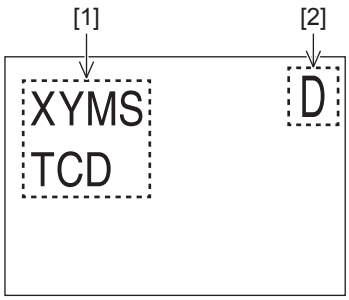
16.5.2 Selecting a device

A device to be monitored and tested can be selected.

1. Description of display

	Display Content
[1]	Displayed device
[2]	32-bit display*1

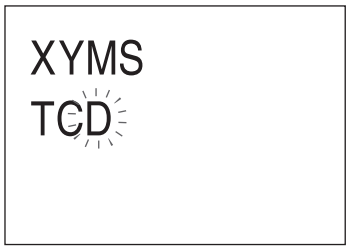
*1. Displayed when a data register (D) is selected.



2. Device selection operation

1) Select device using the [+] and [-] buttons.

When the [+] button is pressed, selected device is changed in the following order:
Data register (D) → Data register (DD) → Input (X) → Output (Y) → Auxiliary relay (M) → State (S) → Timer (T) → Counter (C)



2) Select the desired device and press the [OK] button.
The monitor/test screen appears.
Press the [ESC] button before pressing the [OK] button to return to the time display screen.

16.5.3 When "Input (X)", "Output (Y)", "Auxiliary relay (M)" or "State (S)" is selected

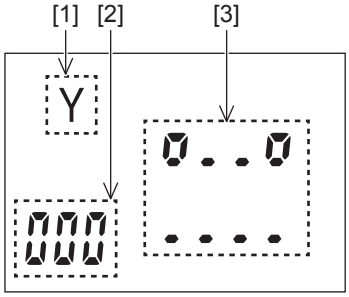
"Input (X)", "Output (Y)", "Auxiliary relay (M)" and "State (S)" can be monitored.
"Output (Y)", "Auxiliary relay (M)" and "State (S)" can be tested also.

1. Description of display

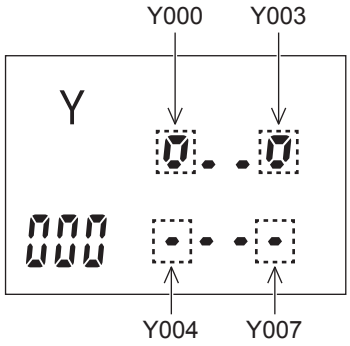
	Display Content
[1]	Displayed device
[2]	Displayed device No.
[3]	ON/OFF status of device*1

*1. From the displayed device No., the ON/OFF status of 8 points (in the case of X or Y) or 10 points (in the case of M or S) is indicated.

. : OFF status 0: ON status

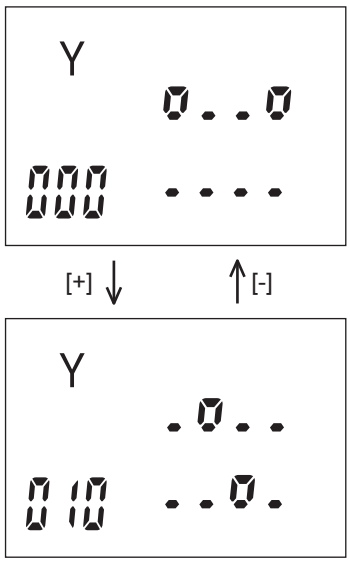


"Y000" is specified as the device to be displayed, only Y000 and Y003 are in the ON status.



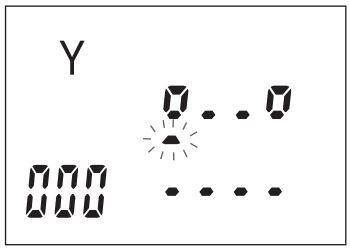
2. Monitor mode operation

Every time the [+] or [-] button is pressed, the displayed device number is increased or decreased by "10", and the ON/OFF status is displayed for the corresponding devices.
To return to the device selection screen, press [ESC] button.



3. Test mode operation

1) Press the [OK] button in the monitor mode to select the forced set/reset mode.
However, the forced set/reset mode does not support "Input (X)".



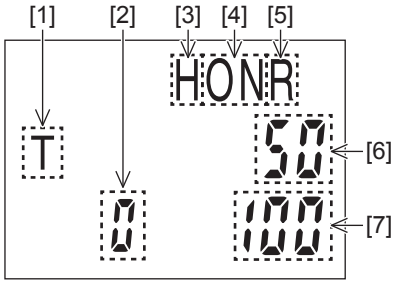
2) Select a device using the [+] and [-] buttons.
The selected device is indicated by flashing underline.
3) When the [OK] button is pressed, the current ON/OFF status is reversed.
4) To return to the device selection screen, press [ESC] button.

16.5.4 When "Timer (T)" is selected

Monitoring and testing can be performed for the timer (T).

1. Description of display

	Display Content
[1]	Displayed device
[2]	Displayed device No.
[3]	Hexadecimal*1
[4]	ON/OFF status*2
[5]	Reset*3
[6]	Current value
[7]	Setting value



*1. Displayed when a hexadecimal is specified.

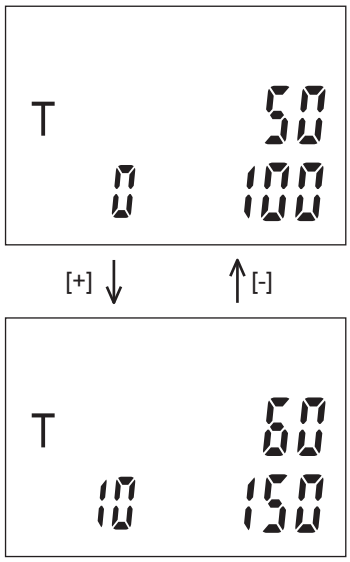
*2. Displayed while timer (T) is ON.

*3. Displayed while timer (T) is reset.

2. Monitor mode operation

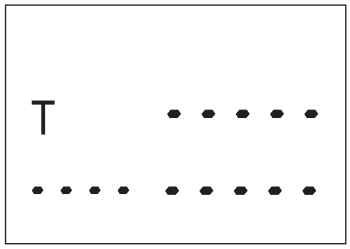
Press the [+] or [-] buttons to change the device to monitor.
Timer (T) that is not used in the program is not displayed.
To return to the device selection screen, press [ESC] button.

Example when T0 and T10 are used in the program



A horizontal line "-" is displayed if there is no timer (T) in the program.

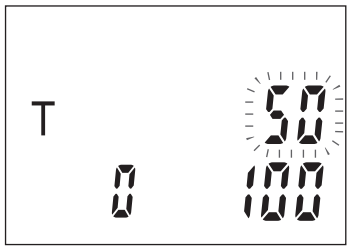
Example when "Timer (T)" is not used in the program



3. Test mode operation

1) Press the [OK] button once in the monitor mode to change the current value.
Press the [OK] button twice in the monitor mode to change the set value.

Changing the current value



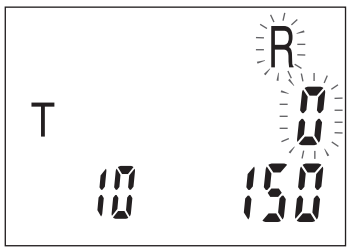
2) Use the [+] / [-] buttons to change the value as desired.
Press and hold the [+] or [-] button for 1 second or more to increase or decrease the value at high speed.

3) Press the [OK] button to determine the input. At this time, the input data is written to the PLC.

Case of resetting the current value

When the [OK] button is pressed and held for 2 seconds or more while the current value is being changed, the current value is reset to "0", and the character "R" and current value "0" start to blink.
Press the [OK] button while "R" and the current value are blinking to write the current value "0" to the PLC, turn OFF the contact, and return to the monitor mode.

Resetting the current value

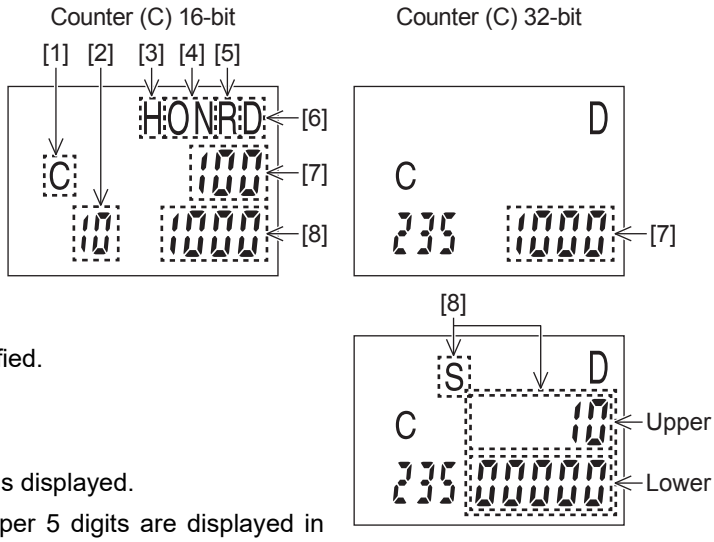


16.5.5 When "Counter (C)" is selected

Monitoring and testing can be performed for the counter (C).

1. Description of display

	Display Content
[1]	Displayed device
[2]	Displayed device No.
[3]	Hexadecimal*1
[4]	ON/OFF status*2
[5]	Reset*3
[6]	32-bit
[7]	Current value
[8]	Setting value*4*5



*1. Displayed when hexadecimal is specified.

*2. Displayed while counter (C) is ON.

*3. Displayed while counter (C) is reset.

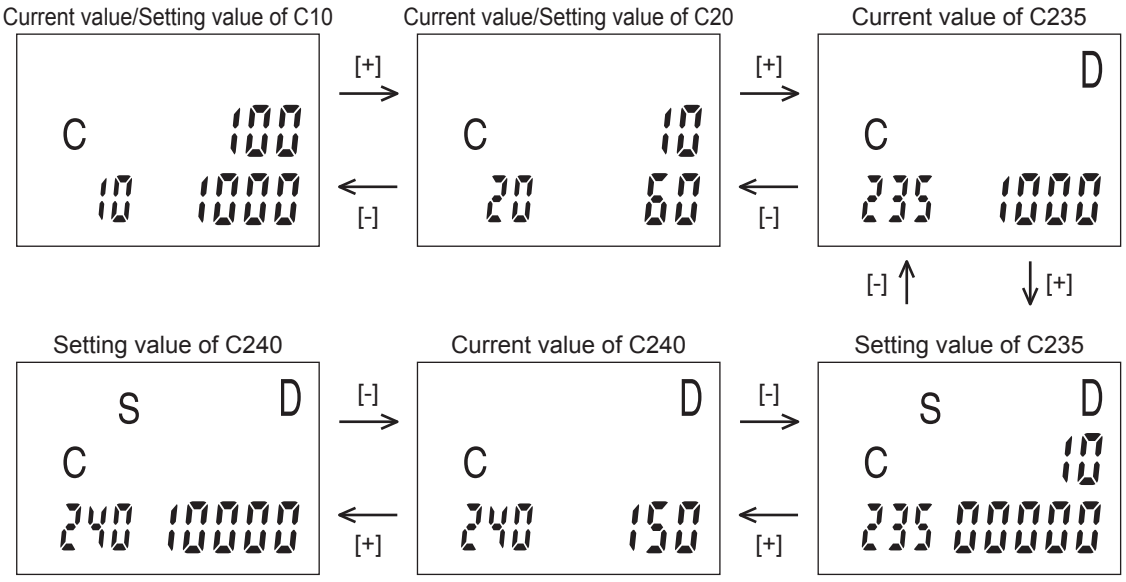
*4. "S" is displayed when a setting value is displayed.

*5. In the case of 32-bit counter (C), upper 5 digits are displayed in upper row and the lower 5 digits are displayed in lower row.

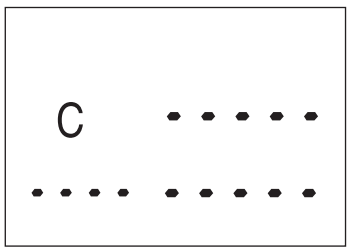
2. Monitor mode operation

Press the [+] or [-] buttons to change the device to monitor.
Counter (C) that is not used in the program is not displayed.
To return to the device selection screen, press [ESC] button.

Example when C10, C20, C235 and C240 are used in the program



A horizontal line "-" is displayed if there is no counter (C) in the program.



3. Test mode operation

Counter (C) 16-bit

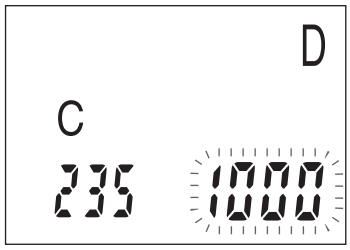
The operation is same as the test mode operation of timer (T).

→ **Refer to Subsection 16.5.4 for test mode operation of timer (T).**

Counter (C) 32-bit

1) Press the [OK] button on the displayed screen to change the current value or set value.
   The current value or set value blinks while it is being changed.

Changing the current value

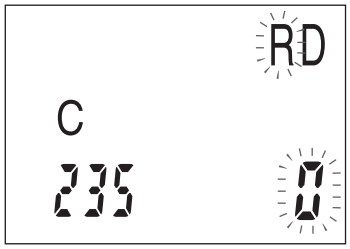


2) Use the [+] / [-] buttons to change the value as desired.
   Press and hold the [+] or [-] button for 1 second or more to increase or decrease the value at high speed.
3) Press the [OK] button to determine the input. At this time, the input data is written to the PLC.

Case of resetting the current value

When the [OK] button is pressed and held for 2 seconds or more while the current value is being changed, the current value is reset to "0", and the character "R" and current value "0" start to blink.
Press the [OK] button while "R" and the current value are blinking to write the current value "0" to the PLC, turn OFF the contact, and return to the monitor mode.

Resetting the current value

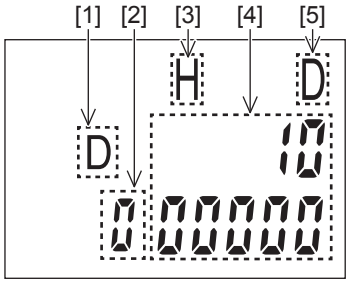


16.5.6 When "Data register (D)" is selected

Monitoring and testing can be performed for the data register (D).

1. Description of display

	Display Content
[1]	Displayed device
[2]	Displayed device No.
[3]	Hexadecimal*1
[4]	Current value*2
[5]	32-bit



*1. Displayed when hexadecimal is specified.

*2. In the case of 16-bit data register (D), current value is displayed in upper row.
In the case of 32-bit data register (D), upper 5 digits are displayed in upper row and the lower 5 digits are displayed in lower row.

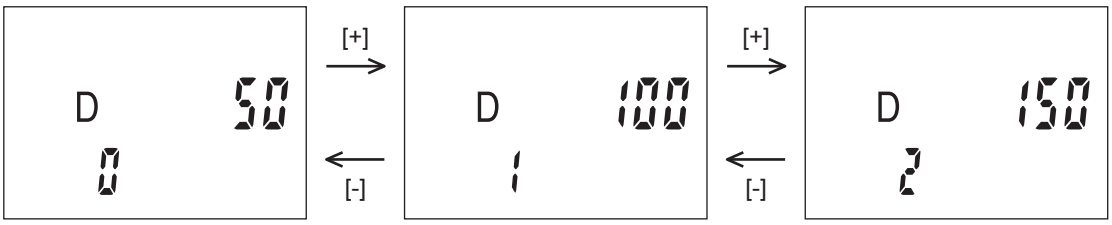
2. Monitor mode operation

Press the [+] or [-] buttons to change the device to monitor.
Return to the selecting a device screen, press [ESC] button.

Example when data register (D) 16-bit is monitored

Press the [+] button to increase the device number by "1". Press the [-] button to decrease the device number by "1".
Press and hold the [+] or [-] button for 1 second or more to increase or decrease the value at high speed.
In the case of the list shown below, the screen display is as follows.

Device	Current value
D0	50
D1	100
D2	150



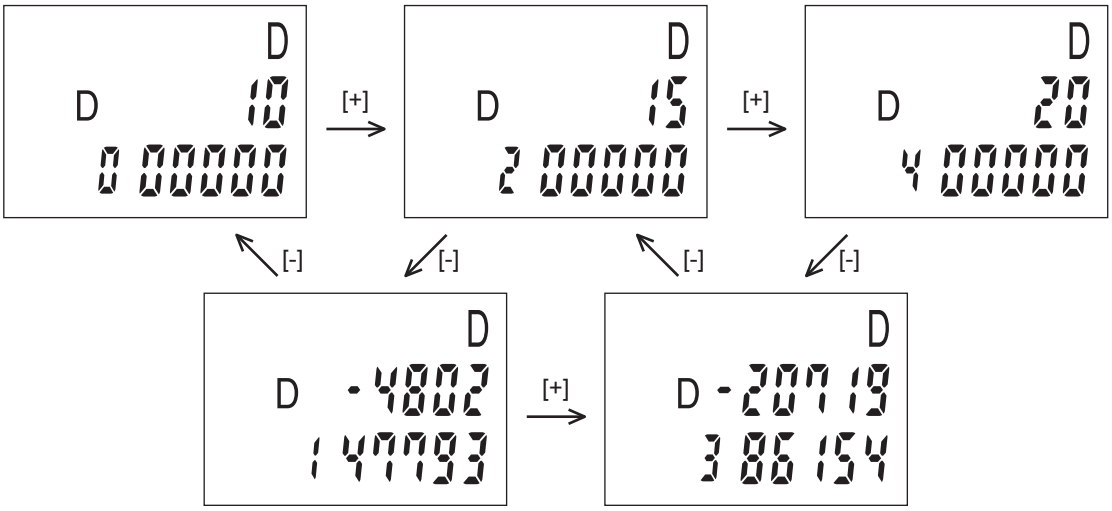
Example when data register (D) 32-bit is monitored

Press the [+] button to increase the device number by "2". Press the [-] button to decrease the device number by "1".

Press and hold the [+] or [-] button for 1 second or more to increase or decrease the value at high speed.

In the case of the list shown below, the screen display is as follows.

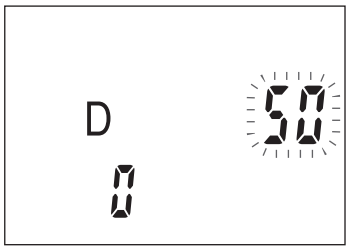
Device	Current value
D0 (D1)	1000000
D2 (D3)	1500000
D4 (D5)	2000000



3. Test mode operation

1) Press the [OK] button in the monitor mode to change the current value. The current value blinks while it is being changed.
2) Use the [+] / [-] buttons to change the value as desired. Press and hold the [+] or [-] button for 1 second or more to increase or decrease the value at high speed.
3) Press the [OK] button to determine the input. At this time, the input data is written to the PLC.

Changing the current value

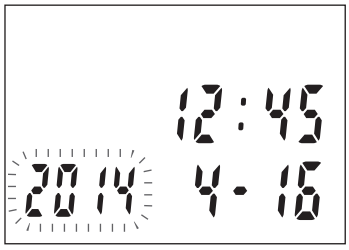


16.6 Time Display and Setting

Display and setting can be performed for the current time.

1. Time display

Year, month, day, hour and minute are displayed when the power is turned ON.



2. Time setting

1) Press and hold the [OK] button for 2 seconds or more to make data blink.
2) Use the [+] / [-] buttons to change the blinking data as desired.
3) Press the [OK] button to determine the input.
   Set "year, month, day, hour and minute" in this order.
   When the [OK] button is pressed at "minute" set up, the setting operation will be completed.
   Press the [ESC] button to return to the previous set item.
   While the "year" data is blinking, however, pressing the [ESC] button cancels the previous time setting and returns to the time display screen.

16.7 Error Display

PLC errors and keyword error are displayed.

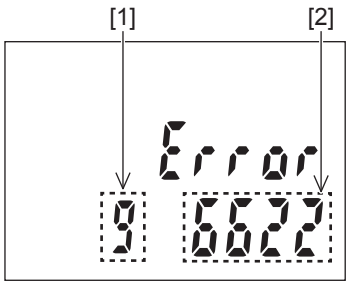
1. Error display

When an error occurs in the PLC, the error step No. and error code are displayed.
One of the following errors is displayed when it occurs:
PLC hardware error, Parameter error, Syntax Error, Circuit error
Whether or not operation errors, etc. are to be displayed can be selected from the program.

→ **Refer to Subsection 14.6.3 for error code.**
→ **Refer to Section 16.12 for error display valid/invalid.**

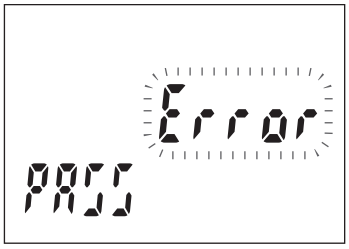
Press an operation button on the display module while an error is displayed to return to the screen displayed before the error display screen.

	Display Content
[1]	Error step No.
[2]	Error code



2. Keyword error display

When the keyword is registered in the PLC, only "Time display and setting" and "Error display valid/invalid" are displayed, and other items cannot be displayed.
If the [OK] button is pressed when the keyword is registered, the error display blinks for 5 seconds.
Release the keyword by using a peripheral unit.



16.8 5DM Control Functions (Restrictions From PLC)

Some of the display module functions require system information settings in order to enable program control of these functions. Functions which require the use of system information are listed below.

- Specified device monitor function
  → **Refer to Section 16.9 details.**
- Back light off function
  → **Refer to Section 16.10 details.**
- Display screen protect function
  → **Refer to Section 16.11 details.**
- Error display valid/invalid
  → **Refer to Section 16.12 details.**
- Operation button ON/OFF information
  → **Refer to Section 16.13 details.**
- Decimal/hexadecimal current value display setting
  - For hexadecimal display of value
    → **Refer to Section 16.14 for the setting procedure.**

16.8.1 System information list

Devices with head number specified in special data register D8158 and D8159 are assigned as system information devices (data register, auxiliary relay). Data register (excluding special data register) should be specified for the system information's "system signal 1", and auxiliary relay (excluding special auxiliary relay) should be specified for the system information's "system signal 2". Both D8158 and D8159 have default settings of "-1" (Disables 5DM control functions).
→ **Refer to Section 16.9 to Section 16.14 for explanations of each system signal.**

1. System signal 1

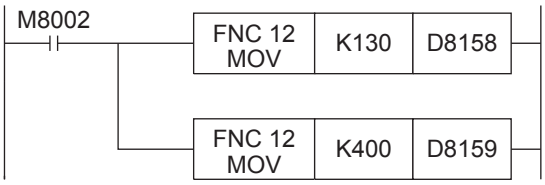
Special data register	System Information	Description		Reference
D8158=K□□ Occupies 5 points	D□□	Device type to be displayed	For specified device monitor function	Section 16.9
	D□□+1	Device No. to be displayed		
	D□□+2	Back light off time (minutes)		Section 16.10
	D□□+3	Device for display screen protect function		Section 16.11
	D□□+4	Not used		-

2. System signal 2

Special data register	System Information	Description		Reference
D8159=K△△ Occupies 15 points	M△△	Request Edit of displayed device data		Section 16.9
	M△△+1	Edit completion response		
	M△△+2	Back light off function invalid (Turns on backlight forcedly.) ON: Disable OFF: Enable		Section 16.10
	M△△+3	Error display valid/invalid		Section 16.12
	M△△+4	[ESC] button status	Operation button ON/OFF information	Section 16.13
	M△△+5	[-] button status		
	M△△+6	[+] button status		
	M△△+7	[OK] button status		
	M△△+8	Decimal/hexadecimal value display setting ON: Hexadecimal OFF: Decimal		Section 16.14
	M△△+9	Specified device monitor screen display status ON: The specified device monitor screen is displayed. OFF: Any screen other than the specified device monitor screen is displayed.		Section 16.9
	M△△+10 to 14	Not used		-

16.8.2 System information setting program example

The following is a program example in which the system information has been assigned to D130 to D134 and M400 to M414.



System information (system No.1) is set at D130 to D134.

System information (system No.2) is set at M400 to M414.

16.9 Specified Device Monitor Function

The specified device monitor function can change the top screen to the monitor/test screen for a device specified by the user.

For the specified device monitor function, specify the device type to be displayed in "D□□" of the system information (system signal 1), and specify the device number to be displayed in "D□□+1" of the system information (system signal 1).

It is necessary to turn ON M△△ to enable the test operation on the specified device monitor screen.

16.9.1 System information - specified device monitor function

1. System signal 1

Special data register	System Information	Description
D8158=K□□	D□□	Device type to be displayed
	D□□+1	Device No. to be displayed*1

*1. Maximum or minimum value of the corresponding device if the device number is set outside the allowable range

The table below shows the device type to be displayed in accordance with the numeric value written in D□□. If any numeric value outside the range from 1 to 10 is written in D□□, the specified device monitor function is disabled.

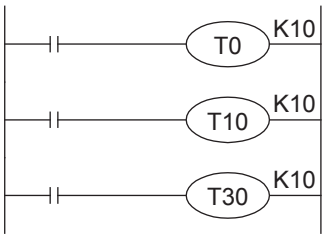
Value stored in D□□	Device type
1	Input (X)
2	Output (X)
3	Auxiliary relay (M)
4	State (S)
5	Timer (T)
6	Counter (C) 16-bit (current value/setting value), Counter (C) 32-bit (setting value)
7	Data register (D) 16-bit
8	Data register (D) 32-bit
9	Time display
10	Counter (C) 16-bit (current value/setting value), Counter (C) 32-bit (current value)

2. System signal 2

Special data register	System Information	Description
D8159=K△△	M△△+9	Specified device monitor display status ON: The specified device monitor screen is displayed. (When specified device monitor function or specified device editing function is used.) OFF: Any screen other than the specified device monitor screen is displayed.

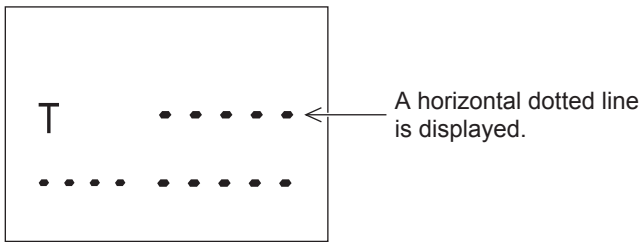
Rule in the special device monitor

- When a device number not existing in the program is specified while a timer (T) or counter (C) is monitored in the specified device monitor function, the following operations occur.
  In the example below, T0, T10 and T30 are specified in the OUT instruction.



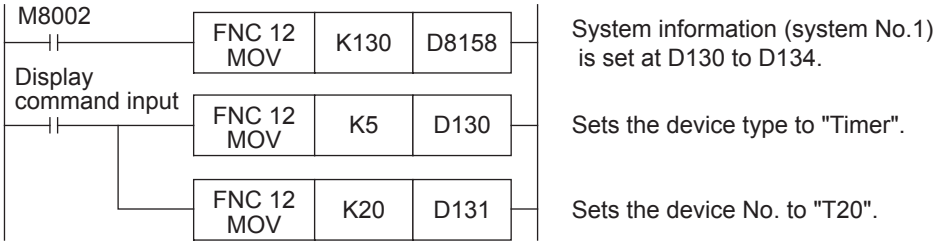
Operation	Description
Operation 1: Displays T10 if T1 to T9 is specified.	Displays the next device number larger than the specified device number.
Operation 2: Displays T30 if T11 to T29 is specified.	
Operation 3: Displays T30 if T31 or more is specified.	Displays T30 if the device range is exceeded.

- When the OUT instruction for any timer (T) or counter (C) does not exist in the program while a timer (T) or counter (C) is monitored in the specified device monitor function, a horizontal dotted line is displayed.
  A horizontal dotted line is displayed also for timers and counters used as operands of applied instructions.



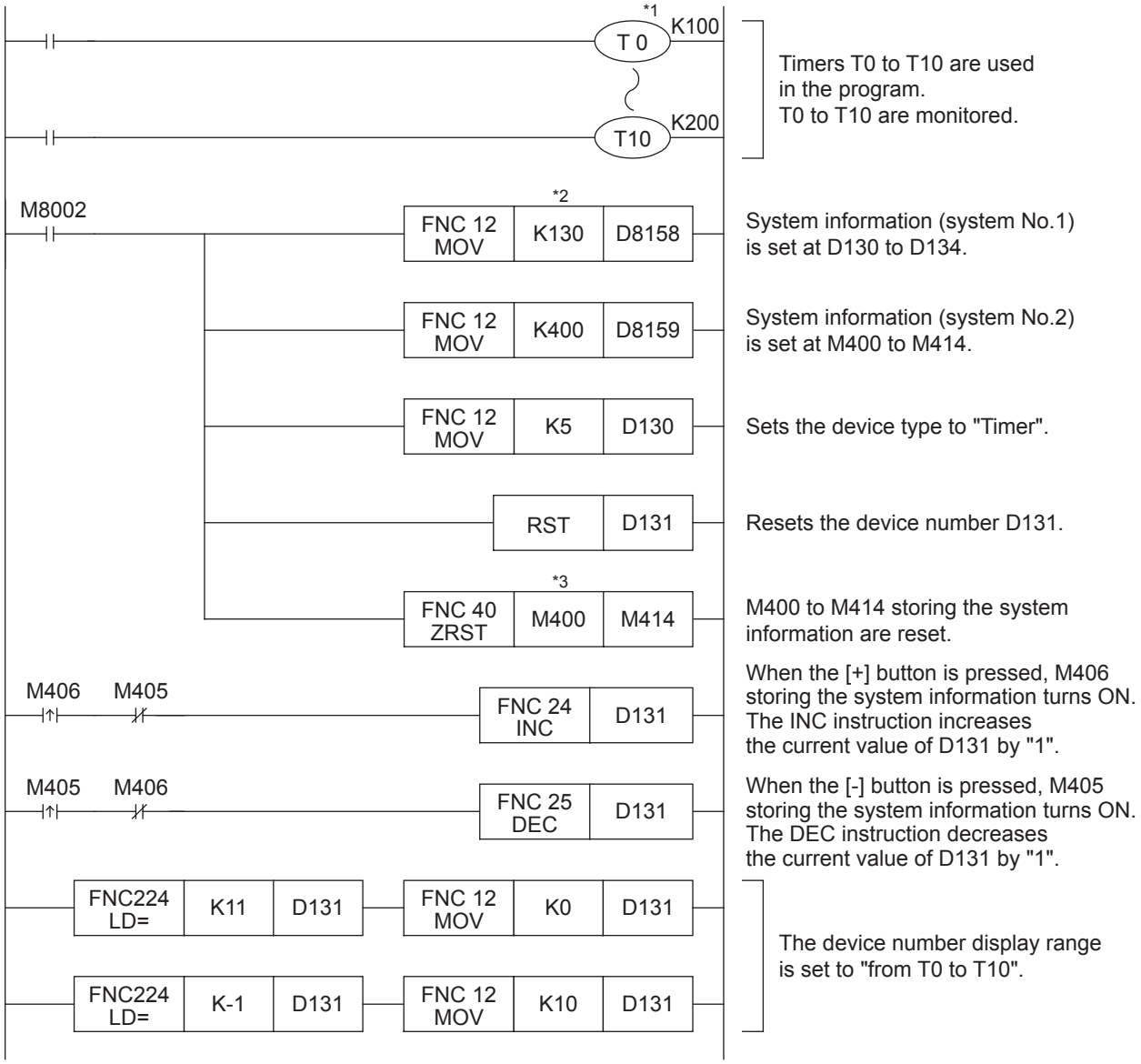
16.9.2 Program example1

In this program example, the device type to be displayed on the specified device monitor screen is set to "timer (T)". Sets the device No. to "T20".
System information is assigned from D130 to D134.



16.9.3 Program example2 (when monitoring consecutive timers using operation button)

In this program example, the device type to be displayed on the specified device monitor screen is set to "timer (T)". The operation buttons [+] and [-] in the display module are available to scroll device numbers T0 to T10 during monitoring.
System information is assigned from D130 to D134 and from M400 to M414.



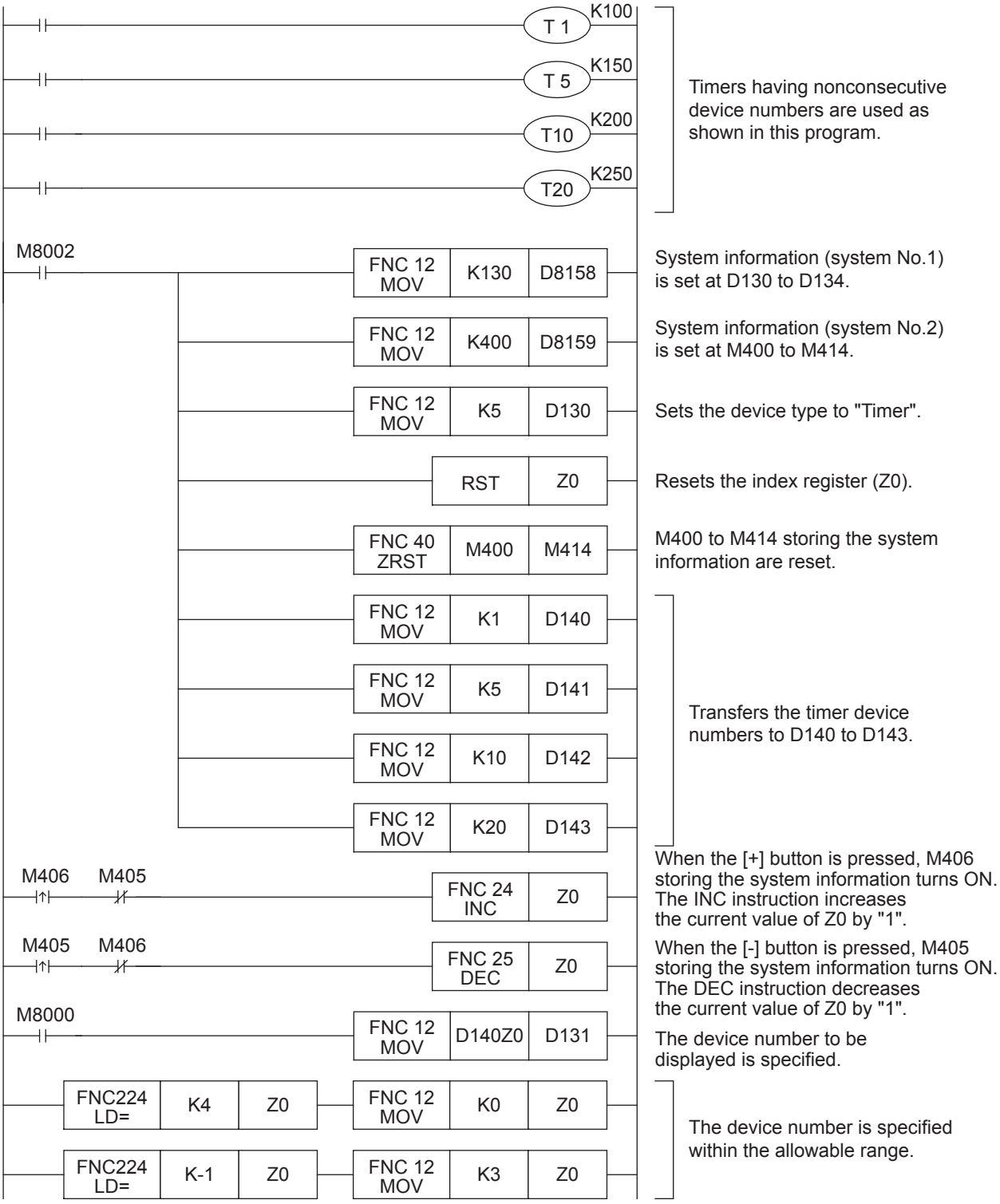
*1. If device numbers are not consecutive, refer to program example 3 on the next page.

*2. When a non-keep type data register is used for D8158, the current value of the data register becomes "0" when the PLC is stopped. As a result, the device type displayed as "D□□" becomes invalid, and the operator functions become valid.
Use a keep type data register as shown above for making invalid the operator functions.

*3. When a keep type auxiliary relay is used for D8159, initialize it using the FNC 40 (ZRST) instruction, etc.

16.9.4 Program example3 (when monitoring non-consecutive timers using operation buttons)

In this program example, the device type to be displayed on the specified device monitor screen is set to "timer (T)". The operation buttons [+] and [-] in the display module are available to scroll device numbers T1, T5, T10 and T20 during monitoring.
System information is assigned from D130 to D134 and from M400 to M414.



16.9.5 Specified device editing function

Devices displayed in the specified device monitor function can be edited.

1. System signal 1

Special data register	System Information	Description
D8158=K□□	D□□	Device type to be displayed
	D□□+1	Device No. to be displayed*1

*1. Maximum or minimum value of the corresponding device if the device number is set outside the allowable range

→ **Refer to Subsection 16.9.1 for system signal 1.**

2. System signal 2

Special data register	System Information	Description
D8159=K△△	M△△	Request edit of specified device monitor
	M△△+1	Edition completion response of specified device monitor

1) Operation of [M△△]
ON : Enables the device editing function
OFF : Disables the device editing function

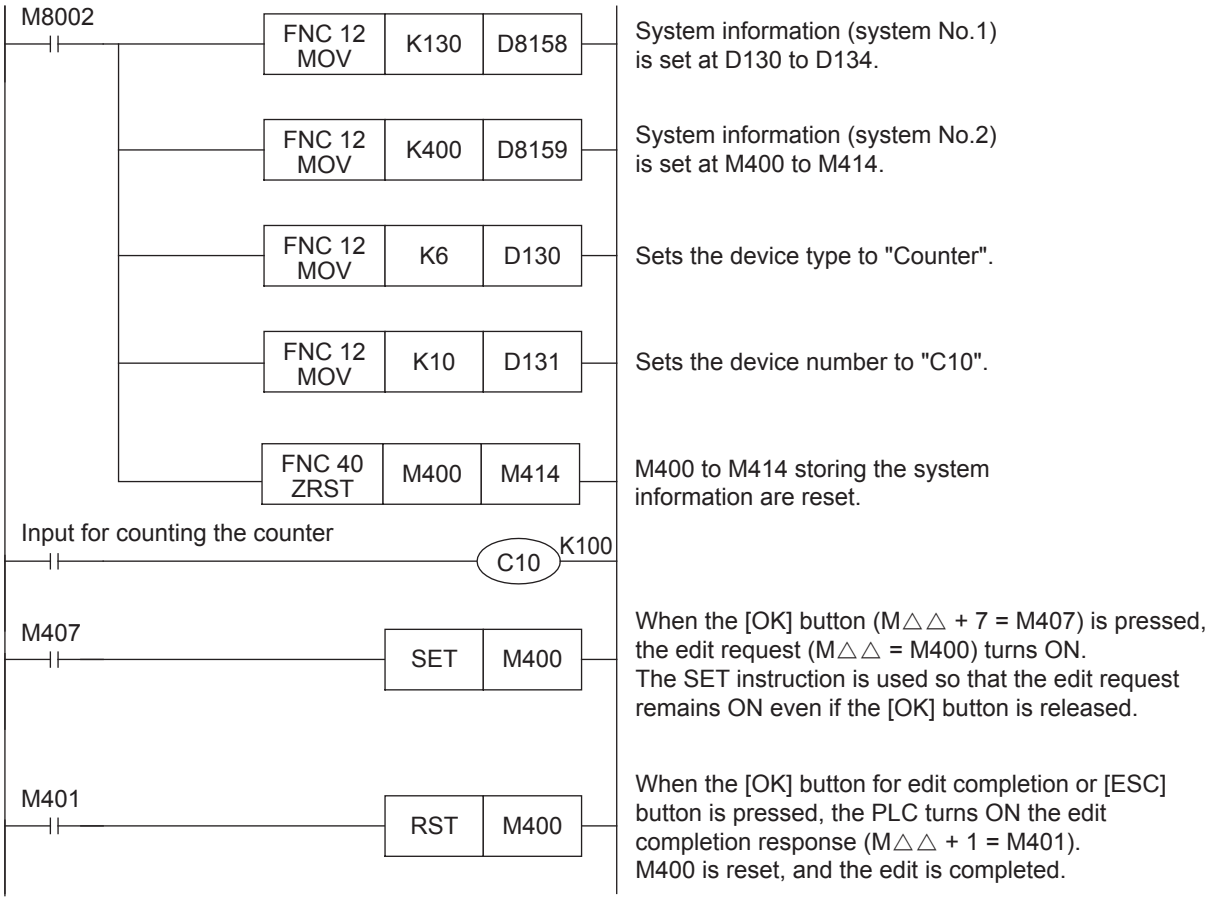
When the edition request turns ON, bit devices (Y, M and S) can be forcibly turned ON or OFF, and the current value/set value of word devices (D, T and C) can be edited.
The operation is same as the test mode operation of monitor/test.

→ **Refer to Subsection 16.9.1 to 16.5.6 for operation of monitor/test.**

2) Operation of [M△△+1]
Turns ON after completion of a test operation for a specified device monitor (or when the [OK] or [ESC] button operated).
To turn OFF, the request edit of a specified device monitor is turned off or it is turned off in the user's program.

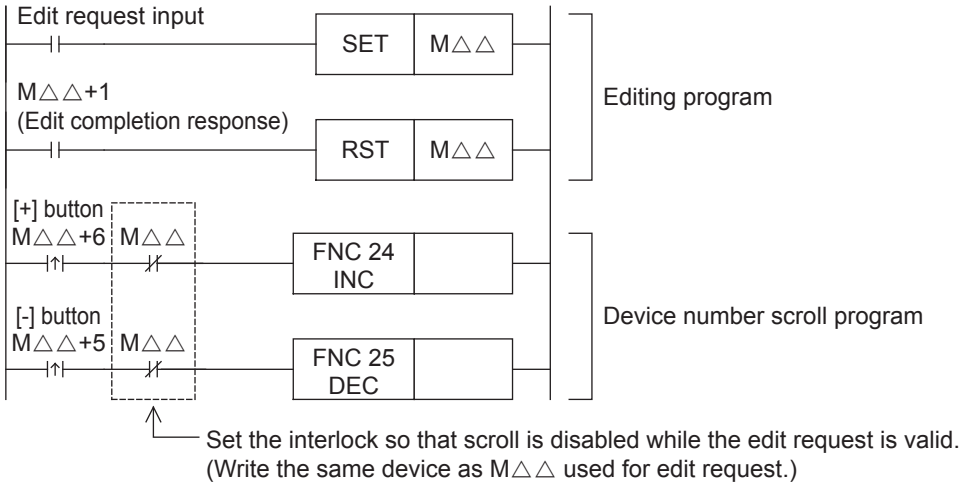
Program example

In this program example, the counter C10 is displayed, and current value/set value edit (data change) is enabled when the [OK] button is pressed.
System information is assigned from D130 to D134 and from M400 to M414.



Cautions on using the edit function

It is necessary to make valid the specified device monitor function before using the specified device editor function.
When the [+] and [-] buttons are used for scrolling the device number, the device number scroll program is activated if the current value or set value is increased or decreased during editing.
In such a combination, it is necessary to set the following interlock:



16.10 Back light off function

Use this function to turn OFF the backlight after the specified time.
The initial value is "10 minutes". The backlight will turn OFF 10 minutes later if the backlight off time is not set.
Once the backlight turns OFF, it will turn ON again when any button is pressed.
This button will act as a trigger, not an effective button.
The contents displayed before the backlight OFF will be shown.

16.10.1 System Information - Back light off function

1. System signal 1

Special data register	System Information	Description
D8158=K□□	D□□+2	Back light off time (minute)

Operation of [D□□+2]
Back light off time can be set in the following range.

0	: 10 minutes
1 to 240	: 1 to 240 minutes
240 or more	: 240 minutes
Negative value	: Forced OFF

Caution

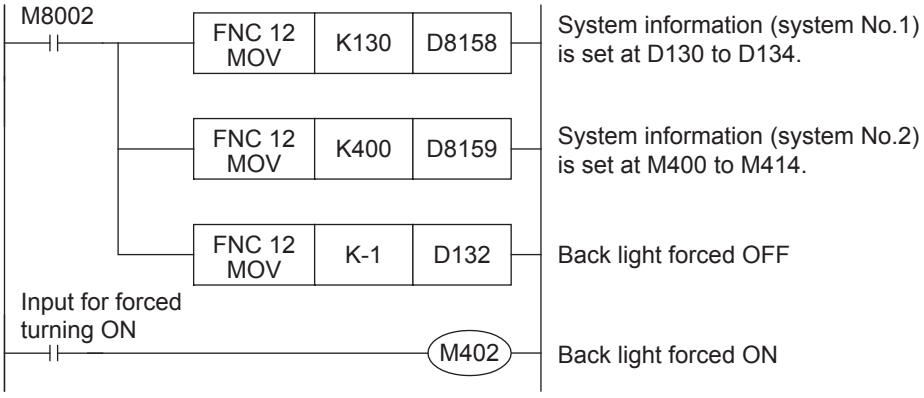
Setting a Negative value in [D□□+2] will force the backlight OFF, setting [M△△+2] the backlight can be forced ON.

2. System signal 2

Special data register	System Information	Description
D8159=K△△	M△△+2	Disable automatic backlight OFF (Forced ON) ON: Disable OFF: Enable

3. Program example

In this program example, the backlight forced turning ON/OFF is set.
System information is assigned from D130 to D134 and from M400 to M414.



16.11 Display Screen Protect Function

The display screen protect function prevents accidental operation by restricting the display module functions.
The display screen protect function is enabled when no keyword is registered.
The display screen protect function's protection level is specified in the system information (system signal 1) "D□□+3".

→ **Refer to Section 16.3 for display module function.**
→ **Refer to Section 16.8 for system information setting.**

16.11.1 System information - display screen protect function

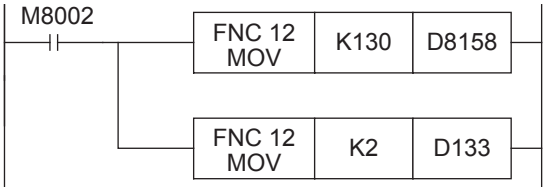
1. System signal 1

Special data register	System Information	Setting Content (Level)	Description
D8158=K□□	D□□+3	0	All operator functions are valid, no protection
		1	Only time display is valid, current time cannot be changed
		2	Only device monitor display is valid, settings cannot be changed
		Other values	All operator functions are valid, no protection

2. System signal 2
System signal 2 is unrelated to this function.

16.11.2 Program example (screen protect function setting)

In this program example, the display screen protect function is set to "level 2".



The system information for the screen protect function is set to D133.

The display is set to "only device monitor".

16.12 Error display enable/disable

It is selectable whether or not operation errors, etc. will be displayed.

Special data register	System Information	Description
D8159=K△△	M△△+3	Enable / Disable operation errors etc. ON: Enables the display of operation errors and serial communication error 1. OFF: Disables the display of operation errors and serial communication error 1.

Caution

- The following errors are unconditionally displayed when they occur.
  PLC hardware error, Parameter error, Syntax error, Circuit error
- If two or more errors have occurred, the priority is given to errors to be unconditionally displayed.
  Additionally the error with the smallest error number has overall priority.

→ **Refer to Section 16.7 for error display screen.**

16.13 Operation Button ON/OFF Information

Operation button ON/OFF information can be monitored at the system information (system signal 2) "M +4 to M +7" while the PLC is running.

→ **Refer to Section 16.8 for system information setting.**

16.13.1 Various applications

1. **Operation button function checks**
   The programming tool can be used to monitor the system information's (system signal 2) "operation button ON/OFF information", to verify that operation buttons are functioning properly.

2. **Specified device monitor function device changes**
   Devices handled in the specified device monitor function can be changed by using both the "specified device monitor display status" and "operation button ON/OFF information" in the system information (system signal 2).

→ **Refer to Subsection 16.13.1 for the specified device monitor function setting procedure.**

16.13.2 System information - operation button ON/OFF information

1. **System signal 1**
   System signal 1 has no system information related to this function.

2. **System signal 2**

Special data register	System Information	Status	Description
D8159=K△ △	M△ △+4	ON	[ESC] button is pressed.
		OFF	[ESC] button is not pressed.
	M△ △+5	ON	[-] button is pressed.
		OFF	[-] button is not pressed.
	M△ △+6	ON	[+] button is pressed.
		OFF	[+] button is not pressed.
	M△ △+7	ON	[OK] button is pressed.
		OFF	[OK] button is not pressed.

16.14 Specifying a Decimal/Hexadecimal Current Value Display Format

The display format for monitored values can be changed between "decimal" and "hexadecimal".

Special data register	System Information	Description
D8159=K△ △	M△ △+8	Specifying decimal/hexadecimal display format ON: Hexadecimal OFF: Decimal

The display format can be changed for the following devices:

- Timer (T) [current value/setting value]
- Counter (C) [current value/setting value]
- Data register (D) [16-bit/32-bit],

17. Memory Cassette

STARTUP AND MAINTENANCE PRECAUTIONS ⚠**CAUTION**

- Turn off the power to the PLC before attaching or detaching the memory cassette. If the memory cassette is attached or detached while the PLC's power is on, the data in the memory may be destroyed, or the memory cassette may be damaged.
- Do not disassemble or modify the PLC.
  Doing so may cause fire, equipment failures, or malfunctions.
  For repair, contact your local Mitsubishi Electric representative.

17.1 Outline

The memory cassette can be installed at the main unit, and when installed, the memory cassette's internal program is used in place of the internal EEPROM memory. The loader function transfers (reads and writes) programs between the memory cassette and the internal EEPROM.

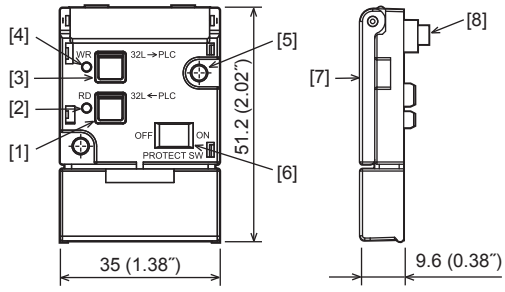
17.2 Specifications

17.2.1 Electrical specifications

Model Name	Max. Memory Capacity	Memory Type	Max. Allowable Write	PROTECT Switch	Loader Function
FX3G-EEPROM-32L	32,000 steps The FX3S Series PLC can hold 16,000 steps of memory, but user program capacity is limited to 4,000 steps.	EEPROM memory	10,000 times	Provided	Provided

17.2.2 Part names and external dimensions

Unit: mm (inches)



[1] RD key
(Reading: PLC → memory cassette)

[2] RD LED

[3] WR key
(writing: memory cassette → PLC)

[4] WR LED

[5] Memory cassette fixing holes(2-φ3.2 Mounting holes)

[6] PROTECT switch

[7] Detachment lever

[8] Main unit connector

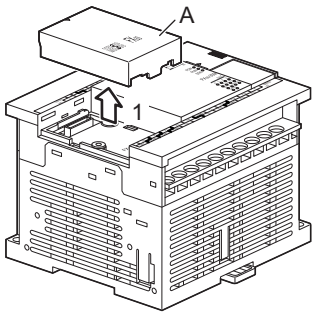
17.3 Installation

Be sure that the power is OFF when installing the memory cassette.

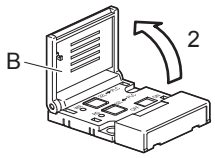
17.3.1 Installation (when the expansion board/connector conversion adapter is not used together)

Installation procedure

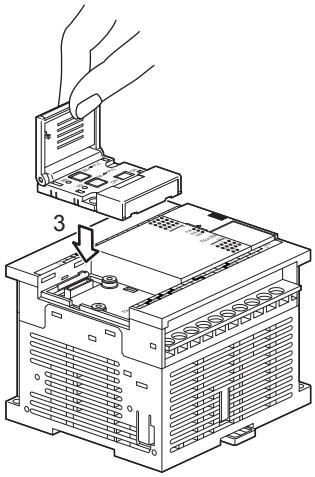
1 **Remove the top cover (A in the right figure).**



2 **Raise the memory cassette detachment lever (B in the right figure).**

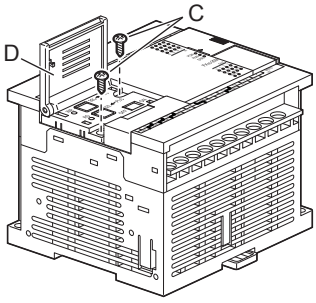


3 **Install the memory cassette to the main unit.**



4 **The memory cassette (D in the right figure) can be fixed with provided M3 tapping screws (C in the right figure) to the main unit. This work is not required when fixation is not necessary.**

- Tightening torque: 0.3 to 0.6 N•m



Caution

Two types of M3 tapping screws are provided.
Use M3×8 (shorter) screws.
Do not use M3×16 (longer) screws because they may damage the main unit.

17.3.2 Installation (when the expansion board/connector conversion adapter is used together)

Installation procedure

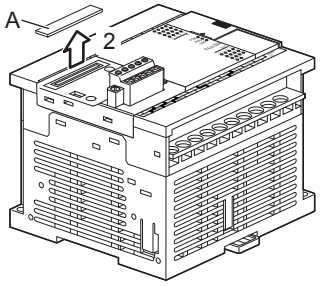
1 **Attach the expansion board/connector conversion adapter to the main unit.**

→ **For the attachment method, refer to Chapter 7.**

Caution

Make sure to attach the expansion board/connector conversion adapter before the memory cassette. Tightening with tapping screws (M3×8) is not necessary.

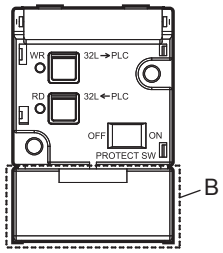
2 **Remove the upper connector cover (A in the right figure).**



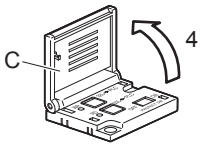
3 **Remove the part B shown in the right figure using a nipper, etc.**

Caution

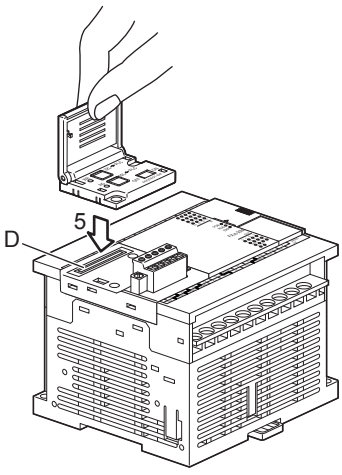
Removal of the part B is not necessary when the connector conversion adapter is used together.



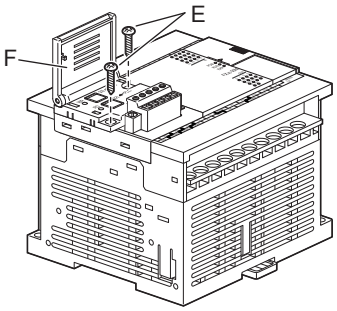
4 **Raise the memory cassette detachment lever (C in the right figure).**



5 **Attach the memory cassette to the option connector (D in the right figure) of the expansion board or connector conversion adapter.**



6 Fix the memory cassette (F in the right figure) with provided M3 tapping screws (E in the right figure) to the expansion board or connector conversion adapter.



- Tightening torque: 0.3 to 0.6 N•m

Caution

- Two types of M3 tapping screws are provided.
  Use M3×16 (longer) screws.
- Fixation is not necessary when using only the loader function and not always connecting the memory cassette.

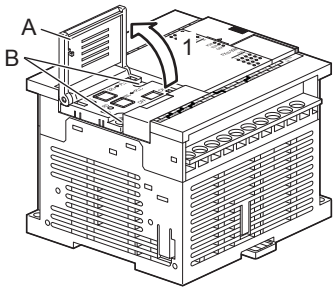
17.4 Removal

Be sure that the power is OFF when removing the memory cassette.

17.4.1 Removal (when the expansion board/connector conversion adapter are not used together)

Removal procedure

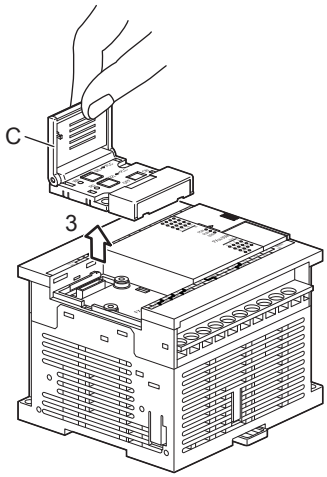
1 **Raise the memory cassette detachment lever (A in the right figure).**



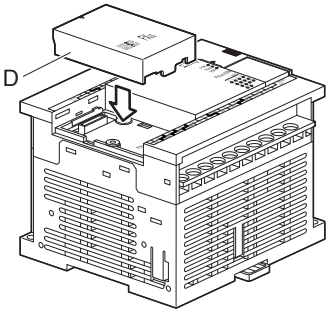
2 **Remove the tapping screws (B in the right figure) which fix the memory cassette.**

Proceed to the step 3 when the memory cassette is not fixed with tapping screws.

3 **Grasp the detachment lever (C in the right figure) and pull it vertically to remove the memory cassette.**



4 **Attach the top cover (D in the right figure).**



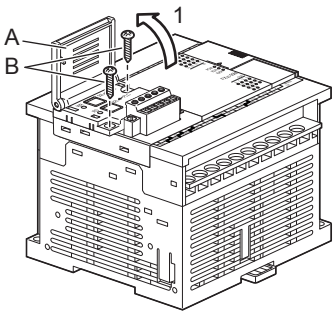
17.4.2 Removal (when the expansion board/connector conversion adapter are used together)

Removal procedure

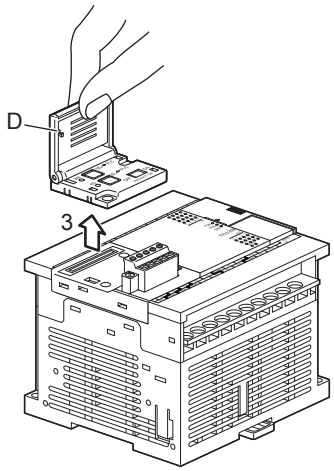
1 **Raise the memory cassette detachment lever (A in the right figure).**

2 **Remove the tapping screws (B in the right figure) which fix the memory cassette.**

Proceed to the step 3 when the memory cassette is not fixed with tapping screws.



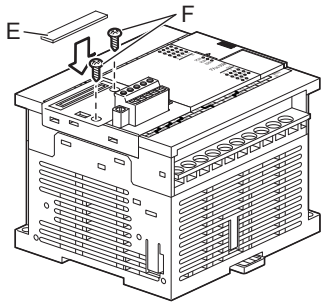
3 **Grasp the detachment lever (D in the right figure) and pull it vertically to remove the memory cassette.**



4 **Attach the upper connector cover (E in the right figure).**

5 **Fix the expansion board with the tapping screws (F in the right figure) provided for fixing the memory cassette.**

- Tightening torque: 0.3 to 0.6 N•m



Caution

Two types of M3 tapping screws are provided.
Use M3×8 (shorter) screws.
Do not use M3 × 16 (longer) screws removed in the step 2 because they may damage the main unit.

17.5 Saved Data Content

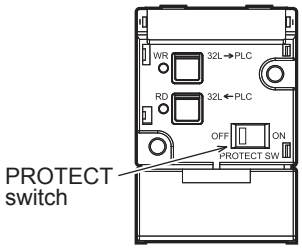
The following data is saved on the memory cassette.

Item	Description	
Parameters	• Memory capacity setting - Memory capacity 2 k/4 k/16 k steps - Comment capacity - File register capacity • Modem initializing settings, RUN terminal settings • RS/RS2 instructions/computer link/inverter communication function communication settings • Special parameters	
Sequence programs	User-created sequence programs Max. 4,000 steps	Comments and file registers can be created in the memory by setting them in the parameter memory capacity.
Comments	Max. 1,200 points (0 to 24 blocks, 1 block = 50 points/500 steps)	
File registers	Max. 2,000 points (0 to 4 blocks, 1 block = 500 points/500 steps)	

17.6 PROTECT Switch

17.6.1 PROTECT switch setting

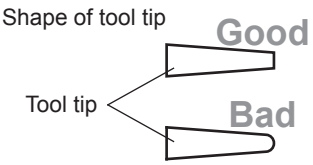
Reading from and writing to memory cassette operations can be performed by using the programming tool.
Because sequence programs are written by an electronic format, a special ROM writer and ultraviolet eraser are not required.
The PROTECT switch must be turned OFF to enable writing.



17.6.2 PROTECT switch operation

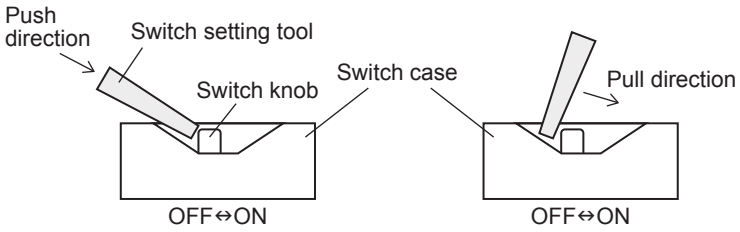
1. Preparing the operation tools

Set the PROTECT switch knob by using the tip of a pair of tweezers, a precision screwdriver, or a tool with a tip width of approx. 0.8 mm (0.04").
Do not use objects with round tips, as the round tip can easily slip off the switch knob, possibly resulting in an incorrect setting.



2. Switch operation procedure

As shown in the figure below, the switch knob can be "pushed" or "pulled". When setting the switch, do not set it in an intermediate position.



17.6.3 Precautions when setting and using the switch

Leaving the switch knob at an intermediate position for an extended period can cause an equipment failure.

17.7 Memory Cassette <-> PLC (EEPROM Memory) Transfers by Loader Function

The FX3G-EEPROM-32L loader function ([WR] and [RD] key operation) is explained in this section.

- Program transfers (reading/writing) are possible between the memory cassette and the PLC's internal EEPROM memory.
- The loader function is enabled while the PLC is stopped.

17.7.1 Writing (WR: FX3G-EEPROM-32L -> PLC)

A memory cassette program is written to the PLC's internal EEPROM memory.

Required condition: The PLC must be stopped.

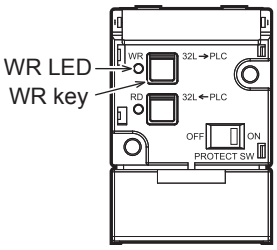
1 Install the memory cassette on the main unit.

Setting the PROTECT switch to ON (on memory cassette's rear face) prevents accidental overwriting of memory cassette program.

→ **Refer to Section 17.3 for the installation procedure.**

- Verify that the PLC power is OFF, then install the memory cassette on the PLC.
- Turn the PLC power ON.
- Raise the memory cassette's eject lever.

2 Press the [WR] key 1 time.



The [WR] LED lights, and a preparation status is established.

- To cancel, press the [RD] key.

3 Press the [WR] key again.

Writing is executed, and the [WR] LED blinks.

- It takes several seconds to write data to the built-in EEPROM. The [WR] LED flickers while data is written.

4 Remove the memory cassette from the main unit.

Writing is completed when the [WR] LED goes off.
After turning the PLC power OFF, remove the memory cassette from the PLC.

→ **Refer to Section 17.4 for the removal procedure.**

17.7.2 Reading (RD: FX3G-EEPROM-32L <- PLC)

Programs are read from the PLC's internal RAM memory to the memory cassette.

Required condition: The PLC must be stopped, and the PROTECT switch must be OFF.

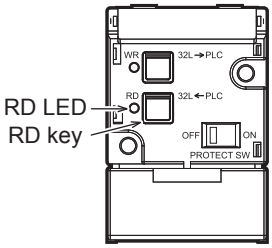
1 Install the memory cassette on the main unit.

Set the PROTECT switch to OFF.

→ **Refer to Section 17.3 for the installation procedure.**

- Verify that the PLC power is OFF, then install the memory cassette on the PLC.
- Turn the PLC power ON.
- Raise the memory cassette's eject lever.

2 Press the [RD] key 1 time.



The [RD] LED lights, and a preparation status is established.

- To cancel, press the [WR] key.

3 Press the [RD] key again.

Reading is executed, and the [RD] LED blinks.

- It takes several seconds to read data from the built-in EEPROM. The [RD] LED flickers while data is read.

4 Remove the memory cassette from the main unit.

Reading is completed when the [RD] LED goes off. After turning the PLC power OFF, remove the memory cassette from the PLC, then turn the PROTECT switch ON.

→ **Refer to Section 17.4 for the removal procedure.**

17.8 Memory cassette precautions for use

1. **Tapping screws provided for fixing the memory cassette**
   Two types of (longer and shorter) M3 tapping screws are packed together with the memory cassette.
   Read carefully the installation method described in Section 17.3, and use the proper type.

2. **Number of available units**
   Only one memory cassette may be connected to a FX3S main units.

3. **EEPROM memory writing count**
   10,000 writing operations are permitted at the EEPROM memory.

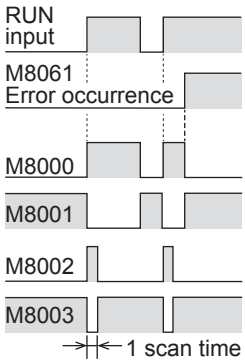
4. **Precaution for file register (D) usage**
   Writing to the flash memory occurs at each PLC operation cycle if BMOV instructions are used in a continuous execution format with regard to a file register.
   To prevent this, be sure to use "pulse execution format" (BMOVP) instructions.
   Writing data to the flash memory is executed also by writing data to file registers from peripheral equipment (programming software, handy programming panels, and display units).

Appendix A: Special Device List

The device numbers and functions of the special auxiliary relays (indicated as "special M" in tables) and special data registers (indicated as "special D" in tables) are shown below.
Note that functions of certain devices vary depending on the series of the PLC.
Do not use the undefined/blank special auxiliary relays and special data registers in the sequence program since they are occupied by the CPU.
In addition, do not activate or write to the devices with brackets on the first letter such as [M]8000 or [D]8001 in the program.

→ **For detailed explanation, refer to the Programming Manual.**

Appendix A-1 Special Auxiliary Relay (M8000 to M8511)

Number and name	Operation and function	Corresponding special device
PLC status		
[M]8000 RUN monitor NO contact		-
[M]8001 RUN monitor NC contact		-
[M]8002 Initial pulse NO contact		-
[M]8003 Initial pulse NC contact		-
[M]8004 Error occurrence	ON when either M8061, M8062, M8064, M8065, M8066, or M8067 is ON.	D8004
[M]8005 to [M]8009	Not used	-
Clock		
[M]8010	Not used	-
[M]8011 10 ms clock pulse	ON and OFF in 10 ms cycle (ON: 5 ms, OFF: 5 ms)	-
[M]8012 100 ms clock pulse	ON and OFF in 100 ms cycle (ON: 50 ms, OFF: 50 ms)	-
[M]8013 1 sec clock pulse	ON and OFF in 1 sec cycle (ON: 500 ms, OFF: 500 ms)	-
[M]8014 1 min clock pulse	ON and OFF in 1 min cycle (ON: 30 sec, OFF: 30 sec)	-
M 8015	Clock stop and preset For real time clock	-
M 8016	Time read display is stopped For real time clock	-
M 8017	±30 seconds correction For real time clock	-
[M]8018	Installation detection (Always ON) For real time clock	-
M 8019	Real time clock (RTC) error For real time clock	-

Number and name	Operation and function	Corresponding special device
Flag		
[M]8020 Zero	ON when the result of addition/ subtraction is 0.	-
[M]8021 Borrow	ON when the result of subtraction is less than the min. negative number.	-
M 8022 Carry	ON when 'carry' occurs as a result of addition or when an overflow occurs as a result of shift operation.	-
[M]8023	Not used	-
M 8024*1	BMOV instruction (FNC 15) direction specification	-
[M]8025 to [M]8027	Not used	-
M 8028	100 ms/10 ms timer changeover	-
[M]8029 Instruction execution complete	ON when operation such as DSW instruction (FNC 72) is completed.	-
PLC mode		
M 8030	Not used	-
M 8031*2 Non-latch memory all clear	If this special auxiliary relay is activated, the ON/OFF image memory of Y, M, S, T, and C, and present values of T, C, D and special data registers are cleared to zero. However, file registers (D) in program memory.	-
M 8032*2 Latch memory all clear		-
M 8033 Memory hold STOP	When PLC is switched from RUN to STOP, image memory and data memory are retained.	-
M 8034*2 All outputs disable	All external output contacts of PLC are turned OFF.	-
M 8035 Forced RUN mode	Refer to Programming Manual for details.	-
M 8036 Forced RUN signal		-
M 8037 Forced STOP signal		-
[M]8038 Parameter setting	Communication parameter setting flag (for N:N network setting)	D8176 to D8180
M 8039 Constant scan mode	When M8039 is ON, PLC waits until scan time specified in D8039 and then executes cyclic operation.	D8039

*1. Cleared when PLC switches from RUN to STOP.
*2. Executed at END instruction.

Number and name	Operation and function	Corresponding special device
Step ladder		
M 8040 Transfer disable	While M8040 is turned ON, transfer between states is disabled.	-
[M]8041*1 Transfer start	Transfer from initial state is enabled in automatic operation mode.	-
[M]8042 Start pulse	Pulse output is given in response to a start input.	-
M 8043*1 Zero return complete	Set this in the last state of zero return mode.	-
M 8044*1 Zero point condition	Set this when machine zero return is detected.	-
M 8045 All output reset disable	Disables the 'all output reset' function when the operation mode is changed.	-
[M]8046*2 STL state ON	ON when M8047 is ON and either of S0 to S255 is active.	M8047
M 8047*2 STL monitoring enable	D8040 to D8047 are enabled when M8047 is ON.	D8040 to D8047
[M]8048 to [M]8049	Not used	-
Interrupt disable		
M 8050*1 (Input interrupt) I00□ disable	• If an input interrupt or timer interrupt occurs while a special auxiliary relay for that interrupt (M8050 to M8058) is ON, the interrupt will not operate. For example, turning M8050 ON disables the I00□ interrupt; hence, the interrupt routine is not processed even in an allowable program area. • If an input interrupt or timer interrupt occurs while a special auxiliary relay for that interrupt (M8050 to M8058) is OFF, a) The interrupt will be accepted. b) The interrupt routine will be processed promptly if it is permitted by the EI (FNC 04) instruction. However, if the DI (FNC 05) instruction disables interrupts, the interrupt program will not be processed until EI (FNC 04) permits the interrupts.	-
M 8051*1 (Input interrupt) I10□ disable		-
M 8052*1 (Input interrupt) I20□ disable		-
M 8053*1 (Input interrupt) I30□ disable		-
M 8054*1 (Input interrupt) I40□ disable		-
M 8055*1 (Input interrupt) I50□ disable		-
M 8056*1 (Timer interrupt) I6□□ disable		-
M 8057*1 (Timer interrupt) I7□□ disable		-
M 8058*1 (Timer interrupt) I8□□ disable		-
M 8059	Not used	-

*1. Cleared when PLC switches from RUN to STOP.

*2. Executed at END instruction.

Number and name	Operation and function	Corresponding special device
Error detection		
[M]8060	Not used	-
[M]8061	PLC hardware error	D8061
[M]8062	PLC/PP communication error	D8062
[M]8063*3	Serial communication error 1	D8063
[M]8064	Parameter error	D8064
[M]8065	Syntax error	D8065 D8069 D8314 D8315
[M]8066	Circuit error	D8066 D8069 D8314 D8315
[M]8067*4	Operation error	D8067 D8069 D8314 D8315
M 8068	Operation error latch	D8068 D8312 D8313
M 8069	Not used	-
Parallel link		
M 8070*4	Parallel link Set M8070 when using master station.	-
M 8071*4	Parallel link Set M8071 when using slave station.	-
[M]8072	Parallel link ON when operating	-
[M]8073	Parallel link ON when M8070 or M8071 setting is incorrect	-
Memory information		
[M]8101 to [M]8104	Not used	-
[M]8105	ON during writing in RUN mode	-
[M]8106 to [M]8108	Not used	-
FX3G-4EX-BD		
[M]8112*5	BX0 input	-
[M]8113*5	BX1 input	-
[M]8114*5	BX2 input	-
[M]8115*5	BX3 input	-
FX3G-2EYT-BD		
M 8116*5	BY0 output	-
M 8117*5	BY1 output	-

*3. Cleared when PLC power supply from OFF to ON.

*4. Cleared when PLC switches from STOP to RUN.

*5. Supported in Ver. 1.10 or later.

Number and name	Operation and function	Corresponding special device
RS instruction (FNC 80) and Computer link [ch1]		
[M]8120	Not used	-
[M]8121*1	RS instruction (FNC 80) instruction: Send wait flag	-
M 8122*1	RS instruction (FNC 80) instruction: Send request	D8122
M 8123*1	RS instruction (FNC 80) instruction: Receive complete flag	D8123
[M]8124	RS instruction (FNC 80) instruction: Carrier detection flag	-
[M]8125	Not used	-
[M]8126	Computer link [ch1]: Global ON	D8127 D8128 D8129
[M]8127	Computer link [ch1]: On-demand send processing	
M 8128	Computer link [ch1]: On-demand error flag	
M 8129	Computer link [ch1]: On-demand Word/Byte changeover RS instruction (FNC 80) instruction: Time-out check flag	
Positioning [PLSY, PLSR instruction]		
M 8145	[Y000] Pulse output stop command	-
M 8146	[Y001] Pulse output stop command	-
[M]8147	[Y000] Pulse output monitor (BUSY/READY)	-
[M]8148	[Y001] Pulse output monitor (BUSY/READY)	-
Inverter communication function		
[M]8150	Not used	-
[M]8151	Inverter communication in execution [ch1]	D8151
[M]8152*2	Inverter communication error [ch1]	D8152
[M]8153*2	Inverter communication error latch [ch1]	D8153
[M]8154 to [M]8159	Not used	-

*1. Cleared when PLC switches from RUN to STOP or RS instruction is OFF.

*2. Cleared when PLC switches from STOP to RUN.

Number and name	Operation and function	Corresponding special device
Advanced function		
M 8160	Not used	-
M 8161*3*4	8-bit process mode	-
M 8162	High speed parallel link mode	-
[M]8163 to [M]8167	Not used	-
M 8168*3	SMOV instruction (FNC 13): HEX data handling function	-
[M]8169	Not used	-
Pulse catch		
M 8170*5	Input X000 pulse catch	-
M 8171*5	Input X001 pulse catch	-
M 8172*5	Input X002 pulse catch	-
M 8173*5	Input X003 pulse catch	-
M 8174*5	Input X004 pulse catch	-
M 8175*5	Input X005 pulse catch	-
[M]8176 to [M]8177	Not used	-
N:N Network		
[M]8180 to [M]8182	Not used	-
[M]8183	Data communication error (Master station)	D8201 to D8218
[M]8184	Data communication error (Slave station No. 1)	
[M]8185	Data communication error (Slave station No. 2)	
[M]8186	Data communication error (Slave station No. 3)	
[M]8187	Data communication error (Slave station No. 4)	
[M]8188	Data communication error (Slave station No. 5)	
[M]8189	Data communication error (Slave station No. 6)	
[M]8190	Data communication error (Slave station No. 7)	
[M]8191	Data communication in execution	
[M]8192 to [M]8199	Not used	-

*3. Cleared when PLC switches from STOP to RUN.

*4. Applicable to RS instruction (FNC 80), ASCI instruction (FNC 82), HEX instruction (FNC 83), and CCD instruction (FNC 84).

*5. Cleared when PLC switches from STOP to RUN.

Number and name	Operation and function		Corresponding special device
Counter up/down counter counting direction			
M 8200	C200	When M8□□□ is ON, the corresponding C□□□ is changed to down mode. • ON: Down count operation • OFF: Up count operation	-
M 8201	C201		-
M 8202	C202		-
M 8203	C203		-
M 8204	C204		-
M 8205	C205		-
M 8206	C206		-
M 8207	C207		-
M 8208	C208		-
M 8209	C209		-
M 8210	C210		-
M 8211	C211		-
M 8212	C212		-
M 8213	C213		-
M 8214	C214		-
M 8215	C215		-
M 8216	C216		-
M 8217	C217		-
M 8218	C218		-
M 8219	C219		-
M 8220	C220		-
M 8221	C221		-
M 8222	C222		-
M 8223	C223		-
M 8224	C224		-
M 8225	C225		-
M 8226	C226		-
M 8227	C227		-
M 8228	C228		-
M 8229	C229		-
M 8230	C230		-
M 8231	C231		-
M 8232	C232		-
M 8233	C233		-
M 8234	C234		-
High-speed counter up/down counter counting direction			
M 8235	C235	When M8□□□ is ON, the corresponding C□□□ is changed to down mode. • ON: Down count operation • OFF: Up count operation	-
M 8236	C236		-
M 8237	C237		-
M 8238	C238		-
M 8239	C239		-
M 8240	C240		-
M 8241	C241		-
M 8242	C242		-
M 8243	C243		-
M 8244	C244		-
M 8245	C245		-

Number and name	Operation and function		Corresponding special device
High-speed counter up/down counter monitoring			
[M]8246	C246	When C□□□ of 1-phase 2-input counter or 2-phase 2-input counter is in down mode, the corresponding M8□□□ turns ON. • OFF: Down count operation • ON: Up count operation	-
[M]8247	C247		-
[M]8248	C248		-
[M]8249	C249		-
[M]8250	C250		-
[M]8251	C251		-
[M]8252	C252		-
[M]8253	C253		-
[M]8254	C254		-
[M]8255	C255		-
[M]8256 to [M]8259	Not used		-
Analog expansion board (Refer to Appendix A-3 for details)			
M8260 to M8269	Expansion board		-
[M]8270 to [M]8279	Not used		-
Analog special adapter (Refer to Appendix A-4 for details)			
M8280 to M8289	Special adapter		-
[M]8290 to [M]8299	Not used		-
Flag			
[M]8300 to [M]8303	Not used		-
[M]8304 Zero	Turns ON when the multiplication or division result is 0.		-
[M]8305	Not used		-
[M]8306 Carry	Turns ON when the division result overflows.		-
[M]8307 to [M]8311	Not used		-
[M]8312*1	Real time clock data lost error		-
[M]8313 to [M]8328	Not used		-
[M]8329	Instruction execution abnormal end		-

*1. Backed up against power interruption, and automatically cleared when M8312 itself is cleared or when the clock data is set again.

Number and name	Operation and function	Corresponding special device
Positioning		
[M]8330 to [M]8337	Not used	-
M 8338*1	PLSV instruction (FNC157): Acceleration/deceleration operation	-
[M]8339	Not used	-
[M]8340	[Y000] Pulse output monitor (ON: BUSY/ OFF: READY)	-
M 8341*1	[Y000] Clear signal output function enable	-
M 8342*1	[Y000] Zero return direction specification	-
M 8343	[Y000] Forward limit	-
M 8344	[Y000] Reverse limit	-
M 8345*1	[Y000] DOG signal logic reverse	-
M 8346*1	[Y000] Zero point signal logic reverse	-
M 8347	Not used	-
[M]8348	[Y000] Positioning instruction activation	-
M 8349*1	[Y000] Pulse output stop command	-
[M]8350	[Y001] Pulse output monitor (ON: BUSY/ OFF: READY)	-
M 8351*1	[Y001] Clear signal output function enable	-
M 8352*1	[Y001] Zero return direction specification	-
M 8353	[Y001] Forward limit	-
M 8354	[Y001] Reverse limit	-
M 8355*1	[Y001] DOG signal logic reverse	-
M 8356*1	[Y001] Zero point signal logic reverse	-
M 8357	Not used	-
[M]8358	[Y001] Positioning instruction activation	-
M 8359*1	[Y001] Pulse output stop command	-
[M]8360 to [M]8369	Not used	-
High-speed counter function		
[M]8380 to [M]8387	Not used	-
[M]8388	Contact for high-speed counter function change	-
[M]8389 to [M]8391	Not used	-
M 8392	Function changeover device for C248 and C253	-
[M]8393 to [M]8397	Not used	-
Ring counter		
M 8398	Ring counter operation (in units of 1 ms, 32 bits)*2	D8398 D8399
[M]8399	Not used	-

*1. Cleared when PLC switches from RUN to STOP.

*2. 1 ms ring counter (D8399, D8398) will operate after M8398 turns ON.

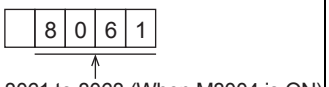
Number and name	Operation and function	Corresponding special device
RS2 instruction (FNC 87) [ch1]		
[M]8400	Not used	-
[M]8401*3	RS2 instruction (FNC 87) [ch1] Send wait flag	-
M 8402*3	RS2 instruction (FNC 87) [ch1] Send request	D8402
M 8403*3	RS2 instruction (FNC 87) [ch1] Receive complete flag	D8403
[M]8404	RS2 instruction (FNC 87) [ch1] Carrier detection flag	-
[M]8405	RS2 instruction (FNC 87) [ch1] Data set ready (DSR) flag	-
[M]8406 to [M]8408	Not used	-
M 8409	RS2 instruction (FNC 87) [ch1] Time-out check flag	-
[M]8410 to [M]8420	Not used	-
MODBUS communication [ch1]		
[M]8401	MODBUS request in process	-
[M]8402	MODBUS communication error	D8402
[M]8403	MODBUS communication error (latched)	D8403
[M]8404 to [M]8407	Not used	-
[M]8408	Retry	-
[M]8409	Timeout	-
[M]8410	Not used	-
M 8411	MODBUS configuration request flag	-
FX3U-ENET-ADP [ch1]		
[M]8404	FX3U-ENET-ADP unit ready	-
[M]8405	Not used	-
[M]8406*4	Time setting execution	-
[M]8407 to [M]8410	Not used	-
M 8411*4	Execute time setting	-
Positioning		
[M]8460 to [M]8463	Not used	-
M 8464	DSZR instruction (FNC150), ZRN instruction (FNC156) [Y000] Clear signal device specification function enabled	D8464
M 8465	DSZR instruction (FNC150), ZRN instruction (FNC156) [Y001] Clear signal device specification function enabled	D8465
[M]8466 to [M]8467	Not used	-
Error detection		
[M]8468 to [M]8486	Not used	-
[M]8487	USB communication error	D8487
[M]8488	Not used	-
[M]8489	Special parameter error	D8489

*3. Cleared when PLC switches from RUN to STOP or when RS2 instruction [ch1] is OFF.

*4. Used when the SNTP function setting is set to "Use" in the time setting parameters.

Number and name	Operation and function	Corresponding special device
FX3U-ENET-ADP [ch1]		
[M]8490 to [M]8491	Not used	-
M 8492	IP address storage area write request	-
[M]8493	IP address storage area write completion	-
[M]8494	IP address storage area write error	-
M 8495	IP address storage area clear request	-
[M]8496	IP address storage area clear completion	-
[M]8497	IP address storage area clear error	-
[M]8498	IP address change function enable flag	-
[M]8499 to [M]8511	Not used	-

Appendix A-2 Special Data Register (D8000 to D8511)

Number and name	Content of register	Corresponding special device
PLC status		
D 8000 Watchdog timer	Default value is 200 ms (in 1 ms steps) (Writes from system ROM at power ON) Value overwritten by program is valid after END or WDT instruction execution.	-
[D]8001 PLC type and system version		D8101
[D]8002 Memory capacity	• 2...2 K steps • 4...4 K steps*1	D8102
[D]8003 Memory type	Stores the memory type (built-in EEPROM or memory cassette) and the PROTECT switch ON/OFF status of the memory cassette.*2	-
[D]8004 Error number M		M8004
[D]8005 to [D]8009	Not used	-
Clock		
[D]8010 Present scan time*3	Accumulated instruction-execution time from 0 step (in units of 0.1 ms)	-
[D]8011 Minimum scan time*3	Minimum value of scan time (in units of 0.1 ms)	-
[D]8012 Maximum scan time*3	Maximum value of scan time (in units of 0.1 ms)	-
D 8013 Second data	0 to 59 seconds (for real time clock)	-
D 8014 Minute data	0 to 59 minutes (for real time clock)	-
D 8015 Hour data	0 to 23 hours (for real time clock)	-
D 8016 Day data	1 to 31 days (for real time clock)	-
D 8017 Month data	1 to 12 months (for real time clock)	-
D 8018 Year data	2 digits of year data (0 to 99) (for real time clock)	-
D 8019 Day-of-the-week data	0 (Sunday) to 6 (Saturday) (for real time clock)	-

*1. "4" is displayed even when the memory capacity is set to 16 K steps in the parameter setting.

*2. D8003 becomes the undermentioned content.

Present value	Type of memory	Protect switch
02H	EEPROM memory cassette	OFF
0AH	EEPROM memory cassette	ON
10H	Built-in memory in PLC	-

*3. Indicated value includes waiting time of constant scan operation (when M8039 is activated).

Number and name	Content of register	Corresponding special device
Input filter		
D 8020 Input filter adjustment	Input filter value of X000 to X017 (Default: 10 ms)	-
[D]8021 to [D]8027	Not used	-
Index register Z0 and V0		
[D]8028	Value of Z0 (Z) register*4	-
[D]8029	Value of V0 (V) register*4	-
Analog volume and constant scan		
[D]8030*5	Value of analog volume VR1 (Integer from 0 to 255)	-
[D]8031*5	Value of analog volume VR2 (Integer from 0 to 255)	-
[D]8032 to [D]8038	Not used	-
D 8039 Constant scan duration	Default: 0 ms (in 1 ms steps) (Writes from system ROM at power ON) Can be overwritten by program	M8039
Stepladder		
[D]8040*6 ON state number 1	The smallest number out of active state ranging from S0 to S255 is stored in D8040 and the second-smallest state number is stored in D8041. Active state numbers are then sequentially stored in registers up to D8047 (Max. 8 points).	M8047
[D]8041*6 ON state number 2		
[D]8042*6 ON state number 3		
[D]8043*6 ON state number 4		
[D]8044*6 ON state number 5		
[D]8045*6 ON state number 6		
[D]8046*6 ON state number 7		
[D]8047*6 ON state number 8		
[D]8048 to [D]8059	Not used	-

*4. The values of Z1 to Z7 and V1 to V7 are stored in D8182 to D8195.

*5. FX3S-30M□/E□-2AD is not supported.

*6. Executed at END instruction.

Number and name	Content of register	Corresponding special device
Error detection (Refer to Subsection 14.6.3 for details)		
[D]8060	Not used	-
[D]8061	Error code for PLC hardware error	M8061
[D]8062*1	Error code for PC/PP communication error	M8062
[D]8063*1	Error code for serial communication error [ch1]	M8063
[D]8064	Error code for parameter error	M8064
[D]8065	Error code for syntax error	M8065
[D]8066	Error code for circuit error	M8066
[D]8067*2	Error code for operation error	M8067
D 8068	Operation error step number latched	M8068
[D]8069*2	Error step number of M8065 to M8067	M8065 to M8067
Parallel link		
[D]8070	Parallel link error time-out check time: 500 ms	-
[D]8071 to [D]8073	Not used	-
Memory information		
[D]8100	Not used	-
[D]8101 PLC type and system version		-
[D]8102 Memory capacity	2.....2 K steps 4.....4 K steps*3	-
[D]8103 to [D]8109	Not used	-
RS instruction (FNC 80) and computer link [ch1]		
D 8120*4	RS instruction (FNC 80) and computer link [ch1] Communication format setting	-
D 8121*4	Computer link [ch1] Station number setting	-
[D]8122*2	RS instruction (FNC 80): Remaining points of transmit data	M8122
[D]8123*2	RS instruction (FNC 80): Monitoring receive data points	M8123
D 8124	RS instruction (FNC 80): Header <Default: STX>	-
D 8125	RS instruction (FNC 80): Terminator <Default: ETX>	-
[D]8126	Not used	-
D 8127	Computer link [ch1] Specification of on-demand head device register	M8126 to M8129
D 8128	Computer link [ch1] Specification of on-demand data length register	
D 8129*4	RS instruction (FNC 80), computer link [ch1] Time-out time setting	

*1. Cleared when PLC power supply from OFF to ON.

*2. Cleared when PLC switches from STOP to RUN.

*3. "4" is displayed even when the memory capacity is set to 16 K steps in the parameter setting.

*4. Latch device.

Number and name	Content of register		Corresponding special device
Positioning			
[D]8130 to [D]8135	Not used		-
D 8136	Lower	PLSY instruction (FNC 57), PLSR instruction (FNC 59): Accumulated total number of pulses output to Y000 and Y001	-
D 8137	Upper		
[D]8138 to [D]8139	Not used		-
D 8140	Lower	Accumulated number of pulses output to Y000 for PLSY instruction (FNC 57) and PLSR instruction (FNC 59)	-
D 8141	Upper		
D 8142	Lower	Accumulated number of pulses output to Y001 for PLSY instruction (FNC 57) and PLSR instruction (FNC 59)	-
D 8143	Upper		
[D]8144 to [D]8149	Not used		-
Inverter communication function			
D 8150*5	Response wait time of inverter communication [ch1]		-
[D]8151	Step number of instruction during inverter communication [ch1] Default: -1		M8151
[D]8152*6	Error code for inverter communication [ch1]		M8152
[D]8153*6	Inverter communication error step number latched [ch1] Default: -1		M8153
[D]8154 to [D]8157	Not used		-
Display module (FX3S-5DM) function			
D 8158*7	Control device (D) for display module Default: -1		-
D 8159*7	Control device (M) for display module Default: -1		-
Advanced function			
[D]8160 to [D]8168	Not used		-
[D]8169	Access restriction status*8		-

*5. Cleared when PLC power supply from OFF to ON.

*6. Cleared when PLC switches from STOP to RUN.

*7. Supported in Ver. 1.20 or later.

*8. Details of each access restriction

Present value	Access restriction status	Program		Monitoring	Present value change
		Read	Write		
H**00*10	2nd keyword is not set	✓*9	✓*9	✓*9	✓*9
H**10*10	Write protection	✓	-	✓	✓
H**11*10	Read/write protection	-	-	✓	✓
H**12*10	All online operation protection	-	-	-	-
H**20*10	Keyword cancel	✓	✓	✓	✓

*9. Accesses are restricted by the keyword setting status.

*10. "**" indicates areas used by the system.

Number and name	Content of register	Corresponding special device
N:N Network (setting)		
[D]8170 to [D]8172	Not used	-
[D]8173	Station number	-
[D]8174	Total number of slave stations	-
[D]8175	Refresh range	-
D 8176	Station number setting	M8038
D 8177	Total slave station number setting	
D 8178	Refresh range setting	
D 8179	Retry count setting	
D 8180	Comms time-out setting	
[D]8181	Not used	-
Index register Z1 to Z7 and V1 to V7		
[D]8182	Value of Z1 register	-
[D]8183	Value of V1 register	-
[D]8184	Value of Z2 register	-
[D]8185	Value of V2 register	-
[D]8186	Value of Z3 register	-
[D]8187	Value of V3 register	-
[D]8188	Value of Z4 register	-
[D]8189	Value of V4 register	-
[D]8190	Value of Z5 register	-
[D]8191	Value of V5 register	-
[D]8192	Value of Z6 register	-
[D]8193	Value of V6 register	-
[D]8194	Value of Z7 register	-
[D]8195	Value of V7 register	-
[D]8196 to [D]8199	Not used	-

Number and name	Content of register	Corresponding special device
N:N Network (monitoring)		
[D]8200	Not used	-
[D]8201	Current link scan time	-
[D]8202	Maximum link scan time	-
[D]8203	Number of communication error at master station	M8183 to M8191
[D]8204	Number of communication error at slave station No.1	
[D]8205	Number of communication error at slave station No.2	
[D]8206	Number of communication error at slave station No.3	
[D]8207	Number of communication error at slave station No.4	
[D]8208	Number of communication error at slave station No.5	
[D]8209	Number of communication error at slave station No.6	
[D]8210	Number of communication error at slave station No.7	
[D]8211	Code of communication error at master station	
[D]8212	Code of communication error at slave station No.1	
[D]8213	Code of communication error at slave station No.2	
[D]8214	Code of communication error at slave station No.3	
[D]8215	Code of communication error at slave station No.4	
[D]8216	Code of communication error at slave station No.5	
[D]8217	Code of communication error at slave station No.6	
[D]8218	Code of communication error at slave station No.7	
[D]8219 to [D]8259	Not used	-
Analog expansion board (Refer to Appendix A-3 for details)		
D8260 to D8269	Expansion board	-
Built-in analog input *1 (Refer to Chapter 11 for details)		
[D]8270	Channel-1 input data	-
[D]8271	Channel-2 input data	-
[D]8272 to [D]8273	Not used	-
D 8274	Averaging time for channel-1	-
D 8275	Averaging time for channel-2	-
[D]8276 to [D]8277	Not used	-
[D]8278	Error status	-
[D]8279	Model code	-
Analog special adapter (Refer to Appendix A-4 for details)		
D8280 to D8289	Special adapter	-
[D]8290 to [D]8299	Not used	-

*1. Available only for FX3S-30M□/E□-2AD.

Number and name	Content of register		Corresponding special device
Positioning			
D 8340	Lower	[Y000] Current value register Default: 0	-
D 8341	Upper		
D 8342	[Y000] Bias speed Default: 0		-
D 8343	Lower	[Y000] Maximum speed Default: 100000	-
D 8344	Upper		
D 8345	[Y000] Creep speed Default: 1000		-
D 8346	Lower	[Y000] Zero return speed Default: 50000	-
D 8347	Upper		
D 8348	[Y000] Acceleration time Default: 100		-
D 8349	[Y000] Deceleration time Default: 100		-
D 8350	Lower	[Y001] Current value register Default: 0	-
D 8351	Upper		
D 8352	[Y001] Bias speed Default: 0		-
D 8353	Lower	[Y001] Maximum speed Default: 100000	-
D 8354	Upper		
D 8355	[Y001] Creep speed Default: 1000		-
D 8356	Lower	[Y001] Zero return speed Default: 50000	-
D 8357	Upper		
D 8358	[Y001] Acceleration time Default: 100		-
D 8359	[Y001] Deceleration time Default: 100		-
D 8360 to D 8369	Not used		-
Ring counter			
D 8398	Lower	Up-operation ring counter of 0 to 2,147,483,647 (in units of 1 ms, 32 bit)*1	M8398
D 8399	Upper		

*1. 1 ms ring counter (D8399, D8398) will operate after M8398 turns ON.

Number and name	Content of register	Corresponding special device
RS2 instruction (FNC 87) [ch1]		
D 8400	RS2 instruction (FNC 87) [ch1] Communication format setting	-
[D]8401	Not used	-
[D]8402*2	RS2 instruction (FNC 87) [ch1] Remaining points of transmit data	M8402
[D]8403*2	RS2 instruction (FNC 87) [ch1] Monitoring receive data points	M8403
[D]8404	Not used	-
[D]8405	Communication parameter display [ch1]	-
[D]8406 to [D]8408	Not used	-
D 8409	RS2 instruction (FNC 87) [ch1] Time-out time setting	-
D 8410	RS2 instruction (FNC 87) [ch1] Header 1 and 2 <Default: STX>	-
D 8411	RS2 instruction (FNC 87) [ch1] Header 3 and 4	-
D 8412	RS2 instruction (FNC 87) [ch1] Terminator 1 and 2 <Default: ETX>	-
D 8413	RS2 instruction (FNC 87) [ch1] Terminator 3 and 4	-
[D]8414	RS2 instruction (FNC 87) [ch1] Receive sum (received data)	-
[D]8415	RS2 instruction (FNC 87) [ch1] Receive sum (calculated result)	-
[D]8416	RS2 instruction (FNC 87) [ch1] Send sum	-
[D]8417	Not used	-
[D]8418		-
[D]8419	Operation mode display [ch1]	-
MODBUS communication [ch1]		
D 8400	Communication format	-
D 8401	Protocol	-
D 8402	Communication error code	M8402
D 8403	Error details	M8403
D 8404	Error step number	-
[D]8405	Communication format display	-
[D]8406	Not used	-
[D]8407	Step number being executed	-
[D]8408	Current retry value	-
D 8409	Slave response timeout	-
D 8410	Turn around delay	-
D 8411	Message to message delay	-
D 8412	Number of retries	-
[D]8413	Not used	-
D 8414	Slave node address	-
[D]8415 to [D]8418	Not used	-
[D]8419	Communication mode	-

*2. Cleared when PLC switches from RUN to STOP.

Number and name	Content of register	Corresponding special device
FX3U-ENET-ADP [ch1]		
[D]8400	IP Address (Low-order)	-
[D]8401	IP Address (High-order)	-
[D]8402	Subnet mask (Low-order)	-
[D]8403	Subnet mask (High-order)	-
[D]8404	Default router IP address (Low-order)	-
[D]8405	Default router IP address (High-order)	-
[D]8406	Status information	-
[D]8407	Connection condition of the Ethernet port	-
[D]8408	FX3U-ENET-ADP version	-
D 8409	Communication timeout time	-
D 8410	Connection forcible nullification	-
[D]8411	Time setting functional operation result	-
[D]8412 to [D]8414	Host MAC address	-
[D]8415	Not used	-
[D]8416	Model code	-
[D]8417	Error code of the Ethernet adapter	-
[D]8418	Not used	-
[D]8419	Operation mode	-
Positioning		
[D]8460 to [D]8463	Not used	-
D 8464	DSZR instruction (FNC150) and ZRN instruction (FNC156): [Y000] Clear signal device specification	M8464
D 8465	DSZR instruction (FNC150) and ZRN instruction (FNC156): [Y001] Clear signal device specification	M8465
[D]8466 to [D]8467	Not used	-
Error detection		
[D]8468 to [D]8486	Not used	-
[D]8487	USB communication error	M8487
[D]8488	Not used	-
[D]8489	Error code for special parameter error	M8489
FX3U-ENET-ADP [ch1]		
D 8492	IP address setting (Low-order)	-
D 8493	IP address setting (High-order)	-
D 8494	Subnet mask setting (Low-order)	-
D 8495	Subnet mask setting (High-order)	-
D 8496	Default router IP address setting (Low-order)	-
D 8497	Default router IP address setting (High-order)	-
[D]8498	Error code for IP address storage area write	-
[D]8499	Error code for IP address storage area clear	-
[D]8500 to [D]8511	Not used	-

Appendix A-3 Analog expansion boards [M8260 to M8269 and D8260 to D8269]

When analog expansion boards are connected, operations and functions are assigned to the devices shown in the tables.
Devices which cannot be written are shaded in "Operation and function" column.

→ **For details, refer to the Analog Control Edition.**

Appendix A-3-1 Special auxiliary relays (M8260 to M8269)

Number	Operation and function	
	FX3G-2AD-BD	FX3G-1DA-BD
M 8260	Input mode switching Ch1	Output mode switching
M 8261	Input mode switching Ch2	Not used
M 8262	Not used	Not used
M 8263	Not used	Not used
M 8264	Not used	Output hold mode
M 8265	Not used	Not used
M 8266	Not used	Not used
M 8267	Not used	Not used
M 8268	Not used	Not used
M 8269	Not used	Not used

Appendix A-3-2 Special data registers (D8260 to D8269)

Number	Operation and function	
	FX3G-2AD-BD	FX3G-1DA-BD
D 8260	Input data Ch1	Output data
D 8261	Input data Ch2	Not used
D 8262	Not used	Not used
D 8263	Not used	Not used
D 8264	Averaging time for Ch1 (1 to 4095)	Not used
D 8265	Averaging time for Ch2 (1 to 4095)	Not used
D 8266	Not used	Not used
D 8267	Not used	Not used
D 8268	Error status	Error status
D 8269	Model code: K3	Model code: K4

Appendix A-4 Analog special adapters [M8280 to M8289 and D8280 to D8289]

When analog special adapters are connected, operations and functions are assigned to the devices shown in the tables below.
Devices which cannot be written are shaded in "Operation and function" column.

→ **For details, refer to the Analog Control Edition.**

Appendix A-4-1 Special auxiliary relays (M8280 to M8289)

Number	Operation and function		
	FX3U-4AD-ADP	FX3U-4DA-ADP	FX3U-3A-ADP
M 8280	Input mode switching Ch1	Output mode switching Ch1	Input mode switching Ch1
M 8281	Input mode switching Ch2	Output mode switching Ch2	Input mode switching Ch2
M 8282	Input mode switching Ch3	Output mode switching Ch3	Output mode switching
M 8283	Input mode switching Ch4	Output mode switching Ch4	Not used
M 8284	Not used	Output hold mode cancel Ch1	Not used
M 8285	Not used	Output hold mode cancel Ch2	Not used
M 8286	Not used	Output hold mode cancel Ch3	Output hold mode cancel
M 8287	Not used	Output hold mode cancel Ch4	Sets whether or not input channel 1 is used.
M 8288	Not used	Not used	Sets whether or not input channel 2 is used.
M 8289	Not used	Not used	Sets whether or not output channel is used.

Number	Operation and function		
	FX3U-4AD-PT(W)-ADP	FX3U-4AD-TC-ADP	FX3U-4AD-PNK-ADP
M 8280	Temperature unit selection	Temperature unit selection	Temperature unit selection
M 8281	Not used	Type-K/-J switching	Input sensor selection
M 8282	Not used	Not used	Not used
M 8283	Not used	Not used	Not used
M 8284	Not used	Not used	Not used
M 8285	Not used	Not used	Not used
M 8286	Not used	Not used	Not used
M 8287	Not used	Not used	Not used
M 8288	Not used	Not used	Not used
M 8289	Not used	Not used	Not used

Appendix A-4-2 Special data registers (D8280 to D8289)

Number	Operation and function		
	FX3U-4AD-ADP	**FX3U-4DA-ADP**	**FX3U-3A-ADP**
D 8280	Input data Ch1	Output data Ch1	Input data Ch1
D 8281	Input data Ch2	Output data Ch2	Input data Ch2
D 8282	Input data Ch3	Output data Ch3	Output data
D 8283	Input data Ch4	Output data Ch4	Not used
D 8284	Averaging time for Ch1 (1 to 4095)	Not used	Averaging time for Ch1 (1 to 4095)
D 8285	Averaging time for Ch2 (1 to 4095)	Not used	Averaging time for Ch2 (1 to 4095)
D 8286	Averaging time for Ch3 (1 to 4095)	Not used	Not used
D 8287	Averaging time for Ch4 (1 to 4095)	Not used	Not used
D 8288	Error status	Error status	Error status
D 8289	Model code: K1	Model code: K2	Model code: K50

Number	Operation and function		
	FX3U-4AD-PT(W)-ADP	**FX3U-4AD-TC-ADP**	**FX3U-4AD-PNK-ADP**
D 8280	Ch1 temperature measurement data	Ch1 temperature measurement data	Ch1 temperature measurement data
D 8281	Ch2 temperature measurement data	Ch2 temperature measurement data	Ch2 temperature measurement data
D 8282	Ch3 temperature measurement data	Ch3 temperature measurement data	Ch3 temperature measurement data
D 8283	Ch4 temperature measurement data	Ch4 temperature measurement data	Ch4 temperature measurement data
D 8284	Averaging time for Ch1 (1 to 4095)	Averaging time for Ch1 (1 to 4095)	Averaging time for Ch1 (1 to 4095)
D 8285	Averaging time for Ch2 (1 to 4095)	Averaging time for Ch2 (1 to 4095)	Averaging time for Ch2 (1 to 4095)
D 8286	Averaging time for Ch3 (1 to 4095)	Averaging time for Ch3 (1 to 4095)	Averaging time for Ch3 (1 to 4095)
D 8287	Averaging time for Ch4 (1 to 4095)	Averaging time for Ch4 (1 to 4095)	Averaging time for Ch4 (1 to 4095)
D 8288	Error status	Error status	Error status
D 8289	Model code: PT: K20 PTW: K21	Model code: K10	Model code: K11

Appendix B: Instruction List

Appendix B-1 Basic Instructions

Mnemonic	Function
Contact Instruction	
LD	Initial logical operation contact type NO (normally open)
LDI	Initial logical operation contact type NC (normally closed)
LDP	Initial logical operation of Rising edge pulse
LDF	Initial logical operation of Falling/trailing edge pulse
AND	Serial connection of NO (normally open) contacts
ANI	Serial connection of NC (normally closed) contacts
ANDP	Serial connection of Rising edge pulse
ANDF	Serial connection of Falling/trailing edge pulse
OR	Parallel connection of NO (normally open) contacts
ORI	Parallel connection of NC (normally closed) contacts
ORP	Parallel connection of Rising edge pulse
ORF	Parallel connection of Falling/trailing edge pulse
Connection Instruction	
ANB	Serial connection of multiple parallel circuits
ORB	Parallel connection of multiple contact circuits
MPS	Stores the current result of the internal PLC operations
MRD	Reads the current result of the internal PLC operations
MPP	Pops (recalls and removes) the currently stored result
INV	Invert the current result of the internal PLC operations
MEP	Conversion of operation result to leading edge pulse
MEF	Conversion of operation result to trailing edge pulse

Mnemonic	Function
Out Instruction	
OUT	Final logical operation type coil drive
SET	SET Bit device latch ON
RST	RESET Bit device OFF
PLS	Rising edge pulse
PLF	Falling/trailing edge pulse
Master Control Instruction	
MC	Denotes the start of a master control block
MCR	Denotes the end of a master control block
Other Instruction	
NOP	No operation or null step
End Instruction	
END	Program END, I/O refresh and Return to Step 0

Appendix B-2 Step Ladder Instructions

Mnemonic	Function
STL	Starts step ladder
RET	Completes step ladder

Appendix B-3 Applied Instructions ... in Ascending Order of FNC Number

FNC No.	Mnemonic	Function
Program Flow		
00	CJ	Conditional Jump
01	CALL	Call Subroutine
02	SRET	Subroutine Return
03	IRET	Interrupt Return
04	EI	Enable Interrupt
05	DI	Disable Interrupt
06	FEND	Main Routine Program End
07	WDT	Watchdog Timer Refresh
08	FOR	Start a FOR/NEXT Loop
09	NEXT	End a FOR/NEXT Loop
Move and Compare		
10	CMP	Compare
11	ZCP	Zone Compare
12	MOV	Move
13	SMOV	Shift Move
14	CML	Complement
15	BMOV	Block Move
16	FMOV	Fill Move
17	-	
18	BCD	Conversion to Binary Coded Decimal
19	BIN	Conversion to Binary
Arithmetic and Logical Operation		
20	ADD	Addition
21	SUB	Subtraction
22	MUL	Multiplication
23	DIV	Division
24	INC	Increment
25	DEC	Decrement
26	WAND	Logical Word AND
27	WOR	Logical Word OR
28	WXOR	Logical Exclusive OR
29	-	
Rotation and Shift Operation		
30	ROR	Rotation Right
31	ROL	Rotation Left
32	-	
33	-	
34	SFTR	Bit Shift Right
35	SFTL	Bit Shift Left
36	WSFR	Word Shift Right
37	WSFL	Word Shift Left
38	SFWR	Shift Write [FIFO/FILO Control]
39	SFRD	Shift Read [FIFO Control]

FNC No.	Mnemonic	Function
Data Operation		
40	ZRST	Zone Reset
41	DECO	Decode
42	ENCO	Encode
43	SUM	Sum of Active Bits
44	BON	Check Specified Bit Status
45	MEAN	Mean
46	-	
47	-	
48	-	
49	FLT	Conversion to Floating Point
High Speed Processing		
50	REF	Refresh
51	-	
52	MTR	Input Matrix
53	HSCS	High Speed Counter Set
54	HSCR	High Speed Counter Reset
55	HSZ	High Speed Counter Zone Compare
56	SPD	Speed Detection
57	PLSY	Pulse Y Output
58	PWM	Pulse Width Modulation
59	PLSR	Acceleration/Deceleration Setup
Handy Instruction		
60	IST	Initial State
61	SER	Search a Data Stack
62	ABSD	Absolute Drum Sequencer
63	INCD	Incremental Drum Sequencer
64	-	
65	-	
66	ALT	Alternate State
67	RAMP	Ramp Variable Value
68	-	
69	-	
External FX I/O Device		
70	-	
71	-	
72	DSW	Digital Switch (Thumbwheel Input)
73	-	
74	SEGL	Seven Segment With Latch
75	-	
76	-	
77	-	
78	-	
79	-	

FNC No.	Mnemonic	Function
External FX Device		
80	RS	Serial Communication
81	PRUN	Parallel Run (Octal Mode)
82	ASCI	Hexadecimal to ASCII Conversion
83	HEX	ASCII to Hexadecimal Conversion
84	CCD	Check Code
85	VRRD	Volume read
86	VRSC	Volume scale
87	RS2	Serial Communication 2
88	PID	PID Control Loop
89	-	
Floating Point		
110	ECMP	Floating Point Compare
111	-	
112	EMOV	Floating Point Move
113 to 119	-	
120	EADD	Floating Point Addition
121	ESUB	Floating Point Subtraction
122	EMUL	Floating Point Multiplication
123	EDIV	Floating Point Division
124	-	
125	-	
126	-	
127	ESQR	Floating Point Square Root
128	-	
129	INT	Floating Point to Integer Conversion
Positioning Control		
150	DSZR	DOG Search Zero Return
151	-	
152	-	
153	-	
154	-	
155	ABS	Absolute Current Value Read
156	ZRN	Zero Return
157	PLSV	Variable Speed Pulse Output
158	DRVI	Drive to Increment
159	DRVA	Drive to Absolute
Real Time Clock Control		
160	TCMP	RTC Data Compare
161	TZCP	RTC Data Zone Compare
162	TADD	RTC Data Addition
163	TSUB	RTC Data Subtraction
164	-	
165	-	
166	TRD	Read RTC data
167	TWR	Set RTC data
168	-	
169	HOUR	Hour Meter

FNC No.	Mnemonic	Function
External Device		
170	GRY	Decimal to Gray Code Conversion
171	GBIN	Gray Code to Decimal Conversion
172	-	
173	-	
174	-	
175	-	
176	-	
177	-	
178	-	
179	-	
Data Comparison		
220 to 223	-	
224	LD=	Load Compare (S1) = (S2)
225	LD>	Load Compare (S1) > (S2)
226	LD<	Load Compare (S1) < (S2)
227	-	
228	LD<>	Load Compare (S1) ≠ (S2)
229	LD<=	Load Compare (S1) ≤ (S2)
230	LD>=	Load Compare (S1) ≥ (S2)
231	-	
232	AND=	AND Compare (S1) = (S2)
233	AND>	AND Compare (S1) > (S2)
234	AND<	AND Compare (S1) < (S2)
235	-	
236	AND<>	AND Compare (S1) ≠ (S2)
237	AND<=	AND Compare (S1) ≤ (S2)
238	AND>=	AND Compare (S1) ≥ (S2)
239	-	
240	OR=	OR Compare (S1) = (S2)
241	OR>	OR Compare (S1) > (S2)
242	OR<	OR Compare (S1) < (S2)
243	-	
244	OR<>	OR Compare (S1) ≠ (S2)
245	OR<=	OR Compare (S1) ≤ (S2)
246	OR>=	OR Compare (S1) ≥ (S2)
247 to 249	-	
External Device Communication		
270	IVCK	Inverter Status Check
271	IVDR	Inverter Drive
272	IVRD	Inverter Parameter Read
273	IVWR	Inverter Parameter Write
274	-	
275	IVMC	Inverter Multi Command
276	ADPRW	MODBUS Read/Write

MEMO

Appendix C: Discontinued models

The table below lists the discontinued MELSEC-F Series PLC models and programming tools described in this manual.

Discontinued model	Production stop date	Repair acceptance period
FX3U-232ADP	September 30, 2013	Until September 30, 2020
FX3U-485ADP		
FX-10P(-E)	June 30, 2008	Until June 30, 2015

MEMO

Warranty

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company. However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
   1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
   2. Failure caused by unapproved modifications, etc., to the product by the user.
   3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
   4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
   5. Relay failure or output contact failure caused by usage beyond the specified Life of contact (cycles).
   6. Failure caused by external irresistible forces such as fires or abnormal voltages, and failure caused by force majeure such as earthquakes, lightning, wind and water damage.
   7. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
   8. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued.
Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Product application

(1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.

(2) The Mitsubishi programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or Public service purposes shall be excluded from the programmable logic controller applications.
In addition, applications in which human life or property that could be greatly affected, such as in aircraft, medical applications, incineration and fuel devices, manned transportation, equipment for recreation and amusement, and safety devices, shall also be excluded from the programmable logic controller range of applications.
However, in certain cases, some applications may be possible, providing the user consults their local Mitsubishi representative outlining the special requirements of the project, and providing that all parties concerned agree to the special circumstances, solely at the users discretion.

(3) Mitsubishi shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

Revised History

Date	Revision	Description
5/2013	A	First Edition
9/2013	B	• The following products are added: - Main unit of the built-in analog input FX3S-30MR/ES-2AD, FX3S-30MT/ES-2AD, FX3S-30MT/ESS-2AD - Main unit of DC power supply type FX3S-10MR/DS, FX3S-14MR/DS, FX3S-20MR/DS, FX3S-30MR/DS, FX3S-10MT/DS, FX3S-14MT/DS, FX3S-20MT/DS, FX3S-30MT/DS, FX3S-10MT/DSS, FX3S-14MT/DSS, FX3S-20MT/DSS, FX3S-30MT/DSS - Expansion board FX3G-4EX-BD, FX3G-2EYT-BD, FX3G-485-BD-RJ • Ver. 1.10 is supported. - Supports FX3G-4EX-BD - Supports FX3G-2EYT-BD • Errors are corrected.
10/2014	C	• The following products are added: - Display module FX3S-5DM • Ver. 1.20 is supported. - Supports the display module function. - Special data register of display module is added. (Appendix A) • Errors are corrected.
4/2015	D	• A part of the cover design is changed.
2/2018	E	• The contents of standards are changed.
4/2021	F	• Precautions for product security are added. • Precaution for file register (D) usage. (Section 17.8)
12/2021	G	• Compliance with UKCA marking is added.

Japanese manual number: JY997D48501G

FX3S SERIES PROGRAMMABLE CONTROLLERS

USER'S MANUAL

Hardware Edition

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE: TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN

MODEL	FX3S-HW-E
MODEL CODE	09R535

JY997D48601G
(MEE)

Effective December 2021
Specifications are subject to change without notice.