

PLC

MELSEC iQ-F Series Basics

This training course is prepared for those handling the MELSEC iQ-F Series programmable controller for the first time.

Introduction Purpose of the Course

This training course is prepared for those handling the MELSEC iQ-F Series programmable logic controller (hereinafter referred to "MELSEC iQ-F Series") for the first time to learn the basic methods of designing and constructing the programmable controller system.

The programmable controller system can be constructed using the following procedure:

1. Determining the contents to be automated
2. Preparing required equipment
3. Installing and wiring the prepared equipment
4. Creating programs for operating the installed and wired equipment

This course explains the above procedure.

Those who will learn this course should have fundamental knowledge of programmable controllers.
Complete the following course in advance:

- FA Equipment for Beginners (PLCs)

This course consists of the following chapters.
It is recommended to learn these chapters in order from Chapter 1.

Chapter 1: Introduction of MELSEC iQ-F Series

You can learn about the outline of the MELSEC iQ-F Series and the lineup of products.

Chapter 2: Design of Programmable Controller System

You can learn about the system configuration of the MELSEC iQ-F Series and how to select modules.

Chapter 3: Installation and Wiring

You can learn about how to attach and wire modules.

Chapter 4: Creation and Execution of Sequence Program

You can learn about a series of procedures from creation to execution of a sequence program.

Final Test

Passing grade: 60% or more

Go to the next page		Go to the next page.
Back to the previous page		Back to the previous page.
Move to the desired page		"Table of Contents" will be displayed, enabling you to navigate to the desired page.
Exit the learning		Exit the learning.

Safety precautions

When you learn based on using actual products, please carefully read the safety precautions in the corresponding manuals.

Precautions in this course

The displayed screens of the software version that you use may differ from those in this course.

This course uses the following software version:

- GX Works3 Version 1.007H

Chapter 1 Introduction of MELSEC iQ-F Series

In this chapter, you can learn about the outline of the MELSEC iQ-F Series and the lineup of products.

- 1.1 Outline of MELSEC iQ-F Series
- 1.2 Built-in functions of MELSEC iQ-F Series
- 1.3 System configuration of MELSEC iQ-F Series
- 1.4 CPU modules
- 1.5 Extension modules
- 1.6 Expansion boards and expansion adapters
- 1.7 Bus conversion modules
- 1.8 Development and maintenance of sequence programs
- 1.9 Summary

1.1

Outline of MELSEC iQ-F Series

Programmable controllers of Mitsubishi Electric Corporation are developed to automate equipment, and generally called PLCs.

Designed on the concepts of outstanding performance, superior drive control, and user centric programming, Mitsubishi's MELSEC-F Series has been reborn as the MELSEC iQ-F series.

From stand alone use to network system application, MELSEC iQ-F Series brings your business to the next level of industry.

MELSEC iQ-F_{series}

FX5U



FX5UC



The next level of industry

1.2

Built-in functions of MELSEC iQ-F Series

Advanced built-in functions

MELSEC iQ-F Series PLCs are compact next-generation models in which one CPU module incorporates various built-in functions. We can offer two types of series, standard FX5U Series and space saving FX5UC Series. (Click the tab to switch the display.)

FX5U

CPU performance

A new sequence execution engine is at the core of MELSEC iQ-F, capable of running structured programs and multiple programs, and supports structured text and function blocks, etc.

FX5UC

Built-in positioning function

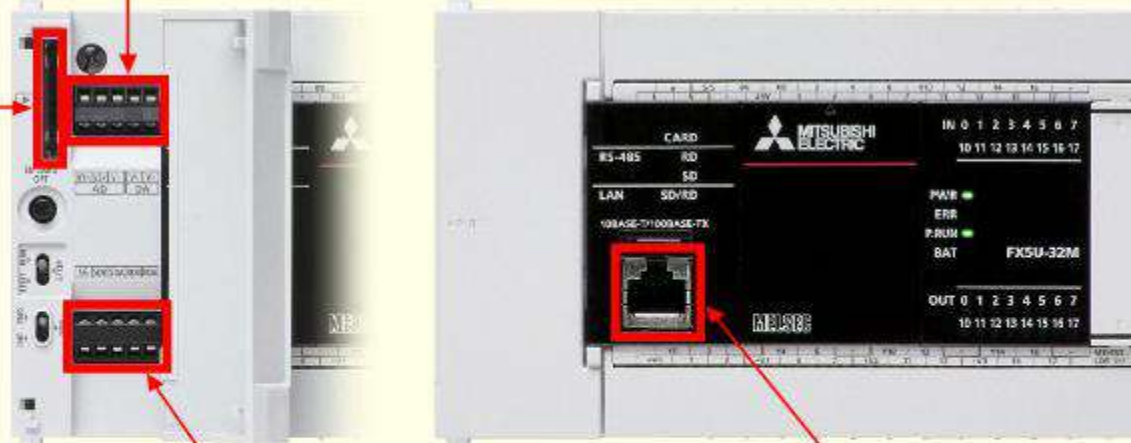
FX5U/FX5UC has built-in positioning functions for 8 channels high speed pulse input and 4 axes pulse output.

Batteryless and maintenance-free

Programs can be held without a battery. Clock data is held for 10 days by supercapacitor.

Built-in analog inputs and output

The FX5U incorporates 2 channels of 12-bit analog input and 1 channel of analog output.

**Built-in SD memory card slot**

The built-in SD memory card slot is convenient to update programs and mass-produce products.

Built-in RS-485 ports

Built-in RS-485 communication ports enable communication with up to 16 Mitsubishi general-purpose inverters in a distance of 50 m maximum.

Built-in Ethernet port

The Ethernet communication port handles communication with up to 8 connections in the network, and enables connection of many personal computers and equipment.

1.2

Built-in functions of MELSEC iQ-F Series

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FX5U

CPU performance

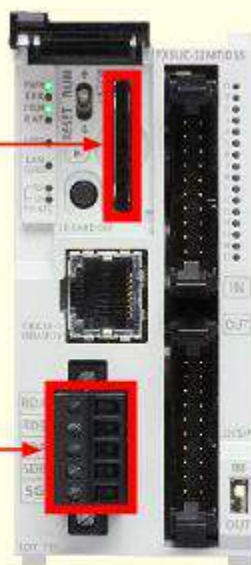
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FX5UC

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Programs can be held without a battery. Clock data is held for 10 days by supercapacitor.

**Built-in Ethernet port**

The Ethernet communication port handles communication with up to 8 connections in the network, and enables connection of many personal computers and equipment.

1.3

System configuration of MELSEC iQ-F Series

This section explains the basic system configuration of the MELSEC iQ-F Series.
Let's confirm the role of each module in the FX5U Series/FX5UC Series.(Click the tab to switch the display.)

FX5U

FX5UC

Put the mouse cursor on the device to get its explanation.



CPU module

PLC main module incorporating the CPU, power supply, inputs and outputs and program memory.



1.3

System configuration of MELSEC iQ-F Series

This section explains the basic system configuration of the MELSEC iQ-F Series.
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FX5U

FX5UC

Put the mouse cursor on the device to get its explanation.



CPU module

PLC main module incorporating the CPU, inputs and outputs and program memory.



1.4

CPU modules

Let's learn about the name and role of each part of the CPU module.

FX5U

FX5UC

Put the mouse in a red frame of the equipment to highlight in red the corresponding explanation in the table below.
Put the mouse in an explanation in the table below to highlight in red the corresponding part of the equipment.



No	Name	Role
(1)	Terminal block cover	Protects the terminal block. This cover can be opened for wiring.
(2)	Built-in Ethernet communication connector	Connects Ethernet-enabled equipment. (with cover)
(3)	Top cover	Protects the SD memory card slot, [RUN/STOP/RESET] switch and others.
(4)	LED area [1]	Indicates the operation status of the CPU module. The operator can check the CPU module power ON/OFF state, error condition, input/output ON/OFF state and others.
(5)	LED area [2]	Indicates the operation status of the SD memory card, built-in RS-485 communication and built-in Ethernet communication.
(6)	Built-in RS-485 communication terminal block	Connects RS-485-enabled equipment.
(7)	SD memory card disable switch	Disables accesses to the SD memory card before removal of the SD memory card.

No	Name	Role
(8)	RUN/STOP/RESET switch	Changes the operation status of the CPU module.
(9)	RS-485 terminal resistor selector switch	Switches the terminal resistor for built-in RS-485 communication.
(10)	Built-in analog I/O terminal block	Provided for using the built-in analog function.
(11)	SD memory card slot	Accepts the SD memory card.
(12)	Power terminals	Provided for wiring the power supply. Wiring will be explained in Chapter 3.
(13)	Input terminals	Provided for wiring external equipment on the input side such as switches and sensors. Wiring will be explained in Chapter 3.
(14)	Output terminals	Provided for wiring external equipment on the output side such as devices to be driven. Wiring will be explained in Chapter 3.

1.4

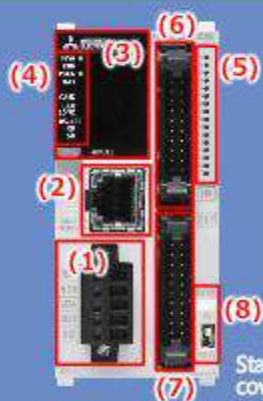
CPU modules

Let's learn about the name and role of each part of the CPU module.

FX5U

FX5UC

Put the mouse in a red frame of the equipment to highlight in red the corresponding explanation in the table below.
Put the mouse in an explanation in the table below to highlight in red the corresponding part of the equipment.



State in which the top cover is closed



State in which the top cover is open



Bottom

No	Name	Role
(1)	Built-in RS-485 communication terminal block	Connects RS-485-enabled equipment.
(2)	Built-in Ethernet communication connector (with cover)	Connects Ethernet-enabled equipment.
(3)	Top cover	Protects the SD memory card slot, [RUN/STOP/RESET] switch and others.
(4)	LED area [1]	Indicates the operation status of the CPU module. The operator can check the CPU module power ON/OFF state, error condition, SD memory card operation status, built-in RS-485 communication status and built-in Ethernet communication status.
(5)	LED area [2]	Indicates the ON/OFF state of inputs and outputs.
(6)	Input connector	Connects the input signal cable.

No	Name	Role
(7)	Output connector	Connects the output signal cable.
(8)	DISP switch	Switches inputs and outputs in the LED area [2].
(9)	SD memory card slot	Accepts the SD memory card.
(10)	RUN/STOP/RESET switch	Changes the operation status of the CPU module.
(11)	SD memory card disable switch	Disables accesses to the SD memory card before removal of the SD memory card.
(12)	CPU module power connector	Connects the power cable.
(13)	RS-485 terminal resistor selector switch	Switches the terminal resistor for built-in RS-485 communication.

1.5 Extension modules(1)

Let's learn about extension modules.

Up to 16 extension modules (excluding power extension modules) can be connected to the right side of the CPU module.

■ I/O modules (input/output extension modules)

These modules are available to extend the number of input/output points in increments of 8 to 32 points when the number of input/output points in the CPU module is insufficient. Some I/O modules incorporate a power supply.



Input/output modules incorporating power supply

FX5-32ER/ES

FX5-32ET/ES

FX5-32ET/ESS



Input modules

FX5-8EX/ES

FX5-16EX/ES



Output modules

FX5-8EYR/ES

FX5-8EYT/ES

FX5-8EYT/ESS

FX5-16EYR/ES

FX5-16EYT/ES

FX5-16EYT/ESS

1.5 Extension modules(2)

■ Positioning/simple motion module (intelligent function module*)

The FX5-40SSC-S provides positioning, speed, and torque control for 4 axes connected on SSCNET III/H. This module combines linear interpolation, 2-axis circular interpolation and continuous path control using table type programs, and enables easy drawing of smooth paths.

*Intelligent function modules indicate modules for adding various functions to the PLC, and the positioning/simple motion module is one of them.



Simple motion module

FX5-40SSC-S

■ Power extension module

The FX5-1PSU-5V is available when the built-in power supply of the CPU module is insufficient. This module can supply power to I/O modules, intelligent function modules and bus conversion modules. Up to 2 power extension modules can be connected to the CPU module.



Power extension module

FX5-1PSU-5V

1.6

Expansion boards and expansion adapters(1)

Let's learn about expansion boards and expansion adapters.

- Expansion boards

Function expansion boards can be connected to the PLC to extend its functions.

Only 1 function expansion board can be connected to the front face of the CPU module. (One function expansion board and up to 6 expansion adapters can be used together.)



For communication

Easily achieves data link and communication with external serial interface equipment.

FX5-232-BD	For communication in accordance with RS-232C
FX5-485-BD	For communication in accordance with RS-485
FX5-422-BD-GOT	For communication with peripheral equipment (GOT) in accordance with RS-422

1.6

Expansion boards and expansion adapters(2)

■ Expansion adapters

Expansion adapters can be connected to the CPU module to add special controls. Up to 6 expansion adapters can be connected to the left side of the CPU module.

**For communication**

Easily achieves data link and communication with external serial interface equipment.

FX5-232ADP	For RS-232C communication
FX5-485ADP	For RS-485 communication

For analog

Inputs and outputs voltage/current signals and analog data sent from temperature sensors.

FX5-4AD-ADP	4 channels for voltage input/current input
FX5-4DA-ADP	4 channels for voltage output/current output

In the FX5 system, FX3 intelligent function modules can be connected when used together with the bus conversion module.



Bus conversion module

FX5-CNV-BUS

■ Connectable FX3 intelligent function module list

Analog	
FX3U-4AD	4 channels for voltage input/current input
FX3U-4DA	4 channels for voltage output/current output
FX3U-4LC	4 channels for temperature control (resistance thermometer, thermocouple and low voltage) 4 points for transistor output
Positioning	
FX3U-1PG	Pulse output for independent 1-axis control
High-speed counter	
FX3U-2HC	2 channels for high-speed counter
Network	
FX3U-16CCL-M	Master station for CC-Link (compatible with Ver. 2.00 and Ver. 1.10)
FX3U-64CCL	Intelligent device station for CC-Link
FX3U-128BTY-M	Master station for AnyWire® Bitty*
FX3U-128ASL-M	Master station for AnyWire® ASLINK*

* AnyWire is a registered trademark of AnyWire Corporation.

1.8

Development and maintenance of sequence programs

GX Works3 is an engineering tool for creating and maintaining sequence programs for PLCs including the MELSEC iQ-F Series and MELSEC iQ-R Series.

By connecting a Windows® personal computer in which GX Works3 is installed and CPU module with dedicated cables, USB cables and Ethernet connection cables, you can develop programs, check program operations, write programs to the CPU module and check the module status.



* Windows is a registered trademark or trademark of Microsoft Corporation (USA) in the USA and other countries.

* Ethernet is a trademark of Xerox Corporation (USA).

1.9**Summary**

The table below summarizes the contents you have learned in Chapter 1.

Built-in functions of MELSEC iQ-F Series	<p>The CPU module incorporates the following functions:</p> <ul style="list-style-type: none">•Analog inputs and outputs•Positioning•Ports for Ethernet communication•Ports for RS-485 communication•SD memory card slot
System configuration of MELSEC iQ-F Series	<p>You have learned about the basic system configuration of the MELSEC iQ-F Series and roles of the following modules:</p> <ul style="list-style-type: none">•CPU modules•Extension modules•Expansion boards and adapters•Bus conversion module
Development and maintenance of sequence programs	<p>Programming of the MELSEC iQ-F Series requires a personal computer in which the engineering tool GX Works3 is installed.</p>

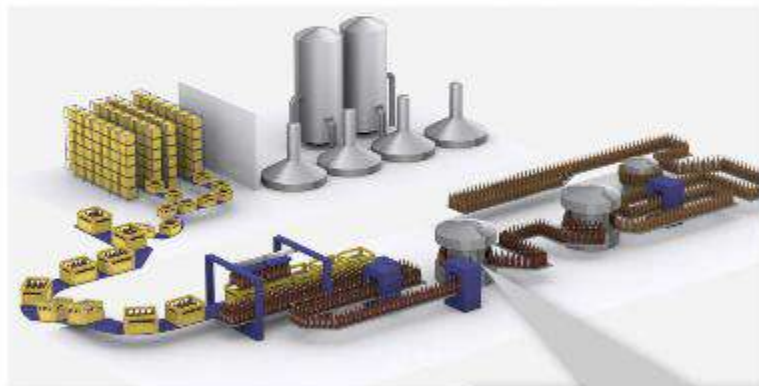
Chapter 2 Design of Programmable Controller System

In this chapter, you can learn about the system configuration of the MELSEC iQ-F Series and how to select modules.

- 2.1 Example of PLC system
- 2.2 Configuration of PLC and equipment used in labeling system example
- 2.3 How to select CPU module
- 2.4 How to read product model
- 2.5 Summary

2.1

Example of PLC system



When a bottle is detected by the sensor 1, the stopper starts to be closed.

When the labeling machine start switch turns ON, the labeling machine operates.

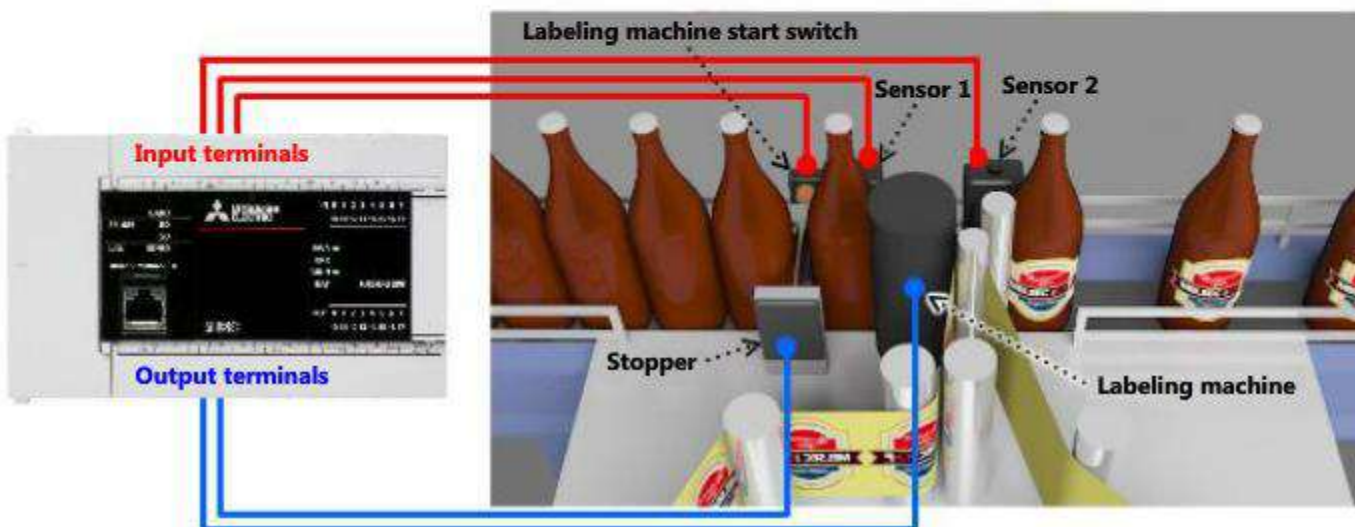
When the bottle is detected by the sensor 2, the stopper opens.

When the labeling machine start switch turns OFF, the labeling machine stops.



2.2 Configuration of PLC and equipment used in labeling system example

This section explains the configuration of PLC and external I/O equipment used in the labeling system example. The labeling system consists of 1 CPU module and 5 external I/O equipment.



Item	Equipment name	Model	Role/function
PLC system	CPU module	FX5U-32MR/ES	Controls operation by transferring ON/OFF signals to external I/O equipment in accordance with the contents of the sequence program.
External I/O equipment	Sensor 1	—	Turns ON when detecting the passage of a bottle. When this sensor turns ON, the stopper starts close.
	Stopper	—	Keeps a constant interval between bottles.
	Labeling machine start switch	—	Turns ON when the stopper is completely closed. While this switch is ON, the labeling machine operates. When this switch turns OFF, the labeling machine stops.
	Labeling machine	—	Sticks labels on bottles.
	Sensor 2	—	Turns ON when detecting the passage of a bottle. When this sensor turns ON, the closed stopper opens.

2.3

How to select CPU module

For constructing the PLC system, select a CPU module suitable for the system specifications.

The table below shows the specifications of each CPU module.

Select the proper CPU module model in consideration of the required number of I/O points, external power supply, program capacity, types of available instructions, required processing speed, etc.

On factory sites, 24 V DC is generally used as the power for driving sensors and switches.

In the subject (labeling system) in this course, it is assumed that the I/O specifications are as follows:

- (1) Total number of I/O points and I/O type
 - (a) Input: 24 V DC, ON/OFF input, 3 points
 - (b) Output: 24 V DC, relay output, 2 points
 Total: 5 points

The capacity of the program to be written to the PLC is within 1k steps.

- (2) Sequence program capacity: Within 1k steps

The supply voltage specification shall be as follows:

- (3) Supply voltage: 100 V AC



FX5U-32MR/ES

<Applicable CPU modules>

You can select either CPU module shown in the table below in accordance with the condition.

*** In this course, learning will proceed on the assumption that "FX5U-32MR/ES" is selected.**

Module model	Rated input voltage		Relay output specifications		Program capacity	Supply voltage
	Rated input voltage	Number of input points	Rated load voltage	Number of output points		
FX5U-32MR/ES	24 V	16 points	30 V DC or less, 240 V AC or less	16 points	64k steps	100 to 240 V AC
FX5U-64MR/ES	24 V	32 points	30 V DC or less, 240 V AC or less	32 points	64k steps	100 to 240 V AC
FX5U-80MR/ES	24 V	40 points	30 V DC or less, 240 V AC or less	40 points	64k steps	100 to 240 V AC

2.4

How to read product model

The product model name contains the following information.
 "FX5U-32MR/ES" selected in this course is explained as an example.

FX5U-32MR/ES

(1)

(2)

(3)

(4)

(1)	Series name	FX5U, FX5UC
(2)	Total number of I/O points	32, 64, 80, etc.
(3)	Module category	M: CPU module E: I/O module EX: Input module EY: Output module
(4)	I/O type and power supply	Examples R/ES: Relay output, AC power supply, 24 V DC (sink/source) input T/ES: Transistor (sink) output, AC power supply, 24 V DC (sink/source) input T/ESS: Transistor (source) output, AC power supply, 24 V DC (sink/source) input X/ES: 24 V DC (sink/source) input YR/ES: Relay output

The table below summarizes the contents you have learned in Chapter 2.

Example of PLC system	As an example of the PLC system, this course picks up the labeling process in which labels are stuck on bottles in the beverage manufacturing line.
Configuration of PLC and equipment used in labeling system example	You have learned about the configuration of PLC and external I/O equipment used in the labeling system example. The labeling system consists of 1 CPU module and 5 external I/O equipment.
How to select CPU module	You have learned about how to select the CPU module suitable for the system specifications. <ul style="list-style-type: none">• Selection condition• Total number of I/O points and I/O type• Sequence program capacity• Supply voltage
How to read product model	You have learned about how to read the product model name. Example: FX5U-32MR/ES <ul style="list-style-type: none">• FX5U ... Series name• 32 ... Total number of input and output points• M ... Module category (CPU module)• R/ES ... I/O type and power supply

Chapter 3 Installation and Wiring

In this chapter, you can learn about how to attach and wire modules.

- 3.1 PLC installation environment
- 3.2 Installation location
- 3.3 Grounding
- 3.4 Attachment of CPU module battery
- 3.5 Assignment of I/O numbers
- 3.6 Wiring of power supply
- 3.7 Wiring of input equipment
- 3.8 Wiring of output equipment
- 3.9 Summary

3.1

PLC installation environment

PLCs have a certain degree of environment resistance because they are usually used on manufacturing sites. However, PLCs are generally installed inside the control panel so that they can offer stable performance for a long time.



Refer to "General Specifications" described in the manual for detailed conditions.

Do not install PLCs in the following environment:



• High ambient temperature



• High ambient humidity and condensation



• Vibration or heavy impacts



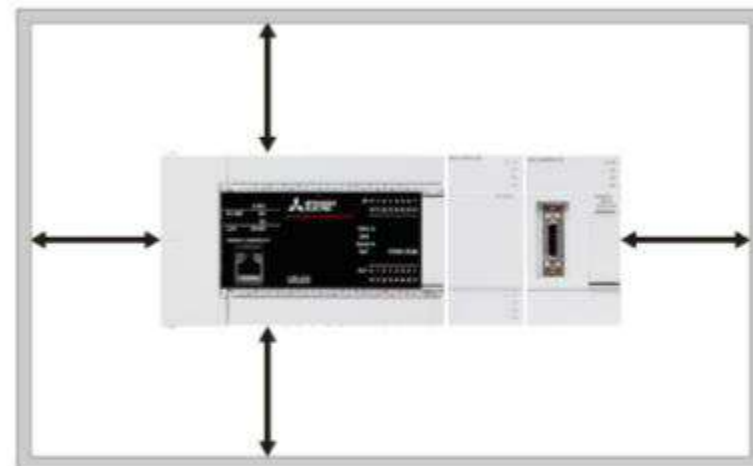
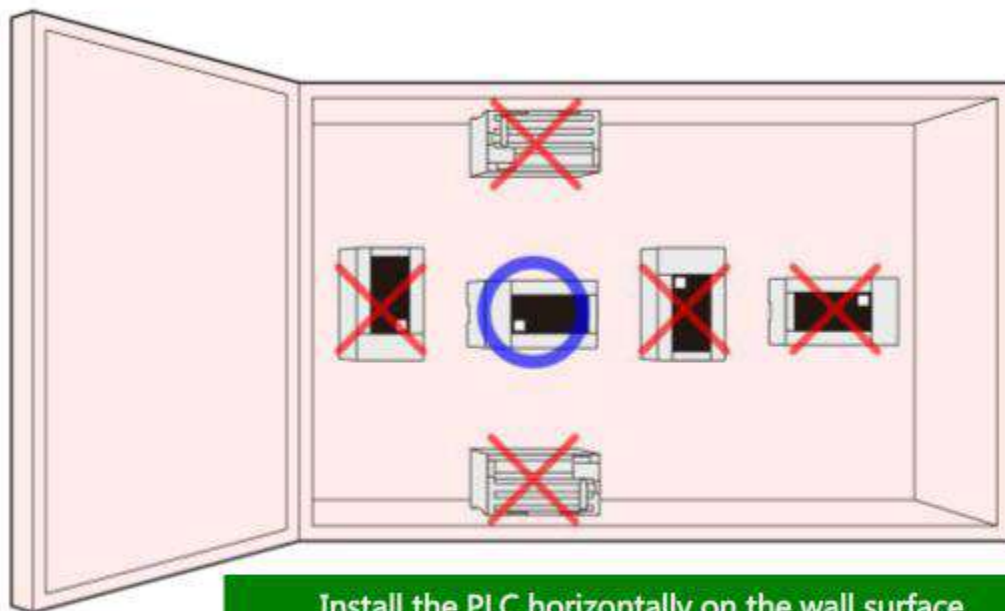
• Excessive dust
• Combustible gas or corrosive gas

3.2

Installation location

■ Installation location and space inside the panel

- Do not install the PLC on the floor surface or ceiling surface or in the vertical direction to prevent temperature rise. Make sure to install the PLC horizontally on the wall surface as shown in the figure below.
- Ensure a space of 50 mm or more between the PLC main module and another equipment and between the PLC main module and the structure. Keep the PLC main module away from high-voltage lines, high-voltage equipment and power equipment as much as possible.
- In the MELSEC iQ-F Series, extension device can be connected to both the left side and the right side of the CPU module. If extension device may be added in the future, ensure the required space on the left side and right side.



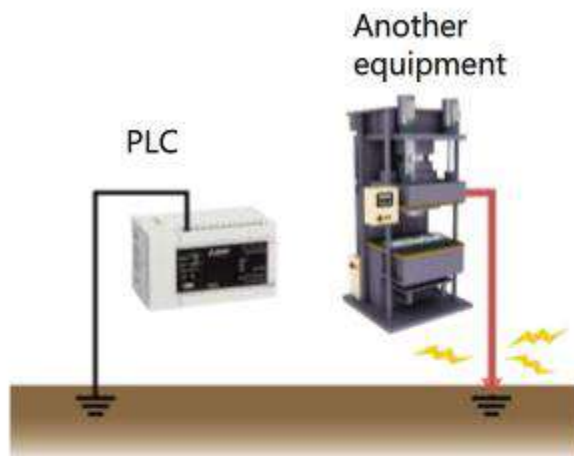
3.3

Grounding

- To prevent electrical shock and malfunction, perform grounding while paying attention to the following contents:
Perform independent grounding in which each equipment has its own grounding wire.
If independent grounding is impossible, perform shared grounding in which all grounding wires have the same length. Perform Class D grounding (Grounding resistance: 100 Ω or less).
- Shorten the distance between the grounding point and the PLC as much as possible, and shorten the grounding wire as much as possible.

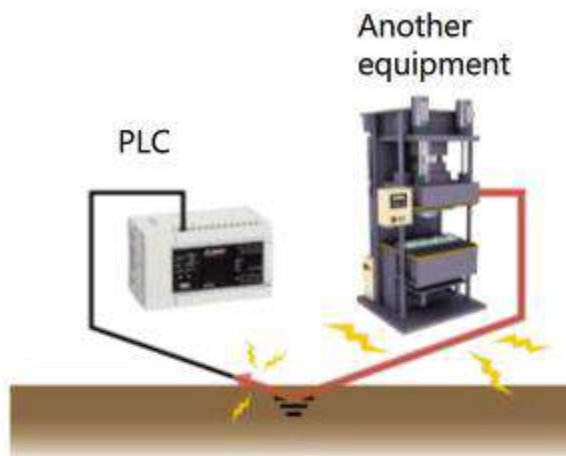
(1) Grounding each equipment independently

Independent grounding...**Best**



(2) Using grounding wires of the same length

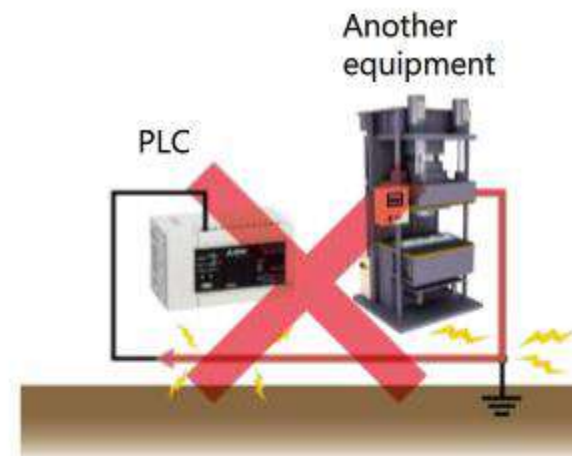
Shared grounding...**Good**



(3) Branching one grounding wire

Common grounding

...**Not allowed**




*In common grounding, the PLC is grounded by way of the grounding system of another equipment, and is affected by the other equipment.

3.4

Attachment of CPU module battery

Use the battery for latching (holding against power interruption) device memories and clock data.
 A battery is not supplied with the CPU module when shipped from the factory.
 Arrange the battery if necessary.
 Confirm the connection method in the animation.

The animation is finished.
 Click  to proceed to the next step.
 Click the [Play again] button to start from the beginning again.

Play again

Step 1: Turn OFF the power.



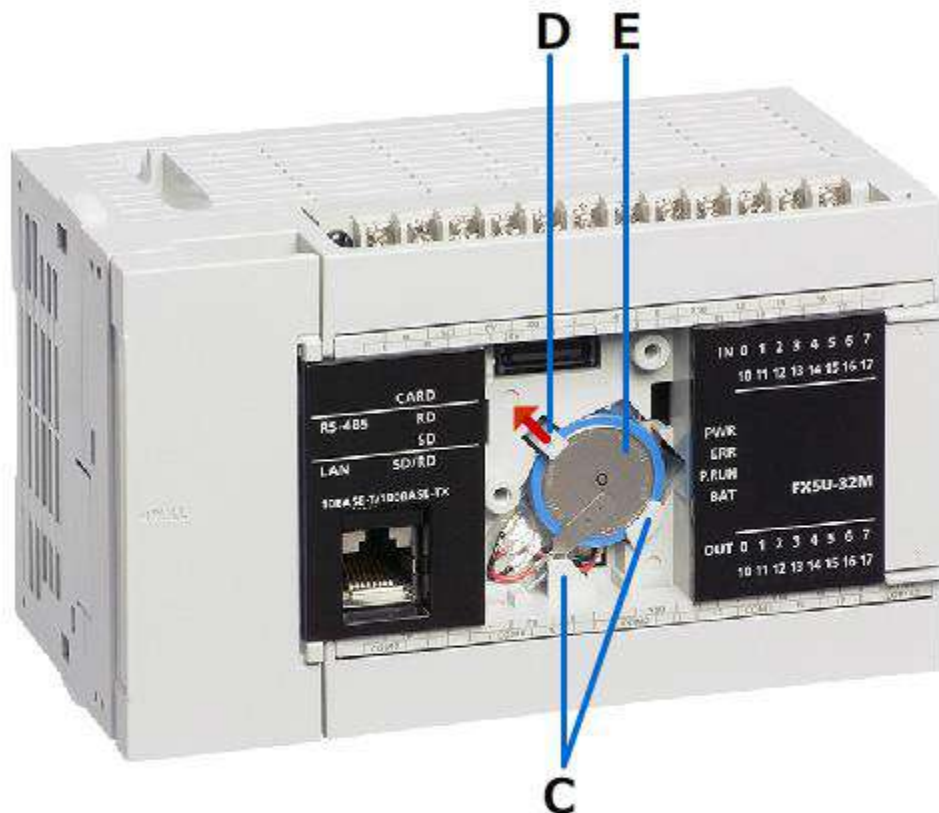
Step 2: Connector cover for expansion board connection
 (Remove A in the figure.)



Step 3: Insert the battery connector (B in the figure) of the battery.



Step 4: Insert the battery inside the lower hook (C in the figure), and fit the battery into the battery holder (E in the figure) while pushing up the upper hook (D in the figure) toward the left.
 Attach the connector cover for expansion board connection.
 If the expansion board was removed in the step 2, attach it again.



3.5

Assignment of I/O numbers

Numbers in increments of 8 points are assigned to I/O terminals of the CPU module for wiring I/O equipment. These numbers called "I/O numbers" are provided so that the CPU module can recognize signals sent from I/O equipment.

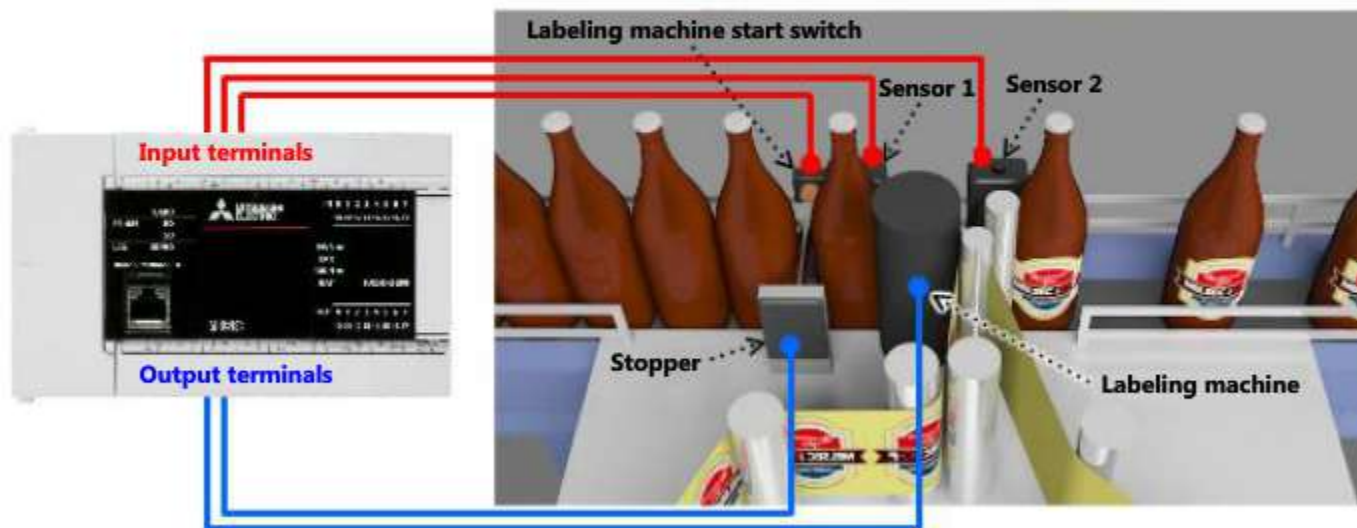
- I/O numbers are numbers beginning with "0", and expressed in octal notation.

- At assignment, "X" is added before a number for input equipment, and "Y" is added before a number for output equipment.

In the labeling system adopted as an example in this course, I/O numbers shown in the table below are assigned.

■ Assignment of I/O numbers and applicability of I/O equipment in the labeling system example

	I/O equipment name	I/O number
Input equipment	Sensor 1	X0
	Sensor 2	X1
	Labeling machine start switch	X2
Output equipment	Stopper	Y0
	Labeling machine	Y1

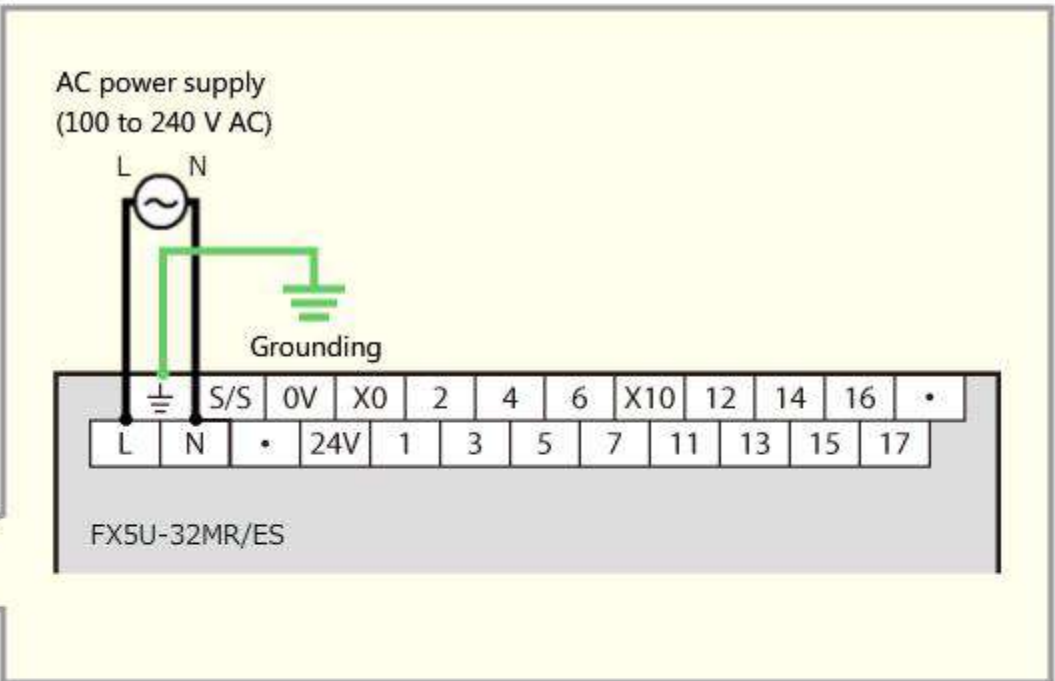


3.6 Wiring of power supply

This section explains the wiring of the power supply.

- In wiring, it is necessary to open the terminal block cover provided on the module front face.
- Connect the input AC power supply to the power input terminals (L and N).
(Check the printed characters "L" and "N" during wiring.)
- Make sure to ground the grounding terminal to ensure stable operation.

Note that cable colors vary depending on the country.



3.7 Wiring of input equipment

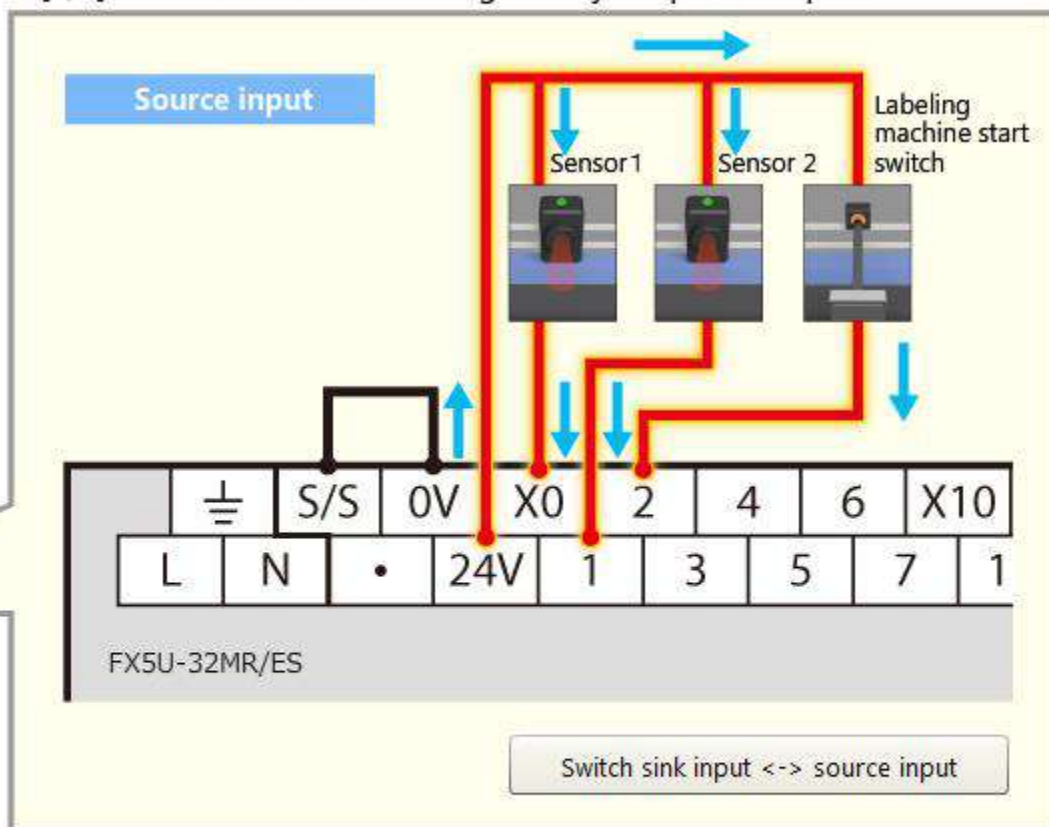
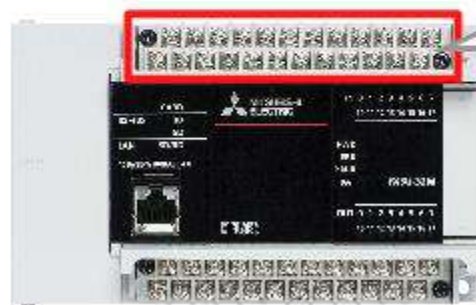
Wire input equipment to input terminals of the CPU module.

"Sink input" and "source input" are available for wiring input terminals. Select either method in accordance with the external equipment to be connected.

■ "Sink input" and "source input"

- In the sink input method, DC input signals flow out of input (X) terminals. Connect the [24 V] terminal and [S/S] terminal.
- In the source input method, DC input signals flow into input (X) terminals. Connect the [0 V] terminal and [S/S] terminal.

*The sink input method in which the [24 V] terminal and [S/S] terminal are connected is generally adopted in Japan.



* Click the [Switch sink input <-> source input] button, and check differences in the wiring between two input methods.

3.8

Wiring of output equipment

Wire output equipment to output terminals of the CPU module.

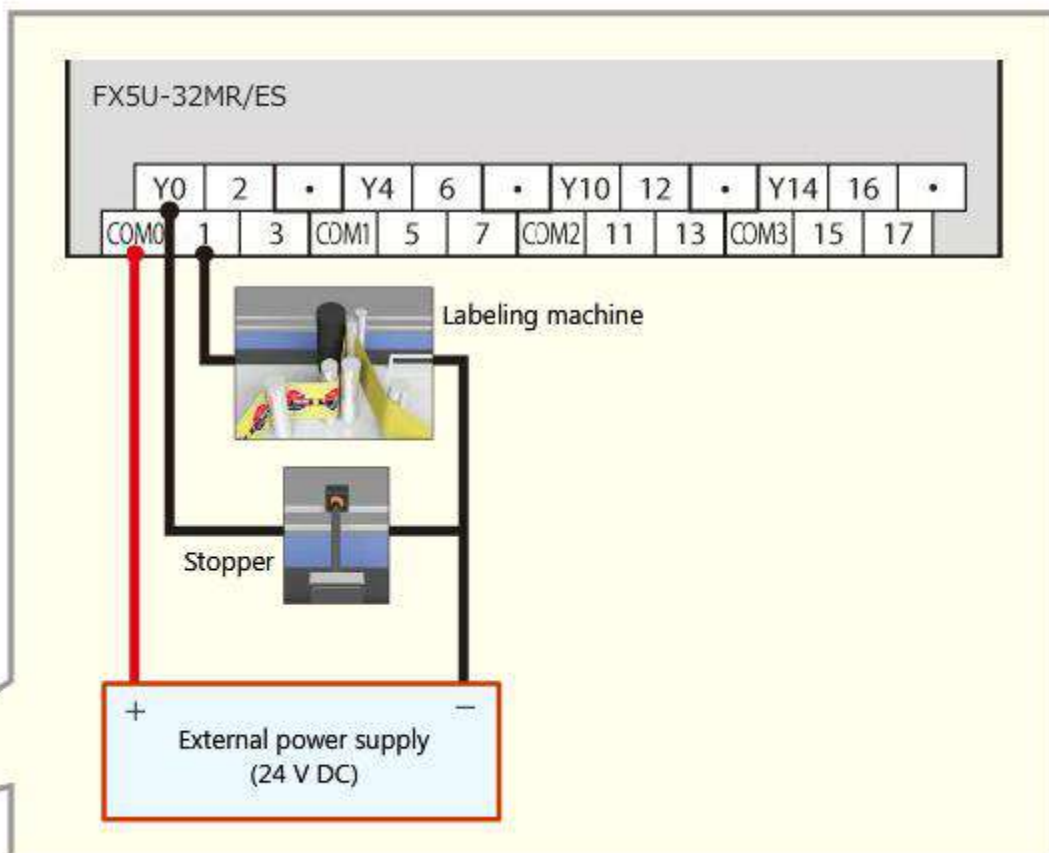
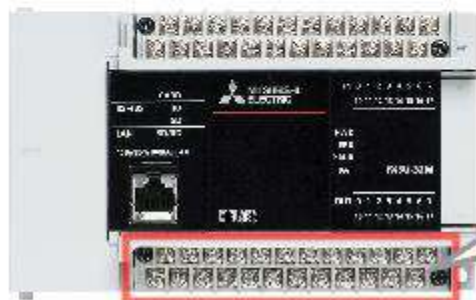
- Four outputs share 1 common terminal (COM).

Even when two or more output equipment are connected, the space and wiring can be saved if the common terminals can be shared.

- The FX5U-32MR has 4 common terminals, COM0 to COM3.

Each common terminal corresponds to output numbers (Y) shown in the table below, and can be used to drive equipment belonging to a different circuit voltage system (for example: 100 V AC and 24 V DC).

Common terminal number (COM)	Output number (Y)
COM0	Y0~Y3
COM1	Y4~Y7
COM2	Y10~Y13
COM3	Y14~Y17



The table below summarizes the contents you have learned in Chapter 3.

PLC installation environment	<p>Do not install PLCs in the following places:</p> <ul style="list-style-type: none"> •High ambient temperature •High ambient humidity and condensation •Vibration or heavy impacts •Excessive dust, Combustible gas or corrosive gas
Installation location	<p>You have learned about the installation location and space inside the panel.</p> <ul style="list-style-type: none"> •Make sure to install the PLC horizontally on the wall surface. Do not install the PLC on the floor surface or ceiling surface or in the vertical direction to prevent temperature rise. •Ensure a space of 50 mm or more between the PLC main module and another equipment and between the PLC main module and the structure.
Grounding	<p>You have learned about proper grounding to prevent electrical shock and malfunction.</p> <ul style="list-style-type: none"> •Perform independent grounding in which each equipment has its own grounding point.
Attachment of CPU battery	<p>You have learned about the procedure to attach the battery to the CPU module.</p> <ul style="list-style-type: none"> •Use the battery for latching (holding against power interruption) device memories and clock data.
Assignment of I/O numbers	<p>You have learned about assignment of I/O numbers to I/O terminals.</p> <ul style="list-style-type: none"> •I/O numbers are numbers expressed in octal notation assigned so that the CPU module can recognize signals from I/O equipment. •At assignment, "X" is added before a number in input equipment, and "Y" is added before a number in output equipment.
Wiring of power supply	<p>You have learned about the wiring of the power supply.</p> <ul style="list-style-type: none"> •Connect the input AC power supply to the power input terminals (L and N). •Make sure to ground the grounding terminal to ensure stable operation.
Wiring of input equipment	<p>You have learned about the wiring of input equipment to input terminals.</p> <p>"Sink input" and "source input" are available for wiring input terminals. Select either method in accordance with the external equipment to be connected.</p> <ul style="list-style-type: none"> •In the sink input method, DC input signals flow out of input (X) terminals. Connect the [24 V] terminal and [S/S] terminal. •In the source input method, DC input signals flow into input (X) terminals. Connect the [0 V] terminal and [S/S] terminal.
Wiring of output equipment	<p>You have learned about the wiring of output equipment to output terminals.</p> <ul style="list-style-type: none"> •Four outputs share 1 common terminal (COM). <p>Even when two or more output equipment are connected, the space and wiring can be saved if the common terminals can be shared.</p>

Chapter 4 Creation and Execution of Sequence Program

In this chapter, you can learn about a series of procedures from creation to execution of a sequence program.

- 4.1 Outline of sequence programs
- 4.2 Connection of CPU module and personal computer
- 4.3 Creation of a sequence program
- 4.4 Writing and execution of a sequence program
- 4.5 Operations in labeling system example
- 4.6 Summary

4.1 Outline of sequence programs

Sequence programs are required to operate the MELSEC iQ-F Series.

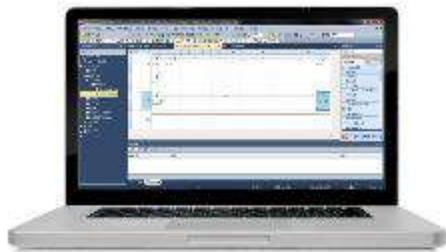
Sequence programs are such that the contents of sequence control are described in a dedicated programming language such as ladder, ST and function block (FB).

Sequence programs can be created in a personal computer in which the engineering tool (GX Works3) for the MELSEC iQ-F Series is installed, and can be executed after they are written to the CPU module.

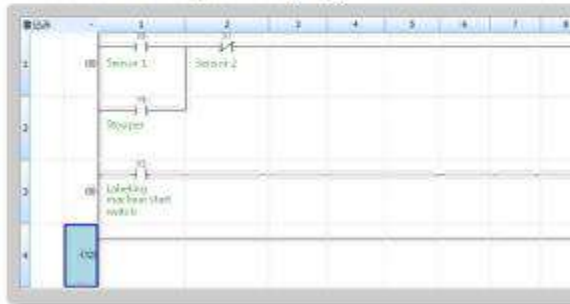
Changes and extension of the specifications can be handled flexibly by changing sequence programs.


In this course, the basic program creation procedure is explained using a programming language called ladder.

It is recommended to take the basic programming course for acquiring more knowledge of programming.



Execute the sequence program written in the CPU module.



The animation is finished.
Click  to proceed to the next step.
Click the [Play again] button to start from the beginning again.

Play again

1. Create a sequence program.



2. Write the sequence program.

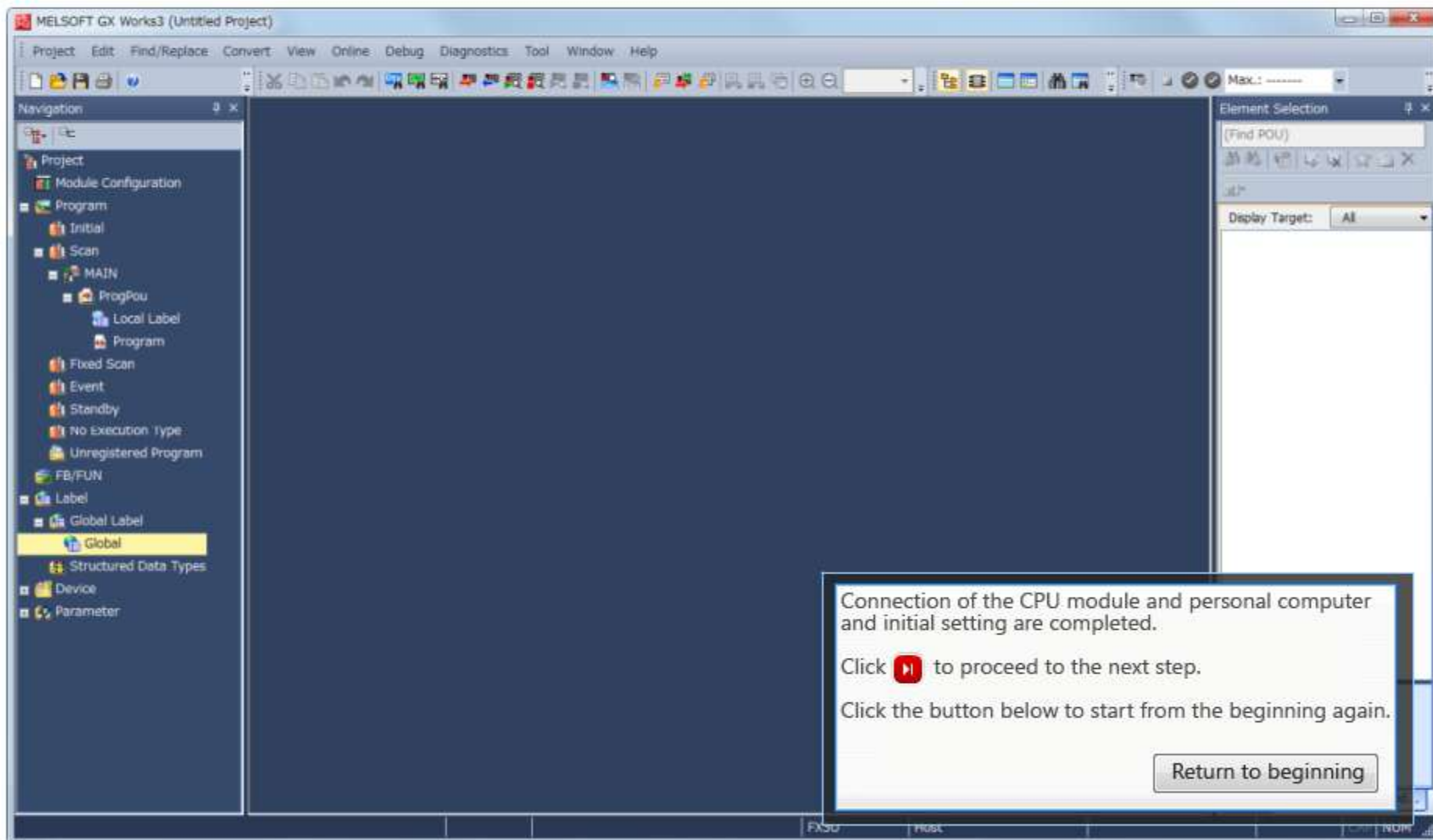


3. Execute the sequence program written in the CPU module.

4.2


Connection of CPU module and personal computer

This section explains the procedure to connect the CPU module and personal computer. It is necessary to perform this connection procedure before writing sequence programs.



The screenshot displays the MELSOFT GX Works3 software interface. The main window shows the 'Navigation' pane on the left, the 'Element Selection' pane on the right, and the main workspace in the center. The 'Navigation' pane is expanded to show the 'Global' folder, which is highlighted in yellow. The 'Element Selection' pane shows a search for '(Find POU)' and a 'Display Target' dropdown set to 'All'. A text box in the bottom right corner provides instructions for the next step.

Connection of the CPU module and personal computer and initial setting are completed.

Click  to proceed to the next step.

Click the button below to start from the beginning again.

[Return to beginning](#)

4.3

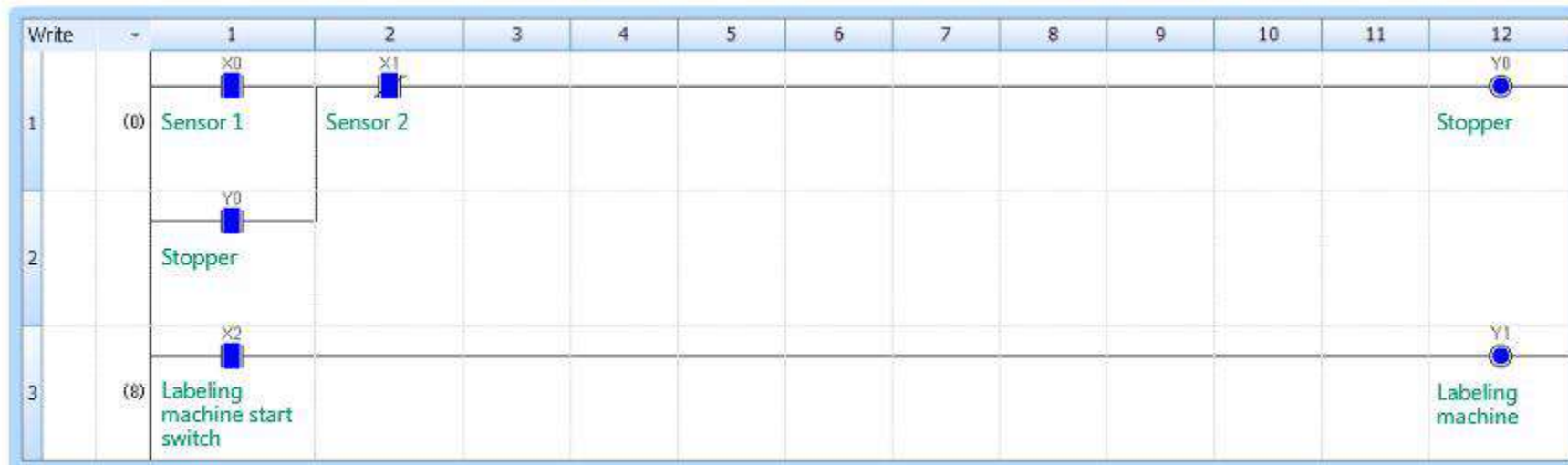
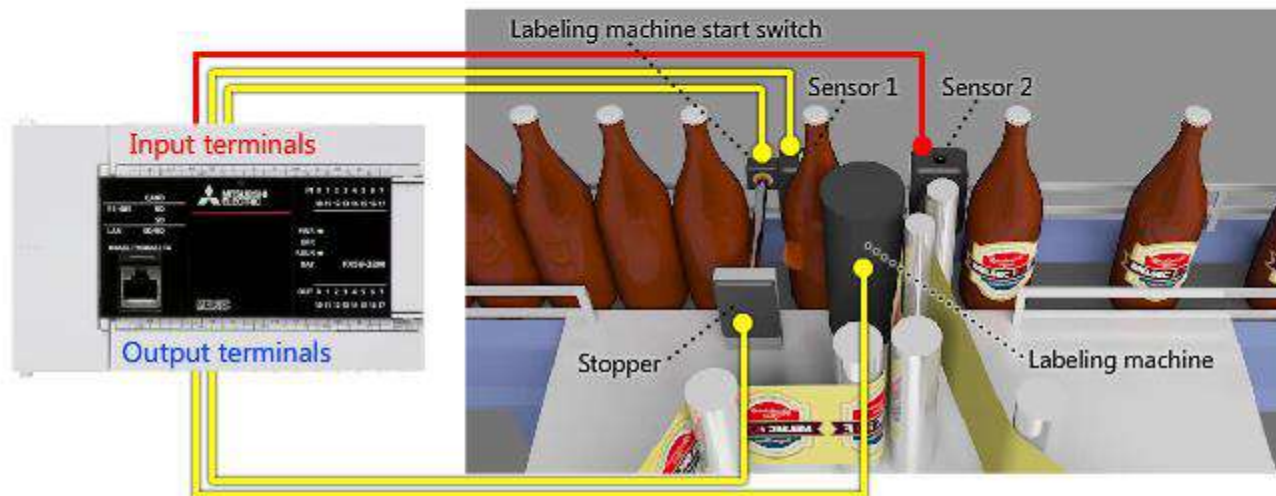
Creation of a sequence program(1)

This section explains a sequence program used in the labeling system example.

Confirm the correspondence between the operation of the sequence program and the operation of each equipment in the following animation:

Click the button below to advance the animation.

▶ Start from beginning



4.3

Creation of a sequence program(2)

This section explains the sequence program creation method.
You can easily create sequence programs mainly using the mouse.

MELSOFT GX Works3 (Untitled Project) - [ProgPou [PRG] [LD] 13Step]

Project Edit Find/Replace Convert View Online Debug Diagnostics Tool Window Help

ProgPou [PRG] [Local Label ...] ProgPou [PRG] [LD] 13Step x Module Configuration

Write

Step	1	2	3	4	5	6	7	8	9	10	11	12
1	(0) Sensor 1	Sensor 2										Stopper
2	Stopper											
3	(8) Labeline machine start switch											Labeling machine
4	(12)											

Element Selection

(Find POU)

Display Target: All

SEQUENCE INSTRUCTIONS

- Contact instructions
- Association instructions
- Output instructions
- ALT[1] Alternate stat
- ALTP[1] Alternate stat
- ANR[0] Annunciator re
- ANRP[0] Annunciator re
- ANS[3] Timed annunc
- FF[1] Bit device out
- OUT[1] Out instruction
- OUT[2] Timers / Rete

Creation of a sequence program is completed.

Click to proceed to the next step.

Click the button below to start from the beginning again.

Return to beginning

FX5U Host-0.0.0.0 12/13 Step Overwrite NOM

4.4

Writing and execution of a sequence program

For executing a created sequence program, it is necessary to write it to the CPU module first. This section explains the procedure to write and execute a sequence program.



The CPU module reset operation is explained below.

- * After the memory is initialized, the [ERROR] indicator lamp flickers because required parameters are not written in the CPU module.

4.5

Operations in labeling system example

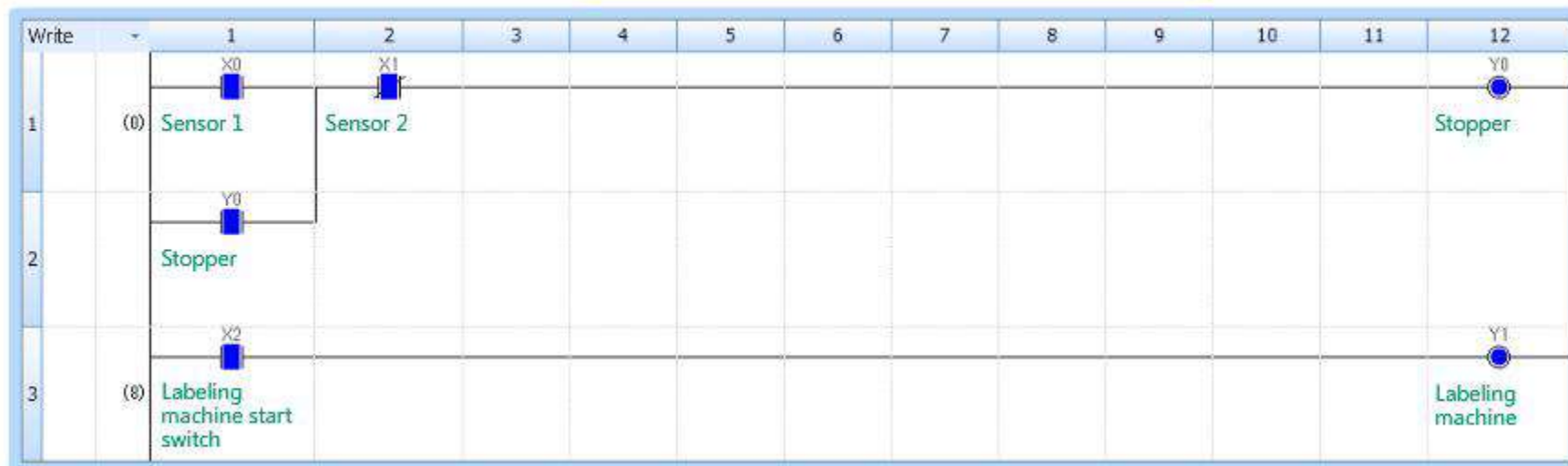
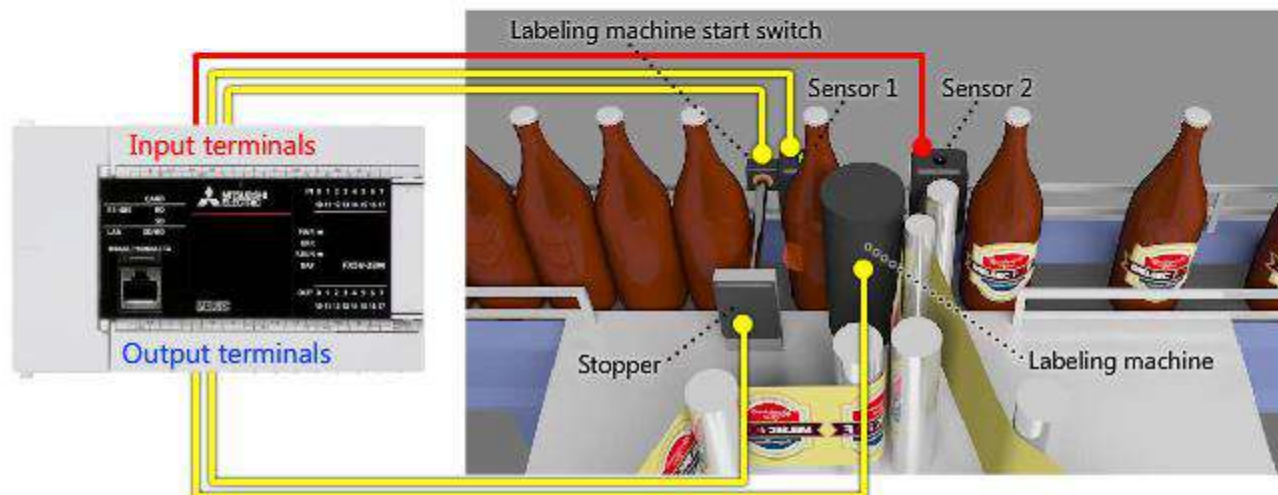
The labeling system is completed.

Learning in this course is finished.

Operation of the labeling system example is shown here one more time.

Click the button
below to advance
the animation.

▶ Start from beginning



4.6**Summary**

The table below summarizes the contents you have learned in Chapter 4.

Outline of sequence programs	<p>In this course, you have learned about the basic program creation procedure using the programming language called ladder.</p> <ul style="list-style-type: none">•Creating a sequence program•Writing the sequence program to the CPU module•Executing the sequence program written in the CPU module
Connection of CPU module and personal computer	<p>You have learned about the procedure to connect the CPU module and personal computer.</p> <ul style="list-style-type: none">•Connecting a personal computer in which the engineering tool GX Works3 is installed and CPU module with the Ethernet connection cable•Starting GX Works3 in the personal computer, setting the connection with the CPU module, and then performing the communication test•Initializing the memory of the CPU module
Creation of a sequence program	<p>You have learned about the sequence program creation method.</p> <ul style="list-style-type: none">•Creating a sequence program on the ladder editor screen of GX Works3.
Writing and execution of a sequence program	<p>You have learned about the sequence program writing and execution procedures.</p> <ul style="list-style-type: none">•Writing the created sequence program to the CPU module.•Resetting the CPU module, and setting the CPU module to the sequence program execution status by using the [RUN/STOP/RESET] switch
Operations in labeling system example	<p>In the animation, you have confirmed the operations of the labeling system learned and created in this course.</p>

Test**Final Test**

Now that you have completed all of the lessons of the **MELSEC iQ-F Series Basics** course, you are ready to take the final test. If you are unclear on any of the topics covered, please take this opportunity to review those topics.

There are a total of 7 questions (7 items) in this Final Test.

You can take the final test as many times as you like.

How to score the test

After selecting the answer, make sure to click the **Answer** button. Your answer will be lost if you proceed without clicking the Answer button. (Regarded as unanswered question.)

Score results

The number of correct answers, the number of questions, the percentage of correct answers, and the pass/fail result will appear on the score page.

Correct answers : 7

Total questions : 7

Percentage : 100%

To pass the test, you have to answer **60%** of the questions correct.

Proceed

Review

- Click the **Proceed** button to exit the test.
- Click the **Review** button to review the test. (Correct answer check)
- Click the **Retry** button to retake the test again.



Functions built in the MELSEC iQ-F Series

Select connection ports built in the CPU module of the MELSEC iQ-F Series PLCs. (Multiple answers allowed)



Ethernet connection port



RS-485 communication port



RS-232 communication port

Back



System configuration of the MELSEC iQ-F Series

Select devices to be attached on the right side of the CPU module for addition to or extension of the CPU module of the MELSEC iQ-F Series PLCs.



- Extension module
- Function expansion board
- Expansion adaptor

Back



How to read the product model

Select what "32" means in the MELSEC iQ-F Series PLC model "FX5U-32MR/ES".

- Program capacity
- Number of input points
- Number of output points
- Total number of input and output points

Back



How to read the product model

Select what "M" means in the MELSEC iQ-F Series PLC model "FX5U-32MR/ES".

- Extension module
- CPU module
- Expansion board or expansion adapter
- Bus conversion module

Back

**Grounding**

Select proper choices to make correct sentences explaining the grounding method for the MELSEC iQ-F Series PLC system.

Perform independent grounding in which the grounding wire is in each model.



Perform class D grounding.

If independent grounding is impossible, perform shared grounding in which all grounding wires have a same .



Make the distance between the grounding point and the PLC as as possible and shorten the grounding wire.



Back

**Assignment of I/O numbers**

Select proper choices to make correct sentences explaining the assignment of I/O numbers while wiring I/O equipment to the MELSEC iQ-F Series PLC.

Numbers in increments of 8 points are assigned to I/O terminals of the CPU module for wiring I/O equipment.

These numbers called "I/O numbers" are provided so that the CPU module can recognize signals sent from I/O equipment.

-I/O numbers are serial numbers beginning with "0", and expressed in



-At assignment, "" is added before a number for input equipment, and "" is added before a number for output equipment.

Back

**Creation and execution of a sequence program**

Select the correct sequence of procedures A to D required before execution of a sequence program in the MELSEC iQ-F Series PLC.

Procedure A: Writing a created sequence program to the CPU module

Procedure B: Connecting the personal computer and CPU module with the Ethernet connection cable

Procedure C: Initializing the memory of the CPU module

Procedure D: Resetting the CPU module and setting the CPU module to the sequence program execution state by manipulating the [RUN/STOP/RESET] switch

A -> B -> C -> D

B -> C -> A -> D

B -> D -> A -> C

Back

Test**Test Score**

You have completed the Final Test. Your results are as follows.
To end the Final Test, proceed to the next page.

Correct answers : 7

Total questions : 7

Percentage : 100%

Proceed

Review

Congratulations. You passed the test.

You have completed the **MELSEC iQ-F Series Basics** course.

Thank you for taking this course.

We hope you enjoyed the lessons and the information you acquired in this course will be useful in the future.

You can review the course as many times as you want.

Review

Close