**MITSUBISHI ELECTRIC**
*Changes for the Better*

# PLC
# MELSEC-L Series Basics

This training course (e-learning) is designed for those using the MELSEC-L series programmable controller for the first time.

L(NA)00124ENG

# Introduction Purpose of the Course

This course provides basic knowledge of setting up the hardware from system designing to wiring checking.
The course is intended for those using the MELSEC-L series programmable controller (PLC) for the first time or the person in charge of the hardware system.

# Introduction | Course Structure

The contents of this course are as follows.
We recommend that you start from Chapter 1.

### Chapter 1 - MELSEC-L Series

You will learn about the features of the MELSEC-L series and names of each part.

### Chapter 2 - PLC System Construction Procedure

You will learn about the system construction procedures using an example system.

### Chapter 3 - System Design

You will learn how to define control items and how to examine the connection with external equipment, necessary I/O specifications and number of I/O points.

### Chapter 4 - Product Selection

You will learn how to select module types.

### Chapter 5 - Advance Preparation

You will learn about advance preparation from confirming individual modules to formatting the memory.

### Chapter 6 - Installation and Wiring

You will learn how to install and wire each module.

### Chapter 7 - Wiring Check

You will learn how to check I/O signal wirings using the GX Works2 software.

### Chapter 8 - Final Test

Passing grade: 60% or higher.

| Go to the next page | ▶I | Go to the next page. |
|---|---|---|
| Back to the previous page | I◀ | Back to the previous page. |
| Move to the desired page | TOC | "Table of Contents" will be displayed, enabling you to navigate to the desired page. |
| Exit the learning | ✕ | Exit the learning.<br>Window such as "Contents" window and the learning will be closed. |

## Safety precautions

When you learn by 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 is for the following software version:

- GX Works2 Version 1.39R

# Chapter 1 MELSEC-L Series

In this course, you will learn how to set up the Mitsubishi MELSEC-L series general-purpose PLC system hardware.

# 1.1 What is a PLC?

What is a programmable controller or PLC (Programmable Logic Controller)?
A PLC is a rugged digital computer that performs sequence control and logic operations. Typically they are used to control electrical signals sent to output devices based on the electrical signals it receives from input devices. Programmable controllers require a program, which can be created using dedicated software on a personal computer. The programs can be easily modified to allow the PLC to perform different functions for different tasks.
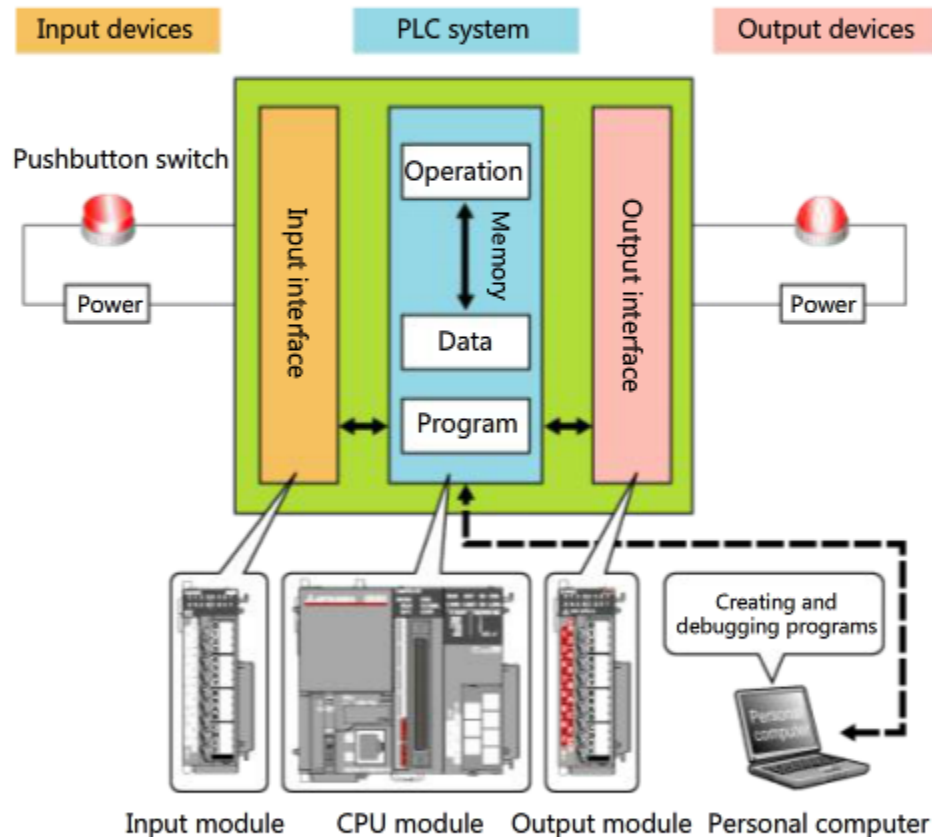
| Module name | Use |
|---|---|
| Input module | Receives electrical signals from external devices and converts them into data to be used by the CPU. |
| CPU module | Operates the sequence program and performs signal input/output processing. |
| Output module | Transmits electrical signals to external devices when commanded by the CPU. |

# 1.2 Comparison between MELSEC-L Series and MELSEC-Q Series

Some basic differences between MELSEC-L Series and MELSEC-Q Series programmable controllers can be seen in the table below

| | MELSEC-L series | MELSEC-Q series |
|---|---|---|
| Method of adding modules | Modules can be connected in the lateral direction. As no base unit is required, the installation area is minimized. *Modules are directly connected* | Modules are individually mounted to the base unit, allowing for easy replacement and certain modules to be hot-swapped. *Modules are mounted to the base unit* |
| Implementation of load distribution (*1) and function distribution (*2) | Functions are divided for each PLC CPU and information is shared through the network. *Function distribution through the network* | In order to achieve load and function distribution, different CPU types such as motion, PC CPU, C CPU, and sequence can be connected using the high-speed bus provided by the base unit. *Load distribution by up to four CPUs* |
| Available functions | Minimum requirements for input/output, communication, and positioning are built into the CPU module, and so far relatively small-scale control, functions can be compactly implemented while keeping the system cost low. *Built-in functions: Input/output, CC-Link, Ethernet (*3), and data logging* | A variety of Q series function modules are available. Function modules can be added according to the specifications of connected devices to support various applications. *Many types of function modules are available* |

*1 Load distribution: A method of using multiple CPU modules to share processing in case a heavy load is concentrated on one CPU module.
*2 Function distribution: A method used for minimizing the area affected by a fault. It involves dividing the processing into units of functions such as the production line, packing line, sequence, and positioning.
*3 Ethernet is a registered trademark of Xerox Corp.

The same GX Works2 software for development and maintenance is used for both the L and Q series controllers.

# 1.3    Features of MELSEC-L Series

**Combine different modules to fit the application**

At bare minimum, a power supply, CPU module and an end cover are required for every L-Series system.
The system functionality can be expanded by connecting additional modules to suit the application.
Because there is no base unit, all space can be used effectively because there are no unused slots.

Place the mouse cursor over the components below  for additional information.

Display unit
(optional)

Power supply
module
(required)

RS-232 adapter
(optional)

CPU module
(required)

I/O module or intelligent
function module
(optional)

END cover
(required)

SD memory card (optional)
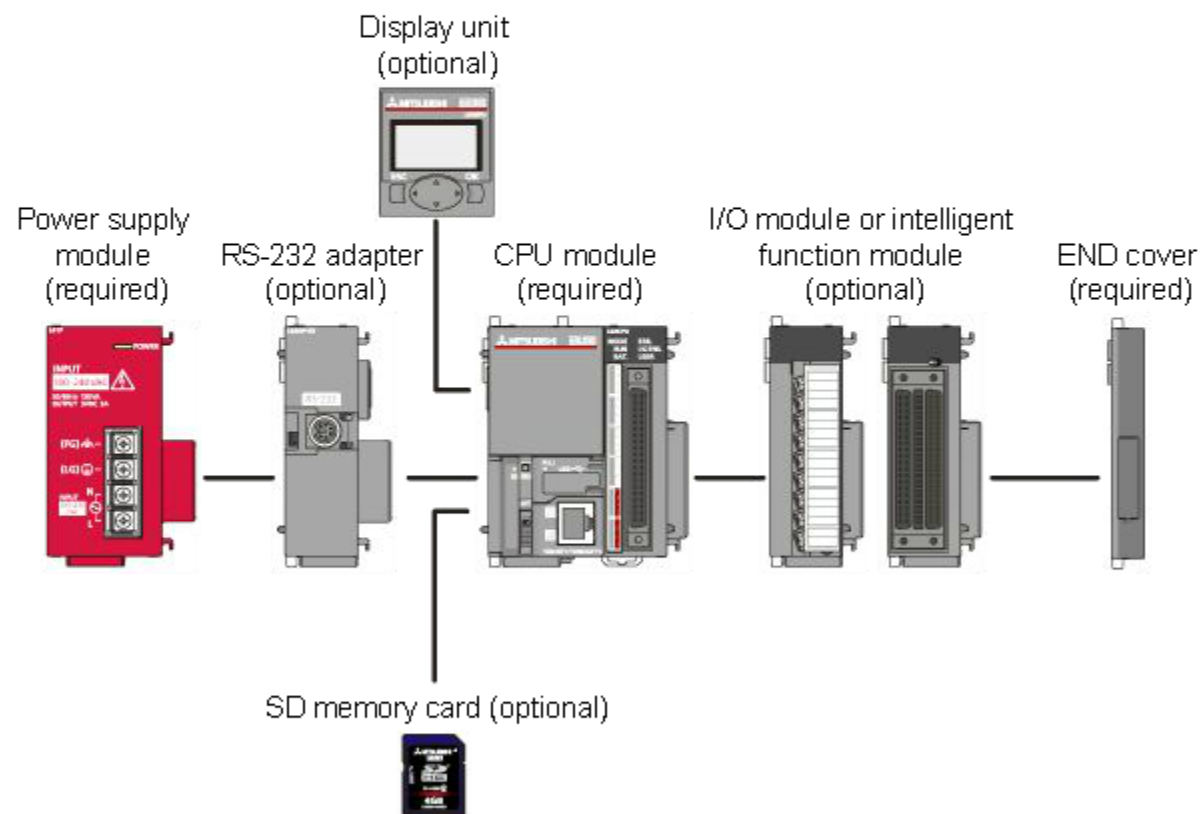
# 1.3 Features of MELSEC-L Series

## Make use of the built-in functions to configure a compact system

MELSEC-L Series CPU modules include many built-in features to provide immediate solutions for common requirements. The fact that these features are integrated with the CPU means that the need for separate modules can be eliminated, thereby saving space and resulting in a compact system.

### Built-in Ethernet function

Ethernet

Hub

Vision sensor

GX Works2    GX Works2    GOT

### Built-in I/O function

General-purpose input function    Interrupt input function    Pulse catch function

General-purpose output function    High-speed counter function    Positioning function

### Data logging function

Data collection is accomplished easily using simple settings.

Setting

Data can be saved to SD memory card in CSV format.

CSV format

### Built-in CC-Link function

CC-Link

* Only the L26CPU-BT includes built-in CC-Link.

# 1.4 Module Names and Functions

In this section, we will review the parts that make up the CPU modules, power supply modules, and I/O modules. Before putting an L-Series system together, it is beneficial to know these part names and their functions.

Let's start with the CPU module.

# 1.4.1 Part names of CPU module

Let's learn the names and applications of individual parts of the CPU module. If you place the mouse cursor in the following table or on a specific part of the CPU module drawings, the relevant areas are highlighted.
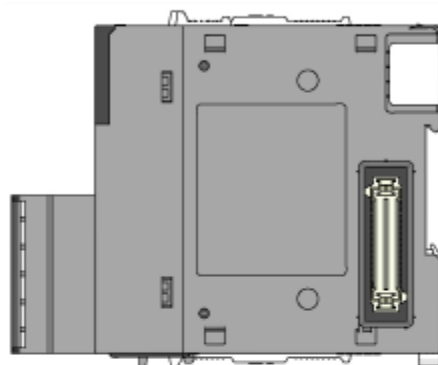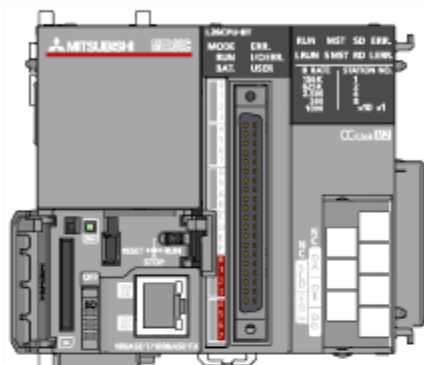
Battery holder (bottom surface)

| Name | Application |
|---|---|
| LED part | Indicates the operating status or error status of the CPU module. |
| RUN/STOP/RESET switch | Used to control the operating status of the CPU module. |
| USB connector | Used to connect USB peripheral devices. |
| Connector for external device | Used to connect an I/O signal cable from external equipment. |
| Module joint levers | Used for connecting two modules. |
| Battery | Provides backup power for backing up data in the standard RAM and latch devices in case of a power failure. |
| Battery connector pin | Used for connecting a lead wire for the battery. (The lead wire is disconnected from the connector at the factory to protect the battery during shipping.) |
| DIN rail hook | Used to mount the modules on the DIN rail. |

# 1.4.2 Part names of power supply module

Let's learn the names and applications of individual parts of the power supply module.
If you place the mouse cursor in the following table or on a specific part of the power supply module drawings, the relevant areas are highlighted.
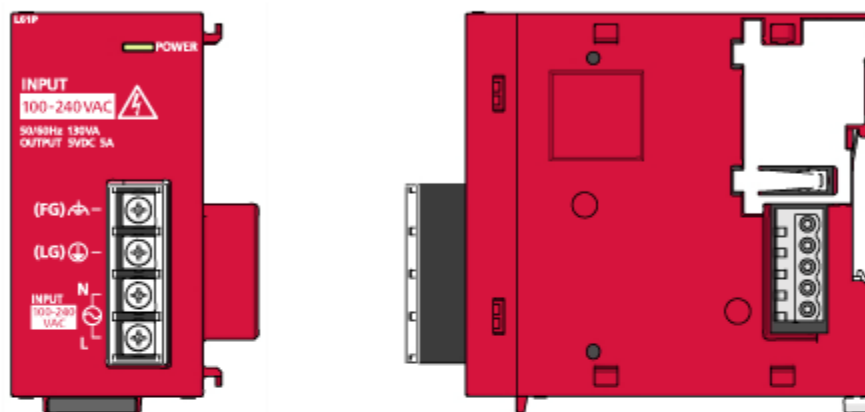
| Name | Application |
|---|---|
| POWER LED | Indicates the operating status of the power. |
| FG terminal | A ground terminal connected to the shielded pattern on the printed circuit board |
| LG terminal | A ground terminal for the power filter. For AC input, it has half the potential of the input voltage. |
| Power input terminal | Power input terminal |
| DIN rail hook | Used to mount the module on the DIN rail. |

## 1.4.3 Part names of I/O module

Let's learn the names and applications of individual parts of the I/O module.
If you place the mouse cursor in the following table or on a specific part of the I/O module drawings, the relevant areas are highlighted.

40-pin connector type    18-point screw terminal block type
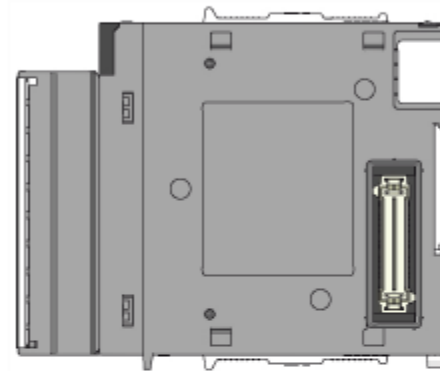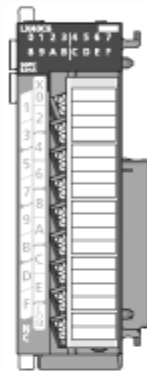
| Name | Application |
|------|-------------|
| I/O operation status indicator LEDs | Indicate the ON/OFF status of I/O operations. |
| Connector for external device | Used to connect an I/O signal cable from external equipment. |
| Terminal block | Used to connect I/O signal cables to/from external equipment. |
| Terminal cover | Protects against electric shock when turning on the power. |
| Module joint levers | Used for connecting two modules. |
| DIN rail hook | Used to mount the modules on the DIN rail. |

# 1.5 Sequence Program Development and Maintenance

The PLC engineering software GX Works2 is used for developing and maintaining MELSEC series PLC programs. The same GX Works2 software is used for both the MELSEC-L and -Q series.

By connecting a personal computer in which GX Works2 is installed to the CPU module through a USB or LAN cable, you can develop programs, verify operations, write to the CPU module, confirm the module status, and collect error history information.

In this course, you will learn how to initialize the CPU module (Section 5.6) and check wiring (Chapter 7) by using GX Works2.

Personal computer

GX Works2

CPU module

USB or LAN cable
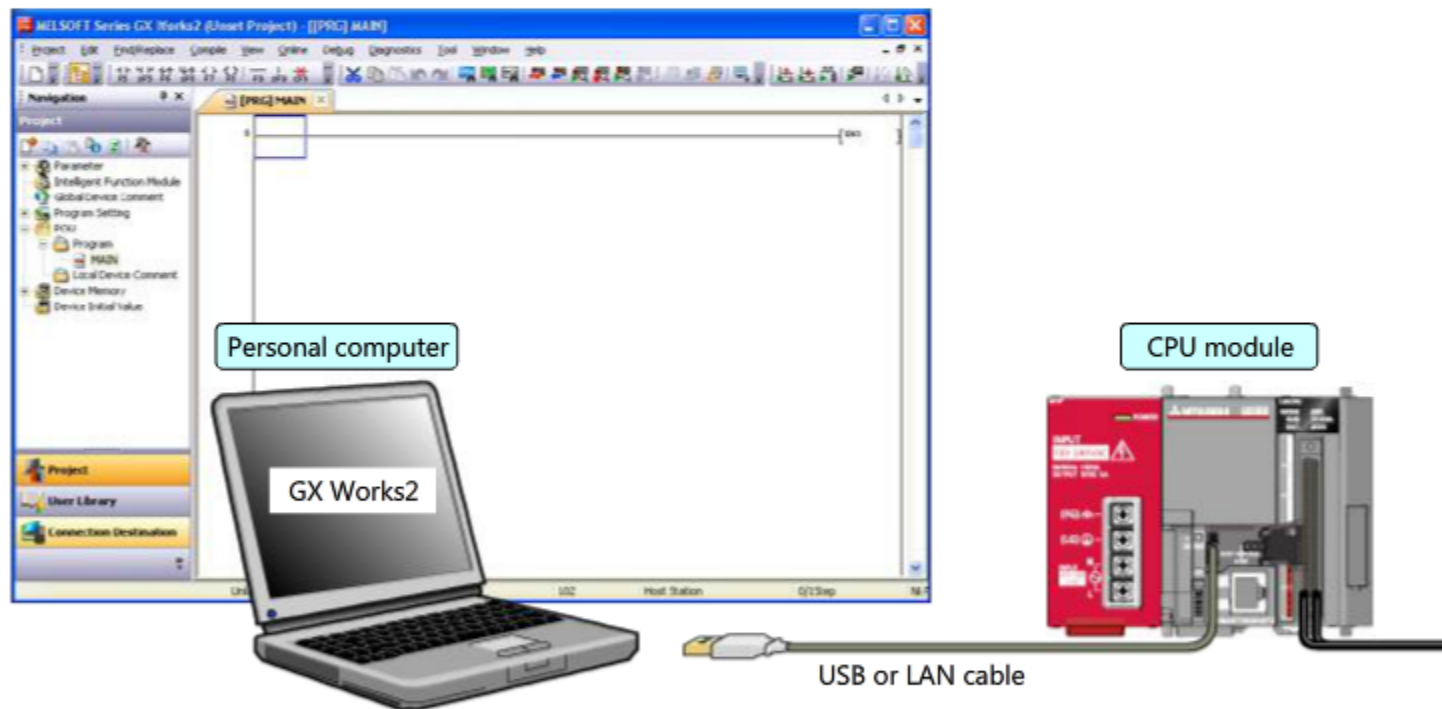
# Chapter 2  PLC System Construction Procedure

This chapter describes the procedures for constructing a programmable controller (PLC) system.
In this course, you will learn the hardware designing procedure as part of the system construction procedure.

**Hardware design**

| (1) System design | ............................................ Chapter 3 |

↓

| (2) Product selection | ........................................ Chapter 4 |

↓

| (3) Advance preparation | ................................. Chapter 5 |

↓

| (4) Installation and wiring | ........................... Chapter 6 |

↓

| (5) Wiring check | ..................................... Chapter 7 |

**Scope of this course**

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**Software design**

| (6) Program design | ...... GX Works2/GX Developer Basics Course |

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| (7) Programming | ...... GX Works2/GX Developer Basics Course |

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| (8) Debugging | ...... GX Works2/GX Developer Basics Course |

↓

| (9) Operation |

# 2.1 Hardware Configuration of Example System Used for Learning

In this course, you will construct a PLC system (called "example system" hereafter), which starts the robot according to a procedure. A diagram of the hardware configuration of the example system is shown below with a list of hardware components.
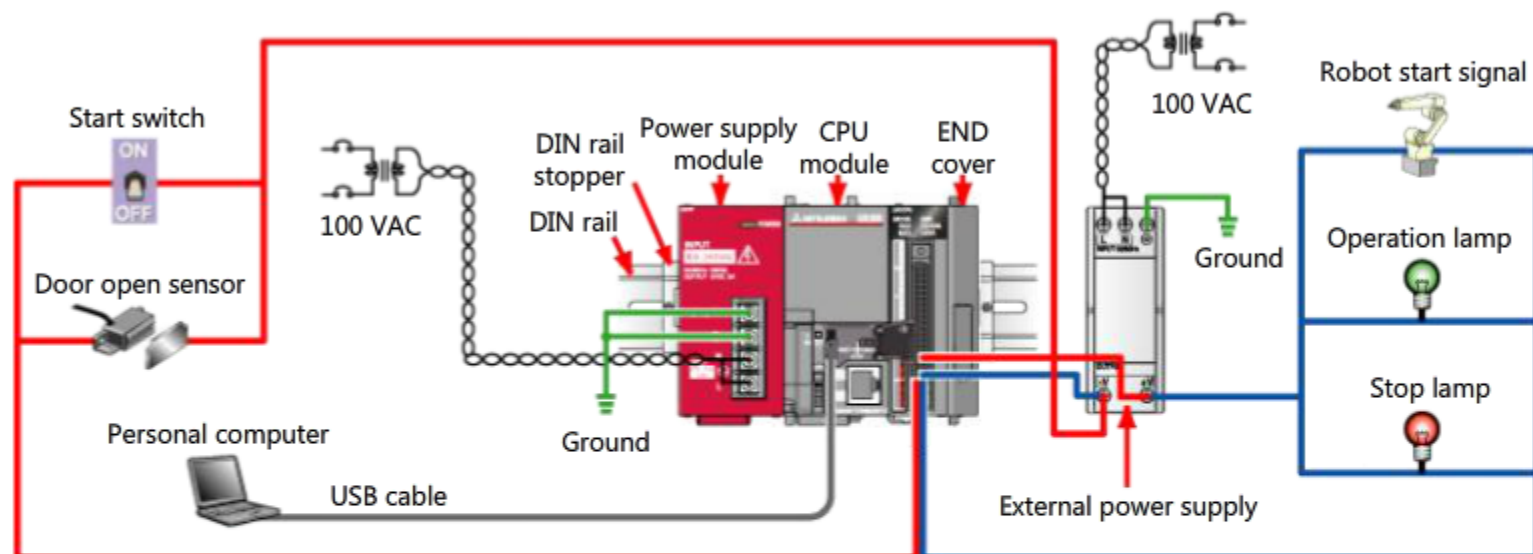


| Item | Component | Model | Description |
|------|-----------|-------|-------------|
| PLC system | Power supply module | L61P | Supplies power to modules including the CPU module and I/O module. |
| | CPU module | L02CPU | Controls the PLC system. |
| | END cover | L6EC | Mounted on the right end of the stacked modules. |
| | USB cable | MR-J3USBCBL3M | Connects the personal computer, in which GX Works2 is installed, to the CPU module. |
| | Personal computer | — | Runs with GX Works2 installed. |
| External power supply | — | — | Supplies power to external I/O equipment. |
| External I/O equipment | Switch | — | Set to ON to start control. |
| | Sensor | — | Detects whether the door is open or closed. |
| | Robot | — | Operates in accordance with control signals. |
| | Two lamps | — | Light according to the operation status. |

# Chapter 3 System Design

In this chapter, you will learn how to determine control items and examine the necessary I/O specifications and number of I/O points.

| | |
|---|---|
| System Design ························ Chap.3 | |
| ↓ | |
| Product Selection ···················· Chap.4 | |
| ↓ | |
| Advance Preparation ················ Chap.5 | |
| ↓ | |
| Installation and Wiring ············· Chap.6 | |
| ↓ | |
| Wiring Check ························· Chap.7 | |
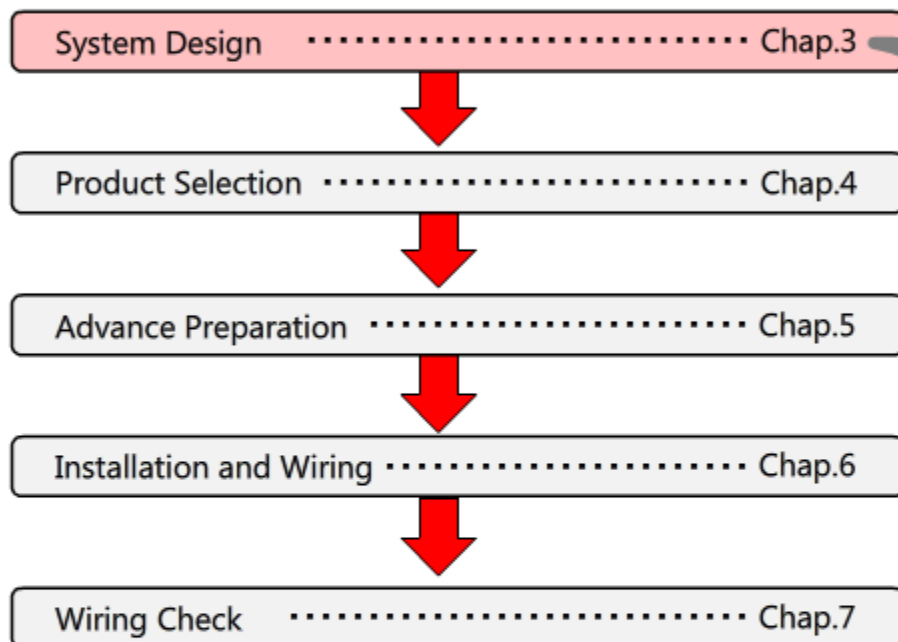
**Learning steps in Chapter 3**

3.1 Defining Control Items
3.2 Examining the Necessary I/O Specifications and Number of I/O Points

# 3.1 Defining Control Items

One of the first steps to designing a system is to identify what needs to be controlled.
In this example system, the starting and stopping of a robot is controlled.
When the door to the safety fence is open the robot is prevented from starting, and when the door is opened during operation, is it s stopped.

**Example system operation**　　　　　　　　　◯ Click inside the red circle

Robot control panel

Operation lamp

ON

OFF

Stop lamp

Robot in the safety fence

Door open sensor: OFF
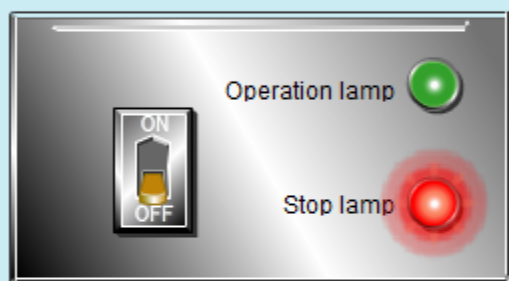
Robot start signal: OFF
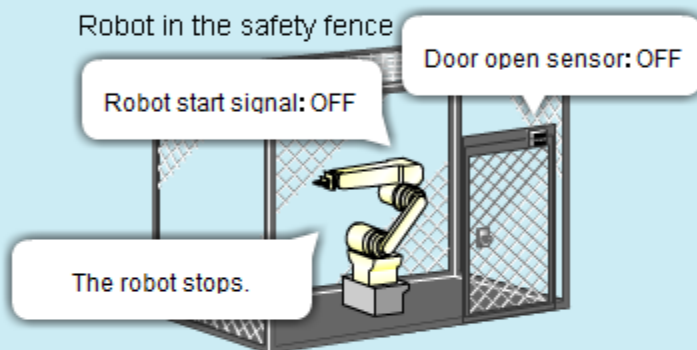
The robot stops.

When you set the start switch to OFF, the robot start signal turns off to stop robot operation.
Simultaneously, the operation lamp on the control panel turns off, and the stop lamp turns on.

Replay

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# 3.2 Examining the Necessary I/O Specifications and Number of I/O Points

Next, consider the necessary I/O specifications and number of I/O points.
According to the control items in Section 3.1, select the I/O specifications and number of I/O points as shown below.

| Name | Input specification | Output specification |
|---|---|---|
| Start switch | 24 VDC ON/OFF input: 1 point | — |
| Door open sensor | 24 VDC ON/OFF output: 1 point | — |
| Robot start signal | — | 24 VDC transistor output: 1 point |
| Operation lamp | — | 24 VDC transistor output: 1 point |
| Stop lamp | — | 24 VDC transistor output: 1 point |

Number of input points: 2

Number of output points: 3

# Chapter 4 Product Selection

In Chapter 4, you will learn how to select products (I/O modules, CPU module, and power supply module).

System Design ................................ Chap.3

Product Selection ............................. Chap.4

Advance Preparation ......................... Chap.5

Installation and Wiring ...................... Chap.6

Wiring Check ................................. Chap.7
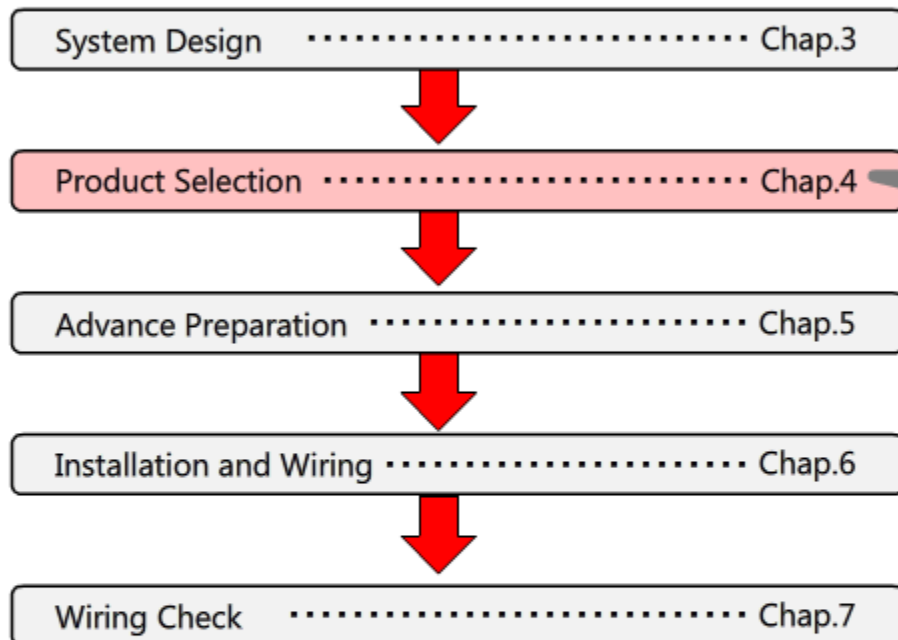
**Learning steps in Chapter 4**

4.1 Selecting the Types and Number of I/O Modules

4.2 Selecting a CPU Module Suitable for Control Requirements

4.3 Selecting a Power Supply Module for Operating All Selected Modules

# 4.1 Selecting the Types and Number of I/O Modules

In factories, 24 VDC is commonly used as a power supply for sensors and valves.

The I/O specifications you confirmed in Section 3.2 are as follows:

(1) Input: 24 VDC ON/OFF input: 2 points

(2) Output: 24 VDC transistor output: 3 points

These specifications can be satisfied sufficiently with the I/O devices built into the CPU module (L02CPU or L26CPU-BT) as shown in the following table.

| Module | Module model | Input specification | | Output specification | |
|---|---|---|---|---|---|
| | | Rated input voltage | Number of input points | Rated load voltage | Number of output points |
| CPU module (built-in I/O) | L02CPU | 24 VDC | 16 points | 5 to 24 VDC | 8 points |
| | L26CPU-BT | 24 VDC | 16 points | 5 to 24 VDC | 8 points |

If the number of I/O points built into the CPU module, input voltage specification, or load current specification is not sufficient in the actual system, add an I/O module.

## 4.2 Selecting a CPU Module Suitable for Control Requirements

The L-Series CPU specifications are listed in the table below.
Choose which CPU is appropriate for the application based on the number of required I/O points, program capacity, and processing speed.

For the example system described in chapter 3, the number of necessary I/O points is 5 and the program size should be less than 1k steps. Accordingly, the L02CPU is sufficient.

(1)  Number of I/O points

    1)  Number of input points: 2

    2)  Number of output points: 3

    Total: 5 points

(2)  Program capacity

    1k steps or less

### L-Series CPU Specifications

The L02CPU specifications are shown in light grey.

| Module model | Processing speed | Number of I/O points | Built-in CC-Link function | Program capacity |
|---|---|---|---|---|
| L02CPU | 40ns | 1,024 points | No | 20k steps |
| L26CPU-BT | 9.5ns | 4,096 points | Yes | 260k steps |

# 4.3 Selecting a Power Supply Module for Operating All Selected Modules

The specifications of power supply modules are listed in the table below.
To select a power supply module, check whether the following two conditions are satisfied.

(1) Specifications of the power supply for a PLC system

| 100 to 240 VAC | or | 24 VDC | → | In the example system, commercial 100 VAC power is used. Therefore, the L61P is chosen. |

(2) The power consumption of all modules must not exceed the rated output current.
   To calculate the system's maximum power consumption, add the power consumption of CPU module, I/O modules, and the end cover.

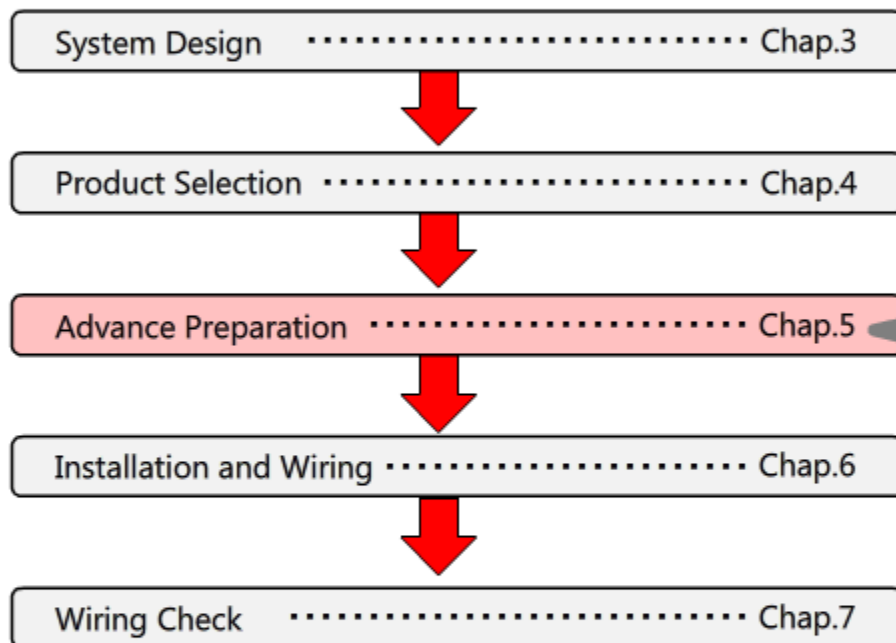| CPU module (L02CPU) Power consumption **0.94 A** | **+** | I/O module Power consumption **0 A (not used)** | **+** | END cover Power consumption **0.04 A** | **=** | Power consumption of all modules 0.98 A $\leqq$ Rated output current (5 A) |

## L-Series power supply specifications

The L61P specifications are shown in light grey.

| Module model | Input power | Rated output current (5 VDC) |
|---|---|---|
| L61P | 100 to 240 VAC | 5 A |
| L63P | 24 VDC | 5 A |

# Chapter 5 Advance Preparation

In Chapter 5, you will learn the advance preparation to be made before installation and wiring.
The advance preparation includes confirming individual modules, mounting the modules, wiring the power supply module, verifying that power can be turned on normally, and initializing the CPU module.

| | |
|---|---|
| System Design | Chap.3 |
| Product Selection | Chap.4 |
| Advance Preparation | Chap.5 |
| Installation and Wiring | Chap.6 |
| Wiring Check | Chap.7 |

**Learning steps in Chapter 5**

5.1  Procedure for Advance Preparation
5.2  Confirming Individual Modules
5.3  Mounting Modules
   5.3.1  Connecting the Battery
   5.3.2  Assembling Modules
   5.3.3  Mounting Modules on the DIN Rail
   5.3.4  Assigning I/O Numbers
5.4  Wiring the Power Supply Module
5.5  Checking the Power Supply
5.6  Initializing the CPU Module
   5.6.1 Connecting the CPU Module to the Personal Computer
   5.6.3 Setting Up the Connection between GX Works2 and PCL System
5.6.3  Formatting Memory

# 5.1 Procedure for Advance Preparation

Perform advance preparation before installation and wiring as follows.

```
(1) Confirming Individual Modules (Section 5.2)
    Visually check the modules you purchased for any damage.
```

⬇

```
(2) Assembling Modules (Section 5.3)
```

⬇

```
(3) Wiring the Power Supply Module (Section 5.4)
```

⬇

```
(4) Checking the Power Supply (Section 5.5)
```

⬇

```
(5) Initializing the CPU Module (Section 5.6)
    Format the memory in the personal computer using GX Works2.
```

# 5.2 Confirming Individual Modules

Unpack the product package and check for missing components by referring to "Checking Bundled Items" in the manual that came with the product. Next, visually check each component for any damage.

## 1. Checking Bundled Items

Check that the product package contains all of the following items before using the product.

(1) L02CPU



CPU module (L02CPU) + END cover (L6EC)
(A dummy cover for the display unit is attached.)

This manual

Battery (Q6BAT)
(installed in the CPU module)

Battery replacement data stickers to fill out
(three stickers on one sheet)

Assemble the modules according to the following procedure.

| |
|---|
| (1) Connecting the Battery (Section 5.3.1) |

↓

| |
|---|
| (2) Assembling Modules (Section 5.3.2) |

↓

| |
|---|
| (3) Mounting Modules on the DIN Rail (Section 5.3.3) |

# 5.3.1 Connecting the Battery

The battery is used to back up clock data, error history, etc. stored in memory in the CPU module. The purchased product is delivered with the power connector of the battery disconnected from the CPU module; be sure to connect it, otherwise the data in memory will be lost when the PLC power is turned off. In some cases, even the main program could be lost depending on the type of CPU module.

Connect the battery according to the following procedure. (To make it easier, connect the battery before mounting the CPU module.)

(1) Open the cover at the bottom of the CPU module.

↓

(2) Confirm the directions of the connectors, and insert the battery side connector into the CPU module side connector.

↓

(3) Close the cover at the bottom of the CPU module.

↓

Complete

CPU module side connector

(2)

Battery side connector
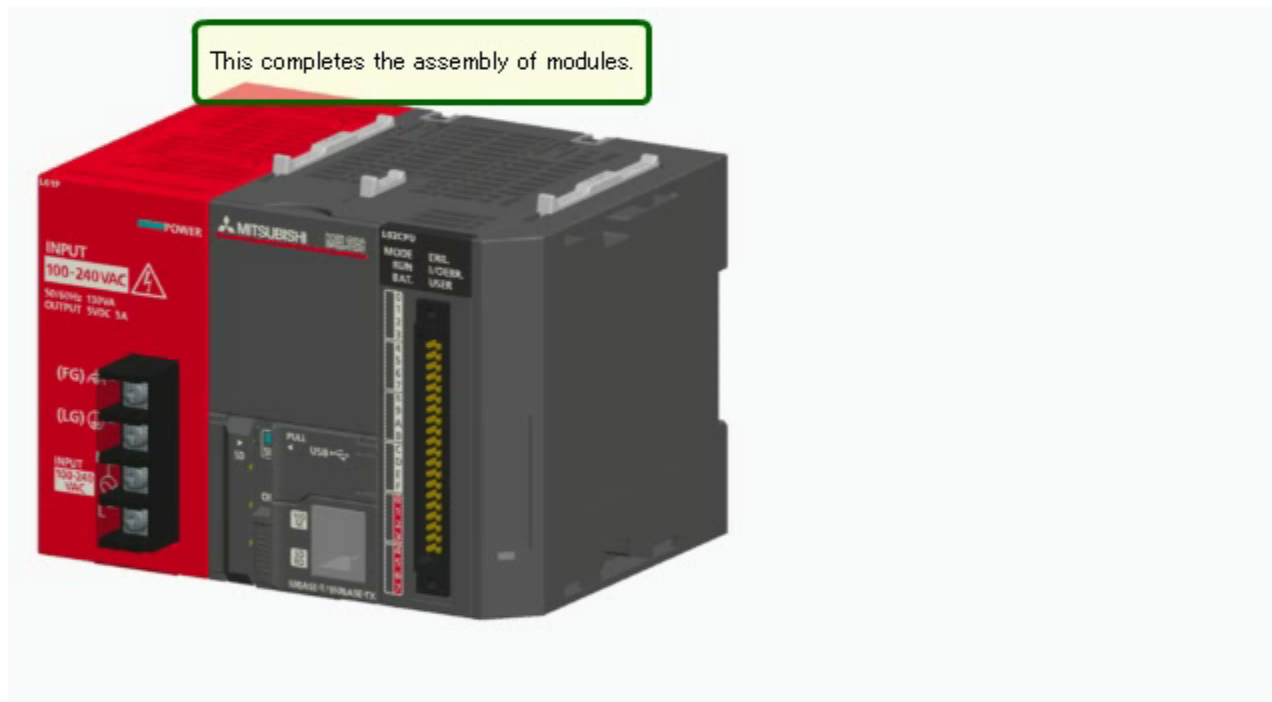
(3)

(1)

Battery

CPU module
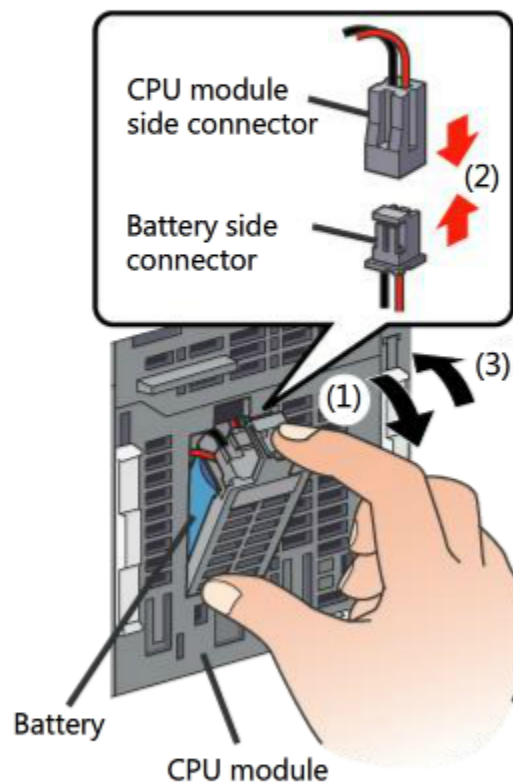
# 5.3.2 Assembling Modules

Because the MELSEC-L series programmable controller does not use a base unit, assemble the modules by joining them to each other. The END cover must be attached as the last step.

Assemble the modules according to the following procedure.

This completes the assembly of modules.

(Duration: 00:29)

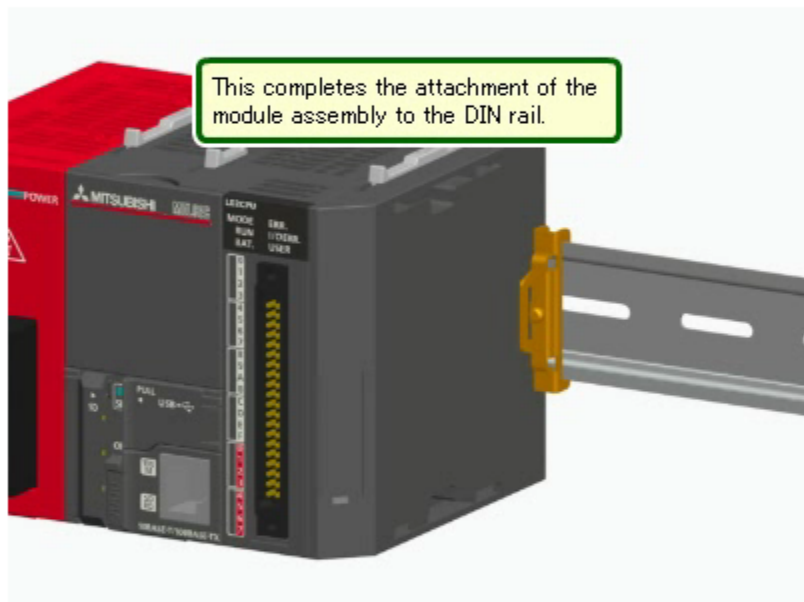# 5.3.3 Mounting Modules on the DIN Rail

After assembling the modules, mount them on the DIN rail.
Be sure to attach the DIN rail stoppers on both ends of the module assembly to prevent module vibration.

Mount the modules on the DIN rail as follows.



This completes the attachment of the module assembly to the DIN rail.

(Duration: 01:40)

# 5.3.4 Assigning I/O Numbers

You will learn how to assign I/O numbers required for the CPU module to send data to, or receive data from, an I/O module.
When the LO2CPU is used, I/O numbers are assigned by default as shown below.

| Assigned to | Input number | Output number |
|---|---|---|
| Internal I/O | X00 to X0F | Y00 to Y07 |
| Module at the right side of the CPU module | X10 and after* | Y10 and after* |

These numbers are assigned when the LO2CPU is used.
When the L26CPU-BT is used, X30 and after are assigned to input and Y30 and after are assigned to output.

The table below shows the I/O correspondence for the example system.
Creating a correspondence table reduces program errors (device number input errors) and improves programming efficiency.

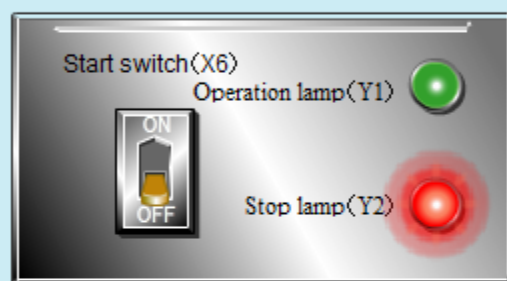| I/O device name | Device No. | I/O type | Description |
|---|---|---|---|
| Start switch | X6 | Input | This switch starts or stops robot operation. |
| Door open sensor | X7 | Input | This sensor checks whether the door of the safety fence of the robot is open. When the door opens, the sensor turns on. When the door closes, the sensor turns off. |
| Robot start signal | Y0 | Output | When this signal turns on, the robot starts operation. |
| Operation lamp | Y1 | Output | This lamp lights while the robot is operating. |
| Stop lamp | Y2 | Output | This lamp lights while the robot is stopped. |

# 5.3.4 Assigning I/O Numbers

The example system to which a device number has been added is shown below.

**Example system operation**                    Click inside the red circle

Robot control panel

Start switch(X6)
Operation lamp(Y1)
ON
OFF
Stop lamp(Y2)

Robot in the safety fence

Door open sensor(X7) : OFF

Robot start signal(Y0) : OFF
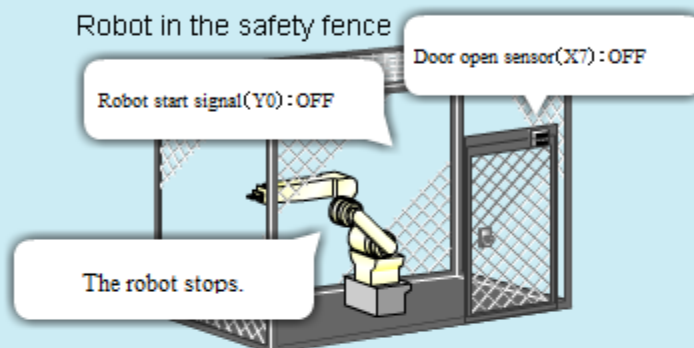
The robot stops.

When you set the start switch (X6) to OFF, the robot start signal (Y0) turns off to stop robot operation. Simultaneously, the operation lamp (Y1) on the control panel turns off, and the stop lamp (Y2) turns on.

Replay

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# 5.4 Wiring the Power Supply Module

Connect the power and ground lines as seen in the following diagram.
Grounding is necessary to prevent electrical shocks, malfunctions, and noise interference.

(1) Connect the 100 VAC power supply to the power input terminal via the circuit breaker and isolation transformer.

(2) Ground the LG and FG terminals.



Power supply module (L61P)

L61P
POWER
INPUT
100-240VAC
50/60Hz 130VA
OUTPUT 5VDC 5A

AC
100 VAC

(2)FG
(2)LG
(1) INPUT
100 to 240 VAC

Grounding wire
Ground
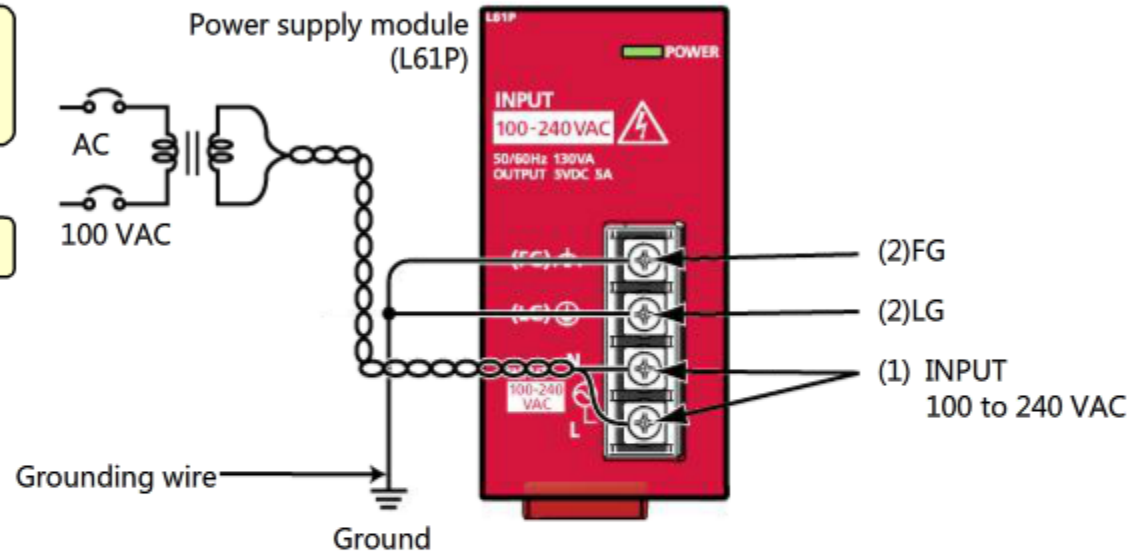
# 5.5 Checking the Power Supply

Use the following procedure to determine if the system is operating normally when powered on.

(1) Before turning on the power, double check the following:
• The power supply is wired correctly
• The supply voltage matches the power supply input voltage

↓

(2) Set the CPU module to STOP.
Open the front cover of the CPU module and set the switch to STOP.

↓

(3) Power on the system
Close the circuit breaker allowing the supply power to enter the power supply module.

↓

(4) Check that the power supply is working normally.
1) The green POWER LED on the power supply module is illuminated.
2) The red ERR. LED on the CPU module is flashing.
(When the CPU module is powered on but parameters have not yet been written, the ERR. LED will flash but this is not a problem at this time.)

RESET/STOP/RUN

(1)          (2)
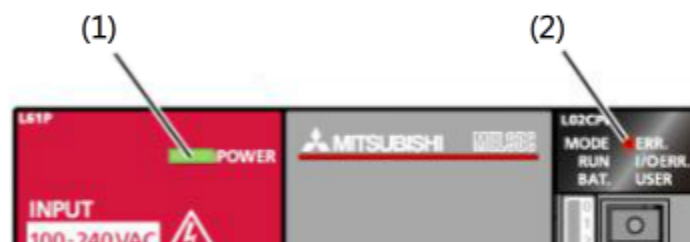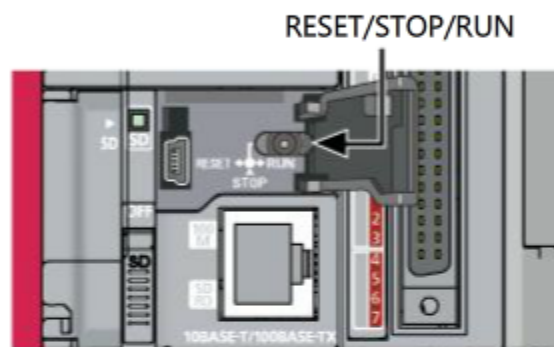
# 5.6 Initializing the CPU Module

Sequence programs and parameters are written to the memory in the CPU module.
The memory is not ready to use when it is purchased; you need to format (initialize) the memory so it can be used.

You can format memory using the PLC engineering software GX Works2. For this operation, the CPU module must be connected to a personal computer via a USB cable. Before formatting, install GX Works2 in a personal computer and have a USB cable ready.

Format the memory according to the following procedure.

(1) Connecting the CPU Module to the Personal Computer (Section 5.6.1)

⬇

(2) Setting Up the Connection between GX Works2 and Programmable Controller (Section 5.6.2)

⬇

(3) Formatting Memory (Section 5.6.3)

# Connecting the CPU Module to the Personal Computer

Connect the USB cable between the CPU module and the USB port of the personal computer.

Personal computer

CPU module

USB cable

# 5.6.2 Setting Up the Connection between GX Works2 and PLC System

After connecting the CPU module to the personal computer, set up the connection between GX Works2 and the PLC system.
Note that communication cannot be performed by only connecting the devices with the USB cable.

Use [Transfer setup] to set up the connection.
On the next page, try performing the transfer setup using the simulated window.
An example of the Transfer Setup window is shown below.

**MELSOFT Series GX Works2 (Unset Project) - [[PRG] MAIN]**

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

**Navigation**

**Connection Destination**

**Current Connection**
- Connection1

**All Connections**
- Connection1

**Project**

**User Library**

**Connection Destination**

[PRG] MAIN

0 ────────────────────────────────────────[ END ]

Transfer Setup is completed.

Click ▶ to proceed.

Unlabeled | L02 | Host Station | 0/1Step

# 5.6.3 Formatting Memory

Upon completion of the transfer setup, GX Works2 is ready to communicate with the CPU module. Continue to format the memory in the CPU module using [Format PLC Memory] of GX Works2.

On the next page, try performing [Format PLC Memory] using the simulated window.

An example of the Format PLC Memory window is shown below.

**Format PLC Memory**

Connection Channel List

Connection Interface | USB | <--> | PLC Module

Target PLC   Network No. 0   Station No. Host   PLC Type L02

Target Memory | Program Memory ▼ |

Format Type

⦿ Do not create a user setting system area (the required system area only)

◯ Create a user setting system area

High speed monitor area from other station | 0 | K Steps
(0--15K Steps)

Online change area of multiple blocks | 0 ▼ | K Steps

Execute          Close

MELSOFT Series GX Works2 (Unset Project) - [[PRG] MAIN]

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

**Navigation**

**Project**

- Parameter
- Intelligent Function Module
- Global Device Comment
- Program Setting
- POU
  - Program
    - MAIN
  - Local Device Comment
- Device Memory
- Device Initial Value

[PRG] MAIN

0                   [END ]

**Project**

**User Library**

**Connection Destination**

The PLC memory is now formatted.

Click   ▶|   to proceed.

Unlabeled         L02         Host Station         0/1Step

# Chapter 6 Installation and Wiring

In Chapter 6, you will learn how to install and wire each module.

| | |
|---|---|
| System Design ································· Chap.3 | |
| ↓ | |
| Product Selection ······························ Chap.4 | |
| ↓ | |
| Advance Preparation ·························· Chap.5 | |
| ↓ | |
| Installation and Wiring ······················ Chap.6 | |
| ↓ | |
| Wiring Check ································· Chap.7 | |
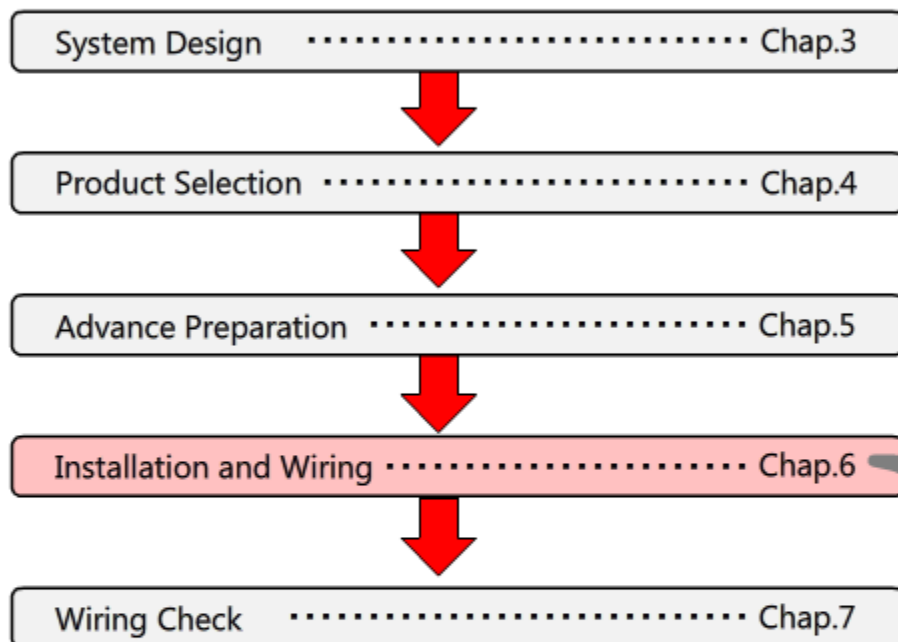
**Learning steps in Chapter 6**

6.1 Installation Environment
6.2 Installation Position
6.3 Grounding
6.4 Wiring I/O Modules

# 6.1 Installation Environment

Do not install the system in a location subject to the environmental conditions listed below.
Installing and operating the system in such locations could result in electrical shock, fire, malfunction, product damage, or product deterioration.

1. Temperature and humidity
   - A location where the environmental temperature is outside the range of 0 to 55° C (32 to 131° F)
   - A location where the environmental humidity is outside the range of 5 to 95%
   - A location where rapid temperature changes could cause condensation

2. Atmosphere
   - A location affected by corrosive gas or flammable gas
   - A location with a lot of dust, a conductive powder such as iron powder, oil mist, salt, or organic solvent

3. Noise
   - A location subject to strong radio frequency interference (RFI)  or electro magnetic interference (EMI).

4. Vibration and impact
   - A location where vibration or impact is applied directly to the product

5. Location
   - A location where the product is in direct sunlight

## 6.2 Installation Position

To keep the area well-ventilated and to facilitate module replacement, secure the following distances above and below the modules and between structures and components. Depending on the system configuration used, larger distances than shown below may be needed.

30 mm or more

30 mm or more

50 mm or more

50 mm or more

PLC system

Panel

Door

20 mm or more
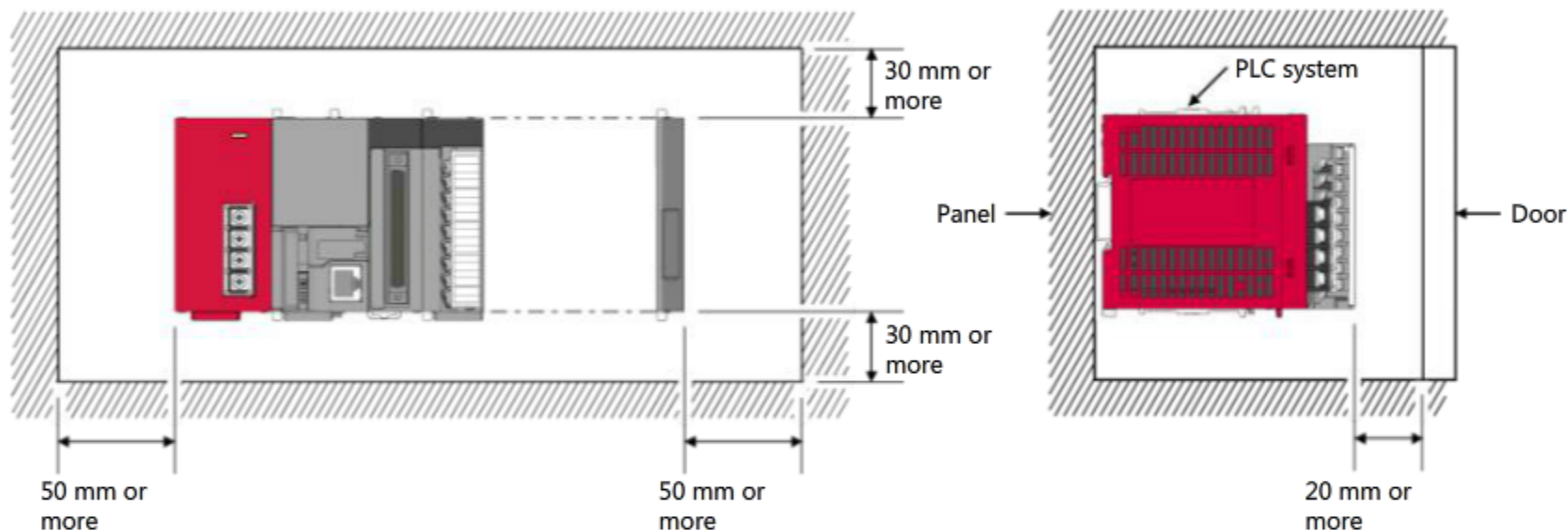
## 6.3 Grounding

To prevent electrical shock and malfunction, observe the following for grounding.

- Provide independent grounding wherever possible. (Grounding resistance: 100Ω or less)
- If independent grounding cannot be provided, provide shared grounding using grounding wires of the same length.
- Bring the grounding point as close to the programmable controller as possible so that the grounding wire can be shortened.
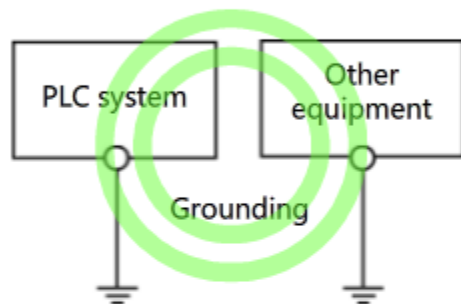


(1) Independent grounding:
    Recommended
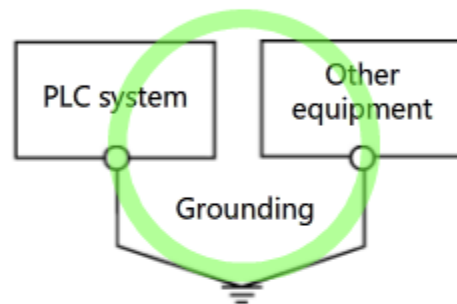
(2) Shared grounding:
    Allowed
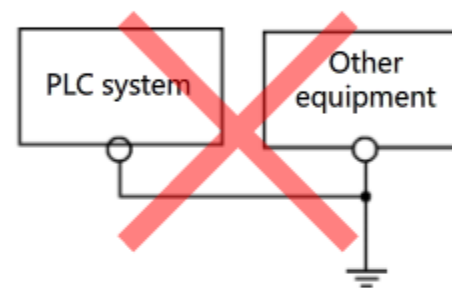
(3) Common grounding:
    Not allowed

# 6.4 Wiring I/O Modules

The CPU's built-in I/O uses a standard connector plug.
Wire the connections to the appropriate pins of an A6CON1 connector and plug it into the CPU's built-in I/O socket.
Use the diagram below to connect the start switch (X6), door open sensor (X7), robot start signal (Y0), operation lamp (Y1), and stop lamp (Y2).



External device connector
(model: A6CON1)

The pin assignments of the flat cable connector are as follows (viewed from the connector insertion side).

Door open sensor (X7)

Operation lamp (Y1)

Output common

Input common
Start switch (X6)

Robot start signal (Y0)
Stop lamp(Y2)

External power supply

Output common

Start switch (X6)

Door open sensor (X7)

Input common

Robot start signal (Y0)

Operation lamp (Y1)

Stop lamp (Y2)

# Chapter 7 Wiring Check

Before you start programming, you must check whether the wiring is done correctly.
In this chapter, you will learn how to check input signals and output signals.

| | |
|---|---|
| System Design | Chap.3 |

↓

| | |
|---|---|
| Product Selection | Chap.4 |

↓

| | |
|---|---|
| Advance Preparation | Chap.5 |

↓

| | |
|---|---|
| Installation and Wiring | Chap.6 |

↓

| | |
|---|---|
| Wiring Check | Chap.7 |
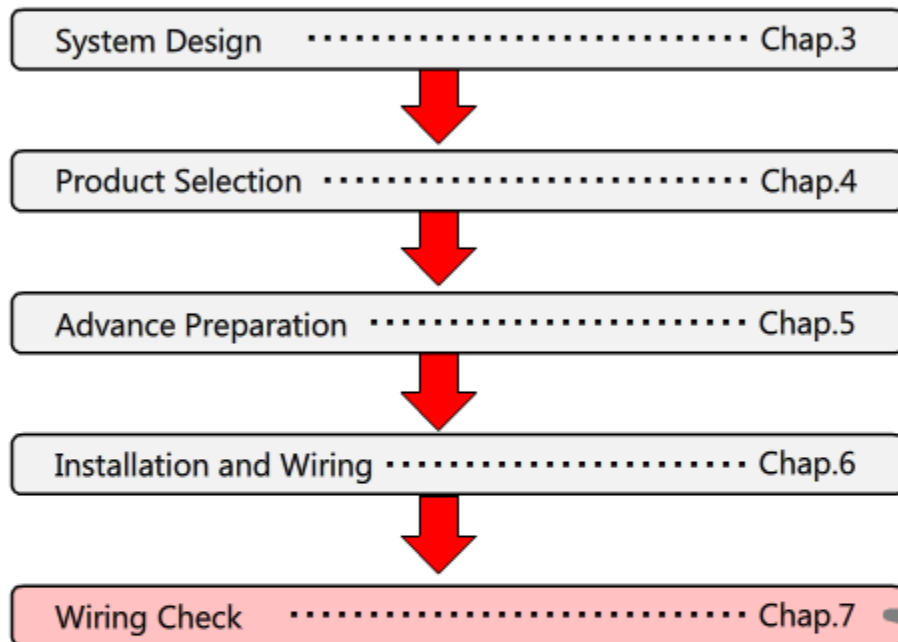
**Learning steps in Chapter 7**

7.1 Checking Input Signals
7.2 Checking Output Signals

# 7.1　Checking Input Signals

First, visually check the I/O wiring to ensure there is no problem.
Next, check the input signal wiring using [Device/buffer memory batch monitor] of GX Works2.

[Device/buffer memory batch monitor] enables real-time monitoring of the status (ON or OFF) of the specified range of devices.
On the next page, try the device/buffer memory batch monitor using the simulated window.

An example of the device/buffer memory batch monitor window is shown below.

| Device | |
|---|---|
| X6 | 0 |
| X7 | 0 |
| X8 | 0 |
| X9 | 0 |
| X0A | 0 |
| X0B | 0 |
| X0C | 0 |
| X0D | 0 |
| X0E | 0 |
| X0F | 0 |
| X10 | 0 |
| X11 | 0 |
| X12 | 0 |
| X13 | 0 |
| X14 | 0 |
| X15 | 0 |
| X16 | 0 |
| X17 | 0 |

**MELSOFT Series GX Works2 (Unset Project) - [Device/Buffer Memory Batch Monitor-1]**

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

[PRG] MAIN    Device/Buffer Memory Bat...

**Navigation**

**Project**

- Parameter
- Intelligent Function Module
- Global Device Comment
- Program Setting
- POU
  - Program
    - MAIN
  - Local Device Comment
- Device Memory
- Device Initial Value

**Project**

**User Library**

**Connection Destination**

**Device**

( ) Device Name  X6        T/C Set Value Reference Program        Reference...

( ) Buffer Memory  Module Start        (HEX)  Address        DEC

**X6 and all subsequent input devices are displayed.**

ve Display Format...

| Device | |
|--------|---|
| X6 | 0 |
| X7 | 0 |
| X8 | 0 |
| X9 | 0 |
| X0A | 0 |
| X0B | 0 |
| X0C | 0 |
| X0D | 0 |
| X0E | 0 |
| X0F | 0 |
| X10 | 0 |
| X11 | 0 |
| X12 | 0 |
| X13 | 0 |
| X14 | 0 |
| X15 | 0 |
| X16 | 0 |
| X17 | 0 |

Preparation for checking input signals is now completed.

Click ▶ to proceed.

Unlabeled        L02        Host Station

# 7.1     Checking Input Signals

After completing the preparation for the device/buffer memory batch monitor, check the input signal wiring as follows.

(1) Turn on the start switch (X6) and door open sensor (X7). Click the start switch and door open sensor in the figure below.

(2) Using [Device/buffer memory batch monitor], confirm that the devices corresponding to the start switch (X6) and door open sensor (X7) turn on (1 is displayed in the window).

**Input**        **PLC system**

Start switch(X6)
ON
OFF

Door open sensor(X7)
OFF
(door closed)

**Device**

- ● Device Name | X6 | ▼    T/C Set Value Reference
- ○ Buffer Memory | Module Start | ▼ (HEX)

[ Modify Value... ] [ Display Format... ] [ Open Display Format... ] [ S

| Device | |
|--------|---|
| X6 | 0 |
| X7 | 0 |
| X8 | 0 |
| X9 | 0 |
| X0A | 0 |
| X0B | 0 |
| X0C | 0 |
| X0D | 0 |
| X0E | 0 |
| X0F | 0 |
| X10 | 0 |
| X11 | 0 |
| X12 | 0 |
| X13 | 0 |
| X14 | 0 |
| X15 | 0 |
| X16 | 0 |

> Tthe start switch is OFF (0).

> The door open sensor is OFF (0).

# 7.2 Checking Output Signals

Next, using [Forced input output registration/cancellation], check the output signal wiring.

[Forced input output registration/cancellation] allows you to forcibly change the status (ON or OFF) of each device from GX Works2. On the next page, try the forced input output registration/cancellation using the simulated window.

An example of the forced input output registration/cancellation window is shown below.

**Forced Input Output Registration/Cancellation**

Device

[ Register FORCE ON ] [ Cancel Registration ]

[ Register FORCE OFF ]

| No. | Device | ON/OFF | No. | Device | ON/OFF |
|-----|--------|--------|-----|--------|--------|
| 1 | Y0 | ON | 17 | | |
| 2 | Y1 | ON | 18 | | |
| 3 | Y2 | ON | 19 | | |
| 4 | | | 20 | | |
| 5 | | | 21 | | |
| 6 | | | 22 | | |
| 7 | | | 23 | | |
| 8 | | | 24 | | |
| 9 | | | 25 | | |
| 10 | | | 26 | | |
| 11 | | | 27 | | |
| 12 | | | 28 | | |
| 13 | | | 29 | | |
| 14 | | | 30 | | |
| 15 | | | 31 | | |
| 16 | | | 32 | | |

[ Update Status ] [ Batch Cancel Registration ] [ Close ]

# 7.2 Checking Output Signals

MELSOFT Series GX Works2 (Unset Project) - [[PRG] MAIN]

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

## Navigation

### Project

- Parameter
- Intelligent Function Module
- Global Device Comment
- Program Setting
- POU
  - Program
    - MAIN
  - Local Device Comment
- Device Memory
- Device Initial Value

**Project**

**User Library**

**Connection Destination**

### Forced Input Output Registration/Cancellation

Device

[ Register FORCE ON ]  [ Cancel Registration ]

[ Register FORCE OFF ]

| No. | Device | ON/OFF | No. | Device | ON/OFF |
|-----|--------|--------|-----|--------|--------|
| 1 | Y0 | ON | 17 | | |
| 2 | Y1 | ON | 18 | | |
| 3 | Y2 | ON | 19 | | |
| 4 | | | 20 | | |
| 5 | | | 21 | | |
| 6 | | | 22 | | |
| 7 | | | 23 | | |
| 8 | | | 24 | | |
| 9 | | | 25 | | |
| 10 | | | 26 | | |
| 11 | | | 27 | | |
| 12 | | | 28 | | |
| 13 | | | 29 | | |
| 14 | | | 30 | | |
| 15 | | | 31 | | |
| 16 | | | 32 | | |

[ Update Status ]  [ Batch Cancel Registration ]

Preparation for checking output signals is now completed.

Click ▶ to proceed.

0

END

Unlabeled     L02     Host Station     0/1Step

## 7.2 Checking Output Signals

After completing the preparation for the forced input output registration/cancellation, check the output signal wiring as follows.

(1) Using [Forced input output registration/cancellation], turn on devices Y0, Y1, and Y2.

(2) Confirm that the robot start signals turn on for the respective devices Y0, Y1, and Y2, and the operation lamp and stop lamp light. Double-click the ON/OFF field corresponding to a device number.

### Forced Input Output Registration/Cancellation
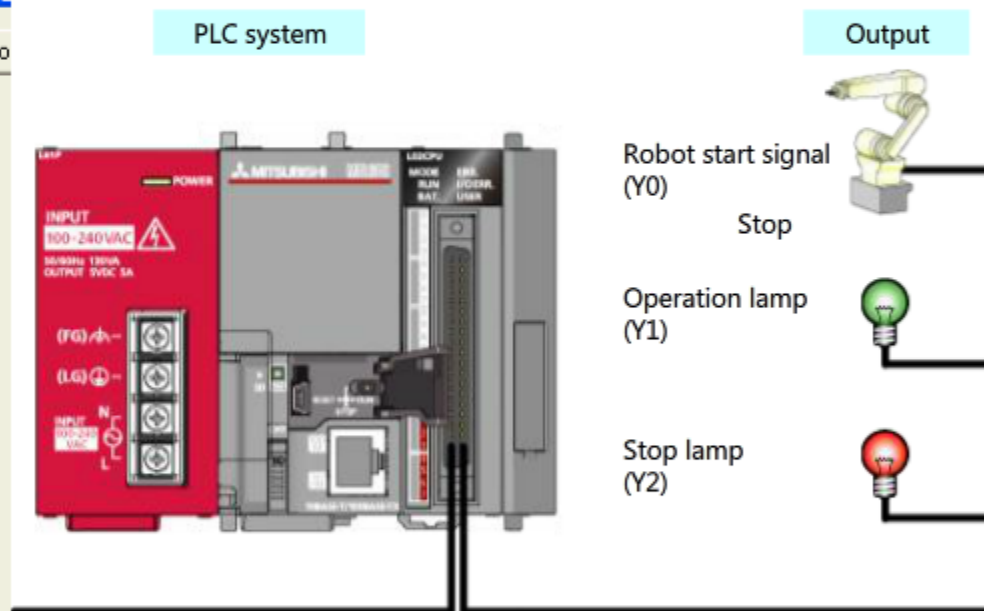
Device

[ Register FORCE ON ]  [ Cancel Registratio ]

[ Register FORCE OFF ]

| No. | Device | ON/OFF | No. | Device | ON/OFF |
|-----|--------|--------|-----|--------|--------|
| 1 | Y0 | OFF | 17 | | |
| 2 | Y1 | OFF | 18 | | |
| 3 | Y2 | OFF | 19 | | |
| 4 | | | 20 | | |
| 5 | | | 21 | | |
| 6 | | | 22 | | |
| 7 | | | 23 | | |
| 8 | | | 24 | | |
| 9 | | | 25 | | |
| 10 | | | 26 | | |
| 11 | | | 27 | | |
| 12 | | | 28 | | |
| 13 | | | 29 | | |
| 14 | | | 30 | | |
| 15 | | | 31 | | |
| 16 | | | 32 | | |

PLC system

Output

Robot start signal (Y0)

Stop

Operation lamp (Y1)

Stop lamp (Y2)

# 7.3 Conclusion

This completes the hardware setup of the MELSEC-L series PLC system.

In this course, you have learned:

- How to setup the hardware
- How to prepare the system so that programs can be written
- L-Series systems can be configured using built-in functions to create a compact system
- The modules are connected directly to one another so that no space is wasted
- By using the built-in I/O connections, a small control system can be created without the need for additional modules

Having completed this course, you now need to study the following course to be able to use the PLC system :

GX Works2 Basics Course : Learn programming, debugging, and writing to the CPU module.

# Test    Final Test

Now that you have completed all of the lessons of the PLC MELSEC-L 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 4 questions (11 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 :     2

Total Questions :     9

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

Percentage :     22%

| Proceed | Review | Retry |

- 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.

Select the built-in functions of the L-Series CPU module.
Check all boxes that apply.

☐ I/O function

☐ Analog I/O function

☐ Ethernet function

☐ CC-Link IE function

[ Answer ]    [ Back ]

# Test    Final Test 2

Select the correct steps for constructing a PLC system.

Step 1  System design

Step 2 ( Q1 [ --Select--     ▼ ] )

Step 3 ( Q2 [ --Select--     ▼ ] )

Step 4 ( Q3 [ --Select--     ▼ ] )

Step 5  Saving projects

[ Answer ]    [ Back ]

## Test    Final Test 3

Select the correct steps for advance preparation before installing the PLC system and wiring.

Step 1  Confirming individual modules

Step 2 ( Q1 [ --Select-- ▼ ] )

Step 3 ( Q2 [ --Select-- ▼ ] )

Step 4 ( Q3 [ --Select-- ▼ ] )

Step 5  Initializing the CPU module

[ Answer ]    [ Back ]

# Test    Final Test 4

Fill in the blanks to complete the explanation of how to ground the PLC system.

Provide ( --Select-- ▼ ) wherever possible.

If ( --Select-- ▼ ) cannot be provided, provide

( --Select-- ▼ ) using grounding wires all of

the same length.

Make the grounding point ( --Select-- ▼ ).

Answer      Back

# Test

## Test Score

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

Correct answers : **0**

Total questions : **4**

Percentage : **0%**

| Proceed | Review | Retry |

# You failed the test.

You have completed the PLC MELSEC-L 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