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ML200 Installation and Commissioning Guide

EPDOC-X366-en-431A
R431.1
December 2014

Release 431.1

Honeywell

Notices and Trademarks

Release 431.1 – December 2014

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About This Document

This document describes the procedures to install and turn on Master Logic 200 PLCs and their associated modules.

Release Information

Document Name	Release Number	Publication Date
ML200 Installation and Commissioning Guide	431.1	December 2014

Document Category
Installation and Upgrades

Acronyms and Definitions

Acronym/Term	Definition
Base	The back plane of the PLC on which the power supply, communication, and other modules are installed. Examples: Main base and expansion base.
CPU	Central Processing Unit
Dnet	DeviceNet Interface
FEnet	Fast Ethernet Network
FO	Fiber-Optic
I/O	Input/Output
IEC	International Electrotechnical Commission
ML	MasterLogic
Module	A standard component with a specific function to configure a system, such as the I/O board assembled that must be inserted into the base motherboard. Examples: CPU module, power module, and I/O module.
PLC	Programmable Logic Controller
PLC System	A system consisting of a PLC, CPU, modules and peripherals configured to be controlled by a user program.
Pnet	Profibus-DP Network.
PSU	Power Supply Unit
RAM	Random Access Memory
Snet	Serial Link Network
SoftMaster	Programming tool for creating, editing, and debugging a program.
STP	Shielded Twisted Pair
TP	Twisted Pair cables (typically CAT5 cables with RJ45 connectors for Ethernet communication.)
UTP	Unshield Twisted Pair

Support and Other Contacts

https://www.honeywellprocess.com/en-US/contact-us/customer-support-contacts/Pages/default.aspx

Symbol Definitions

The following table lists those symbols used in this document to denote certain conditions.

Symbol	Definition
	**ATTENTION:** Identifies information that requires special consideration.
	**TIP:** Identifies advice or hints for the user, often in terms of performing a task.
	**REFERENCE -EXTERNAL:** Identifies an additional source of information outside of the bookset.
	**REFERENCE - INTERNAL:** Identifies an additional source of information within the bookset.
CAUTION	Indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process.
	**CAUTION**: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. **CAUTION** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
	**WARNING**: Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or death. **WARNING** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.

Contents

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1. Masterlogic components

1.1 Types of CPUs

The following are the types of CPUs of the MasterLogic-200 PLC system.

- Non redundant PLCs
  - 2MLI-CPUU
  - 2MLI-CPUH
  - 2MLI-CPUS
  - 2MLI-CPUS/P
- Redundant PLC
  - 2MLR-CPUH/T
  - 2MLR-CPUH/F

The following naming conventions are used across the document.

- 2MLI-CPUU, 2MLI-CPUH, and 2MLI-CPUS are represented as ML200-IEC.
- 2MLR-CPUH/T and 2MLR-CPUH/ F are represented as ML200R.

1.2 Types of power supply

The different types of voltages supported by ML200-IEC and ML200R are as follows:

- AC 110 V
- AC 220 V
- DC 24V

Power supplies for ML200-IEC

The following table lists the types of power modules for ML200-IEC.

Table 1: Power modules for ML200-IEC

Model Number	Specification
2MLP-ACF1	Free Voltage(AC 110V,220V)/DC5V, 3A, DC24V,0.6A

Model Number	Specification
2MLP-ACF2	Free Voltage(AC 110V,220V)/DC5V, 6A
2MLP-AC23	AC 220V/DC 5V, 8.5A
2MLP-DC42	DC 24V/DC 5V

Table 2: Power modules for 2MLI CPUS/P

Model Number	Specification
2MLR-AC12	Redundant power AC 110V, 5.5A
2MLR-AC22	Redundant power AC 220V, 5.5A
2MLR-AC13	Redundant power AC 110V, 8.5A
2MLR-AC23	Redundant power AC 220V, 8.5A
2MLR-DC42	Redundant power DC 24V, 7.5A

The specifications of the power modules for 2MLI CPUS/P and ML200R are the same. For more details, refer to *Table 5: Specifications of the power modules for ML200R*.

The following table lists the specifications of the power modules for ML200-IEC.

Table 3: Specifications of the power modules for ML200-IEC

Items		2MLP-ACF1	2MLP-ACF2	2MLP-AC23	2MLP-DC42
Input	Rated input voltage	AC 100V – AC 240V		AC 200V – AC 240V	DC 24V
	Input voltage range	AC 85V ~ AC 264V		AC 170V ~ AC 264V	-
	Input frequency	50 / 60 Hz (47 ~ 63 Hz)			-
	Inrush current	20 A peak or less			80A peak or less
	Efficiency	65% or more			60% or more
	Input fuse	Built-in (user no change), UL standard (Slow Blow Type)			

Items		**2MLP-ACF1**	**2MLP-ACF2**	**2MLP-AC23**	**2MLP-DC42**
	Allowable momentary shutdown	Within 20ms			
Output1	Output voltage	DC 5V (±2%)			DC5V (±2%)
	Output current	3.0A	6.0A	8.5A	6.0A
	Over current protect	3.2A or more	6.6A or more	9.0A or more	6.6A or more
	Over voltage protect	5.5V ~ 6.5V			
Output2	Output voltage	DC 24V (±10%)	-		-
	Output current	0.6A			
	Over current protect	0.7A or more			
	Over voltage protect	None			
Relay Output	Application	RUN contact (Refer to the section 8.3)			
	Rated switching voltage or current	DC 24V, 0.5A			
	Minimum switching load	DC 5V,1 mA			
	Response time	OFF→ON/ ON→OFF: 10 ms or less/12 ms or less			

Items		2MLP-ACF1	2MLP-ACF2	2MLP-AC23	2MLP-DC42
	Life	Mechanical: More than 20,000,000 times Electrical: More than 100,000 times at rated switching voltage/current			
RUN signal output		Relay output, Rating: DC24V, 0.5A			
Voltage indicator		Output voltage normal, LED ON			
Cable specification		0.75 ~ 2mm^2			
Compressed terminal		RAV 1.25 - 3.5, RAV 2 - 3.5			
Weight		0.4kg		0.6kg	0.5kg

ATTENTION

1. Allowable Momentary Power Failure Time: It is the time that the input voltage keeps normal output voltage (normal operation) in the state that AC 110/220V voltage is lower than the rated value (AC85/170V).
2. Over current protection: If the current is more than the standard and flows in DC 5V, DC 24V circuit, the over current protection device shuts down the circuit to stop the system. Remove the causes such as lack of current capacity or short circuits that leads to over current and then restart the system.
3. Over voltage protection: The over voltage protection device shuts down the circuit to stop the system, if the voltage is greater than the standard and is applied to the DC 5V circuit.

Power supplies for ML200R

ATTENTION

The main reason for using redundant power supply is that it has a component and the CPU checks this component for the status of power failure. This component is not available in a non-redundant power supply.

The following table provides the specifications of the power modules for ML200R.

Table 4: Power modules for ML200R

Model Number	Specification
2MLR-AC12	Redundant power AC 110V, 5.5A
2MLR-AC22	Redundant power AC 220V, 5.5A
2MLR-AC13	Redundant power AC 110V, 8.5A
2MLR-AC23	Redundant power AC 220V, 8.5A
2MLR-DC42	Redundant power DC 24V, 7.5A

The following table lists the specifications of the power modules for ML200R.

Table 5: Specifications of the power modules for ML200R

Items		2MLR-AC12	2MLR-AC22	2MLR-AC13	2MLR-AC23	2MLR-DC42
Input	Rated input voltage	AC 110V	AC 220V	AC 110V	AC 220V	DC24V
	Input voltage range	AC 85V ~ AC 132V	AC 176V ~ AC 264V	85V~132V AC	176V~264V AC	19.2~28.8V DC
	Input frequency	50 / 60 Hz (47 ~ 63Hz)				-
	Maximum input power	110VA/42W	176VA/72W			-
	Inrush current	20 A peak or less (below 8ms)				80A peak or lower
	Efficiency	65% or more				
	Input fuse	Built-in (not replaceable) : AC 250V/3.15A, UL standard (Time-lag Type) and DC power: 125V/10A (Time-lag type), UL-approved				
	Allowable momentary shutdown	Within 20ms				

Items		2MLR-AC12	2MLR-AC22	2MLR-AC13	2MLR-AC23	2MLR-DC42
Output1	Output voltage	DC 5V (±2%)				
	Output current	5.5A		8.5A		7.5A
	Over current protect	6.0A ~ 13.0A		9.3A ~ 17.0A		9.0 A~17.0A
	Output power	27.5W at 55℃		46.75W at 55℃		37.5W at 55℃
Relay Output	Application	RUN contact				
	Rated switching voltage or current	DC 24V, 0.5A				
	Minimum switching load	DC 5V,1mA				
	Response time	OFF→ON/ ON→OFF: 10ms or less/12ms or less				
	Life	Mechanical: More than 20000000 contacts Electrical: More than 100000 contacts at rated switching voltage/current				
RUN signal output		Relay output, Rating: DC24V, 0.5A				
Voltage indicator		Output voltage normal, LED ON				
Cable specification		0.75 ~ 2mm^2				
Compressed terminal		RAV 1.25 - 3.5, RAV 2 - 3.5				

Items	2MLR-AC12	2MLR-AC22	2MLR-AC13	2MLR-AC23	2MLR-DC42
Dimension (W x H x Dmm)	55 x 95 x 90		55 x 95 x 110		
Weight	326g	382g	334g	384g	417g

1.3 Types of modules

The following are the different types of modules supported for ML200 IEC and ML200R.

- Input/Output module
- Special module
- Communication module

Input/Output module

The following table provides details about the different types of input and output modules.

Table 6: Types of I/O modules

Item	Type	Description
Digital input module	2MLI-D21A	DC 24V input, 8 points (current source/sink input)
	2MLI-D22A	DC 24V input, 16 points (current source/sink input)
	2MLI-D24A	DC 24V input, 32 points (current source/sink input)
	2MLI-D28A	DC 24V input, 64 points (current source/sink input)
	2MLI-D22B	DC 24V input, 16 points (current source input)
	2MLI-D24B	DC 24V input, 32 points (current source input)
	2MLI-D28B	DC 24V input, 64 points (current source input)
	2MLI-A12A	AC 110V input, 16 points
	2MLI-A21A	AC 220V input, 8 points

Item	Type	Description
Digital output module	2MLQ-RY1A	Relay output, 8 points (2A, independent COM)
	2MLQ-RY2A	Relay output, 16 points (2A)
	2MLQ-RY2B	Relay output, 16 points (2A), built-in varistor
	2MLQ-TR2A	Transistor output, 16 points (0.5A, sink output)
	2MLQ-TR4A	Transistor output, 32 points (0.1A, sink output)
	2MLQ-TR8A	Transistor output, 64 points (0.1A, sink output)
	2MLQ-TR2B	Transistor output 16 points (0.5A, source output)
	2MLQ-TR4B	Transistor output 32 points (0.1A, source output)
	2MLQ-TR8B	Transistor output 64 points (0.1A, source output)
	2MLQ-SS2A	Triac output, 16 points (0.6A)

Special module

The following table provides the details about the different types of special modules.

Table 7: Types of special modules

Item	Type	Description
Analog input module	2MLF-AV8A	Voltage input, 8 channels
	2MLF-AC8A	Current input, 8 channels
	2MLF-AD8A	Voltage or current input, 8 channels
	2MLF-AD4S	Voltage or current input, 4 channels, Isolated
	2MLF-AD16A	Voltage or current input, 16 channels
Analog output module	2MLF-DV4A	Voltage output, 4 channels
	2MLF-DC4A	Current output, 4 channels
	2MLF-DC8A	Current output, 8 channels
	2MLF-DV8A	Voltage output, 8 channels

Item	Type	Description
	2MLF-DC4S	Current output, 4 channels, isolated
High speed counter module	2MLF-HO2A	Pulse input, 2 channels, open collector
	2MLF-HD2A	Pulse input, 2 channels, line drive
Temperature input module	2MLF-RD4A	RTD input, 4channels
	2MLF-RD4S	RTD input, 4channels, Isolated
	2MLF-TC4S	Thermocouple input, 4channels, Isolated
Event input module	2MLF-SOEA	Event input SOE, 32 channels

Communication module

The following table provides details about the different types of communication modules.

Table 8: Types of communication modules

Item	Type	Description
Snet	2MLL-C22A	Serial communication, RS-232C 2channels
	2MLL-C42A	Serial communication, RS-422 2channels
	2MLL-CH2A	Serial communication, RS-232C/RS-422 (1ch each)
Dnet	2MLL-DMEA	DeviceNet interface module
FEnet	2MLL-EFMT	Fast Ethernet, 100/100Mbps, RJ-45 (Electric)
	2MLL-EFMF	Fast Ethernet, 100/100Mbps, SC Type (Fiber Optic)
Pnet	2MLL-PMEA	Profibus, master, 12Mbps, DP Standard
	2MLL-PSEA	Profibus slave interface
	2MLL-PSRA	Profibus remote interface, DP standard

ATTENTION

The 2MLL-PSRA must be installed only on ML200-IEC CPU bases.

1.4 Types of base

The ML200-IEC and ML200R comprises of main base and expansion base.

ML200-IEC Main base

The main base of ML200-IEC consists of the power module, CPU module, I/O module, special module, and the communication module.

The following table lists the types of bases for ML200-IEC.

Table 9: Types of bases for ML200-IEC

PLC Types	Part Number	Description
2MLI-CPUH 2MLI-CPUS 2MLI-CPUU	2MLB-M04A	Main base 4 slot
	2MLB-M06A	Main base 6 slot
	2MLB-M08A	Main base 8 slot
	2MLB-M12A	Main base 12 slot
2MLI-CPUS/P	2MLR-M06P	Main base 6 slot
	2MLR-E08P	Main base 8 slot
	2MLR-E12P	Main base 12 slot

The following image illustrates the main base of ML200-IEC.

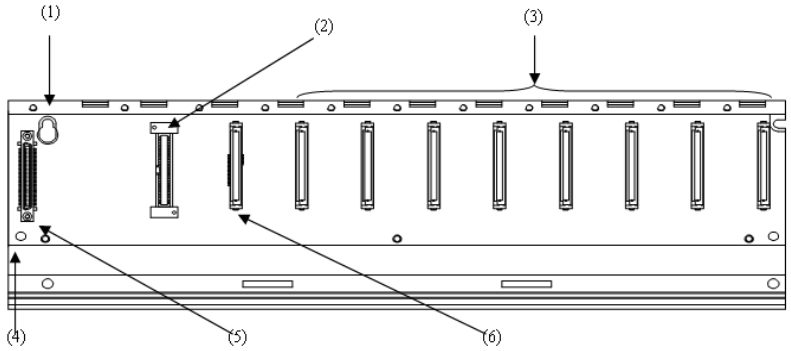


Figure 1: Main base of ML200-IEC

The following table lists the details of the main base.

Table 10: Details of main base

Index	Part	Function
1	Base attached guide hole	For attaching the main base to the panel in the control panel.
2	Power module connector	For installation of Power supply module.
3	Module built-in connector	For installation of I/O, special and other communication modules.
4	FG terminal	The ground terminal connected to the shielded pattern of the PCB board.
5	Expansion cable connector	Connects the main base (CPU base) with the expansion base.
6	CPU module connector	For installation of the CPU module.

ML200-IEC Expansion base

The expansion base consists of the power module, I/O module, special module, and the communication module.

ATTENTION

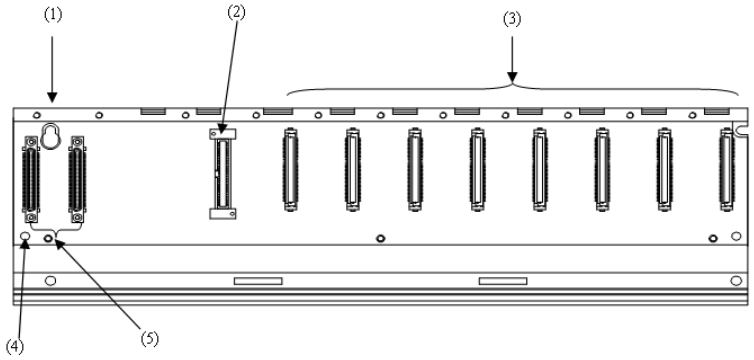
2MLI CPUS/P does not support the Expansion base.

The following table lists the types of expansion bases for ML200-IEC.

Table 11: Types of expansion bases for ML200-IEC

PLC types	Part number	Description
ML200-IEC	2MLB-E04A	Expansion base 4 slot
	2MLB-E06A	Expansion base 6 slot
	2MLB-E08A	Expansion base 8 slot
	2MLB-E12A	Expansion base 12 slot

The following image illustrates the expansion base of ML200-IEC.



The following table lists the details of the expansion base.

Table 12: Expansion base of ML200-IEC

Index	Part	Function
1	Base attached guide hole	For attaching the main base to the panel in the control panel.
2	Power module connector	I/O module built-in connector.
3	Expansion driver module connector	I/O module built-in connector
4	FG terminal	The ground terminal connected to the shielded pattern of PCB board.
5	Expansion cable connector	Connects the main base (CPU base) with the expansion base.

ML200R Main base

The main base of ML200R consists of the power module, CPU module, and the communication module (only Ethernet module is allowed in the main base).

The following table lists the types of bases for ML200R.

Table 13: Types of bases for ML200R

PLC types	Part number	Description
ML200R	2MLR-M02P	Main base 2 slot
	2MLR-M06P	Main base 6 slot

The following image illustrates the 2MLR-M02P.

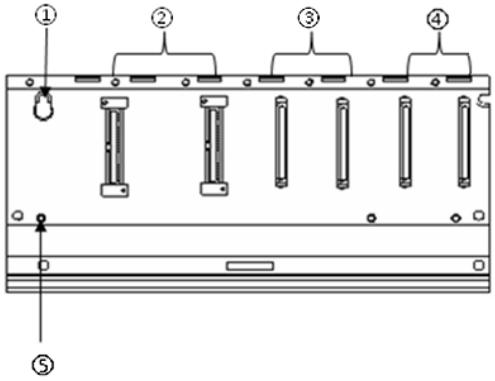


Figure 2: Main base of 2MLR-M02P

The following image illustrates the 2MLR-M06P.

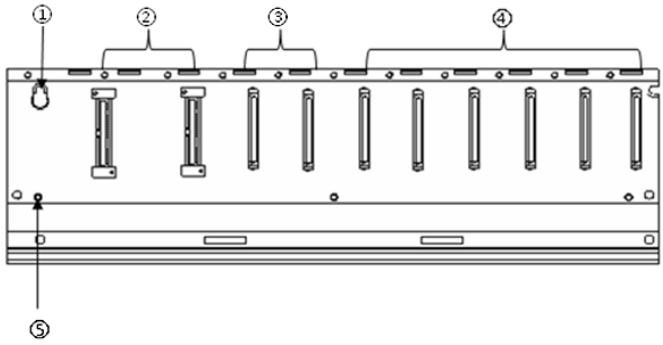


Figure 3: Main base of 2MLR-M06P

The following table provides the main base details of 2MLR-M02P and 2MLR-M06P.

Table 14: Main base details of 2MLR-M02P and 2MLR-M06P

Index	Part	Function
1	Base attached guide hole	For attaching the main base to the panel in the control panel.

Index	Part	Function
2	Power module connector	For installation of the Power supply module.
3	CPU module connector	For installation of the CPU module (2 slots).
4	Module built-in connector	For installation of the communication modules.
5	FG terminal	The ground terminal connected to the shielded pattern of the PCB board.

ML200R Expansion base

ML200R input/output base communication includes expansion base and expansion driver modules. The following are the two types of IO link topology for ML200R.

- Expansion base without dual IO link redundancy
- Expansion base with dual IO link redundancy

Expansion base without dual IO link redundancy

The expansion base of ML200R consists of the power module, expansion driver module, I/O module, special module, and the communication module. (Ethernet module is not allowed in the expansion base).

The following table provides details about the expansion base and expansion driver modules for ML200R.

Table 15: Expansion base and expansion driver module for ML200R

PLC types	Part number	Description
ML200R	2MLR-E08P	Expansion base 8 slot
	2MLR-E12P	Expansion base 12 slot
	2MLR-DBSF	Expansion driver module FO
	2MLR-DBST	Expansion driver module TP
	2MLR-DBSH	Expansion driver module TP/FO

The following image illustrates the expansion base of ML200R, which does not support dual I/O link redundancy.

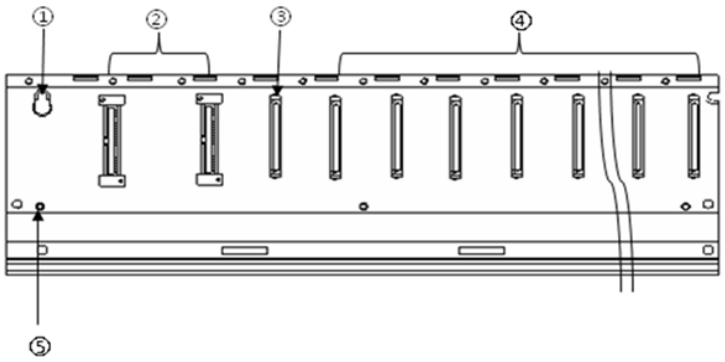


Figure 4: Expansion base of ML200R (without dual I/O link redundancy)

The following table provides the expansion base details of ML200R, without dual I/O link redundancy.

Table 16: Expansion base details of ML200R

Index	Part	Function
1	Base attached guide hole	For attaching the main base to the panel in the control panel.
2	Power module connector	For installation of power supply module.
3	Expansion driver module connector	For installation of expansion driver module.
4	Module built-in connector	For installation of I/O, special and communication modules other than Ethernet module.
5	FG terminal	The ground terminal connected to the shielded pattern of the PCB board.

Expansion base with dual IO link redundancy

The expansion base of ML200R consists of the power module, expansion driver module, I/O module, special module, and the communication module. (Ethernet module is not allowed in the expansion base).

The following table provides details about the expansion base and expansion driver module for ML200R (with dual IO link redundancy).

Table 17: Expansion base and expansion driver module for ML200R

PLC types	Part number	Description
ML200R	2MLR-E12H	Expansion redundancy Base 12 slot
	2MLR-DBDF	Expansion redundancy Driver module FO
	2MLR-DBDT	Expansion redundancy Driver module TP
	2MLR-DBDH	Expansion redundancy Driver module TP/FO

The following image illustrates the expansion base of ML200R, which supports dual I/O link redundancy.

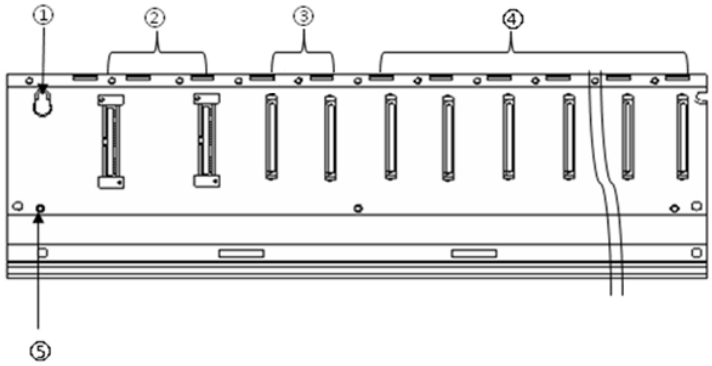


Figure 5: Expansion base of ML200R (with dual I/O link redundancy)

The following table provides the expansion base details of ML200R, with dual I/O link redundancy.

Table 18: Expansion base details of ML200R

Index	Part	Function
1	Base attached guide hole	For attaching the main base to the panel in the control panel.
2	Power module connector	For installation of power supply module.
3	Expansion redundancy drive module connector	For installation of expansion redundancy driver modules.
4	Module built-in connector	For installation of I/O, special and other

Index	Part	Function
		communication modules.
5	FG terminal	The ground terminal connected to the shielded pattern of the PCB board.

1.5 Types of cables

Cables for ML200-IEC

Expansion cable connection

The expansion cables contain high frequency noise. Therefore, to meet the CE conformance standards, attach a ferrite core to the expansion cable as illustrated in the following figure.

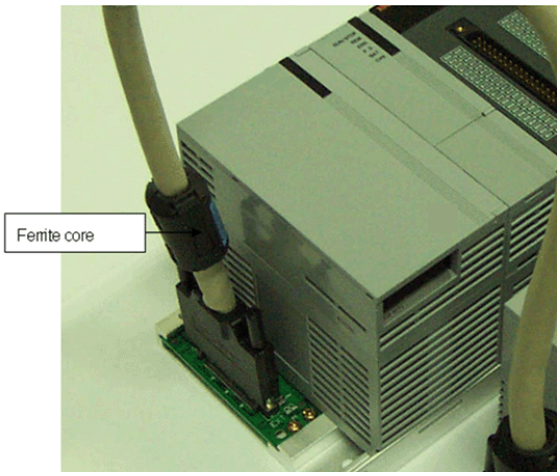


Figure 6: Expansion cable connection for ML200 IEC

Cables for ML200R

Expansion cable connection

Expansion cables are Ethernet cables used for connecting the main bases and expansion bases. The expansion cables are classified into the following two categories.

- Optical cable

- Ethernet cable

The electrical and optical cables are provided for use in accordance with the network type.

Optical cables

The communication between the optical cables is through Multi Mode Fiber (MMF) 50/65 um LC type cable. In ML200R systems, cables are used based on the installation site, indoor type, outdoor type, or conduit type.

ATTENTION

2MLC-F201 (Multimode Fiber Optic Cable, LC connector, 2.0m) is the synchronization cable part number used for ML200R.

The following figure illustrates the MMF (LC Type) optical cable.

Figure 7: MMF (LC Type) optical cable

Ethernet cables

The communication between the Ethernet cables is achieved through 100MB twisted pair cables. However, the data transmission in expansion cables is in 10s of micro units. As external noise affects the system performance and control, the Ethernet cables used in ML200R systems must be twisted pair cables such as UTP, FTP, STP, or FSTP cables. The twisted pair cables are known as Cat5 cables. The twisted pair cables are categorized on the following two criteria.

- **Shielding**: It is classified into three types. The following table lists the three types of twisted pair based on the shielding used.

Table 19: Types of twisted pair

Classification	Details	Purpose
Unshielded Twisted Pair (UTP)	Unshielded cable. Provides high-speed data transmission. Uses twisted pair copper cable. In addition, it is identified as U.UTP.	Maximum 200MHz Phonetic + Data + Low grade video signal.
Foiled Twisted Pair Copper Cable (FTP)	Only shielded cable core. Uses twisted pair copper cable. In addition, it is identified as S.UTP.	Maximum 100MHz electronic impediment (EMI) and electric stability considered Phonetic + Data + Low grade video signal.
Shielded (and Shielded Individual Pair) Twisted Pair Copper Cable (STPor)	Double-shielded cable. Shielded core as well as shielded individual cable pair. Uses twisted pair copper cable. In addition, it is identified as S.STP.	Maximum 500MHz Phonetic + Data + Video signal. Used as a substitute for 75Ω coaxial cable.

The following image illustrates the cross sections of the twisted pair cables.

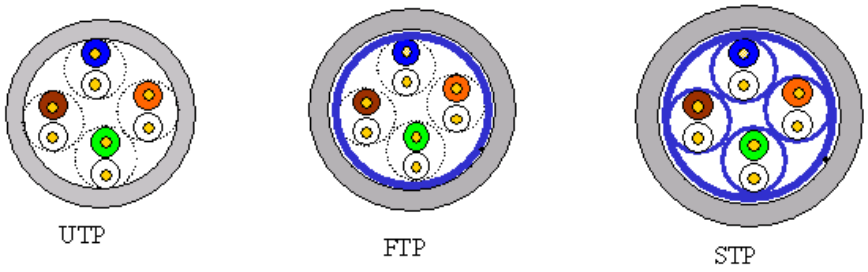


Figure 8: Cross sections of the twisted pair cables

The following two images illustrate the FTP and STP cables.

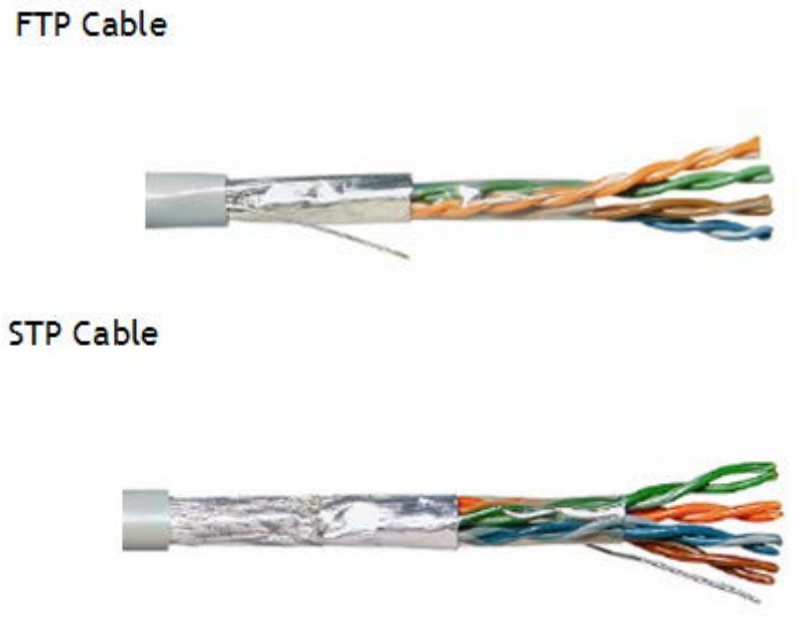


Figure 9: FTP and STP cables

- **Transmission frequency band**: Based on the frequency, the twisted cables are classified into the categories listed in the following table.

Classification	Frequency used (MHz)	Transmission speed (Mbps)	Usage
Category 1	Phonetic frequency	1	Phone network (2-Pair)
Category 2	4	4	Multi-pair communication cable
Category 3	16	16	Phone network + computer network
Category 4	20	20	Computer network transmission + low-loss communication cable
Category 5 and Enhanced Category 5	100	100	Digital phone network + computer network low-loss, and broadband cable

2. Calculating the power supply for components

2.1 Power module specifications

The following table lists the power specifications for all the modules within the PLC.

Table 20: Power specifications

Module	Types of Model	Current consumption (mA)
Non redundant CPU Module	2MLI-CPUU	960
	2MLI-CPUH	960
	2MLI-CPUS	940
	2MLI-CPUS/P	940
Redundant CPU Module	2MLR-CPUH/T	980
	2MLR-CPUH/F	1310
Expansion Driver Module	2MLR-DBST	550
	2MLR-DBSF	550
	2MLR-DBSH	550
	2MLR-DBDT	550
	2MLR-DBDH	550
	2MLR-DBDF	550
Digital Input Module (DC 24V)	2MLI-D21A	20
	2MLI-D22A	30
	2MLI-D22B	30
	2MLI-D24A	50
	2MLI-D24B	50
	2MLI-D28A	60
	2MLI-D28B	60

Module	Types of Model	Current consumption (mA)
Digital Input Module (AC 110V)	2MLI-A12A	30
Digital Input Module (AC220V)	2MLI-A21A	20
Relay output module	2MLQ-RY1A	250
	2MLQ-RY2A	500
	2MLQ-RY2B	500
Digital Output Module (Transistor)	2MLQ-TR2A	70
	2MLQ-TR2B	70
	2MLQ-TR4A	130
	2MLQ-TR4B	130
	2MLQ-TR8A	230
	2MLQ-TR8B	230
Digital Output Module (Triac)	2MLQSS2A	300
	2MLFDV4S	200
Analog Input Module	2MLF-AV8A	420
	2MLF-AC8A	420
	2MLF-AD8A	420
	2MLF-AD16A	330
	2MLF-AD4S	610
Analog Output Module	2MLF-DV4A	190
	2MLF-DC4A	190
	2MLF-DV8A	147
	2MLF-DC8A	243
	2MLF-DC4S	200
	2MLF-DV4S	200

Module	Types of Model	Current consumption (mA)
Temperature Input Module	2MLF-TC4S	610
	2MLF-RD4A	490
High-Speed Counter Module	2MLF-HO2A	270
	2MLF-HD2A	330
FEnet Module	2MLL-EFMF	650
	2MLL-EFMT	420
Snet Module	2MLL-C22A	330
	2MLL-C42A	300
	2MLL-CH2A	340
Profibus-DP Module	2MLL-PMEA	560
Profibus Remote Interface	2MLL-PSRA	550
Profibus Remote Slave Interface	2MLL-PSEA	550

2.2 Selecting the power supply

The selection of a power module is determined by the current and voltage needed by the system. The voltage requirement of a system is calculated as the sum of the current consumption by the digital I/O modules, special modules, CPU module, power module and the communication module (installed on the same base as the power module.)

The system does not operate normally, if the rated output capacity of the power module exceeds the predefined limit.

Example of current consumption/power calculations for ML200-IEC

The following table describes which power supply module must be used in coordination with the corresponding modules for ML200-IEC.

Type	Model	Quantity	Voltage (5V)
CPU module	2MLI-CPUU	1	0.96A

Type	Model	Quantity	Voltage (5V)
12 Slot basic base	2MLB-M12A	-	-
Input module	2MLI-D24A	4	0.2A
Output module	2MLQ-RY2A	4	2.0A
FDEnet module	2MLL-EDMF	2	1.3A
Profibus-DP	2MLL-PMEA	2	1.12A
Current consumption	Calculation		0.96+0.2+2+1.3+1.12
	Result		5.58A
Power consumption	Calculation		5.58×5V
	Result		27.9W

As the value of 5V current consumption is 5.58A, use 2MLP-ACF2 (5V: 6A) or 2MLP-AC23 (5V: 8.5A). The system does not operate if 2MLP-ACF1 (5V: 3A) is used.

Example of current consumption/power calculations for ML200R

This section describes which power supply module must be used in coordination with the corresponding modules for ML200R.

Main base

Type	Model	No.	Voltage (5V)
CPU Module	2MLR-CPUH/F	1	1.31A
Main Base	2MLR-M02P	1	0.2A
	2MLR-M06P	1	0.2A
FEnet Module	2MLL-EFMF	6	0.61A
Current Consumption / Power Consumption		1.31A + 0.61A∗6 = 4.97A/4.97×5V = 24.85W	

Expansion base

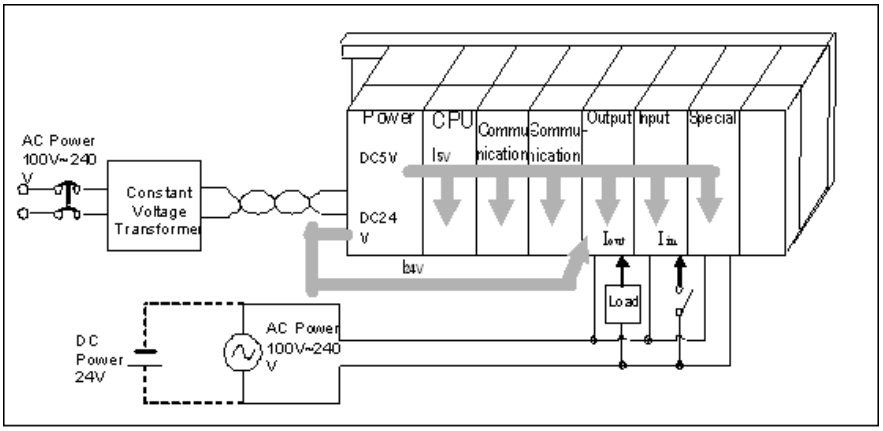
Type	Model	No.	Voltage (5V)
Expansion Driver	2MLR-DBSF	1	0.65A
Expansion Base	2MLR-E12P	1	0.21 A
DI Module	2MLI-D24A	2	0.05A
DO Module	2MLQ-RY2A	6	0.5A
AI Module	2MLF-AD4S	2	0.61A
Profibus-DP	2MLL-PMEA	2	0.56A
Current Consumption/Power Consumption		0.65A + 0.05A∗2 + 0.5A∗6 + 0.61A∗2 + 0.56A∗2 = 6.09[a] / 6.09A × 5V = 30.85 W	

Sum of current consumption is 6.17A. Hence, use 2MLR-AC13 or 2MLR-AC23.

ATTENTION

Maximum power consumption of PLC can be derived from the efficiency of power module. Example: Sum of 5V consumption x Minimum efficiency of Power module = 100W/0.65 = 154W.

The following figure illustrates the method used for calculating the current consumption of the PLC system necessary for heat protection design.



Power consumption of each part

1. Current consumption of power module

The current conversion efficiency of the power module is around 70 %. Radiation consumes 30%, and the current consumption is 3/7 of the output power. The calculation is as follows:

W_{pw} = 3/7 {(I5V X 5) + (I24V X 24)} (W)

I (DC 5V)	Current consumption of DC 5V circuit of each module (internal current consumption).
I (DC 24V)	Average current consumption of DC 24V of output module (current consumption of simultaneous ON point).

If DC 24V is externally supplied or a power module without DC 24V is used, it is not applicable.

2. Sum of DC 5V circuit current consumption: The DC 5V output circuit current of the power supply module is the sum of current consumption of each module.

   W 5V = I5V X 5 (W)

3. DC 24V average current consumption (current consumption of simultaneous ON point): DC 24V output circuit average current of power module is the sum of current consumption of each module.

   W 24V = I24V X 24 (W)

4. Average current consumption by output voltage drop of output module (current consumption of simultaneous ON point).

   i. $W_{out} = I_{out}$ X V_{drop} X Output point X Simultaneous ON rate (W)
   ii. I_{out}: Output current (current in actual use) (A)
   iii. V_{drop}: Voltage drop of each output module (V)

5. Input average current consumption of input module (current consumption of simultaneous ON point).

   i. $W_{in} = I_{in}$ X E X Input point X Simultaneous ON rate (W)
   ii. I_{in}: Input current (actual value in case of AC) (A)
   iii. E: Input voltage (voltage in actual use) (V)

6. Current consumption of special module power assembly

   W_S = I5V X 5 + I24V X 24 + I100V X 100 (W)

The sum of the current consumption calculated for each block is the total current consumption of the PLC system.

$W = WPW + W5V + W24V + W_{out} + W_{in} + W_s$ (W)

Calculate the amount of radiation according to this total current consumption (W) and review the temperature rising in the control panel. Use the following formula for the calculation of the temperature rise in the control panel.

$T = W / UA$ [°C]

Where,

W = power consumption of the entire PLC system (the calculated value)

A = surface area of control panel [m^2]

U: If equalizing the temperature of the control panel by using a fan and others

3. Plan and Install MLPLC

3.1 Plan for Engineering Station

Platform requirements

The SoftMaster is installed in the Engineering station. The following table lists the system requirements for installing SoftMaster.

Table 21: System requirements for installing SoftMaster

Item	Specification
Personal computer and memory	A Pentium computer and 128 MB memory
COM port	RS-232C serial port or USB port
Hard disk	At least 100 MB or more of space.
Monitor	Monitor must have 1024 x 768 and higher resolution
Operating System	Compatible with Windows XP/Vista/7

Only the RS-232C or USB port must be used while configuring the PLC for the first time (PLC without any data). After the IP for FEnet module is configured the Ethernet option can be used for connecting SoftMaster with PLC, provided the system has Ethernet port.

ATTENTION

Refer to the *ML200 CPU and SoftMaster User's Guide* for further information about installation.

Prerequisites for Installation

The PLC system is designed to withstand extreme climatic conditions. However, to ensure reliability and stability ensure that the following conditions are considered.

Essential devices

Ensure that the following devices are available for the installation.

- Basic/expansion base, power module, CPU module, expansion driver (only for ML200R), I/O modules.

- Synchronization cable (only for ML200R) and expansion cable.
- USB programming cable.
- SoftMaster (PLC Configuration and Programming Software)

Environmental conditions

Dos

- Install PLC in a control panel, which is waterproof and can withstand vibration.
- Ensure an ambient temperature of 0 ~ 55°C.
- Ensure incremental humidity: 5 ~ 95 %.

Don'ts

- Do not expose PLC to direct sun-light.
- Do not expose PLC to sudden changes in the temperature.
- Do not expose PLC to corrosive or inflammable gases.

Installation conditions

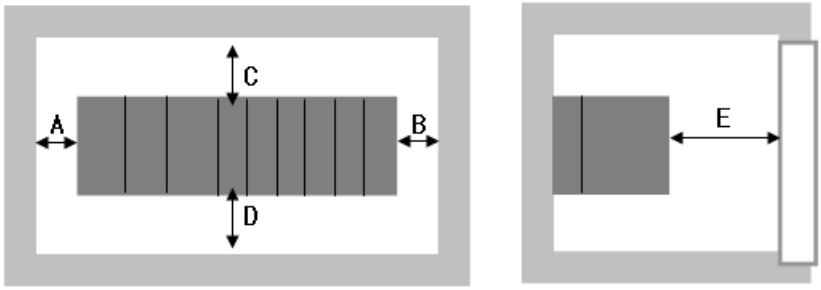
- While drilling holes, fixing screws or wiring, ensure that no wire or any other metallic part enters PLC.
- Do not install PLC on a panel that has a high-voltage device.
- Maintain a distance of at least 50mm from the wiring duct or surrounding modules.
- Ensure the grounding at a place where surrounding noise is minimal.

Heat protection design of control panel

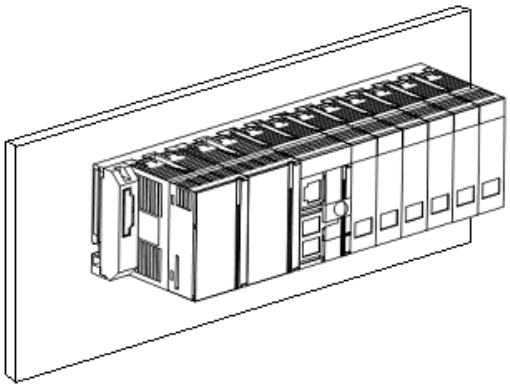
- In case the PLC is installed in an airtight control panel, the heat protection design must be ensured, considering the radiation of other equipment, and heat from PLC. When air circulation is provided using a vent or a general fan, the flow of dust particles or gas can hamper the functioning of the PLC system.
- Installing a filter or use of an airtight heat exchanger is recommended.

Precautions for installing the base

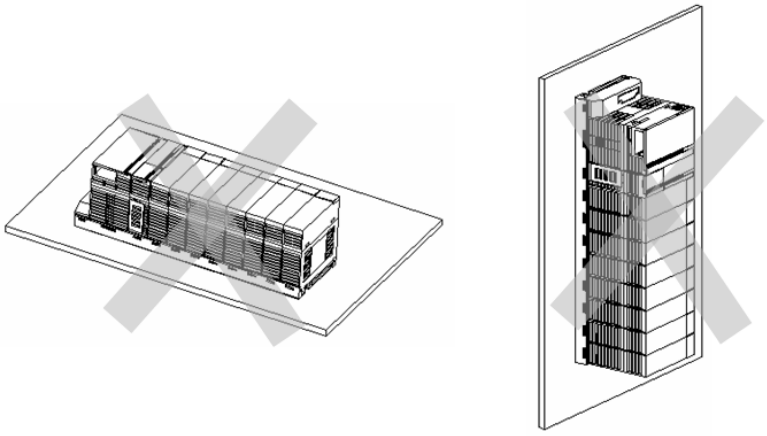
The following precautions must be taken while installing a PLC on the Control Panel. Ensure sufficient ventilation for the modules, especially the upper part of the modules. In addition, this helps in changing the modules, if required.



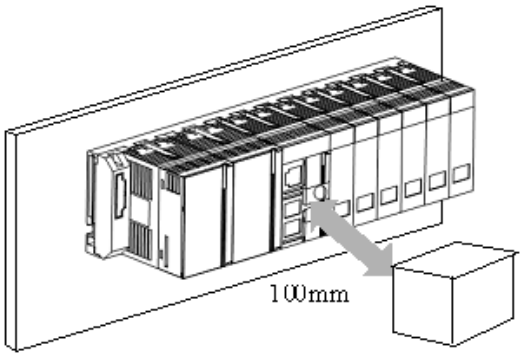
1. A, B: More than 5cm.
2. C, D: More than 5cm for easy installation of module.
   - More than 15cm is recommended if fiber optic modules or full loaded power supply is used.
3. E: More than 8cm, if fiber optic cable or connector-type I/O modules are used or more than 10cm, if the FTP cable is used.
4. If the PLC is installed near a Contactor/Breaker, it is recommended to use a Contactor/Breaker (Large Size) in a different panel.
5. If necessary, install wiring duct for routing the cables. Consider the following points while installing a wiring duct:
   - When installing the wiring duct on the upper part of the PLC, ensure that its distance is more than 50mm to enable adequate ventilation. Maintain sufficient distance from the upper part of the PLC so that the module can be removed easily.
   - When installing the wiring duct on the lower part of the PLC, take into account the connection of the optical cable or coaxial cable, and the minimum cable radius.
6. Install PLC in the direction as shown in the following figure. This helps in protecting the PLC from radiation.



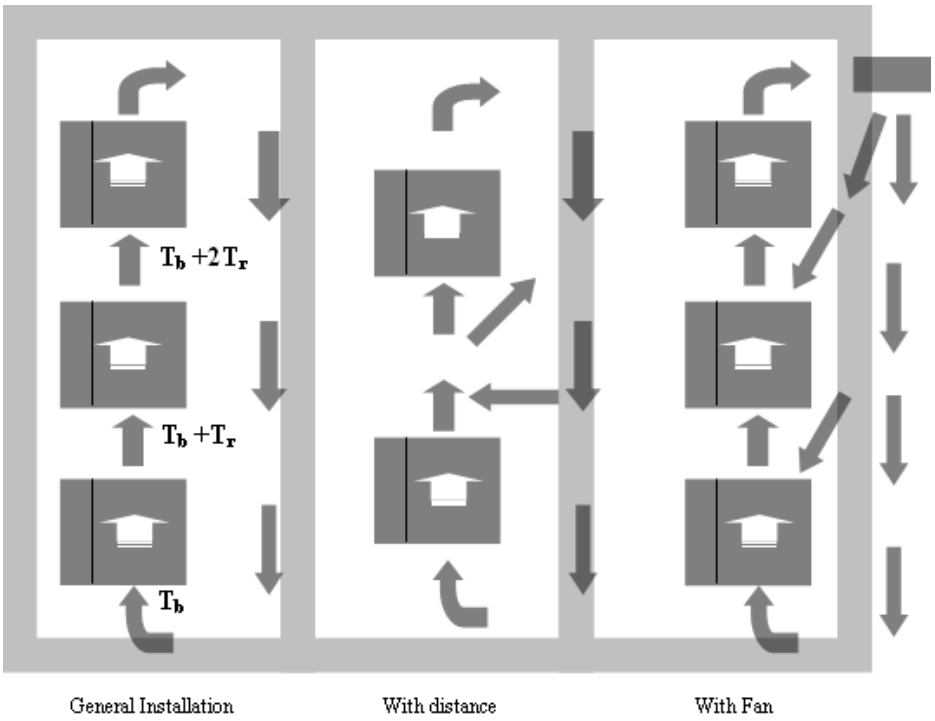
7. Do not install the PLC in the direction displayed in the following figure.



8. To avoid any effect of radiating noise or heat, install the PLC and other devices (relay and electronic contact) with a spacing secured, as indicated in the following figure.



9. Installing a base on top of another leads to a rise in temperature of the cabinet.
   - Install a fan for air circulation or keep maximum distance between the bases.



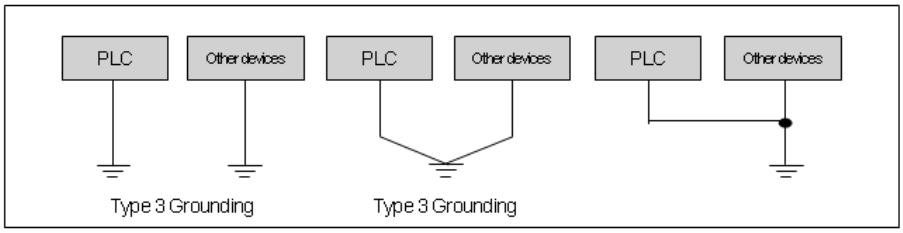
ATTENTION

- If bases are installed without adequate spacing, the air temperature (Tb + Tr) may rise up to 15°C for the fiber optic module and the module installed right above the power module.
- Ensure that air temperature around the module does not exceed 55°C.

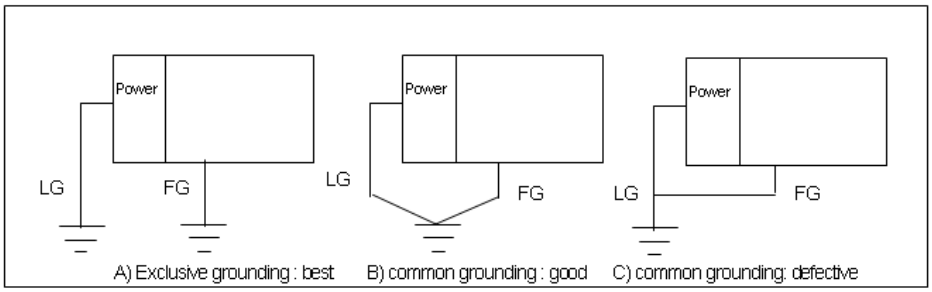
Grounding requirements

Grounding for cabinet mounting

1. Take sufficient measures against noise in PLC, making it possible to be used without grounding.
2. Use dedicated grounding for the wires as far as possible.
3. If the grounding is functional, use class 3 grounding, (grounding resistance must be 100Ω or less).
4. If it is not possible to use dedicated grounding, use common grounding, as depicted in the following figure.



5. Use more than 2mm^2 cables for grounding. Place the earth point near the PLC as much as possible to limit the length of grounding cable.
6. Separate Line Ground (LG) of power module and Frame Ground (FG) of base board for grounding.



7. If a malfunction on grounding is detected, separate the FG of the base from the grounding.

Precautions for installing/handling the PLC modules

Take the following precautions while handling or installing modules.

- Do not drop the PLC module or apply excessive force on it.
- Do not touch the PCB inside the module with bare hands, as this can lead to failure of the PLC Modules.
- Ensure that external materials, such as wiring fragments do not enter the upper part of module casing. Even if such materials accidentally enter the module casing, remove them immediately.

Precautions for installing/handling I/O module

Note the following points while handling or installing the I/O module.

1. **Recheck I/O module specifications**

Check the input voltage for input modules. For output modules, check if the voltage applied exceeds the maximum Open/Close capacity. Over voltage may lead to failure, damage, or sparking.

2. **Cable selection**

Select the appropriate cable after considering its capacity to withstand temperature and intensity of current flowing through it. The minimum specification of cable must be AWG22 ($0.3mm^2$).

3. **Environment**

When wiring an I/O module, ensure that it is not too close to any heat emitting equipment. In addition, avoid the wires from coming in direct contact with oil, as it may cause a short circuit, breakage, or can cause abnormal errors during operation.

4. **Polarity**

The polarity of the module terminals and that of the field signal must be the same.

5. **Wiring**

- The I/O must be wired using high-voltage cables or power cables. Lower-voltage wires can cause inductive disturbance that may result in abnormalities or failure of the PLC operation.
- Ensure that the cables do not pass in front of the I/O operation indicator (LED), as it may obstruct the indicator.
- When inductive load is connected to output module, connect a surge absorber or diode, parallel to the load.

The following image illustrates the terminal block wiring.

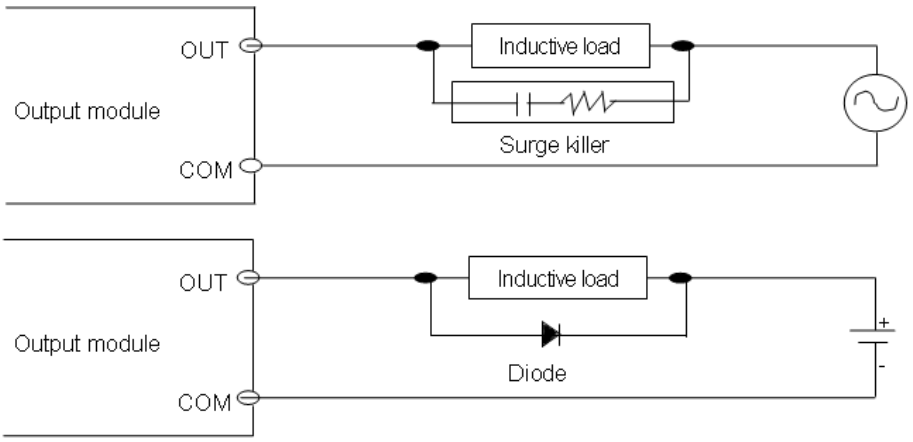


Figure 10: Terminal block wiring

WARNING

Do not apply excessive pressure on the I/O module or separate the PCB board from the case.

3.2 Mounting Chassis

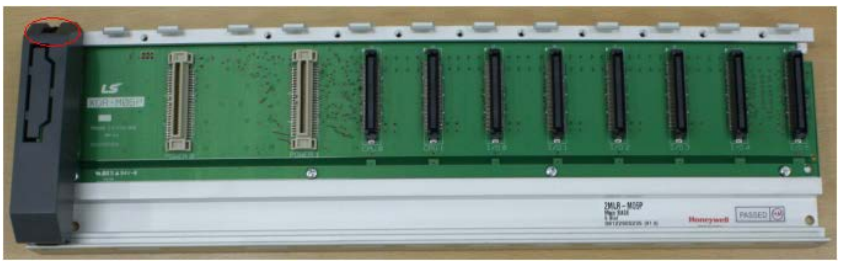
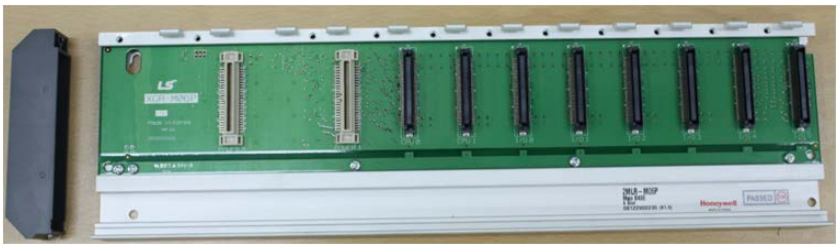
Cabinet mounting

Inserting a module

ATTENTION

The images in this section are an example for ML200R. Chassis mounting and module mounting is common for both ML200 IEC and ML200R.

Perform the following steps to insert a module.

Step	Action
1	Loosen the cover from the base by unscrewing the screw on top of the cover.
	
2	Remove the cover from the base as illustrated in the following image.
	
3	Insert the projection on the lower part of the module into the module-fixing hole of the PLC base, as shown in the figure.
4	Slide the upper part of module to fix into the base. Use the screws in the upper part of the module to hold the module firmly to the base.

TIP

To check if the module is properly installed in the base, slowly pull the upper part of the module.

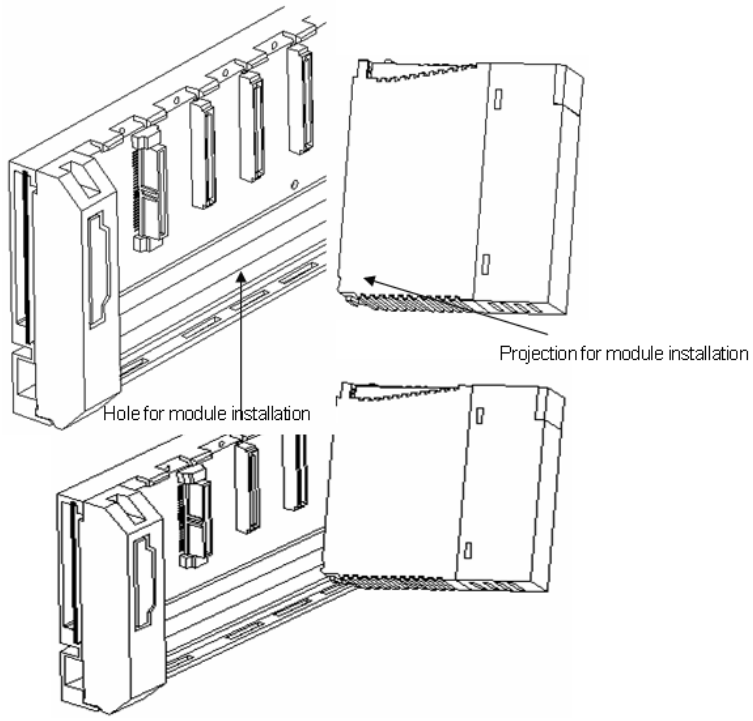
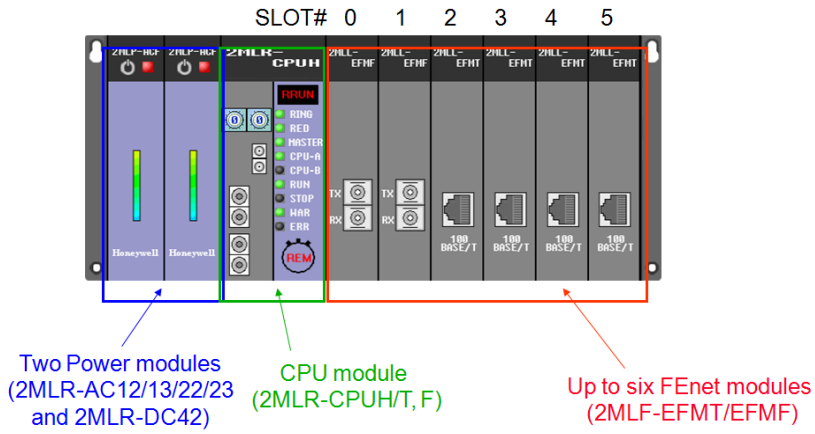


Figure 11: Inserting a module

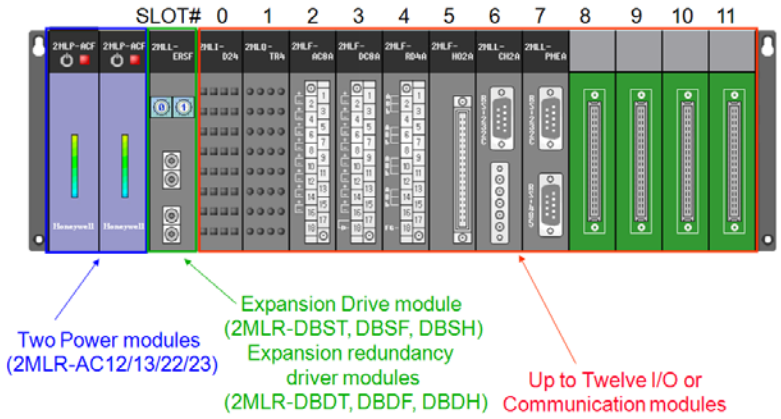
TIP

While installing modules, insert the fixed projection of the module into the module-fixing hole and then press it. The module may break, if the module is forced onto the base in an incorrect position.

The following image illustrates the modules mounted in the CPU base.



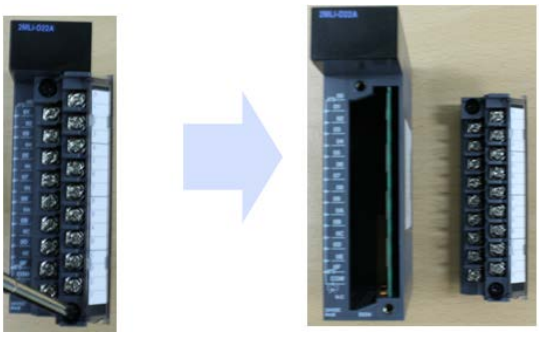
The following image illustrates the modules mounted in the IO base.



Installation of terminal board for I/O module

Perform the following for I/O modules with less than 32 points.

1. Remove the terminal board by unscrewing the black screws.
2. Connect field wires onto the terminal board.
3. Insert terminal board to the I/O module and tighten the screws.



Perform the following for I/O modules with more than 32 points.

1. Connect field wires onto SmartLink terminal board (external).
2. Connect SmartLink terminal board and I/O module using SmartLink cable.

Removing modules

Perform the following steps to remove modules.

Step	Action
1	From the base, loosen the fixed screws on the upper part of the module.
2	Hold the module and thoroughly press the fixed hook of the module.
3	By pressing the hook, pull the upper part of the module from the axis of the lower part.
4	By lifting the module upward, remove the fixed projection of the module from the fixing hole.

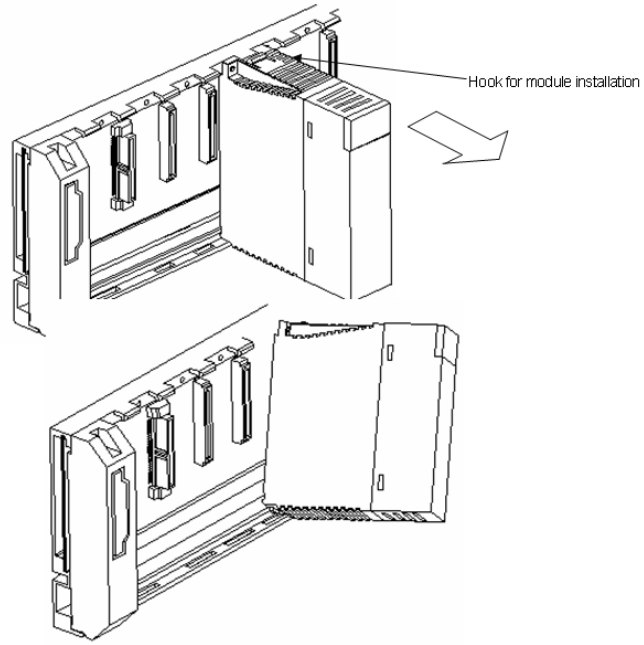


Figure 12: Removing modules

CAUTION

While removing the module, press the hook and remove the module from the base. Then, remove the fixed projection of the module from the module-fixing hole. If module is detached forcefully, the hook or the fixed projection of the module may break.

3.3 Achieving the topology

Achieving the topology for ML200-IEC

ML 200-IEC Architecture

The following figure illustrates the system configuration of ML200-IEC with 12 slot base.

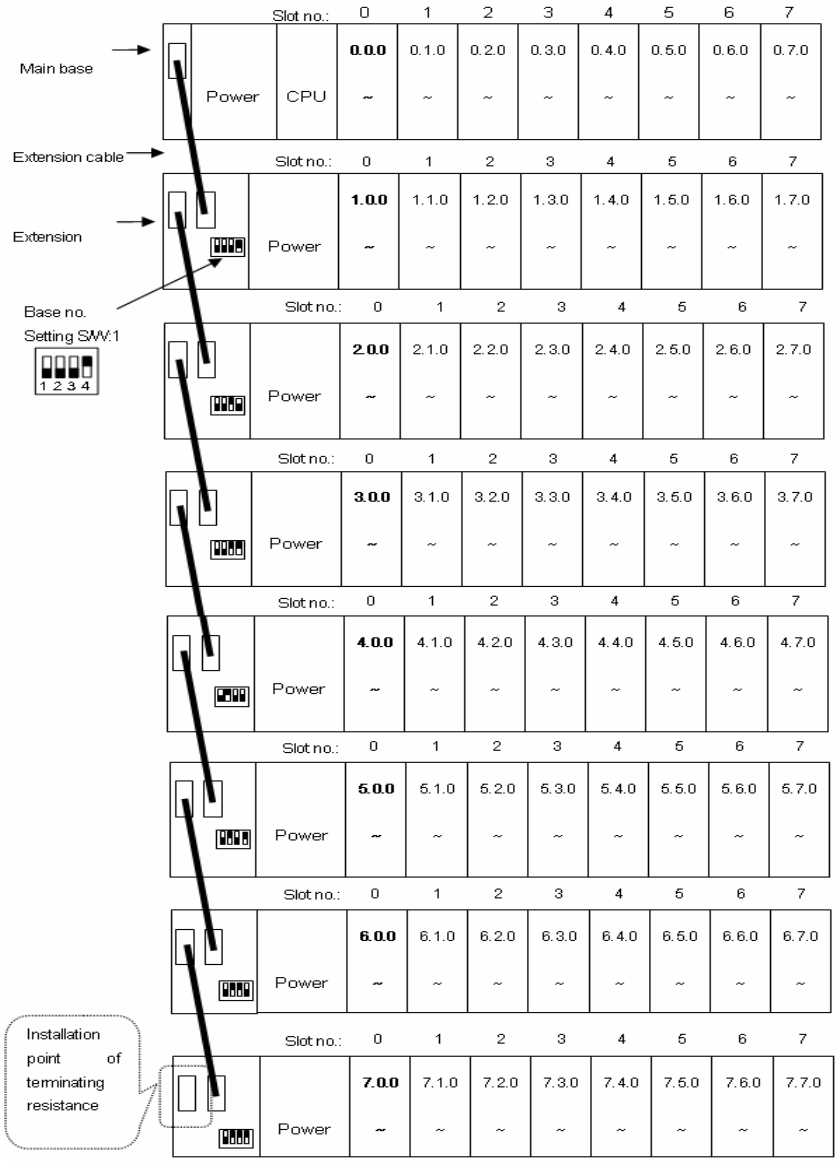


Figure 13: ML200-IEC architecture

ATTENTION

- The base has its base number as '0' and the expansion base has a switch to set the base number.
- The module starts operating once the the module type and I/O parameter are set using SoftMaster and the correct module type is mounted on the base.
- 2MLI CPUS/P does not support expansion base.

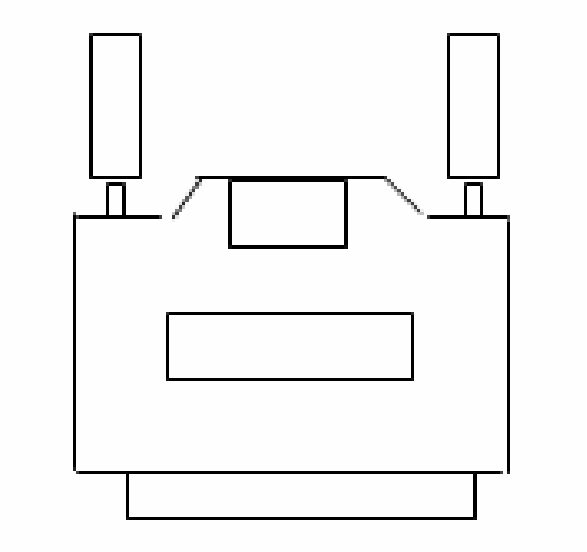
Connecting the Terminating resistance

ATTENTION

This section is not applicable for 2MLI CPUS/P.

If a system requires the main base and the expansion base to be connected, the terminating resistance must be attached to the expansion connector (OUT) of the last expansion base. The terminal resistance is not required to be installed, if the system has only the main (without expansion bases).

1. Structure



2. Installation Position

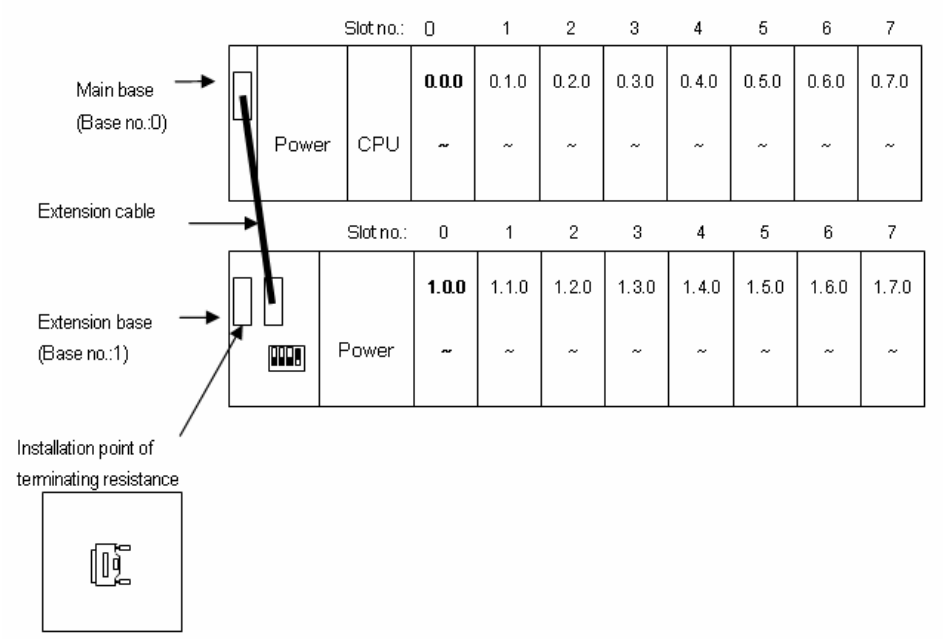


Figure 14: Installation point of terminating resistor

Configuring the Dip switch settings

The following table lists the different types of switches in ML200-IEC.

Table 22: ML200-IEC Dip switch setting

Switches	Description
Boot/Nor switches	Downloads new operating system or upgrades CPU firmware before releasing the product. • ON (right): For normal CPU operation mode. • OFF (left): Downloads new operating system. It is reserved for use by Honeywell factory/authorized personnel. Switching to this position by user is strictly prohibited. **Note**: Both Boot/Nor switches must always be set to the

Switches	Description
	ON (right) position. Setting it to the OFF (left) position may cause abnormal operation or damage to modules.
REMOTE enable switch	Enables the PLC to operate remotely. • ON (right): All functions enabled for remote control. • OFF (left): Limited remote functions.
M.XCHG (Module exchange switch)	To change a module online during CPU operation (hot-swapping). • ON (right): Before changing the module, set the switch to ON position. • OFF (left): After the module is changed, set the switch back to OFF position.
RUN/STOP mode Switch	Sets the operation mode of CPU module. • STOP → RUN: executes the program • RUN → STOP: stops the program These commands operate irrespective of the REMOTE switch setting.
Reset/ D.Clear Switch	• If this switch is moved to: – Left and returned to center - executes RESET action. – Left, held for more than 3 seconds, and then returned to center: executes Overall RESET action. • If this switch is moved to: – Right and pressed - it executes DATA CLEAR action. – Right and returned to center - clear Latch 1 area data and general data area. – Right, held for more than 3s and then returned to center it clears Latch 2 area data and general data area. **Note**: DATA CLEAR acts only in the “STOP” operation

Switches	Description
	mode.

Achieving the topology for ML200R

ML200R has a redundant system for CPU, power supply, and communication modules.

Install two identical sets of main bases consisting of same power supply, CPU, and communication modules and connect two CPU modules with synchronization cable.

One of the two CPU modules is a master system in control of the main operation and another is a standby system for backup control, if the master fails during operation.

After recovering from a fault, ex-Master CPU can be operated as a standby system and you can switch the master with a programming tool or a key switch.

You can select CPU side by a switch on the CPU module (that is, A or B) and duplication of sides gives an error.

The main base comprises of the following modules.

Item		Model
Main Base	CPU	2MLR-CPUH/T, 2MLR-CPUH/F
	Power supply	2MLR-AC12, 2MLR-AC22, 2MLR-AC13, 2MLR-AC23, 2MLR-DC42
	Communication	FEnet
	Base	2MLR-M02P, 2MLR-M06P
	Sync cable	2MLC-F201
Expansion Base	Digital I/O	All types of digital I/O
	Analog I/O	All types of analog I/O
	Communication Module	Pnet/Dnet/Snet I/F module

Power supply redundancy

Redundant power supply can be installed in both main and expansion bases. When one of the power supplies fails to operate, the system can seamlessly operate with another power supply. Faulty power supply module can be repaired during operation.

I/O bus redundancy

Expansion bases and cables can be configured as a ring topology so that single communication cable fault does not stop the system and the operation continues with another cable attached to the system.

In a normal ring configuration, the communication is enabled to the path nearest to the master CPU.

ATTENTION

- CPU module cannot be installed in the expansion base.
- Both CPU modules must have the same version of the operating system.
- The configuration of both the CPU modules must be in the same sequence. For example: If 2MLL-EFMT is installed in the slot 0 of CPU-A, 2MLL-EFMT in the CPU-B must be installed in the slot 0.

Architecture without dual I/O link redundancy

The cable connection for ML200R without dual I/O link redundancy is as follows:

- Connect the synchronization cable between Master and Standby CPUs
  - Synchronization cable: Tx to Rx, Rx to Tx (Multi-mode FO, LC connector type)
- Connect the expansion cable between I/O racks and CPUs in a Ring Configuration
  - UTP cable: Direct or Cross cable (Cross cable is recommended)
  - Fiber Optic cable: Tx to Rx, Rx to Tx (Multi-mode FO, LC connector type)

The following image illustrates the ML 200R architecture without dual I/O link redundancy.

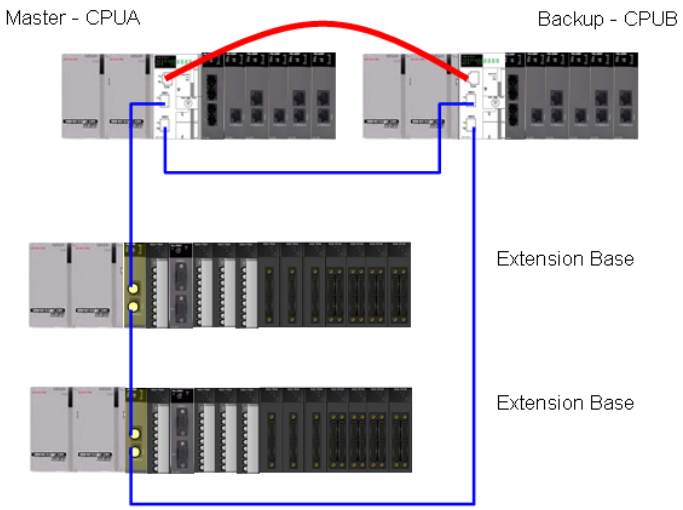


Figure 15: ML200R architecture without dual I/O link redundancy

Architecture with dual I/O link redundancy

The cable connection for ML200R with dual I/O link redundancy and is as follows:

- Connect the synchronization cable between Master and Standby CPUs
  - Synchronization cable : Tx to Rx, Rx to Tx (Multi-mode FO, LC connector type)
- Connect the expansion cable between I/O racks and CPUs in a Ring Configuration
  - UTP cable : Direct or Cross cable (Cross cable is recommended)
  - Fiber Optic cable : Tx to Rx, Rx to Tx (Multi-mode FO, LC connector type)

The following image illustrates the ML200R architecture with dual I/O link redundancy.

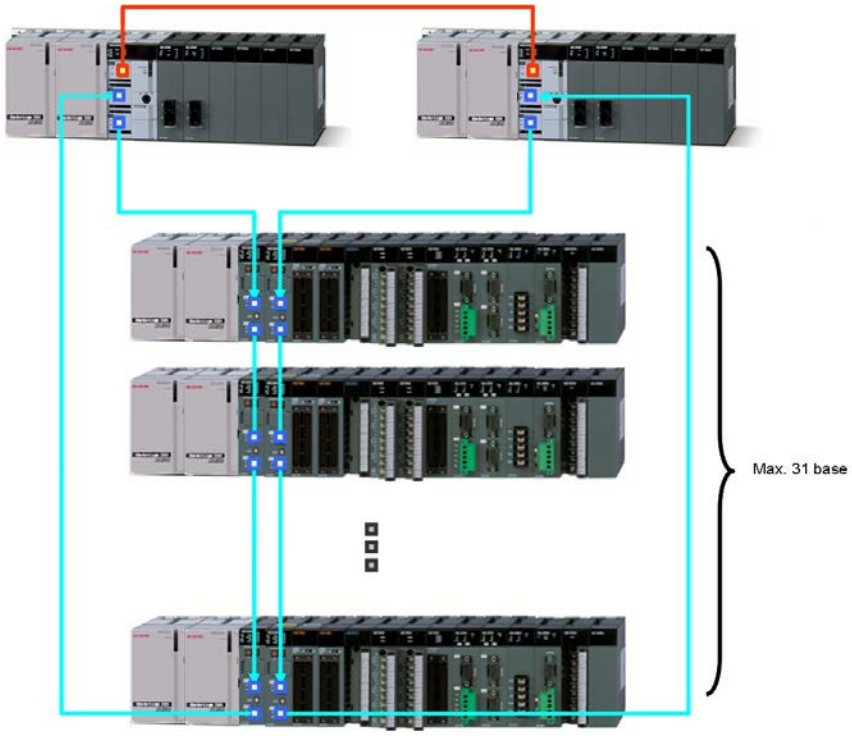


Figure 16: ML200R architecture with dual I/O link redundancy

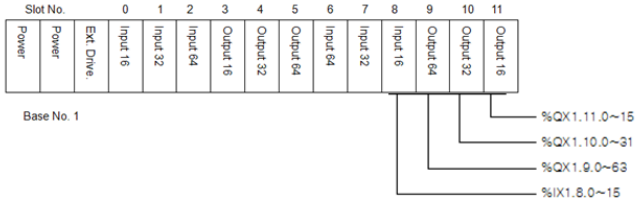
ATTENTION

The images illustrate the architecture of 2MLR-CPUH/T (Electrical). The architecture remains the same for 2MLR-CPUH/F (optic fiber).

The following table describes the topology of ML200R.

Table 23: Topology of ML200R

Item	ML200R Comprises of
Main Base	Two main base with identical module
Maximum Expansion Base	31 Expansion bases

Item	ML200R Comprises of
Max. I/O modules	Up to 372 (31 X 12) I/O modules (Up to 372 (31 X 12) I/O modules can be installed in expansion base.)
Maximum I/O point	16 points module : 5952 points 32 points module : 11904 points 64 points module : 23808 points
Maximum distance between nodes	Fiber Optic : 2km Twisted pair cable : 100m • Total max length – Optical multi mode: 62km (when installing 31 expansion modules) – Optical single mode: 465km (when installing 31 expansion modules) – Electrical: 3.1km (when installing 31 expansion modules)
Allocation of I/O Address in Expansion base	Start address of input and output point is determined by the station number set in the expansion driver module. Each slot of the base is allocated 64 points (fixed), irrespective of the type of module mounted. Special modules can be mounted in any position. Unlike digital I/O modules, a special module is not allocated to any I/O address. A special module is controlled by a dedicated function block and the address is automatically allocated to the memory. For instance, the I/O number of 12 slot base is allocated as follows: 
Allocation of I/O Address in main base	Only communication module is allowed in the main base. Hence, I/O addressing is not required. However, same number of points (that is, 768 points) is assigned to main base and main base has station number of 0.

ATTENTION

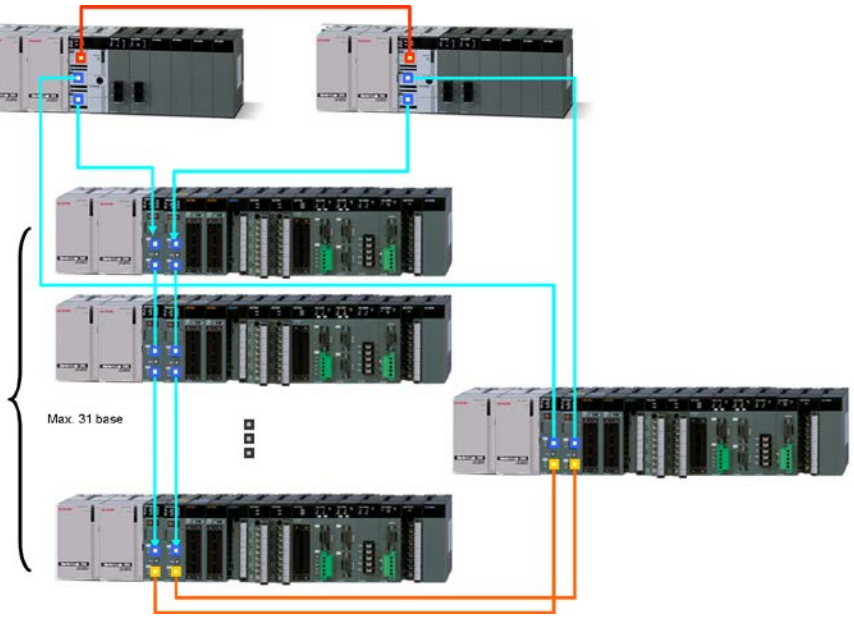
- The base has its base number as '0' and the expansion base has a switch to set the base number.
- The CPU module is only allowed in the main base and two slots are required for the CPU module.
- The module starts operating after the module type and I/O parameter are set using SoftMaster and the correct module type is mounted on the base.

Example of mixed topology (combination of electric and optic fiber)

ML200R with dual I/O link redundancy using mixed modules.

In a system, the optical modules can be used in the following two cases. This helps to build an optical/electrical mixed module network without an additional converter.

- When the distance between electrically established stations is more.
- Electrical noise is severe.



2MLR-CPUH/T for both CPUs and 2MLR-DBDT and 2MLR-DBDH for expansion drive module.

Configuring the Dip switch settings

The following table lists the different types of switches in ML200R.

Table 24: ML200R Dip switch settings

Switches	Description
BOOT/NORMAL switch	Downloads new operating system or upgrades CPU firmware before releasing the product. • ON (right): For normal CPU operation mode. • OFF (left): Downloads new operating system. It is reserved for use by Honeywell factory/authorized personnel. Switching to this position by user is strictly prohibited. **Note**: Both Boot/Nor switches must always be set to ON (right) position. Setting it to OFF (left) position may cause abnormal operation or damage to modules.
A/B side switch (CPU position designation switch)	Defines CPU classification • CPU module is 'A', if the switch is set to the left. • CPU module is 'B', if the switch is set to the right. • Two CPU must have different settings (you can check it using software). • A same setting does not affect operation but may not operate in a normal way.
Reset/D. Clear switch	Resets CPU when switch is set to the left. • Left → Center: RESET • Left → more than 3s → Center: Overall RESET Clears data when switch is set to the right. • Right → Center: clears memory area for M, auto-allocated retain, general data memory address. • Right → more than 3s → Center: Clears memory area for M, auto allocated retain, General Data Memory Address and R Area. **Note**: Data clear is only performed in 'STOP' mode.

3.4 Turn on and start up

Depending on the CPU types used, verify the following before turning on and starting the system.

- Ensure that the modules are mounted correctly in both the CPU base and the I/O base.
- Ensure the following:
  - Synchronization cable is connected between Master and Standby CPUs.
  - Expansion cable is connected between I/O racks and CPUs in a Ring Configuration.
- Ensure that both the CPUs are set to different CPU sides. If not, perform the following to set the CPU sides.
  - To set the CPU to side A, move the switch to left and release.
  - To set the CPU to side B, move the switch to right and release.

ATTENTION

DO NOT change Boot/Normal switch settings.

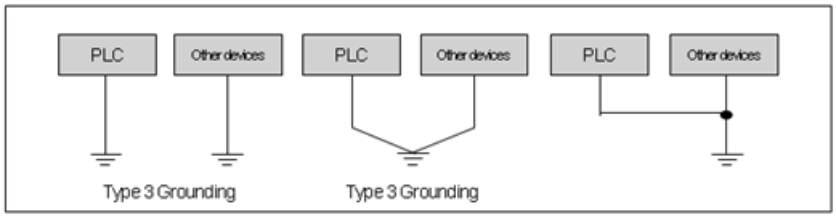
- Ensure that the STATION NUMBER is set using the Rotary switch on the Expansion driver module.

I/O device wiring

Perform the following steps for I/O device wiring.

- The cable used for I/O wiring must be 0.3~2.0mm^2.

1. Use a separate input and output cable for wiring.
2. Separate the I/O signal cable by a distance of at least 100mm from the main circuit cable of high voltage/high current.
3. If it is not possible to separate the main circuit cable and power cable, use the shielded cable in all cases and ground the PLC.



4. In case of pipe wiring, check the pipe for grounding properly.
5. Separate output cable of DC 24V from AC 110V cable or AC 220V cable.

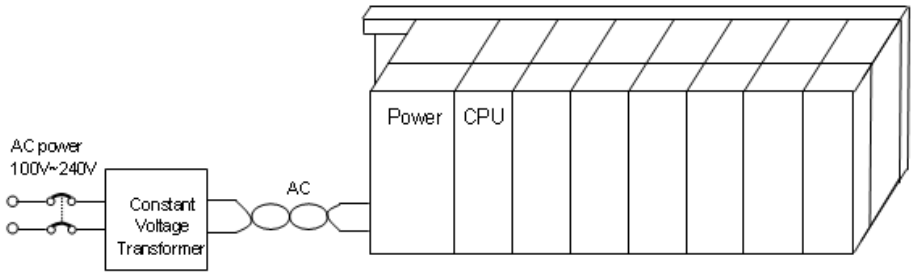
ATTENTION

Current leakage may occur if the wiring is connected for distances greater than 200m. This may be caused by the capacitance.

Power wiring

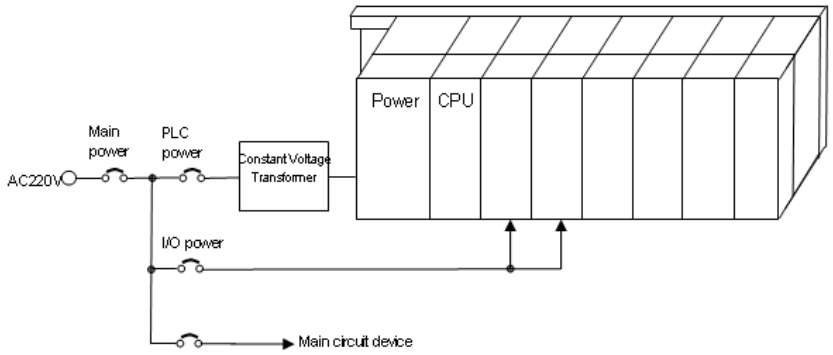
Perform the following steps for power wiring.

1. Connect a voltage regulated transformer, if the power variance is higher than the specified range.



2. In case of excessive interference (noise), use an isolation transformer.

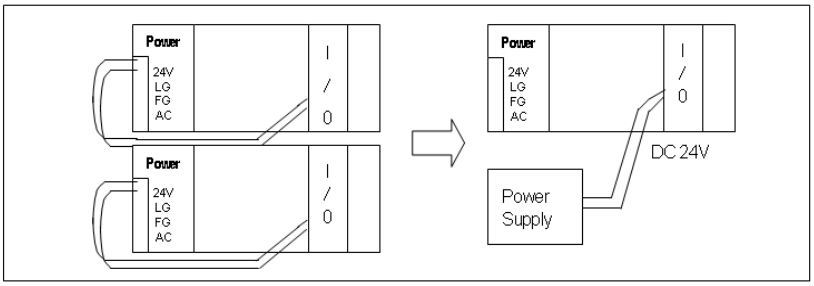
The following figure illustrates the distributions of AC 220V for PLC power supply, I/O modules, and other main circuit equipment.



3. While using power module of DC 24V output:

   a) Do not connect the module, in parallel with the output of several power modules.

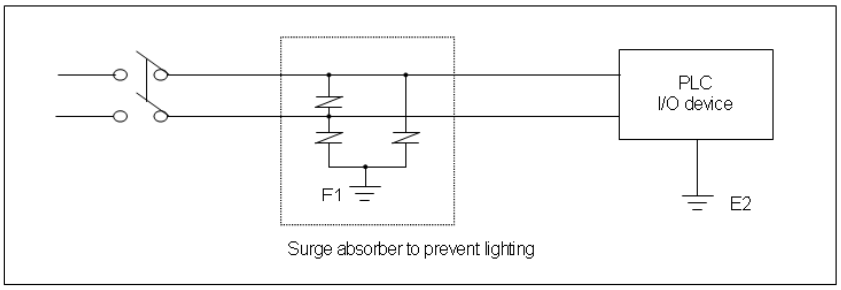
   b) If DC 24V output capacity of a power module is not sufficient for the PLC I/O modules, supply the external DC 24V power, as displayed in the following figure.



4. AC 110V/AC 220V/DC 24V cables must be properly twisted and connected with the shortest distance.

5. AC 110V/AC 220V cable must be as thick as possible ($2mm^2$), to reduce the voltage drop. AC 110V/ DC 24V cables must not be installed close to the main circuit cable (high voltage/high current) and I/O signal cable. They must be 100mm away from such cables.

6. Use a surge absorber as a protection against lightning, as displayed in the following figure.



TIP

- Separate PLC earth (E2) from earth (E1) of surge absorber against lightning.
- In case of an increase in voltage, the surge absorber ensures that it does not increase more than the predefined maximum limit.
- Use a shielded isolation transformer or noise filter in areas where higher noise levels are expected.
- It is advisable to use twisted cable for input power. Ensure that the shielded transformer or noise filter wiring does not pass the duct.

Module LEDs

LED indicators for ML200-IEC

The following table describes the LED indicators for ML200-IEC.

Table 25: LED indicators for ML200-IEC

LED	Description
	Specifies the operation status of the CPU module. • Green light: Implies the CPU operation is in 'RUN' mode either by any of the following: – 'RUN/STOP' switch in CPU set to RUN mode.
	– REMOTE 'RUN' operation through SoftMaster even when the local switch is on 'STOP' mode. • Red light: The CPU operation is in 'STOP' mode either by any of the following

RUN/STOP LED	– RUN/STOP switch in CPU set to STOP mode. – REMOTE 'STOP' operation through SoftMaster even when the local switch is in 'RUN' mode. • Red Blink: Warning or error during 'STOP' operation (if an error occurs, stop the ongoing operation).
REM LED	ON (YELLOW): 'Remote enabled' in case 'REMOTE' switch is 'ON'. OFF: 'Remote disabled' in case 'REMOTE' switch is 'OFF'.
ERR LED	ON (RED): Error has occurred and CPU cannot operate normally. OFF: Normal operation.
PS LED (Programmable Status)	• Red ON: – 'User assigned flag' is 'ON'. – Operating in the error state by 'operation proceeding in the error' setting. – Module is detached or new module is installed in the state where 'M.XCHG' switch is 'ON'. • OFF: Normal operation
BAT LED	ON (Red): Battery voltage is low. OFF: Normal operation.
CHK LED	• Red ON: – Setting is different from standard setting (it is possible to add/delete [clear] by parameter). – 'Module change' switch is set as 'Module change'. – Operating in 'DEBUG mode'. – 'Forced ON' setting state. – 'Fault mask', 'SKIP' flag is set.
	– Warning occurs during operation. – Expansion base power error. • Red Blink: Arithmetic Operation Error during RUN. • OFF: Normal operation.

LED indicators for ML200R

The following table describes the LED indicators for ML200R.

Table 26: LED indicators for ML200R

LED	Description
RUN/STOP LED	Specifies the operation status of the CPU module. • Green light: 'RUN' mode; the module is in operation. – 'RUN' operation by the operation mode switch. – 'RUN' operation by the programming tool with the operation mode switch in 'REM'. • Red light: 'STOP' mode; the module is in operation. – 'STOP' operation by the operation mode switch. – 'STOP' operation by the programming tool with the operation mode switch in 'REM'.
WAR LED	ON(YELLOW): Warning OFF: Normal
ERR LED	ON(RED): Critical Error OFF: Normal
BAT LED	Four-digit display of the Operation Status (Refer to ML200R Error code) • Normal Operation • Warning • Error

Module state transition

The ML200-IEC and ML200R have three operation modes. Each mode describes the operation process of the PLCs.

- RUN mode
- STOP mode
- DEBUG mode

ATTENTION

Refer to *ML200 CPU and SoftMaster User's Guide* for further information about the module state transition.

Changing operation mode

The following methods are used for changing the operation mode.

- Using the mode key of the CPU module.
- Using the programming tool (SoftMaster).
- Using SoftMaster to change the operation mode of a remote CPU module networked with the main CPU.
- Using a networked SoftMaster, HMI and the computer link module.
- Using the 'STOP' command, while a program is operating.

WARNING

Changing the operation mode can energize the field and may cause serious injury to the users.

Setting operation mode

The operation mode for ML200-IECcan is set as follows:

Operation Mode Switch	Remote Switch	SoftMaster Command	Operation Mode
RUN	X	X	Run
Stop	On	Run	Remote Run
		Stop	Remote Stop
		Debug	Debug Run
	Off	Mode change	Transfer (changed) operation mode
RUN → STOP	X	-	Stop

- Remote mode can be changed with 'Remote: On' and 'Mode switch: Stop'
- To change the remote 'RUN' mode to 'Stop' by switch, move the switch (STOP) > RUN >

STOP.

ATTENTION

While changing the remote 'RUN' mode to 'RUN' mode using the switch, the PLC operates continuously without suspension.

Editing during RUN is possible in the 'RUN' mode by switch, but the mode change is restricted by SoftMaster.

Change the mode only when the mode change is not remotely allowed.

The operation mode for ML200R can be set as follows:

Mode Key Switch	Operation Mode
RUN	Local RUN
STOP	Local STOP
STOP → REM	Remote STOP
REM → RUN	Local RUN
RUN → REM	Remote RUN
REM → STOP	Local STOP

Starting the system

Perform the following to start the system.

1. Connect power cables to power supply modules and supply the power to the system.
2. Check the LED status of the CPU module
   - LNK : ON
   - RING : ON
   - CPU-A/CPU-B : ON
   - RED : ON
   - MASTER : one of A/B Side is ON
   - ACT and LINK : Blink (At least one of two ports should blink)

3. Check the LED status of the Expansion Drive module
   - RUN : ON
   - I/F : ON
   - RING : ON
   - Tx/Rx and LINK : ON (At least one of two ports should blink)

ATTENTION

When the system is started for the first time an error may appear. Rectify the errors and bring back PLC to the Run state. Check and ensure that the LED status of the CPU module and Expansion Drive module is as listed previously.

For more information about troubleshooting, see *4 Troubleshooting*.

4. Troubleshooting

4.1 Overview

This chapter describes the types of potential errors that may occur while operating the system, causes of errors, ways to detect them, and corrective measures.

4.2 Basic troubleshooting procedure

To improve the reliability of a system, it is important to take corrective measures promptly, when a trouble/fault occurs. To recover the system from the fault immediately, it is most important to quickly detect the potential causes of a fault and take corrective measures. To troubleshoot the system correctly, ensure the following cautions and procedures are followed:

1. Check the following manually.
   a) Operation status (Stop and Run).
   b) Power On/Off status.
   c) I/O device status.
   d) Wiring status (I/O wiring, expansion, and communication cable).
   e) The status of each displays (POWER LED, RUN/STOP LED, I/O LED, and so on), connect to peripherals, and check the operation condition and program.
2. Check for any abnormality.

   Observe how a fault changes by executing the following:

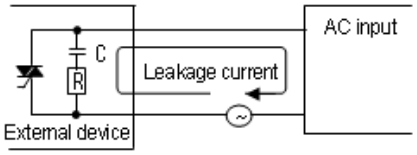
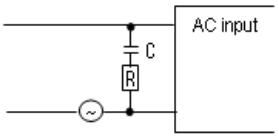
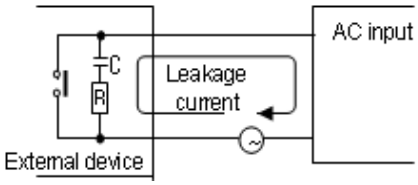
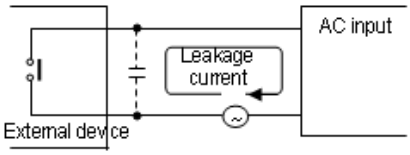
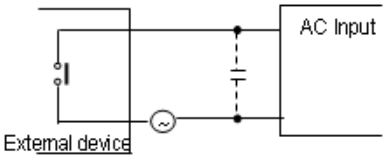
   - Move the key switch to STOP and turn it On/Off.
3. Restricting range.

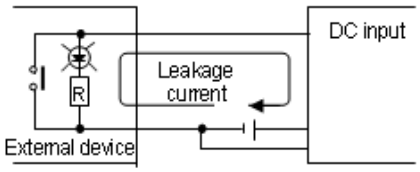
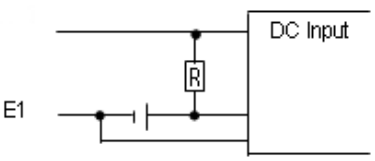
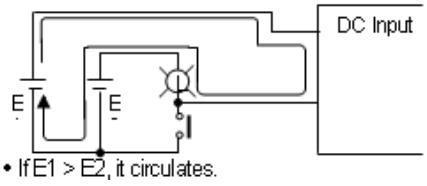
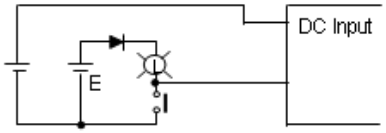
   Estimate by which factor, a fault occurs:
   a) Is it from the PLC or external factor?
   b) I/O module or others?
   c) PLC program?

4.3 Cases and remedies for failures

Trouble types and measures of input circuit

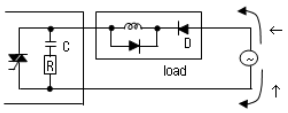
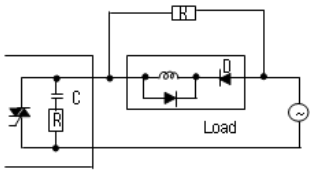
The followings table lists examples of common faults and the recommended measures.

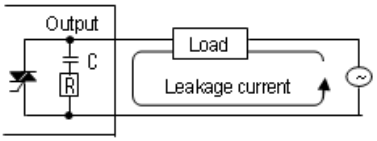
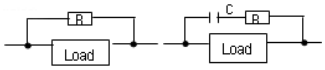
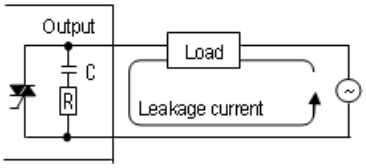
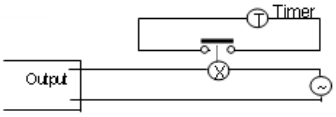
Phenomena	Causes	Measures
Input signal cannot be off	Leakage current of an external device (if operating by proximate switch and others). 	• Connect a proper resistance or capacitor so that the voltage between terminals of input module is less than the return voltage. 
Input signal cannot be off (it must be that a neon lamp is still on)	Leakage current of an external device (if operating by a limit switch with neon lamp). 	• CR value is determined by the value of leakage current. – Recommended value C : 0.1 ~ 0.47μF R : 47 ~ 120Ω (1/2W) • Alternatively, separate a circuit completely and install another display circuit.
Input signal cannot be off	Leakage current from the capacity between wires of wiring cable. 	• Install the power on an external device, as in the following figure. 
	Leakage current of an external device (if operating by a switch with LED mark).	• Connect a proper resistance so that the voltage between input module terminal and common terminal is higher than off voltage, as in the

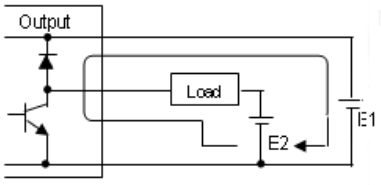
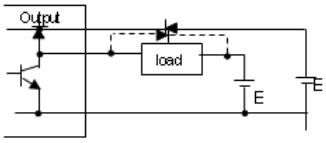
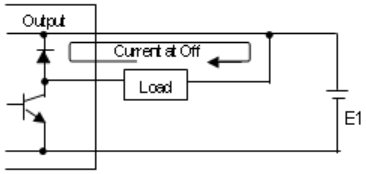
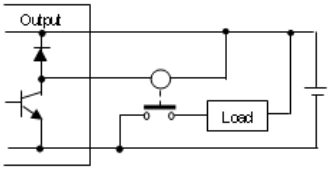
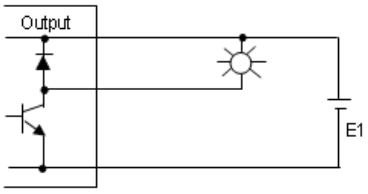
Phenomena	Causes	Measures
Input signal cannot be off		following figure. 
Input signal cannot be off	• Circulating current by using plural different power sources. 	• Change plural to singular power. • Connecting to a circulating current preventive diode. See the following figure. 

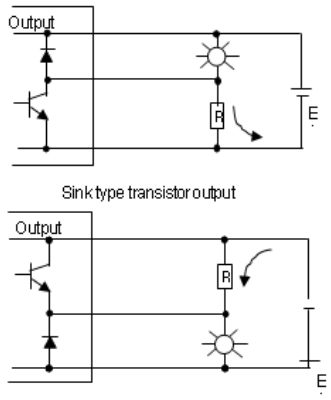
Trouble types and measures of output circuit

The followings table lists examples of common faults and the recommended measure.

Phenomena	Causes	Measures
Excessive voltage is allowed to load when output contact is off.	• If load contains half-wave rectification (solenoid valve may have it). • If the polarity is ←, C is charged while the voltage + power voltage charged to C is allowed to both ends of diode (D). When the polarity is ↑. The maximum voltage is approximately. 2√2. 	• Connect a dozen ~ several hundreds kΩ resistor to a load in parallel. 

Phenomena	Causes	Measures
	Note: While using it as described previously, the output element does not have any problem but the performance of diode (D) in load may be reduced, probably causing a trouble.	
Load cannot be off	• Leakage current from surge absorbing circuit connected to an output element in parallel. 	• Connect a dozen of kΩ resistor or C-R of which impedance is equal to the resistance to load in parallel. Note: If the length of wiring from output module to load is long, it may have leakage current from the capacity of cables. 
Abnormal time when load is a C-R type timer	• Leakage current from surge absorbing circuit connected to an output element in parallel. 	• Operate the C-R type timer by mediating a relay. • Use other one but a C R type timer. **Note**: A timer's internal circuit may have half-wave rectification. 
Load cannot be off (DC)	• Circulating current resulting from two different power source.	• Adjusting plural to singular power source. • Connecting to circulating current preventive diode. See the following figure.

Phenomena	Causes	Measures
	 • It circulates if E1< E2. • It circulates even when E1 is Off (E2 is On).	
Off response from load takes a longer time.	• Over current at Off If a large current load such as solenoid, (time constant L/R is large) is directly operated by the transistor output.  • Since current is allowed through diode when transistor output is off, it may be delayed for 1s and longer depending on load.	• Insert a magnetic connector and others for which time constant is small as presented in the figure and operate load by the contact. 
Output transistor is destructed.	• Inrush current of glow lamp  As soon as it lights up, it may have 10 times higher inrush current.	• To restrict inrush current, it must allow dark current that is 1/3 ~ 1/5 of the rated current of glow lamp.

Phenomena	Causes	Measures
		 Source type transistor output

Error codes list

Code	Error Causes	Measures Restart mode after the measure.	Operation Status	LED Status	Diagnostic Timing
2	Abnormal Data Bus	Contact A/S service if it still exists after turning it on again.	Fault	Blink according to LED orders	When turning it on.
3	Abnormal Data RAM	Contact A/S service if it still exists after turning it on again.	Fault	Blink according to LED orders	When turning it on.
4	Abnormal Click IC(RTC)	Contact A/S service if it still exists after turning it on again.	Fault	ERR : On	When turning it on.
6	Abnormal program memory	Contact A/S service if it still exists after turning it on again.	Fault	ERR : On	When turning it on.
10	Abnormal USB IC	Contact A/S service if it still exists after turning it on again.	Fault	ERR : On	When turning it on.

Code	Error Causes	Measures Restart mode after the measure.	Operation Status	LED Status	Diagnostic Timing
11	Abnormal backup RAM	Contact A/S service if it still exists after turning it on again.	Fault	ERR : On	When turning it on.
12	Abnormal backup flash	Contact A/S service if it still exists after turning it on again.	Fault	ERR : On	When turning it on.
13	Abnormal base information	Contact A/S service if it still exists after turning it on again.	STOP	ERR : On	When turning it on converting to RUN mode.
22	The program of backup flash is defective	Restart after modifying the program of the backup flash.	Fault	ERR : On	Reset converting to RUN mode.
23	If a program to execute is not normal	Operate after the program is reloaded. Replace a battery in case of abnormal battery. After a program is reloaded, check the storage condition and if any fault is found, replace the CPU module.	STOP	ERR : On	Reset converting to RUN mode.
24	Abnormal I/O parameter	Restart after I/O parameter is reloaded. Replace a battery in case of defective battery. After I/O, parameter is reloaded, check the storage condition, and if	STOP	ERR : On	Reset converting to RUN mode.

Code	Error Causes	Measures Restart mode after the measure.	Operation Status	LED Status	Diagnostic Timing
		any fault is found, replace the CPU module.			
25	Abnormal basic parameter	Restart after basic parameter is reloaded. Replace a battery in case of defective battery. After basic parameter is reloaded, check the storage condition and if any fault is found, replace the CPU module.	STOP	ERR : On	Reset Converting to RUN mode.
30	The module set in parameter and the actually installed module do not coincide	Check the wrong slot position by SoftMaster, modify a module or parameter, and then, restart. Reference flag: module type inconsistence error flag.	STOP (RUN)	ERR : On (P.S. : On)	Converting to RUN mode.
31	Module detachment or module addition during operation	Check for detached/added slot position by SoftMaster, modify the installment, and restart (according to parameter). Reference flag: module attachment error flag.	STOP (RUN)	ERR : On (P.S. : On)	When the scan ends.
32	Fuse of a module holding a fuse is burnt out during	Check the position of a slot of which fuse is burnt out by SoftMaster, replace a fuse and restart (according to	STOP (RUN)	ERR : On (P.S. : On)	When the scan ends.

Code	Error Causes	Measures Restart mode after the measure.	Operation Status	LED Status	Diagnostic Timing
	operation	parameter). Reference flag: fuse disconnection error flag.			
33	IO module data cannot be successfully accessed during operation	Check the position of a slot with access error by SoftMaster, replace the module and restart (according to parameter). Reference flag: I/O Module Write/Read error flag.	STOP (RUN)	ERR : On (P.S. : On)	When the scan ends.
34	Special/link module data cannot be successfully accessed during operation	Check the position of a slot with access error by SoftMaster, replace the module, and restart (according to parameter). Reference flag: Special/Link Module interface error.	STOP (RUN)	ERR : On (P.S. : On)	When the scan ends.
39	CPU is incompletely closed or in trouble	System is closed abnormally due to noise or abnormal hardware. 1) Contact A/S service if it still exists after turning it on again. 2) Take a measure against noise.	STOP	RUN: On ERR : On	Always
40	The scan time of a program exceeds the scan delay watchdog	Check the scan delay watchdog time designated by parameter, modify parameter or program,	STOP	RUN: On ERR : On	When the program is executed.

Code	Error Causes	Measures Restart mode after the measure.	Operation Status	LED Status	Diagnostic Timing
	time designated by parameter during the operation.	and restart.			
41	Operation error while executing user program	Eliminating an operation error → reload the program and restart (check). • If STOP: Check the details of the operation error by SoftMaster and modify the program. • If RUN: refer to the error steps of F area.	STOP (RUN)	ERR : On (CHK: blink)	When program is executed.
42	Exceeding the specified stack range during program	Restart	STOP	RUN: On ERR : On	When program is executed.
44	Use of Timer Index error	Modify the timer index program, reload, and start.	STOP (RUN)	RUN: On ERR : On	When scan ends.
50	Error of external device is detected by a user program during operation	Repair a fault device by referring to error detection flag of external device and restart (according to parameter).	STOP (RUN)	ERR : On (P.S. : On)	When scan ends.
60	E_STOP function execution	Eliminate the causes of error operating E_STOP function in the program	STOP	RUN: On ERR : On	When program is executed.

Code	Error Causes	Measures Restart mode after the measure.	Operation Status	LED Status	Diagnostic Timing
		and turn it on again.			
101	CPU position error	CPU is installed at wrong position. Position the CPU correctly.	STOP	S101	Turn it on.
102	Duplicated CPU ID error	Set the A/B side switches of master CPU and standby CPU differently.	STOP	S102	Turn it on.
103	Base abnormal error	Configure the expansion cable as ring topology and position the detached base correctly. For information of detached base, refer to the CPU error log.	STOP, RUN	E103	Execute program.
104	System configuration error	Check for dual IO link redundancy configuration and ring topology. • Check redundancy drive module station number. • Check the version of the operating system of the expansion drive module and the expansion manager.	STOP	E104	When the scan ends, turn it on.
300	Redundancy system synchronous operating	During redundancy operating, synchronization error occurs.	STOP	E300	Switch to redundancy operation.

Code	Error Causes	Measures Restart mode after the measure.	Operation Status	LED Status	Diagnostic Timing
	error.				
301	Standby CPU failed to operate as redundancy because of master CPU error.	Restart as redundancy operation • Set operation mode of standby CPU as STOP. • Cancel the error of master CPU and then restart. • Change standby CPU into RUN mode. Restart standby CPU as single operation. • Disable master CPU (STOP mode or power cut). • Restart standby CPU through reset switch or by changing the operation mode from STOP to RUN.	STOP	E301	Start standby operation.
500	Data memory backup is not possible	Turn it on again if battery is normal. It is converted to STOP mode in Remote mode.	STOP	ERR : On	Reset
501	Abnormal clock data	Reset the time by SoftMaster if battery is normal.	-	CHK: On	Always
502	Low-battery voltage	Replace a battery with the power on.	-	BAT: On	Always

ATTENTION

- Error codes during the CPU operation can be checked at the A/S Service Center.
- Other errors, if any, can be checked by using the error log in SoftMaster.

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