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User's Guide

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About This Document

This document describes configuration of various types of parameters, PLC communication, and the PLC operations using SoftMaster program and debug the MLPLC series.

Release Information

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Acronyms and Definitions

Acronym/Term	Definition
A/D	Analog to Digital Conversion
Base	The back plane of the PLC on which the power supply, communication, and other modules are installed. Examples: Main base and expansion base.
BCD	Binary Coded Decimal
Cold Restart	One of the CPU restart mode, which affects the variable parameters of the I/O image area when the CPU is restarted. With the CPU restart mode set to cold restart, all the parameters like the internal register, timer, and counter, initialize to zero.
CPU	Central Processing Unit
D/A	Digital to Analog Conversion
Direct variable	Memory area which can be directly accessed with the IEC standard addressing notations with or without any variable name. They are: %I (input), %Q (output), and %M (internal flags and registers) variables. Address Examples: %IX0.0.2, %QW1.2.1, and %MD1234
FEnet	Fast Ethernet Network
FO	Fiber-Optic
Function	An operation unit that immediately provides the operation results for an input, such as four arithmetical operations and comparative operations.
Function Block	An operation unit that memorizes the operation results within the commands, such as timer and counter or results derived from several scans. Function blocks are the fundamental element for logic programs. Function blocks like timer and counter have input and output connections, to indicate the flow.
HSL	High-Speed Link Service in MasterLogic communication modules.
I/O	Input/Output

Acronym/Term	Definition
I/O image area	Internal memory area of CPU module installed to maintain I/O states.
IEC	International Electrotechnical Commission
Interrupt Task	Interrupt driven task programs executed on meeting a given condition, in addition, to the regular scan programs. It consists of two types: • Timer Interrupt Task • Internal Flag Interrupt Task
KB	Kilobyte
KStep	Kilo Steps
LSB	Least Significant Bit
MB	Megabyte
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.
MSB	Most Significant Bit
O/S	Operating System
P2P	Point to Point Service in MasterLogic-200 communication modules
PAC	Process Automation Controller
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.
RAM	Random Access Memory

Acronym/Term	Definition
RTC	As an abbreviation of Real Time Clock, it is collectively referred as a universal IC, with the function of a clock.
Snet	Serial Link Network
SoftMaster	Programming tool for creating, editing, and debugging a program.
STP	Shielded Twisted Pair
Symbolic variable	Named Variables, which are declared with a name and type but address is automatically allocated in symbolic memory area (%A) by the CPU. For instance, named variables declared as ‘Valve1’, ‘Pump2’ or ‘Speed3’ with any IEC standard data type.
TP	Twisted Pair cables (typically CAT5 cables with RJ45 connectors for Ethernet communication.)
UTP	Unshield Twisted Pair
Warm Restart	One of the CPU restart mode which affects the variable parameters of the I/O image area when the CPU is restarted. With the CPU restart mode set to warm restart, all the parameters like the internal register, timer and counter retain the previous values.
Watchdog Timer	A timer to monitor pre-determined execution time of a program and to generate a warning, when it is not completed within the time.

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.

Symbol	Definition
	**WARNING, Risk of electrical shock**: Potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible.
	**ESD HAZARD:** Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices.
	**Protective Earth (PE) terminal**: Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	**Functional earth terminal**: Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national local electrical code requirements.
	**Earth Ground**: **Functional earth connection.** NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.
	**Chassis Ground**: Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.

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1. Introduction

1.1 Overview

MasterLogic Programmable Logic Controllers (MLPLCs) are modular, scalable, and rack-based controllers. The controller (PLC) can be either stand-alone or distributed with peer-to-peer connections. The CPUs, power supplies, and rack sizes are available in various models to suit different applications. It is tightly integrated to the control system, and helps to increase operational efficiency.

SoftMaster is a software tool designed to program and debug the MLPLC series.

The MLPLC series are as follows:

- ML-200
- ML-50
- ML-200 IEC
- ML-200R

1.2 Features

The following are key features of MasterLogic PLC.

- Supports full redundancy (CPU, power and network) – same CPU can operate in both redundant and non-redundant mode.
- Compact pocket size modules – rack room and cabinet space saver.
- Supports IEC61131-3 standard programming – Ladder Diagram (LD), Sequential Function Chart (SFC), Structured Text (ST), and Instruction List (IL) language options.
- Supports a huge library of standard function blocks and also supports creating new or user-defined function blocks.
- Supports different types of I/O modules – digital, analog (isolated), High Speed Counter (HSC), Resistance Temperature Detector (RTD) and so on.
- Supports open network protocols with field devices – Profibus™ DP, DeviceNet™, MODBUS (Ethernet and Serial).
- Supports open communication with external systems – Ethernet, fiber-optic (100MBPS), serial RS232/RS422.

- Supports peer-to-peer communications between PLCs – Dedicated Ethernet 100 MBPS or Fiber-optic option.
- Supports smart I/O modules (DIN rail) on open protocols – Profibus-DP, DeviceNet, MODBUS expanding I/O capacity, remote I/O applications or as RTUs for other manufacturers' PLC.
- Used for self-diagnostics – network diagnostics, system logs, Auto scan, and monitoring system.
- Easy to configure and troubleshoot the software.
- Supports program simulator to test programs offline without PLC/CPU.

2. SoftMaster installation

2.1 System requirements

The following are the system requirements of SoftMaster.

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

2.2 Installing SoftMaster

Perform the following steps to install SoftMaster.

Step	Action
1	Insert the SoftMaster CD into the CD-ROM drive.
2	Browse to the folder containing the SoftMaster and double-click the **SoftMaster.exe**.
	The **Open File – Security Warning** dialog box appears.
3	Click **Run**.
	The **Welcome to the InstallShield Wizard for SoftMaster** page appears.
4	Click **Next.**
	The **Customer Information** page appears.
5	Type the **User Name** and name of the **Organization**.

Step	Action
6	Click **Next**. The **Destination Folder** page appears. In this page, you can either install in default location or specify the location to install SoftMaster. Click **Change** to install in different location. You can browse and select the required location.
7	Click **Next**. The **Ready to Install the Program** page appears. **Note**: SoftMaster needs 30 MB of free disk space. In case of inadequate free space, you are prompted to select a disk with enough capacity.
8	Click **Install** to begin installation. All the program features selected are installed. Once the SoftMaster is successfully installed, the **InstallShield Wizard Completed** page appears.
9	Click **Finish**.

Install the USB device driver

If you are installing SoftMaster, you may need to install the USB device driver separately.

Perform the following steps to install USB Device driver.

ATTENTION

When you install a SoftMaster, a **Drivers** sub-folder is created under the folder where SoftMaster is installed and that sub-folder contains two driver files, GmUSBD.sys and GmUSBD.inf. If **Drivers** folder is not created, reinstall the SoftMaster.

Step	Action
1	Turn PLC power ON and connect USB device to the PC. If the connection is established, the **Found New Hardware Wizard** dialog box appears.
2	Click **Install from a list or specific location (Advanced)** option and then click **Next**. The Search and Installation page displays.
3	Select Search for the best driver in these locations and Include this location in the search options.
4	Click **Browse**. The **Browse For Folder** dialog box displays, select **Drivers** folder where SoftMaster is installed.
5	Click **OK**. Then, the system searches for the driver files in the selected folder.
6	When the most suitable device driver is found, system prompts and begins to install the selected device driver. Since, USB device driver operates stably based on Windows OS, click **Continue Anyway**. Once the device driver is installed completely, the **Installation Complete** page displays.
7	Click **Finish** to exit from the wizard.

2.3 SoftMaster user interface

The following image is an illustration of the SoftMaster user interface.

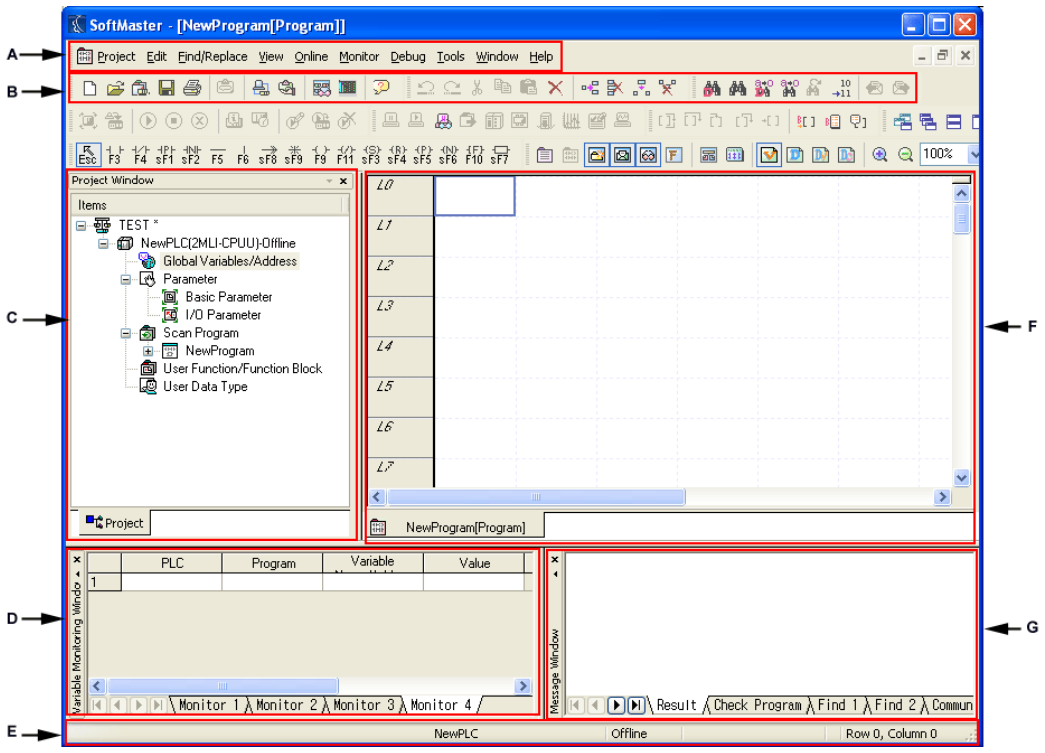


Figure 2-1 SoftMaster user interface

The user interface of SoftMaster can be described as follows:

- **A:** represents **Menu bar**, it is the basic menu bar of SoftMaster.
- **B:** represents **Tool bar**. The toolbar contains buttons and commands to access frequently used tasks.
- **C:** represents **Project window.** It displays the components of the currently open project.
- **D:** represents **Variable Monitoring window**, which is used to register and monitor variables.

- **E:** represents **Status bar.** It displays the status of SoftMaster, the information of the connected PLC, and so on.
- **F:** represents **Edit window**. It displays the current Edit window.
- **G:** represents **Message window**. It displays messages when the SoftMaster is in use.

2.4 Connecting SoftMaster to PLC

The SoftMaster can be connected locally/remotely to PLC using any one of the following communication media.

- RS-232C
- USB
- Extended base USB
- Ethernet

If you…	And…	Then…
Select the type as RS-232C/USB/Extended base USB	Depth as Local/Remote	Refer Local connection settings
Select the type as RS-232C/USB	Depth as Remote 1/Remote 2	Refer To connect PLC using remote RS232C/USB
Select the type as Ethernet	Depth as Remote 1/Remote 2	Refer To connect PLC using Ethernet
Select the type as Modem	Depth as Remote 1/Remote 2	Refer To connect PLC using Modem

Perform the following steps to set the connection options for PLC.

Step	Action
1	In the Menu bar click **Online** > **Connection Settings**. The **Online Settings - NewPLC** dialog box appears.
2	In **Connection settings**, from the **Type** list, click the communication media as per requirement.
3	To specify the connection configuration with the PLC, from the **Depth** list

Step	Action
	select the type of configuration as per requirement.
4	To perform detailed settings for the selected type of connection, click **Settings** and enter the required settings.
5	In **General** field, enter the **Timeout interval** and **Retrial times** values as per requirement.  **ATTENTION** • Ensure that the Timeout interval value does not exceed 90seconds. • Ensure that the Retrial time value does not exceeds nine.
6	To set the frame size for the data transfer, under **Read / Write data size in PLC run mode**, click **Normal** or **Maximum**.  **ATTENTION** This option is available only when the PLC operation is in **Run** mode. In other modes of operation, data is transferred in the maximum frame size.
7	To preview the connection settings, click **Preview**. The **View Connection Settings** dialog box appears.
8	Click **OK**.
9	Click **Connect**. The **Connect** dialog box appears.

Local connection settings

The RS-232C, USB and Extended base USB are the three types of local communication media that can be used to connect SoftMaster to the PLC.

Perform the following steps to connect SoftMaster to PLC using local communication media.

Step	Action
1	In the Menu bar click **Online** > **Connection Settings**. The **Online Settings - NewPLC** dialog box appears.

Step	Action
2	In **Connection settings**, from the **Type** list, click RS-232C or USB or Extended base USB.
3	In **Connection settings**, from the **Depth** list click **Local**. **ATTENTION** The **Settings** option is not available if you select **USB** or **Extended base USB** as the communication media, and **Local** as the depth. In addition, **Local** is the default depth setting for **Extended base USB**.
4	Click **Settings**. The **Details** dialog box appears.
5	In **RS-232C**, under **RS-232C settings**, select the **Port number** and **Baud rate**. **ATTENTION** Ensure to select the port number between the rangeCOM1 ~ COM 8. For RS-232, COM1 is the default communication port and 115200bps is the default communication speed.
6	Click **OK**.
7	In **General** field, enter the **Timeout interval** and **Retrial times** values as per requirement. **ATTENTION** Ensure that the Timeout value does not exceed 90seconds. Ensure that the Retrial time value does not exceeds nine.
8	To set the frame size for the data transfer, under **Read / Write data size in PLC run mode**, click **Normal** or **Maximum**. **ATTENTION** This option is available only when the PLC operation is in Run mode. In other modes of operation, data is transferred in the maximum frame size.

Step	Action
9	To preview the set connection to the PLC, click **Preview**. The **View Connection Settings** dialog box appears.
10	Click **Connect** and then click **OK**.

Remote connection settings

ATTENTION

In the **Online Settings - NewPLC** dialog box, the **Read / Write data size in PLC run mode** field is not available for setting the size of the frame for transferring data to the PLC. This option is available only for local connection.

Perform the following steps to connect PLC using remote RS-232C/USB communication media.

Step	Action
1	In the Menu bar click **Online** > **Connection Settings**. The **Online Settings - NewPLC** dialog box appears.
2	In **Connection settings**, from the **Type** list, select **RS-232C/USB**.
3	In **Connection settings**, from the **Depth** list select **Remote 1/ Remote 2**.
4	Click **Settings**. The **Details** dialog box appears. **ATTENTION** • If you select RS-232C as the type, Remote 1 as the depth and click **Settings** you can view RS-232C tab and Remote 1 tab. • If you select RS-232C as the type, Remote 2 as the depth and click **Settings**, you can view RS-232C tab, Remote 1 tab, and Remote 2 tab. • If you select USB as the type, Remote 1 as the depth and click **Settings**, you can view the Remote 1 tab. • If you select USB as the type, Remote 2 as the depth and click **Settings**, you can view Remote 1 tab and Remote 2 tab.

Step	Action
5	In **RS-232C** tab, under **RS-232C settings**, select the **Port number** and **Baud rate**. **ATTENTION** The RS-232C tab is selected by default, with COM1 as the default communication port and 115200bps as the default communication speed.
6	Click **Remote 1** tab.
7	From the **Network type** list, click the type of network as per requirement.
8	Under **Local communication module**, enter **Base number** and **Slot number**, for the selected communication module. **ATTENTION** The Snet Channel option is available only if you select the network type as **2MLL-Snet**.
9	Under **Remote 1 communication module**, enter the **Station number** and the **IP address** for the selected communication module. **ATTENTION** • The Station number option is not available if you select the network type as **2MLL-FEnet**. Ensure that the value for the station number is between 0~63. • The IP address option is available only if you select the network type as **2MLL-FEnet**.
10	Click **OK**. **ATTENTION** If you select RS-232C as the type of communication media and Remote 2 as the depth, repeat the steps from step 7 through step 9 in the Remote 2 tab.
11	In **General** field, enter the **Timeout interval** and **Retrial times** as per requirement. **ATTENTION** • Ensure that the Timeout value does not exceed 90seconds.

Step	Action
	• Ensure that the Retrial time value does not exceed nine.
12	To preview the set connection to the PLC, click **Preview**. The **View Connection Settings** dialog box appears.
13	Click **Connect** and then click **OK**.

Perform the following steps to connect PLC using Ethernet.

Step	Action
1	In the Menu bar click **Online** > **Connection Settings**. The **Online Settings - NewPLC** dialog box appears.
2	Under **Connection settings**, a) From the **Type** list, click **Ethernet**. b) From the **Depth** list, click **Remote 1/ Remote 2**.
3	Click **Settings**. The **Details** dialog box appears. **ATTENTION** • If you select the depth as Remote 1, on clicking **Settings** you can view the Ethernet tab. • If you select the depth as Remote 2, on clicking **Settings** you can view Ethernet tab and Remote 2 tab.
4	In **Ethernet** tab, under **Set IP addresses**, enter the IP address. **ATTENTION** Perform step 5 through step 8 only if you select the depth as Remote 2.
5	Click **Remote 2** tab.
6	From the **Network type** list, click the type of network as per requirement.
7	Under **Remote 1 communication module**, enter **Base number** and **Slot number**, for the selected communication module.

Step	Action
	ATTENTION The Snet Channel option is available only if you select the network type as **2MLL-Snet**.
8	Under **Remote 2 communication module**, enter the **Station number** and the **IP address** for the selected communication module. **ATTENTION** The Station number option is not available if you select the network type as **2MLL-FEnet**. Ensure that the value for the station number is between 0~63. The IP address option is available only if you select the network type as **2MLL-FEnet**.
9	Click **OK**.
10	In **General** field, enter the **Timeout interval** and **Retrial times** as per requirement. **ATTENTION** • Ensure that the Timeout value does not exceed 90seconds. • Ensure that the Retrial time value does not exceed nine.
11	To preview the set connection to the PLC, click **Preview**. The **View Connection Settings** dialog box appears.
12	Click **Connect** and then click **OK**.

Perform the following steps to connect PLC using Modem.

Step	Action
1	In the Menu bar click **Online** > **Connection Settings**. The **Online Settings - NewPLC** dialog box appears.
2	Under **Connection settings**, a) From the **Type** list, click **Modem**. b) From the **Depth** list, click **Remote 1/ Remote 2**.

Step	Action
3	Click **Settings**. The **Details** dialog box appears. **ATTENTION** • If you select the depth as Remote 1, on clicking **Settings** you can view the Modem tab. • If you select the depth as Remote 2, on clicking **Settings** you can view Modem tab and Remote 2 tab.
4	In **Modem** tab, under **Modem Type**, click **Dialup** or **Dedicated**, as per your requirement.
5	Under **Modem settings**, perform the following: a) From the list, click the **Port number** and **Baud rate** as per requirement. b) Enter the **Phone number** and the **Station number** as per requirement. **ATTENTION** Perform step 6 through step 9 only if you select the depth as Remote 2.
6	Click **Remote 2** tab.
7	From the **Network type** list, click the type of network as per requirement.
8	Under **Remote 1 communication module**, enter **Base number** and **Slot number** for the selected communication module. **ATTENTION** The Snet Channel option is available only if you select the network type as **2MLL-Snet**.
9	Under **Remote 2 communication module**, enter the **Station number** and the **IP address** for the selected communication module. **ATTENTION** The Station number option is not available if you select the network type as **2MLL-FEnet**. Ensure that the value for the station number is between 0~63. The IP address option is available only if you select the network type as **2MLL-FEnet**.

Step	Action
10	Click **OK**.
11	In **General** field, enter the **Timeout interval** and **Retrial times** as per requirement.
	ATTENTION • Ensure that the Timeout value does not exceed 90seconds. • Ensure that the Retrial time value does not exceed nine.
12	To preview the set connection to the PLC, click **Preview**. The **View Connection Settings** dialog box appears.
13	Click **Connect** and then **OK**.

3. Configuration

3.1 Overview

Before you configure CPU or user logics, you must define variables.

Defining a variable

Use of variables is program dependent. In general, global variable is available in every program. To use a global variable as a local variable, it is necessary to declare it as EXTERN before you use. Local variable is available only in a designated program. Direct variable (variables with user specified address) can be used in the program. In addition, a comment can be entered to the direct variable. The following are the types of variables defined in SoftMaster.

- Global Variable
- Local Variable
- Function Block Variable
- Function Variable

Global variable

Global variable consist of address comments and flags. A global variable declares the variable to be used for a program or displays a list of the declared variables, based on the available variables. Address Comment declares the direct variable comment available in a program or displays the comment. The flag displays a list of flags provided by the declaration. The following are the different types of flags.

- System flag
- High-speed link flag
- P2P flag
- PID flag

Perform the following steps to navigate to the global variable.

Step	Action
1	In the **Project Window**, double-click **Global Variables/Address**. The **Global Variables/Address** dialog box appears on the right panel.
2	Click the **Global Variable** tab. The following table summarizes the options in the Global Variable tab.

Field Label	Description
Variable kind	VAR_GLOBAL and VAR_GLOBAL_CONSTANT are available.
Variable name	The declared variable cannot be duplicated. The following points must be noted while entering a variable name. • A numeric value is not allowed as the first character. • A special character is not allowed. (However, '_' is available.) • Space is not allowed as a character. • A direct variable with the same name is not allowed (that is, MX0, WB0) • If a line is empty, BOOL is displayed as the default type when entering a variable.
Type	There are 23 types of variables are available; 20 basic types and 3 derived types. **Basic type (20)**: BOOL, BYTE, WORD, DWORD, LWORD, SINT, INT, DINT, LINT, USINT, UINT, UDINT, ULINT, REAL, LREAL, TIME, DATE, TIME_OF_DAY, DATE_AND_TIME, STRING **Derived type (3)**: ARRAY (that is, ARRAY[0..6,0..2,0..4] OF BOOL) => limit (up to third), STRUCT(that is, STRUCT name display) => STRUCT type is not available in STRUCT, FB_INST(that is, FB name display)
Memory address	Indicates the memory address that can be entered using the direct variable (I, Q, M, R, and W).

Step	Action

Initial value	Indicates the default value that can be set.
Retain	Indicates if memory address is set, and if the retain column is inactive. The following are the options available for retain. • R, W: Always retain area • M: Setting as per basic parameter information • I, Q: Always not retain area
Used	Indicates whether to use a declared variable.
Comment	Allows entry of a comment. Use Ctrl + Enter key to enter multi line comments.
Line validity	To register on global variable window, it needs variable kind, variable name, and variable type. An incomplete entry in a global variable window is highlighted in pink.

3 Click **Address Comment** tab.

The address comment tab displays the comment entered or declared for the variables.

4 From the **Address** list, select the address as per requirement. The address depends on the type of CPU selected.

5 Click **Flag** tab.

The following table summarizes the options in Flag tab.

Field Label	Description
Flag kind	You can select the type of flag (System, HS link, P2P and PID).
All	Used to display the entire list of flags selected from **Flag kind**. In case you select system flag, all the details of system flag appears the window. If **All** is not selected, only the flag applicable to the **Parameter number** and **Block index** appear.

Step	Action	
	Parameter number	This is active only for High-speed link, P2P and PID flag. Only the flag item of the input parameter number appears. The value of the input parameter must lie between 1 ~ 12 and must not exceed 12.
	Block index	This is active only for high-speed link and P2P flag. Only the flag item of the input block index appears. The value of the block index must lie between 0 ~ 127 and must not exceed 127.

Local variable

Local variable declares the variables used in a program or displays the list of declared variables.

VAR, VAR_CONSTANT, VAR_EXTERNAL, and VAR_EXTERNAL_CONSTANT are the four kinds of local variables listed under Variable Kind.

Perform the following steps to navigate to the local variable.

Step	Action
1	In the Project Window, under **Scan Program**, double-click the **Local Variables**. The Local Variable dialog box appears on the right panel.
2	In **Variable Name**, enter the name for the variable.
3	From the **Type** list, select the data type for the variable.
4	In **Address** field, enter the address for the variable.
5	In **Initial Value** field, enter the initial value for the variable.

ATTENTION

- If variable type is CONSTANT, it sets the initial value as default (0).
- If the variable type is VAR_EXTERNAL or VAR_EXTERNAL_CONSTANT, the columns of the initial value and retain value are displayed as defaults.

Function block variable

Function block (FB) variables are a part of user-defined function blocks. FB variable stores operation results in a command such as timer and counter. You can go to user-defined function blocks in the project tree to add a function block.

VAR, VAR_CONSTANT, VAR_INPUT, VAR_OUTPUT, VAR_IN_OUT, VAR_EXTERNAL, and VAR_EXTERNAL_CONSTANT are the different kinds of function block variables listed under Variable Kind.

ATTENTION

- If a variable type is CONSTANT, the initial value is set as default.
- If a variable type is VAR_INPUT, VAR_OUTPUT, and VAR_IN_OUT, the initial value cannot be set.

Function variable

Function (FUN) variables are a part of user-defined functions. FUN Variables do not store the operation results. You can go to user-defined function blocks in the project tree to add a function.

VAR, VAR_INPUT, VAR_OUTPUT, VAR_IN_OUT, and VAR_RETURN are the different kinds of function variables listed under Variable Kind.

There are 22 data types available in functional variable; 20 basic types and 2 derived types.

Basic types (20): BOOL, BYTE, WORD, DWORD, LWORD, SINT, INT, DINT, LINT, USINT, UINT, UDINT, ULINT, REAL, LREAL, TIME, DATE, TIME_OF_DAY, DATE_AND_TIME, STRING.

Derived types (2): ARRAY (that is ARRAY [0..6,0..2,0..4] OF BOOL) => factor limit (up to third), STRUCT(that is STRUCT name display) => STRUCT type is no available in STRUCT.

3.2 Configuring ML CPU

Creating a project

Perform the following steps to create a project.

Step	Action

Step	Action
1	On the Menu bar, click **Project** > **New Project**. The **New Project** dialog box appears.
2	In the **Project name** field, enter a name for the project.
3	In PLC Series, select the respective PLC type (ML-200R or ML-200IEC).
4	In **Program language**, select the **LD** or **SFC** or **ST** as per requirement.
5	Click **OK**. The SoftMaster Window with the specified project name appears.

Configure basic parameters

It is used to specify the basic parameters related with the PLC operation. The basic operation is classified into the following parts.

- Basic operation setup (this involves the basic operation and output control settings)
- Retain area setup
- Error operation setup
- MODBUS setup

Perform the following steps to configure the basic parameter.

Step	Action
1	In the Project Window, double-click the **Basic Parameter**. The **Basic Parameter Setting** dialog box appears.
2	Click the **Basic Operation Setup** tab. The **Basic Operation Setup** page appears.  **ATTENTION** The **Basic Parameter Setting** dialog box appears with the **Basic Operation Setup** tab selected by default.
3	In the **Basic Operations Setup** page, perform the following: a) PLC defines the scan period automatically based on the PLC load.

Step	Action

b) To run the PLC based on fixed scan time, under **Basic Operation**, select **Fixed period operation**. Enter a value between 1ms and 999ms.

ATTENTION

Honeywell recommends auto scan settings. Hence, the **Fixed period operation** option is optional and you can select this option based on the requirement. To avoid watchdog timer error, the **Fixed period operation** value must be set less than or equal to the **Watchdog Timer** value.

c) To keep the PLC from stopping due to program SCAN period error, under **Time Setup**, enter a value between 10ms and 1000 ms in the **Watchdog Timer** box.

d) To specify the standard filter constant value for the input, under **Time Setup**, select a value for the **Standard Input Filter** from the list.

e) To set the restart mode for the CPU, under **Restart Method** click any of the following options.

- **Cold Restart** to initialize all the CPU parameters to zero.
- **Warm Restart** to initialize all the CPU parameters to the previous values.

f) A knob is present on the CPU that enables the user to manually reset or clear the data on the PLC.

Under **Reset Switch Setup**.

ATTENTION

Move the knob to the left and release- PLC is reset, which clears all error/warning information. During power ON, Error/warning may occur based on the situation.

Move the knob to the left and hold for 3 seconds- PLC is Overall reset, which clears error/warning information; latch 1 area data, I/O skip, error mask, and forced I/O setting area to allow power ON

- Select **Disable the reset switch** checkbox to prevent manual reset and overall reset of PLC.
- Select **Disable the overall reset switch** checkbox to prevent overall reset of the PLC manually. However, you can reset the PLC by moving the knob on the CPU to the left and releasing it.

Step	Action

ATTENTION

If Disable the reset switch or Disable the overall reset switch option is selected, use SoftMaster to reset/overall reset the PLC by clicking **Online** > **Reset PLC.**

g) Under **D.CLR Overall Reset Switch Setup**.

ATTENTION

Move the knob to the right and release- The general data area and retain area (M, Automatic variable) is cleared.

Move the knob to the right and hold for 3 seconds- The general data area, retain area (M, Automatic variable) and R area is cleared.

- Select **Disable the D.CLReset switch** to prevent manual clearing of the data.
- Select **Disable the overall D.CLReset switch** to prevent manual overall clearing of the data. However, you can clear the data in the general data area and retain area by moving the knob on the CPU to the right and releasing it.

ATTENTION

D.CLR clear does not function in RUN mode. If you want to use the D.CLR switch, change it to STOP mode. In addition, the default area is initialized when D.CLR switch is cleared.

If Disable the D.CLReset switch or Disable the overall D.CLReset switch option is selected, use SoftMaster for clearing the data.

h) To save the most recent SOE events, under **SOE History**, click **Save the latest SOE events**.

i) To save the first SOE event, under **SOE History**, click **Save the first SOE events**.

j) To keep the output even when debugging the data, under **Output Control**, select **Output during debugging.**

k) To keep the output data to the module even when an error or a specific input occurs, under **Output Control**, select **Keep Output when an error occurs**.

Step	Action
	l) To keep the output the data to the module even when PLC operation mode changes from RUN to STOP, under **Output Control**, select **Keep Output when converting RUN->STOP**.
	m) To keep the output the data to the module as usual or even when PLC operation mode is not changed from STOP to RUN, under **Output Control**, click **Keep Output when converting STOP -> RUN**.
4	Click **Retain Area Setup** tab.
5	In the **Retain Area Setup** page, perform the following:
	a) To set the options necessary for retain area, under **M Area Configuration**, select **M area retain setting(Max size: 128KB)**.
	b) To preserve the data when PLC is restarted, provide value **From %MW** and **To %MW** for M area (retain area).
	ATTENTION The retain area size (From %MW) must be smaller than or equal to M Area (To %MW) size.
6	Click **Error Operation Setup** tab.
7	To specify the operation method when an error occurs in the PLC, under **Error Operation Setup**, perform the following:
	a) To run the PLC even if an error occurs in the fuse connection status of the module during PLC RUN, select **Continue running when a fuse error occurs**.
	b) To run the PLC even if an error occurs on an I/O module during PLC RUN, select **Continue running when an I/O module error occurs**.
	c) To run the PLC even if an error occurs on the special module during PLC RUN, select **Continue running when a special module error occurs**.
	d) To run the PLC even if an error occurs on the communication module, select **Continue running when a communication module error occurs**.
	e) To run the PLC even if an error occurs in the extended base, select **Continue running when an extended base error occurs**. This option is available only for ML-200R PLC series.

Step	Action
	ATTENTION After replacing the error module, select **Disable/Enable the Skip I/O** for that module to make online.
8	The **MODBUS Setup** tab appears only if you select PLC Series as **ML-200 IEC**. Click **MODBUS Setup** tab. **ATTENTION** ML-200 IEC CPU itself can operate as MODBUS serial communication module.
9	Under **Connection settings**, perform the following as per requirement. a) In the **Station number** list, click the station number used for communication. The range is 0 to 63 and default value is 63. b) In the **Data BIT** list, click the number of data bits used for each string. This value is identical to the value specified in the PLC communication. Most string is transferred in 7 or 8 bits. c) In the **Stop BIT** list, click the number of bits to change the time (if time is measured by bit) required to transfer each string. The string transferred in 1 or 2 bits. d) In the **Baud rate** list, click the maximum speed of the data to transfer through port. The default value is 115200. e) In the **Parity BIT** list, click the parity bit as per requirement. f) In the **Serial mode** list, click the mode to specify the transference mode. The available modes are ASCII and RTU.
10	Under **Memory Area**, perform the following as per requirement. **ATTENTION** Only WORD variable type is allowed. a) In the **Digital Input start address** box, specify the start address of DI (Digital Input) memory area to read through MODBUS, where the value should be specified in Word unit. b) In the **Digital Output start address** box, specify the start address of DO (Digital Output) memory area to read through MODBUS, where the value

Step	Action
	should be specified in Word unit. c) In the **Analog Input start address** box, specify the start address of AI (Analog Input) memory area to read through MODBUS, where the value should be specified in Word unit. d) In the **Analog Output start address** box, specify the start address of AO (Analog Output) memory area to read through MODBUS, where the value should be specified in Word unit.
11	Click **OK**.

Configure I/O parameter

It is used to specify the I/O type configured in the PLC and to set the applicable parameters for each slot.

ATTENTION

- The 2MLI project type supports the only fixed allocation type. Therefore, the allocation information column is always displayed as disabled.
- I/O modules can be placed in CPU base for ML-200 IEC CPU.
- Fixed point assignment and variable point assignment are available for the module assignment method. The fixed point assignment assigns 64 points collectively to a slot while the variable point assignment depends on the module type. Exceptionally 32 points is assigned to the special/communication module, and 16 points to the empty slot.
- The table below shows the differences between variable assignment and fixed assignment, based on the basic base.

Slot	Module Name	Variable Assignment	Fixed Assignment
0	16-point Input	P00000 ~ P0000F	P00000 ~ P0003F
1	16-point Output	P00010 ~ P0001F	P00040 ~ P0007F
2	A/D Module	P00020 ~ P0002F	P00080 ~ P0011F
3	Communication Module	P00030 ~ P0003F	P00120 ~ P0015F
4	16-point Output	P00050 ~ P0005F	P00200 ~ P0023F

REFERENCE - INTERNAL

For additional information about the communication module information setting, refer to the section about PLC Communication

Perform the following steps to configure the I/O parameters.

Step	Action
1	In the Project Window, double-click **I/O Parameter**. The **I/O Parameter Setting** dialog box appears.
2	Click the **All Base** tab. It displays the base module information and module information per slot. In case the module is not designated in slot, it is displayed as 'Default'. **ATTENTION** When you click **I/O Parameter**, the **I/O Parameter Setting** dialog box appears with the **All Base** tab selected by default.
3	Select the required base module, and then click **Base Setting**. **ATTENTION** In the All Base tab/Set Base tab, right-click the base module and click **Base Setting**. The **Base Module Setup** dialog box appears.
4	From the **Slot** list, select the number of slots for the currently selected base and then click **OK**.
5	In **I/O Parameter Setting** dialog box, under **Module** column**,** click the slot where the base module is installed.
6	Under **Module,** from the drop-down module list, navigate and select the appropriate modules applicable for the base.
7	Double-click the selected slot. Or Select the slot and then click **Details**. The respective parameter settings dialog box appears.

Step	Action
	For further information about setting the module parameters, refer to the respective module user's guide.
8	Set the parameters for the respective channels and click **OK** to apply the settings.
9	Click **OK** in **I/O Parameter Settings** dialog box. The I/O parameters are configured and displayed in the **Program** window.
10	To configure the special modules, perform the steps from 1 to 9. A confirmation message appears.
11	Click **Yes**. The **Register Special Module Variables** dialog box appears. In the right pane, the variable details for the selected base are displayed. **ATTENTION** You can also navigate to the **Register Special Module Variables** dialog box by performing the following steps. 1. From the toolbar, Click **Edit** > **Register Special/Communication Module Variables**. 2. Click **Yes**. The **Register Special Module Variables** dialog box appears.
12	Select the required variable type and click **OK**. To verify if the selected I/O parameters settings are applied, in the **Project Window**, double-click the **Global Variables/Addresses**, and then verify the flags added in the Global Variables/Address window.

Configure redundancy parameter

MasterLogic-200R (ML-200R) provides redundant configuration required in various applications.

ATTENTION

Redundancy parameter is configured only for redundant PLC series (ML-200R).

Redundant parameter configuration is classified into operation mode setting and data synchronization area setting.

ATTENTION

Unlike the other parameters, redundancy parameter can be changed during operation. As soon as the parameters are written to the PLC, the modified parameter is synchronized between the master and the standby CPU.

Note that you must use the **Write to PLC** function, to download the modified parameter.

Perform the following steps to configure the redundancy parameters.

Step	Action
1	In the **Project Window**, double-click **Redundancy Parameter**. The **Redundancy Parameter** dialog box appears.
2	Click **Basic Operation Setup** tab. **ATTENTION** When you double-click Redundancy Parameter, the **Redundancy Parameter Setting** dialog box appears with the **Basic Operation Setup** tab selected by default.
3	Under **Hot Swapping Option**, select any one of the following options. • **Base:** To operate the system in normal RUN mode except for the base. Although base error occurs in the normal RUN mode, selecting the base once the base is restored, the system operates normally. The I/O expansions can be modified or changed when PLC is in RUN mode. • **Module:** To operate the system normally. You can change the type of the module, but remove and replace the same type of module connected to the PLC.
4	Under **Extended Base Power Failure Setup**, click any one of the following options to handle the situation if the extension base is detached (power off). • **Restart and wait** if an error in the expansion base. The system restarts and CPU waits until the expansion base in failure is normalized. The base failure is indicated with 'Ebxx' in the CPU indicator panel. • **Base power failure error** if an error in the expansion base. But, other bases operate as per error settings defined in the basic parameter.

Step	Action

ATTENTION

If you select **Base power failure error** in the **Redundancy Parameter Settings** dialog box and **Keep output when an error occurs** is selected in the **Basic Parameter Settings** dialog box, then the output of other bases maintain the last output.

5 Under **Warning Option**, click any one of the following options.

- **Disable warning for single power operation** to disable the warning message when one of the power modules in expansion base is off.
- **Disable warning for ring topology** to disable warning message when ring topology fails.
- **Disable warning for single CPU mode** to disable warning message when the project requires only master CPU without redundant operation.
- **Disable warning message for fault mask removal** to disable warning message when fault mask is not applied.

6 Under **Redundancy Synchronization Area**, enter the **Start** and **End** values for the following:

- **I/O Base** The base value must be between 0 ~ 127
- **M Area** The M area value must be between %MD0 ~ %MD65535
- **R (W) Area** The value must be between %RW0 ~ %RW16383
- **PID Block** The block value must be between 0 ~ 7

ATTENTION

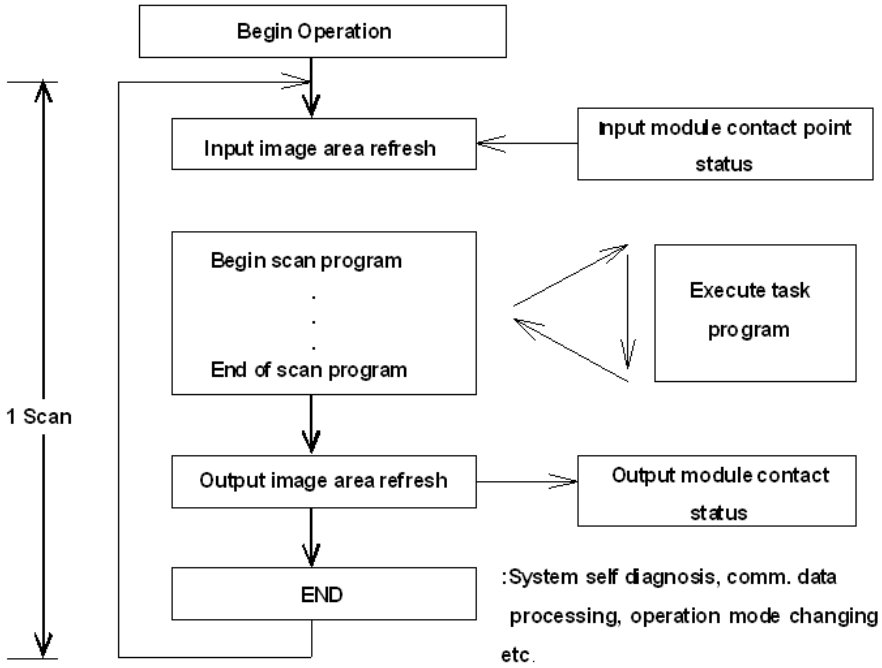
- The size of the M Area and R (W) Area can be extended from double (MD/RW) to word (MW/RW).
- The default settings for M Area in terms of double, %MD0 ~ %MD999 and %RW0 ~ %RW999 for the R (W) Area.
- The default settings for M Area in terms of word is %MW0 ~ %MW2000 and %RW0 ~ %RW2000 for the R (W) Area.
- You can define the Retain area for %M in basic parameters.
- If Master/Standby CPU continues with redundant operation, the following area is synchronized automatically.
  - L (High-Speed Link flag) and N (P2P parameter) area.

Step	Action
	– F (System flag): However, individual flag area is not synchronized – U (Special flag) • If you change the value in the variable monitoring window, the value is applied to both Master and Standby CPU, regardless of synchronization area. • %R and %W resides under data memory.
7	Click **FEnet I/F Operation Setup** tab.
8	Under **Switching condition**, click any of the following switching conditions. • **Disconnection of the cable** to instantly switch the Master CPU when the cable (media) is disconnected at the Master FEnet module. The switchover takes place by updating the flag instantly. • **Disconnection of the server connection** When the cable (media) is disconnected at the Master FEnet module, switchover does not happen during connection wait time. (However, when the connection wait time is more than five seconds, switchover occurs, within six seconds)
9	To set the condition for automatic master switchover operation when FEnet module's cable is disconnected, under **Setting operation for Disconnection to Client**, select **Automatic switchover (redundancy operation)**. The **Slot** and **Group** table is enabled.
10	From **Group** list, select the group for each FEnet module installed at main base. Each module can be set as same or different group. **ATTENTION** When automatic switchover setting and detail option settings are done, the master switchover occurs if the following two conditions are met. • All master base FEnet cables belonging to one group are disconnected. • At least one standby base FEnet cable belonging to the above group is under normal connection status.
11	Click **OK**.

3.3 Configuring user logics

The program for the MLPLC is configured with SoftMaster, compiled into an executable program, and transmitted to PLC for execution.

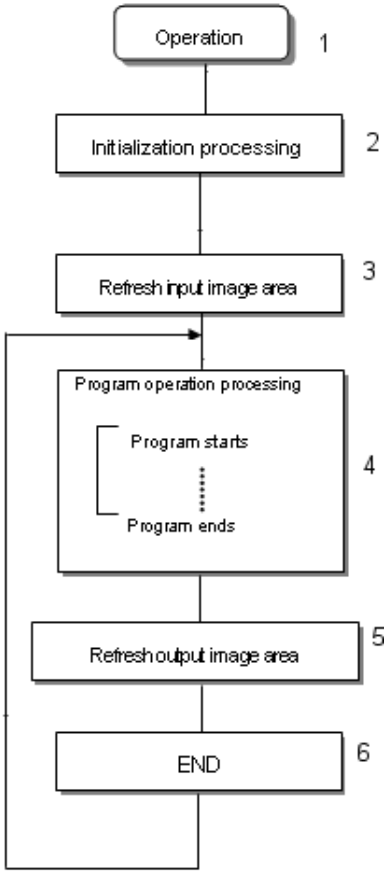
- The programs can be classified into scan programs and task programs. The scan programs are executed at every scanning, and the task programs are executed by a task.
  - Scan program: the program executed at every scan repeatedly
  - Task program: the program executed by task
- A scan program runs from the first to the last step registered in the project in the registered order, and terminates the scanning (END). The entire process is referred to as ‘1 scan’.
- The process methodology which runs a program from the beginning to the end and then runs the entire process again, is called ‘cyclic operation method’.
- Before starting the operation of a scan program, the status of the input module is read and saved in the input image area, and the status of the output image area is entered in the output module when the operation of the scan program is completed. This process is called ‘I/O Refresh’.
- ML-200R and ML-200 IEC PLC series are based on the cyclic operation method. In the operation process, input or output status is not entered directly, but the operation is executed by I/O refreshing by scan unit basis. To this end, the status of the input and output contact points are stored in the memory area of the PLC. This area is called image area.



Program operation methods

Cyclic operation (Scan)

This is a basic method of executing a program on a PLC. It repeatedly performs the same operations as per the program starting from the first step to the last step, and is called ‘Scan program’. The processing is divided per stage. The following figure depicts the scan program process.

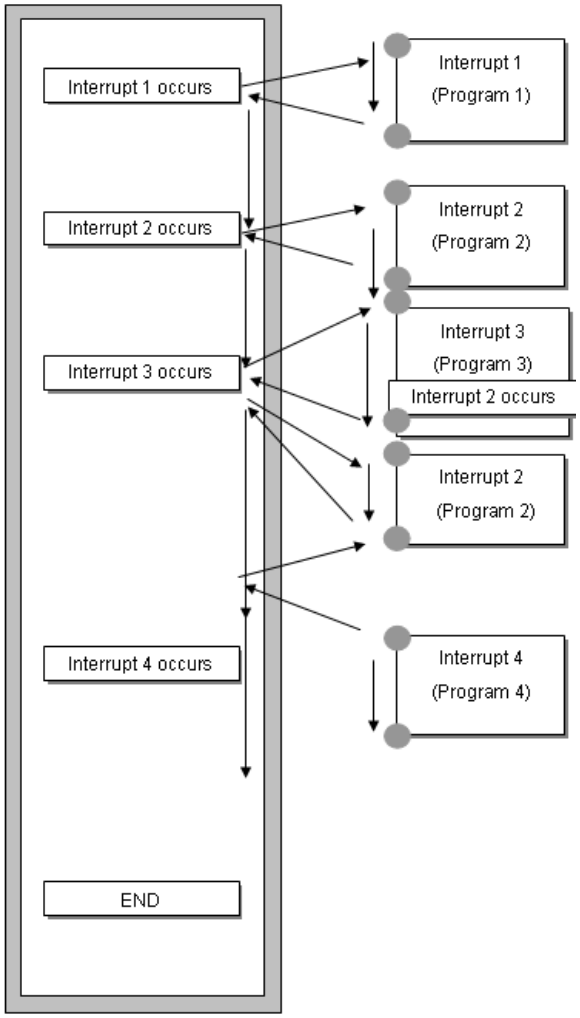


Stage	Processing Description
Operation	With the program downloaded into the PLC, the instruction from the user is received.
Initialization processing	The scan processing starts at this stage. It is executed every time when power is applied or when reset command is executed. It involves the following: • I/O module reset • Self-diagnosis execution • Data clear

Stage	Processing Description
	• Address allocation and type registration of I/O module
Refresh Input image area	The CPU reads the state of input module and saves it in input image area before executing the program. When ON time of input data is shorter than CPU scan time, it is not reflected in the ladder program
Program operation processing	The CPU then executes the program as per the identified steps.
Output image area refresh	If the program operation is completed, it prints out the contents saved in output image area to the output module.
END	The program re-executes all the steps and returns to the first step after CPU module completes one scan processing. The program processing performed is as follows: • Update the current value of timer and counter, and so on. • Execute user event and data trace service. • Execute self-diagnosis. • Execute high-speed link and P2P e-Service. • Check the state of key switch for mode setting.
	ATTENTION The data synchronization between master CPU and standby CPU begins after the start-up of the standby CPU.

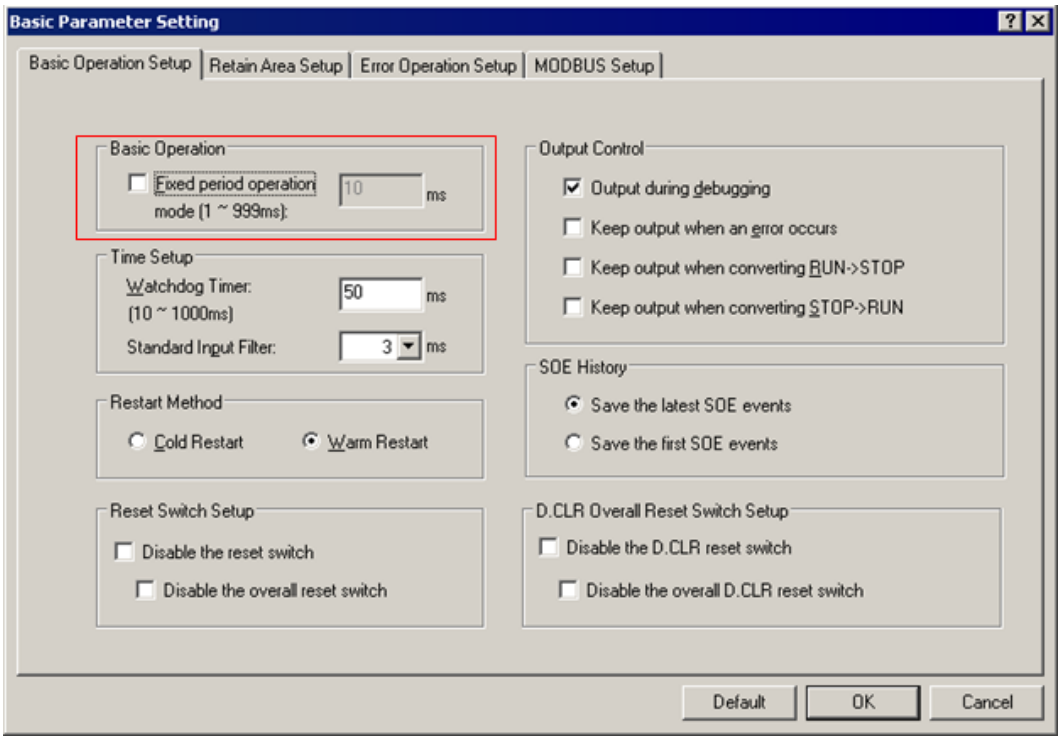
Interrupt operation (time-driven, internal device)

- In this method, if an interruption occurs, the program being executed on the PLC is temporarily stopped. The interrupt operation carries out a process corresponding to the interrupt subroutine and then returns to the main program being executed.
- The signal that informs the urgent interruption to the CPU module is called Interrupt Signal. It can be configured to trigger at pre-defined time intervals.
- Interrupt program can also be triggered by change in the state of internal devices assigned for that purpose.


Interrupt 1 occurs
Interrupt 2 occurs
Interrupt 3 occurs
Interrupt 4 occurs
END
Interrupt 1
(Program 1)
Interrupt 2
(Program 2)
Interrupt 3
(Program 3)
Interrupt 2 occurs
Interrupt 2
(Program 2)
Interrupt 4
(Program 4)

Constant scan (fixed period)

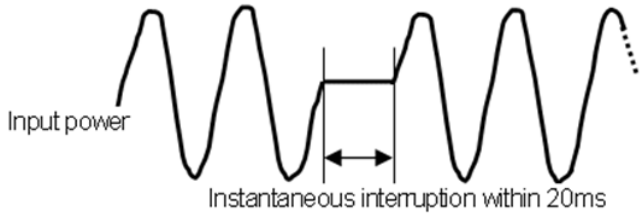
- In this method all the programs being executed are scanned, after a specific time interval. Scanning stops after all the programs are scanned.
- The features that differentiate it with the other programs are the update of input/output and to perform synchronization.
- In constant scan operation, the scan time indicates the net program processing time where the standby time is deducted. In case the scan time is greater than 'constant', '_CONSTANT_ER [%FX2140]' flag is switched ON.



Operation of instantaneous interruption

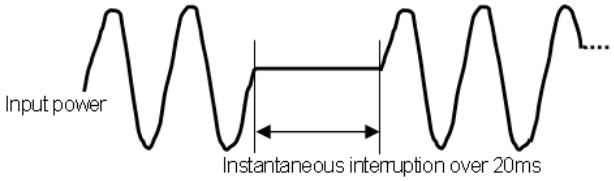
The CPU module detects momentary power failure when the input power voltage supplied to the power module is lower than the normal voltage. If the CPU module detects the momentary power failure, it carries out the operation as follows:

1. In case the instantaneous interruption is less than 20ms.



   - CPU stops the operation and holds the output in the state when momentary power failure occurred.
   - If the momentary power failure resumes, the operation continues.
   - Output voltage of power module keeps the value within the standard range.
   - Even if the operation stops momentary, timer measurement and interrupt timer measurement may be executed normally.

2. In case the instantaneous interruption exceeds 20ms.



   - Initialization occurs.
   - In redundant operation, CPU switches over.

3. In case of redundant power supply, it carries out the operation as follows:
   - If one of the power supplies has instantaneous interruption, the system is not affected.
   - If both of the power supplies have instantaneous interruption less than 20ms, the behavior of the system is as per condition (1).

– If both of the power supplies have instantaneous interruption for more than 20ms, the behavior of the system is as per condition (2).

TIP

Instantaneous interruption is momentary power failure means the state in which the voltage of supply power at power condition designated by PLC is lowered, as it exceeds the allowable variable range and the short time (usually in ms) interruption.

If both the power supplies in the Master base have an instantaneous interruption for more than 20ms, the system tries to switchover to the standby CPU.

Scan time

The processing time from program step 0 to the last step is called the Scan Time.

1. Operation and performance of ML-200R.and ML-200 IEC

   The program execution time, I/O data process time, and communication service time, and the synchronization time between the master and standby CPU are important factors affecting the scan time.

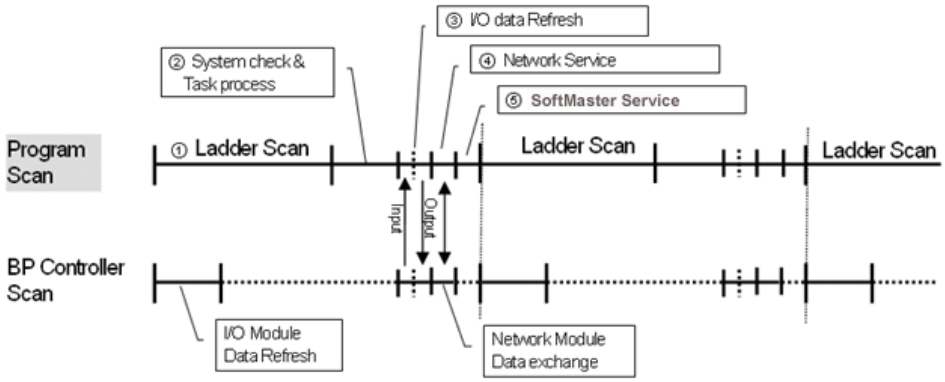
   – Using the hardware relay method, the data exchange between expansion drive modules and the data communication performance of the CPU is improved.

   – The ML CPU reduces scan time through improved data reception performance through ladder program execution and backplane, ladder program execution by MPU, and parallel execution of I/O data scan, and so on.

Type	MPU Processing Time		BP Controller Processing Time		
	Ladder Execution (32 KStep)	System Task	Digital I/O Module (32 points, 1module)	Analog Module (8 ch, 1module)	Communication Module (basic/extension) (200 byte, 1 block)
2MLR-CPUH	2.752 ms	1.0 ms	20μs	75 μs	170 + 44μs
2MLI-CPUU	0.896 ms	0.6 ms	20 μs	75 μs	185 μs

2. Calculation of Scan Time (Single CPU operation).

   The CPU module executes the scan program in the following sequence. You can estimate the scan time performance of a system using the following calculation.



- Scan time (μs) = Scan program process + system check and task process + I/O data refresh + network service + SoftMaster Service + user task program process + CPU

  a) Scan program process = number of program steps created x 2 x 0.042 (μs)
  *Precise scan time requires in addition of processing time for used instructions.
  *x 2 refers to the number of average execution code per instruction step.

  b) System check and task process: 800μs ~ 1.0ms [parameter depending on the usage of auxiliary functions].

  c) SoftMaster service process time: 100μs at the maximum data monitor.
  *10% of maximum scan time, there is a setting in the connection settings to improve the process time.

  d) Task program process time: Sum of task processing time that occurs within a scan; the time calculation by task programs are the same as of scan program.

Example:

The scan time of a system consisting of a CPU (program 16 KStep) + 32 points, 6 I/O modules + 6 analog modules + 4 communication modules (200 bytes, 8 blocks per module) is as follows:

Scan time(μs) = ladder execution time + system processing time + digital module I/O processing time + analog I/O processing time + communication module processing time + SoftMaster Service processing time.

= (16000 x 2 x 0.042) + (20 x 6) + (75 x 6) + (185 x 8 x 4) + (100) + (1500 + 250 x 2 + 1000 x 4 + 1000)

= 14934μs

= 14.9μs

3. Scan time monitor

   Scan time is saved into the following flag (%F) address/memory areas.

   - _SCAN_MAX: Maximum value of scan time (resolution of 0.1ms).
   - _SCAN_MIN: Minimum value of scan time (resolution of 0.1ms).
   - _SCAN_CUR: Current value of scan time (resolution of 0.1ms).

   _SCAN_MAX, _SCAN_MIN value can be initialized using _SCAN_WR flag. If the _SCAN_MAX is greater than WDT (Watch Dog Timer) value, a system error occurs. The WDT time can be setup with the basic parameters.

4. Scan time during redundant operation for ML-200R

   - During redundant operation, the data synchronization between the master and the standby CPU and the scan time varies with the data size that you set.
   - Synchronization data between CPUs: Basic data like system flag, communication flag, and so on. (2.8ms)
   - Redundancy synchronization area.

     a) I/Q base : 1ms/32 bases

     b) M area : 250μs per 2kword (16ms for 128kword)

     c) R area: 1.5ms per 2kword (12ms for maximum 16kword)
     (If 2kword of R area is transferred, 2kword of W area is also transferred; hence, a total of 4kword is transferred.)

     d) PID block : 0.5ms per block (4ms for 8 PID blocks)

Example:

The scan time of a system consisting of a CPU (program 16 KStep) + 32 points, 6 I/O modules + 6 analog modules (PUTGET size of 1000 byte) + 4 communication modules (200 bytes 8 blocks per module) is as follows:

(2 extension bases are used, 2kword of M area, 2 PID blocks)

Scan time = Single CPU execution time + Synchronization time

= Single CPU execution time + Sync system data + I/Q base + M area + R area + PID block

= 14.9 + 2.8 + 1.0 + 0.25 + 0.5x2

= 19.95ms

5. Delay in time, to operate in redundancy.

   – If CPU is added for redundant operation during single CPU mode, the current scan time is momentarily increased by 10%, compared to scan time of single CPU mode. This is to synchronize the data to the standby CPU.

TIP

In single CPU mode including when the standby CPU is in stop mode, data between master and standby CPU is not synchronized. Hence, data may be different from each other.

Configure ladder program

LD program displays the PLC program through graphic signals of coils or contact points used in the relay logic diagram.

Limitations

There are functional limits in LD Program Edit as described in the following table.

Table 1 LD Program edit limit

Item	Description	Limit
Maximum contact points	Maximum contact points available to add in a line	Up to 31
Maximum lines	Maximum lines available to edit	Up to 65535
Maximum copy lines	Maximum copy lines available to copy at a time	Up to 300
Maximum paste lines	Maximum paste lines to paste at a time	Up to 300

Edit tools

The following figure represents the LD tools.

The explanation for the Edit tools is given in the following table.

Table 2 LD Edit tools

Edit tool	Symbol	Shortcut key	Description
Esc	Esc	Esc	Changes to the selection mode.
Normally open contact	F3	F3	Transmits the value/state of the left horizontal line to right horizontal line, when the BOOL variable is ON.

Edit tool	Symbol	Shortcut key	Description
Normally closed contact		F4	Transmits the value/state of the left horizontal line to right horizontal line, when the BOOL variable is OFF.
Positive Transition-sensing Contact		Shift + F1	Maintains ON state during one scan (current scan), if the BOOL variable that was OFF in the previous scan is ON.
Negative Transition-sensing Contact		Shift + F2	Maintains ON state during one scan (current scan), if the BOOL variable that was OFF in the previous scan is OFF.
Horizontal Line		F5	Connects contacts and/or coils. It transmits the left side value to right side.
Vertical Line		F6	Connects contacts and/or coils to make a vertical connection. It is a logical OR of horizontal connection lines of its left side.
Fill Horizontal Line		Shift + F9	Connects contacts and/or points.
Not Instruction Contract		Shift + F9	Performs a NOT operation. It is used with the contract to reverse the input value.
Coil		F9	Stores the state of the left connection line into the associated BOOL variable. It is placed at the extreme right of the LD and to its right is a bus line.
Negated Coil		F11	Stores the negated state of the left connection line into the associated BOOL variable. For example, if the state of the left connection line is OFF, then the associated BOOL variable is ON.
RESET Coil		Shift + F4	Sets the associated BOOL variable to ON/OFF when the left link is in the OFF/ON state and remains reset until

Edit tool	Symbol	Shortcut key	Description
			set by a Set coil.
Positive Transition-sensing Coil		Shift + F5	Sets the associated BOOL value to ON in the current scan, if the state of its left connection that was OFF in the previous scan is ON in the current scan.
Negative Transition-sensing Coil		Shift + F6	Sets the associated BOOL value to ON in the current scan, if the state of its left connection that was ON in the previous scan is OFF in the current scan.
Function/FB		F10	Inserts a function block for performing an operation. The function block processes each input data into an output data type.
Extension Function		Shift + F7	Ends the program by inserting functions such as break, call, end, jump, next, set, subroutine and so on.
Normally Open OR Contact		Ctrl+3	Transmits the value/state of the left horizontal line to right horizontal line, when the BOOL variable is ON.
Normally Closed OR Contact		Ctrl+4	
Positive Transition-sensing OR Contact		Ctrl+5	
Negative Transition-sensing OR Contact		Ctrl+6	

Configuring a ladder diagram

Perform the following steps to configure a ladder diagram.

Step	Action
1	On the Menu bar, click **Project** > **New Project**.
	The **New Project** dialog box appears.
2	In the **Project name** field, enter a name for the project.
3	In PLC Series, click **ML-200R/ML-200 IEC**.
4	In **Program name** box, enter a name for the program.
5	Under **Program language**, click **LD** and then click **OK**.
	The SoftMaster Window appears with the specified project name and the edit field with the specified program.
6	In the right-pane, move the cursor to the desired location for creating the ladder diagram.
7	From the LD tool box, select the LD tool as per requirement.
8	Enter the details and click **OK**.
	The selected LD graphic appears on the edit field.

Perform the following steps to insert a LD diagram having a function block.

Step	Action
1	On the edit field, move the cursor to the desired location for creating the ladder diagram.
2	From the LD tool bar click  and click the specified location.
	Or
	Press **F10**.
	The **Function/Function Block** dialog box appears.
3	In the **Name** field, enter a name for the function.
4	From the **List** field, click the required option.

Step	Action
5	From the **Category** list and **Function** list, select a category and function as per requirement.
6	Click **OK**. The function block appears in the edit field.
7	To provide input to the function block, perform the following steps. a) Move the cursor near the input location. b) From the LD tool bar, click  and click the specified location. Or Press **F3.** The **Select Variable** dialog box appears. c) In the **Variable Name** field, enter a name for the variable and click **OK**. The **Variable Name Add** dialog box appears. d) In the **Address** field, enter an address for the variable. e) In the **Initial Value** field, enter an initial value for the variable. f) Click **OK**. The input variable appears on the selected edit field.
8	Repeat step 7 to provide output to the functional block.

ATTENTION

For more information about LD, refer to *MasterLogic PLC Instruction List User's* guide.

Configure sequential diagram

Sequential Flow Chart (SCF) is used for controlling the execution sequence of other programs (LD, ST) by using graphic symbols like step, transition, and branch.

Limitations

SFC has the following limitations while editing a program.

Table 3 SFC Program limit

Item	Description	Limit
Maximum step number	Indicates the maximum number of available steps excluding the step that is used as a step variable in the program.	512 steps
Maximum row number	Maximum number of editable rows.	65,535 rows
Maximum column number	Maximum number of editable columns.	65,535 columns

Edit tools

To enter the inputs of SFC Edit items, select the input symbols from the LD tool box and click on a specific location or press the associated shortcut key. The following figure represents the SFC edit tool.

The explanation for the Edit tools is given in the following table.

Table 4 SFC Edit tools

Edit tool	Symbol	Shortcut Key	Description
Arrow Mode		Esc	Changes to the selection mode.
Step + Transition		F3	Inserts a step at the selected area.
Action		F4	Specifies execution point/condition for every step.
Block Step + Transition		F5	
Label		F6	Inserts labels to steps or blocks.
Jump		F7	Moves the program control to a specified step or another program.
Left Branch		F8	
Right Branch		F9	

Configuring SFC diagram

Perform the following steps to configure SFC diagram.

Step	Action
1	On the Menu bar, click **Project** > **New Project**.
	The **New Project** dialog box appears.
2	In the **Project name** field, enter a name for the project.
3	In PLC Series, select **ML-200R/ML-200 IEC**.
4	In **Program name** field, enter a name for the program.
5	Under **Program language**, click **SFC** and then click **OK**.

Step	Action
	The SoftMaster Window appears with the specified project name and the edit field with the specified program name.
6	In the right-pane, move the cursor to the desired location for creating the ladder diagram.
7	From the SFC tool box, select the LD tool as per requirement.
8	Enter the details and click **OK**.
	The selected SFC graphic appears on the edit field.

ATTENTION

For more information about SFC, refer to *MasterLogic PLC Instruction List User's* guide.

Configure structured text

Structured Text (ST) is a program language and conforms to IEC 61131-3. It is used to write scan program, user function/function block, and SFC for PLC.

Limit

ST has the following limit while editing a ST language.

Item	Description	Limit
Maximum number of character in one line	Maximum number of character in one line is 2048 for English and 1024 for Korean.	2048

ATTENTION

- Only one scan program is available.
- Language of User Function/Function Block, SFC transition and action can be different from language of scan program.
- Program written in other languages cannot be converted.

Perform the following steps to write a scan program.

Step	Action
1	On the Menu bar, click **Project** > **New Project**. The **New Project** dialog box appears.
2	In the **Project name** field, enter a name for the project.
3	In PLC Series, select **ML-200R/ML-200 IEC**.
4	In **Program name** field, enter a name for the program.
5	Under **Program language**, click **ST** and click **OK**. The SoftMaster Window appears with the specified project name and the edit field with the specified program name.
6	In the edit field, type the program. **ATTENTION** You can also insert variables and/or Function/FB while writing a program. To insert Function/FB. a) Click the edit area. b) Choose **Edit** > **Function/FB**. The Function/FB dialog box appears. c) Type a name for the function. d) From **List** field, select the option as per requirement. e) In **Category** list and **Function** list, select the category and its corresponding function as per requirement. f) Click **OK**. The selected Function/Fb appears on the edit area. To insert a variable. a) Click the edit area. b) Choose **Edit** >**Select/Add Variable**. The **Select Variable** dialog box appears. c) From the list select the required variable or create a new variable.

Step	Action
	Refer to section Defining a variable for more information about creating a variable.

ATTENTION

For more information about ST, refer to *MasterLogic PLC Instruction List User's* guide.

Configure functional blocks

The function block processes each input data into an output data type.

Perform the following steps to configure a functional blocks.

Step	Action
1	On the edit field, move the cursor to the desired location for creating the ladder diagram.
2	From the LD tool bar click {F} F10 and click the specified location. Or Press **F10**. The **Function/Function Block** dialog box appears.
3	In the **Name** field, enter a name for the function.
4	From the **List** field, click the required option.
5	From the **Category** list and **Function** list, select a category and function as per requirement.
6	Click **OK**. The function block appears on the edit field.
7	To provide input to the function block, perform the following steps. a) Move the cursor near the input location. b) From the LD tool bar, click F3 and click the specified location. Or Press **F3.** The **Select Variable** dialog box appears.

Step	Action
	c) In the **Variable Name** field, enter a name for the variable and click **OK**. The **Variable Name Add** dialog box appears. d) In the **Address** field, enter an address for the variable. e) In the **Initial Value** field, enter an initial value for the variable. f) Click **OK**. The input variable appears on the selected edit field.
8	Repeat step 7 to provide output to the functional block.

Apart from the function block provided by SoftMaster, you can create the function block as per requirement.

Perform the following steps to create a user defined function/function block.

Step	Action
1	In the **Project Window**, right-click **User Function/Function Block** and then click **Add Item > Function** or **Function Block**. The **User Function/Function Block** dialog box appears.  **ATTENTION** A user-defined function is created only by LD and ST language. The user-defined function block can be created by the LD, SFC, and ST language.
2	In **Program name** box, enter a name for the Function/Function Block.
3	In L**anguage**, click any of the following language as per requirement. • LD • SFC • ST
4	Select the **Use EN/ENO** check box.  **ATTENTION** If you do not select EN/ENO, you must declare the data type of the first input and first output parameters for the function/function block as BOOL.

Step	Action
5	If you select **Function** from the **Add Item** list, then from the **Return data type** list, select the return data type for the function.
6	Click **OK**. The Function/Function Block with the specified name appears in the **User Function/Function Block** tree.
7	Perform the following steps for creating I/O variable for the user defined Function/Function Block. a) In the **Project Window**, under **User Function/Function Block**, double-click **Local Variables**. The **Local Variables** page appears. **ATTENTION** • The return data type variable that was selected while creating a user-defined function appears in the variables list. • The name of the return variable is the same as the function name. b) From the **Variable Kind** list, select the variable as per requirement. c) In the **Variable Name** box, enter a name for the variable. d) From the **Type** list, select the data type for the variable. The selected variables appears in the variables list.

Step	Action
8	Perform the following steps to use the created function/function block. a) In the **Project Window**, under **User Function/Function Block**, double-click **Program**. The program edit area appears on the right plane. b) On the edit field, move the cursor to the desired location for creating the ladder diagram. c) From the LD tool bar click  and click the specified location. Or Press **F10**. The **Function/Function Block** dialog box appears. d) In the **Name** box, enter the name of the previously created **Function/Function Block**. e) Click **OK**. The selected **Function/Function Block** appears in the edit area. f) Provide the input and output for the selected Function/Function Block.

ATTENTION

For more information about function block, refer to *MasterLogic PLC Instruction List User's* guide.

4. MLPLC Operations

4.1 Loading data to PLC

Read operation

This operation is used to read the user programs, parameters, and comments from PLC to a current project. Perform the following steps to read a data in PLC and to apply them to a new project.

Step	Action
1	To connect to the PLC, click **Online** > **Connect**.
	The **Connect** dialog box appears and the connection is established with the PLC.
2	In the SoftMaster window, click **Online > Read**.
	The **Read** dialog box appears.
3	Select items that must be read from the PLC and click **OK**.
	The selected items are applied to the current project and a message appears to confirm that the reading is complete.

Write operation

This operation is used to transfer the user programs, parameters, and comments from online computer to PLC. Perform the following steps to transfer the user programs, parameters, and comments from an online PC to PLC.

Step	Action
1	To connect to the PLC, click **Online** > **Connect**. The **Connect** dialog box appears and the connection is established with the PLC.
2	In the SoftMaster window, click **Online > Write**. The **Write** dialog box appears.
3	Select the data that must be transferred to the PLC and then click **OK** The data transfer begins. The **Current** and **Total** boxes display the progress of the write operation

ATTENTION

- The special module parameter Write is available only when I/O parameter Write is selected.
- Parameter Write takes more time during CPU RUN than in CPU STOP mode.

4.2 Changing operation mode

This operation is used to convert the operation mode of the PLC. SoftMaster provides the following three modes of operation.

- Run: It executes a program operation normally.
- Stop: It stops the operation with no program execution.
- Debug: It verifies a program while checking the program execution and data.

Perform the following steps to change the operation mode of the PLC.

Step	Action
1	To connect to the PLC, click **Online** > **Connect**. The **Connect** dialog box appears and the connection is established with the PLC.
2	Click **Online** > **Change Mode** > **Run**/**Stop**/**Debug**. The PLC mode changes as per the selection.

Step	Action
	ATTENTION Debug option is not available if the PLC operation is in Run mode.

ATTENTION

- Ensure that PLC's remote dip switch is ON with the operation mode dip switch as Stop.
- If operation mode is changed from Stop to Run, a dialog box confirms the program conversion to an executable code inside the PLC. This dialog box may be visible up to 30s according to the program size.
- If operation mode is changed to Run mode, the Performing Initialization Task dialog box appears while the initialization task is run. After the initialization task is complete or disconnected, the dialog box closes.
- If operation mode is changed to Run or Debug mode, Run or Debug function may not be normal if any error occurs on the PLC. Delete the PLC error first and then change the operation mode.

4.3 Controlling redundancy

Perform the following steps for controlling redundancy for ML-200R PLC series.

Step	Action
1	In the SoftMaster window, choose **Online** > **Control Redundancy**. The Redundancy control dialog box appears.
2	To switchover the Master CPU from A- side to B- side or vice versa, in the **Master CPU** tab, click **Change**. **ATTENTION** If Change is not disabled, it displays inactive mode. The redundancy state is changeable when: • The Master CPU is in stop mode. • The Master CPU has error. • The redundancy system is in run mode.
3	Click **Standby CPU** tab.
4	To change the mode of Standby CPU, under **Standby CPU mode**, click **Run** or **Stop** as per requirement.
5	Click **Change**.
6	To reset the Standby CPU, under **Standby CPU mode**, click **Reset** or **Overall reset**.
7	Click **Execute**. The changes made to the Standby CPU get executed.

4.4 Setting flash memory

In **Flash Memory Operation Mode**, the program is saved into flash memory. If the program data in the RAM is corrupted the system operates from the backup program that is present in the flash memory. The flash memory operation starts when the CPU operation mode is changed to RUN.

Perform the following steps in SoftMaster to view or change the flash memory settings.

I

Step	Action
1	To connect the PLC, click **Online** > **Connect**. The **Connect** dialog box appears and the connection is established with the PLC.
2	Click **Online** > **Set Flash Memory**. The **Flash Memory Run Mode Setup** dialog box appears.
3	Click **Enable flash memory run mode**. It copies the program from user program area to flash.

ATTENTION

- Flash Memory Operation Mode can be changed, irrespective of RUN/STOP mode.
- During Run mode, if a flash memory operation mode is enabled, the program is copied to the flash memory. If the PLC restarts before the changes are saved into flash memory; the system operates with the previously saved program.
- The flash memory operation mode setting is configured to recover the program when PLC status is in error.

4.5 Setting PLC password

The PLC password can be specified, changed or deleted to protect PLC information.

Perform the following steps to set PLC password.

Step	Action
1	To connect to the PLC, click **Online** > **Connect**. The **Connect** dialog box appears and the connection is established with the PLC.
2	Click **Online** > **PLC Information**. The **PLC Information** dialog box appears.
3	Click **Password** tab.

Step	Action
4	In the **New Password** box, enter a new password.
5	In the **Confirm password** box, re-enter the new password.
6	Click **Change**.
	The new password is set in the PLC.

ATTENTION

The password cannot be retrieved if it is lost.

ATTENTION

- The password can contain a maximum of eight alphabets. The alphabets can be of upper case or lower case.
- Special characters can be used for password.
- On setting a password for the PLC, you are prompted to enter password when attempting to connect to the PLC. Only after authentication of the password, the connection to the PLC is established.

Perform the following steps to change an existing password.

1. In the **Current Password** box, enter the saved password.
2. In **New Password** box, enter a new password.
3. In the **Confirm password** box, enter the new password again.
4. Click **Change**.
   The password is changed and saved in the PLC.

Perform the following steps to delete a password.

1. In the **Current Password** box, enter the saved password.
2. Click **Clear**.
   The password is deleted.

4.6 Setting the real-time clock in the PLC

You can set the value of clock by using a program. It is used when setting the time manually by external digital switches or creating a system to calibrate a clock periodically on network.

Perform the following steps to set the Real-Time clock in the PLC.

Step	Action
1	To connect to the PLC, in the SoftMaster window, click **Online** > **Connect**. The **Connect** dialog box appears and the connection is established with the PLC.
2	Choose **Online** > **PLC Information**. The **PLC Information** dialog box appears.
3	Click the **PLC RTC** tab.
4	In the **Date** box, set the date for the PC.
5	In the **Time** box, set the time for the PC.
6	To synchronize the PC date and time with the PLC, click **Synchronize PLC with PC clock**.
7	To transfer user-specified date and time to PLC, click **Send to PLC**. The specified date and time appears in the PLC.

4.7 Setting Force I/O

The forced I/O setting function is used for forcibly turning ON or OFF I/O channels, irrespective of the program execution results. This can be also used to specify the I/O refresh area in PLC.

Forced On/Off processing time and processing method

ATTENTION

In SoftMaster program window, forced IOs will be shown in different color to differentiate between normal IO and forced IO.

Forced input

The input forces the data of the contact point (Digital Input) selected and sets as forced ON/OFF. At the time of input refresh, the forced data is updated to the input image area. Therefore, the user program operates with actual input data while the forced setting area operates with forced setting data.

Forced output

The output replaces data of contact point (Digital Output) selected and sets as forced ON/OFF from the data of output image area. This is achieved during output refresh, on completion of the user program operation execution with the forced setting data. It makes changes in the output module. In case of output, the data of output image area does not change by forced ON/OFF setting.

Cautions for using forced I/O

The following are the cautions for using forced I/O.

- For forcing the point, the Force Flag needs to be set.
- It is possible to set the forced input even if the actual I/O module is not installed.
- The data set in the CPU is retained till it is cleared.
- Forced I/O data is not cleared even if CPU is in Stop mode.
- Click **Delete all** to clear all settings and set forced value again.

Direct I/O operation

The ‘DIREC_IN, DIREC_OUT’ function is used to change the I/O values. This enables you to read the state of input and output contact points directly during program execution.

Perform the following steps to specify a forced I/O and I/O refresh area in PLC.

Step	Action
1	In the SoftMaster widow, choose **Online > Force I/O**. The **Force I/O** dialog box appears.
2	Perform the following steps. a) To force the input signals, under **Forced Input** click **Enable**. b) To force the output signals under **Forced Output** click **Enable**. c) To select an address by using base and slot, click **Module address**. d) To specify the flag and data for each bit, click **Forced I/O**. **ATTENTION** Disable is the default option for Forced Input and Forced Output.
3	Click **Apply**.

ATTENTION

- Forced I/O setting is applicable only for DI/DO modules.
- Obtaining Forced I/O information, takes around 5 seconds at a speed of 115200bps with RS-232C connected, or about 1 second with USB.
- The flag displays the Forced I/O application status for each bit. If you select the flag, it means Force I/O application status is enabled. If you do not select the flag, it means Force I/O application status is disabled.
- The data displays the forced value. If selected, 1 is the forced value, and if not, 0 is the forced value. However, it is effective only when the flag is in Enable status.

The following table describes the force value and the flags.

Flag	Data	Forced Value
0 (not selected)	0 (not selected)	X
0 (not selected)	1 (selected)	X
1 (selected)	0 (not selected)	0

1 (selected)	1 (selected)	1

- Click **Variable Names** to display variables declared on I and Q Address.
- In case of an output module having less than 64-channels, you can specify the flag and data up to 64 channels.

In program monitoring, the following are applicable.

- In the case of forced input, monitoring is displayed with the forced value since the forced input value is updated in the monitor area.
- In the case of forced output, monitoring is not displayed since the forced value is actually the output regardless of the calculation result.

4.8 Setting skip I/O

Skip I/O is used to enable or disable IO Slots during the PLC operation. The I/O module skip function is used for excluding a designated module from operation, while the PLC is in RUN Mode. The I/O data updating and error diagnosis ceases for the designated module. It is used for operating it temporarily, excluding the fault.

- Input (I) image area suspends input refresh, and maintains the value which was set before the skip setting. At this time, it is possible to operate the image by forced ON/OFF.
- The actual output of the output module is set to OFF, when setting the skip function. However, output image changes depending on a user program's operation, irrespective of the skip setting. After the skip setting, the output value of the output module cannot be controlled by forced ON/OFF.

The I/O module skip function is released by the following methods.

- Using the **Online** menu in SoftMaster
- Pressing the Reset key for more than 3 seconds (or when the SoftMaster performs an overall reset).
- Automatically released, in case of memory backup failure because of low-battery level.

Perform the following steps to set the skip I/O during a PLC operation.

Step	Action
1	In the SoftMaster window, choose **Online** > **Skip I/O**.
	The **Skip I/O Setup** dialog box appears.
2	Click **Base Skip I/O** field, to select the base with the slot to specify Skip I/O.
3	Click **Slot Skip I/O** field, to select the slot to specify the Skip I/O.
4	Click **Yes** to display the settings.

4.9 Setting fault mask

Fault mask is configured to run the program even though a module is in fault condition during PLC operation.

The fault mask enables uninterrupted program execution, even in case of errors in the module.

- If the error occurs in the module where the fault mask is set, the corresponding module stops operation. However, the rest of the system continues to operate.
- If the module error occurs when the PLC is in RUN mode, the CPU module sets the error flag and the front PS LED turns ON. You can see the error state through SoftMaster.

The fault mask can be set from the online menu in SoftMaster. Fault mask can be also set by a program. It is achieved by setting fault mask flag with a program.

You can release the fault mask in the following ways:

- Setting release from online menu in SoftMaster.
- Pressing the Reset key for more than 3 seconds (or when the SoftMaster performs an overall reset).
- Automatic release in case memory backup is lost because of battery voltage falling.

ATTENTION

- Check the state of the error flag before releasing the fault mask flag, as the system goes to STOP mode, if the fault mask is released without clearing the error flag.
- To remove an error flag, make sure to release fault mask after setting I/O skip in the respective module.
- A warning message will appear if Fault Mask is not selected for any base. The **Disable warning for fault mask removal** option is provided in Redundancy parameter to disable the warning message.

Perform the following steps to view and set the fault mask.

Step	Action
1	In the SoftMaster widow, click **Online** > **Fault Mask**. The **Fault Mask Setup** dialog box appears.
2	Perform the following steps to set the fault mask. a) In the **Base Fault Mask** field, choose the base to apply base fault mask. If the base module's mask is specified, all slots in the base are of the fault mask. b) In the **Slot Fault Mask** field, choose the slot to apply the fault mask for each slot.
3	Click **OK**. The changes get saved.

Perform the following steps to release the fault mask during PLC operation.

Step	Action
1	In the SoftMaster widow, click **Online** > **Fault Mask**.
	The **Fault Mask Setup** dialog box appears.
2	In the **Base Fault Mask** field, choose the base to release the fault mask.
3	In the **Slot Fault Mask** field, choose the slot to release the fault mask.
4	Clear the check box corresponding to the module.
5	Click **OK**.
	The changes get saved.
	ATTENTION The fault mask cannot be released in the following cases. • Power Off→On • Operation mode change • Program download • PLC reset • Data clear

4.10 Changing the modules

Module changing wizard

This wizard is used to change the module while the PLC is in RUN mode.

Perform the following steps to change the module during PLC operation.

Step	Action
1	In the SoftMaster window, choose **Online** > **Module Changing Wizard**.
	The **Module Changing Wizard** dialog box appears.
2	In **Base Module Tree** field, choose the module that must be changed.
3	From **Slot Modules List**, select the slot installed on the base module.

Step	Action
4	Click **Next**. The **Checking Module** page appears.
5	Click the module that must be changed.
6	Click **Next**. The **Remove Module** page appears.
	ATTENTION The **Remove Module** page appears only if the information displayed in the Module Information field of the Checking Module page is identical to the module that must be changed.
7	Remove the module physically.
8	Click **Next**. The **Changing Module Finished** page appears.
9	Install the module at the module installation stage and then click **Next**.
10	Click **Finish**. The **Module Changing Wizard** appears.

ATTENTION

- During Module removal using the wizard, an error message appears if the module is not removed.
- During Module installation using the wizard, an error message appears if the module is not installed.
- If the Module Changing Wizard is cancelled, Fault Mask and Skip I/O may continue to be active. Activate the Fault mask and Skip I/O to operate the module again.

ATTENTION

Use Hot swap option to change the module without using the Module changing wizard.

Base changing wizard

Base can be changed easily by Base Changing Wizard while PLC is operating. Base Changing Wizard has following four steps.

- Selecting Base
- Removing Base
- Installing New Base
- Changing Base Finished

ATTENTION

In ML200R system, a part of expansion base can be exchanged according to configuration of expansion base.

- Ring topology: All expansion bases can be exchanged.
- Bus topology: In Bus topology, final expansion base is only changed.

Perform the following steps to change the base.

Step	Action
1	In the SoftMaster window, choose **Online** > **Base Changing Wizard**. The **Selecting Base** dialog box appears.
2	Select the base as per requirement and then click **Next**. The **Removing Base** dialog box appears.
	ATTENTION If Base Changing Wizard execution is canceled, selected base is excluded from operation. Ensure to check Fault Mask and I/O Skip.
3	Click **Next**. The **Installing New Base** dialog box appears.
	ATTENTION The **Error in Installing New Base** dialog box appears when the base is not installed. If the base is installed normally, this dialog box appears when the module type is different within setting

Step	Action
	module in I/O parameter and real installed base.
4	Click **Next**. The **Changing Base Finished** dialog box appears.
5	Once the base is changed, click **Finish**.

ATTENTION

Use Hot swap option to change the base without using the Base changing wizard.

4.11 Online editing PLC program

This Online Editing function is used to edit the PLC program with PLC operation in RUN mode.

Perform the following steps to edit the PLC program.

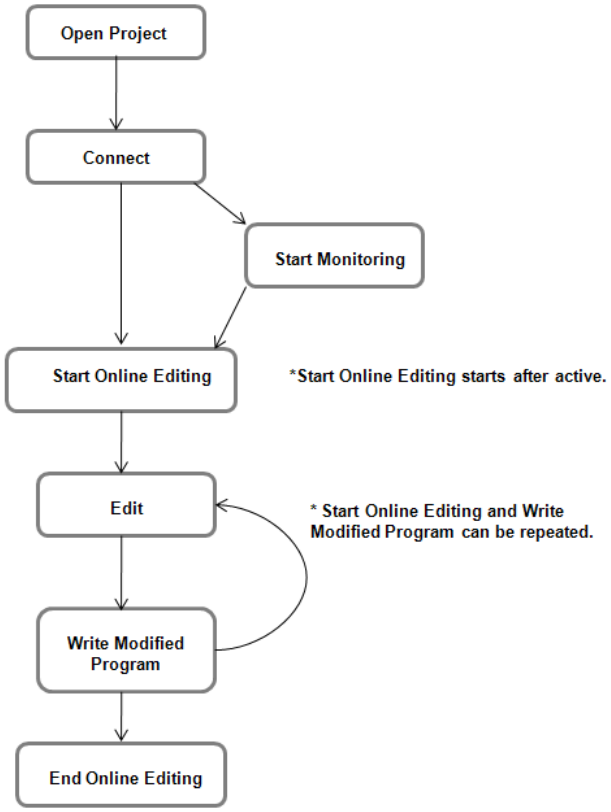
Step	Action
1	In the **SoftMaster** window, click **Project** > **Open Project** and select the required project that must be monitored and edited. The required project identical to the PLC project opens. In addition the program window is active and the program is selected.
2	To connect to the PLC, choose **Online** > **Connect**. The **Connect** dialog box appears and the connection is established with the PLC.
3	Click **Monitor** > **Start Monitoring.** The PLC program is in the Run mode.
4	To start online editing, choose **Online** > **Start Online Editing**.
5	Edit the program or the variable as per requirement. After the program or variable is edited during Run mode, the program window changes to edit mode during Run.

Step	Action
	ATTENTION If Online Editing starts, the background color of the program can be changed through its applicable option. Online Editing is the same as specified in the off-line Edit. In case of the LD program, the edited program is indicated with ('*').
6	To write the modified program onto the PLC, choose **Online** > **Write Modified Program**. The edited program is transferred to the PLC.
7	To end the online editing, choose **Online** > **End Online Editing**.

ATTENTION

- Project cannot be closed during Online Edit.
- One or more programs can be modified during Run.
- While editing during Run, the monitoring value is not correct.

The following flowchart describes the steps performed in online editing.



4.12 Monitoring the system

The system must be connected to the PLC. To connect the SoftMaster with the PLC, from the System Monitoring window, choose **Online** > **Connect**. Once the SoftMaster is connected to the PLC, the base information is read from the PLC and displayed on the module information window.

ATTENTION

If the SoftMaster is already connected to the PLC, the **Connect** option is not available.

System Monitoring is used to display the PLC's slot information, assigned I/O information, module status, and data value. System Monitoring can be initiated in any of the following two ways.

- In the SoftMaster Window, choose **Monitor** > **System Monitoring**.
- Choose **Start** > **Programs** >**SoftMaster** > **System Monitoring**.

System Monitoring is initiated from SoftMaster, or it can also be initiated independently.

The following system monitoring window is an example for 2MLI-CPUU.

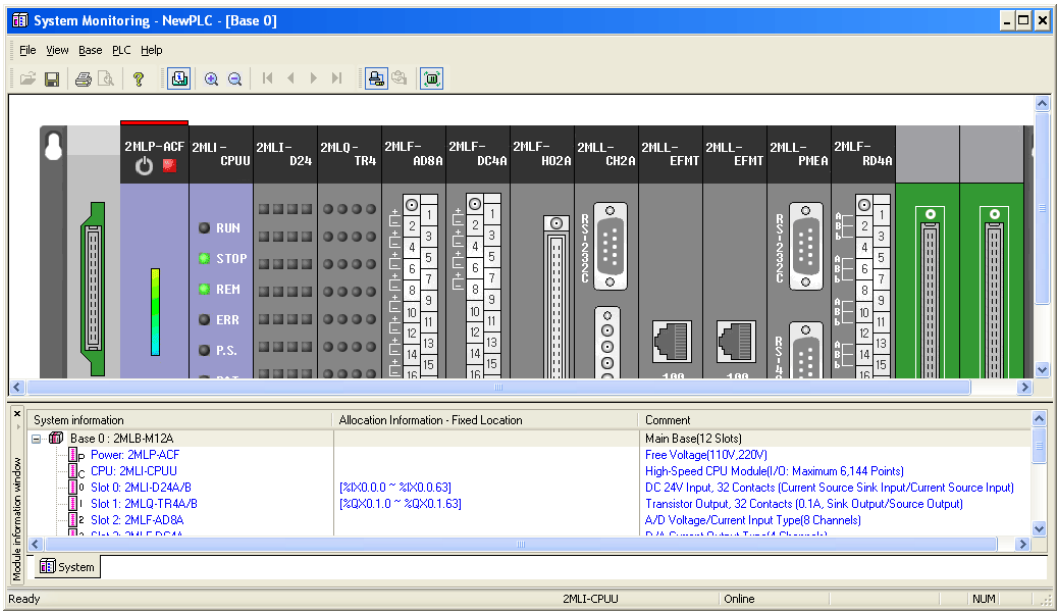


Figure 4-1 System Monitoring window

System synchronization

It reads base information, I/O assignment method, and slot information specified in the PLC to display on the system monitoring window. When monitored, it reads I/O skip information and forced I/O information to change the current value.

Once the system is connected with the PLC, the connection must me synchronized. To synchronize the connection with the PLC, from the System Monitoring window, choose **PLC** > **System synchronization**.

ATTENTION

- Executing system synchronization updates only the module information.
- For details on I/O assignment method refer to section Configure basic parameters.
- To turn on the data value of all the I/O modules on the PLC, from the System Monitoring window, choose **PLC** > **All I/O modules ON**.
- To turn off the data value of all the I/O modules on the PLC, from the System Monitoring window, choose **All I/O modules OFF**.

Module information of power module

Information of Power Module displays base power shutdown history including date, time, and details in which power shutdown bases are displayed. The system must be connected to the PLC to view the information about the power module.

To connect the system to the PLC, choose **PLC** > **Connect**. Once the system is connected to the PLC, select the power module and choose **PLC** > **Module Info**.

ATTENTION

You can also perform the connection settings for the system from the System Monitoring window by clicking **PLC** > **Connection Settings**.

The Module Information window displays the information of the PLC slot. After reading the module information saved in the PLC, it displays the information on the data display screen of the module information window.

The monitoring is categorized into the following:

- CPU modules: displays the CPU version, type, operation mode, key status, CPU status, connection status, mode conversion source, forced I/O setting status, I/O skip, and fault mask status.
- Communication modules: displays module type, operation mode, hardware error and hardware version, O/S version and its installed date.
- Special Modules: displays the module name, O/S version and date and module status.

The motoring can be started or stopped by clicking **PLC** > **Stop/Start Monitoring**.

Special module monitoring

It initiates monitoring the special module (A/D module, D/A module, HS counter module).

Once the system is connected to the PLC, choose **PLC** > **Special Module Monitoring** to view the special monitoring window.

System Configuration

The system configuration displays the configuration details (the topologies and connection) of the system connected with the PLC.

Perform the following steps to view the system configuration details.

Step	Action
1	In the **SoftMaster** window, click **Monitor** > **System Monitoring**. The **System Monitoring** window appears.
2	Click **PLC** > **System Configuration**. The system configuration appears at the left panel of the **System Monitoring** window.

The following figure illustrates system configuration (in case of ring configuration).

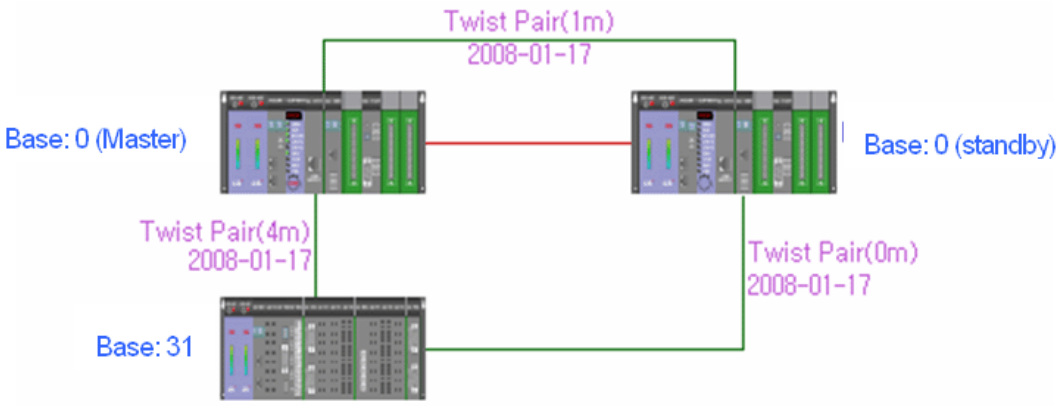


Figure 4-2 System configuration (ring topology)

The following figure illustrates system configuration (in case of line configuration).

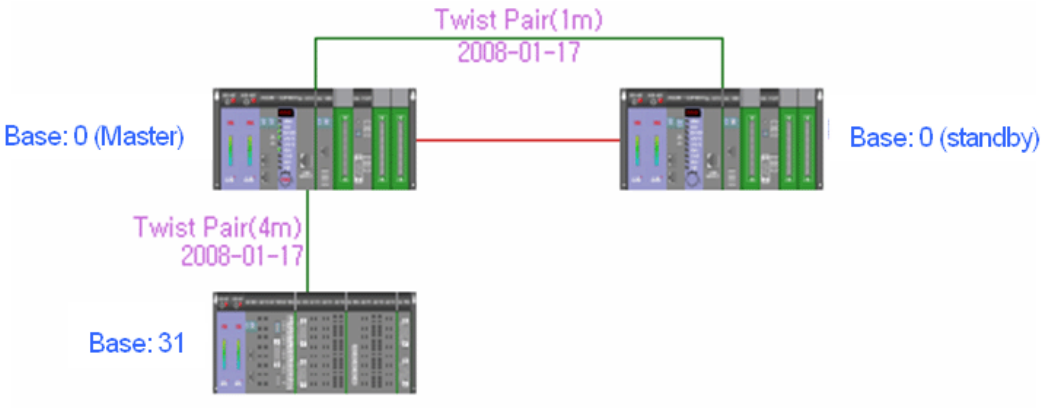


Figure 4-3 System configuration (line configuration)

In case the system is configured as ring, basic base and extension base is displayed in ring like structure. In case the system is configured as line, disconnection between bases is displayed.

The following figure illustrates system configuration (in case of dual I/O ring configuration).

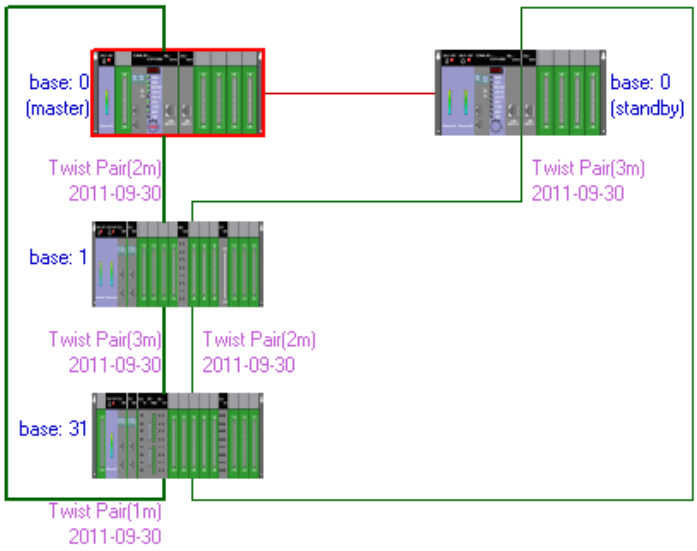


Figure 4-4 System configuration (in case of dual I/O ring configuration)

4.13 Monitoring the address

Address Monitoring enables the monitoring of all the address areas' data in the PLC.

It can write or read data value on the PLC's specific address. In addition, Address Monitoring can display the data value continuously when displayed or entered on the window depending on the bit format and display method.

Address Monitoring can be initiated in the following two ways:

- In the SoftMaster window, choose **Monitor** > **Address Monitoring**.
- Choose **Start** > **Programs** > **SoftMaster** > **Address Monitoring**.

The following image represents the Address Monitoring window.

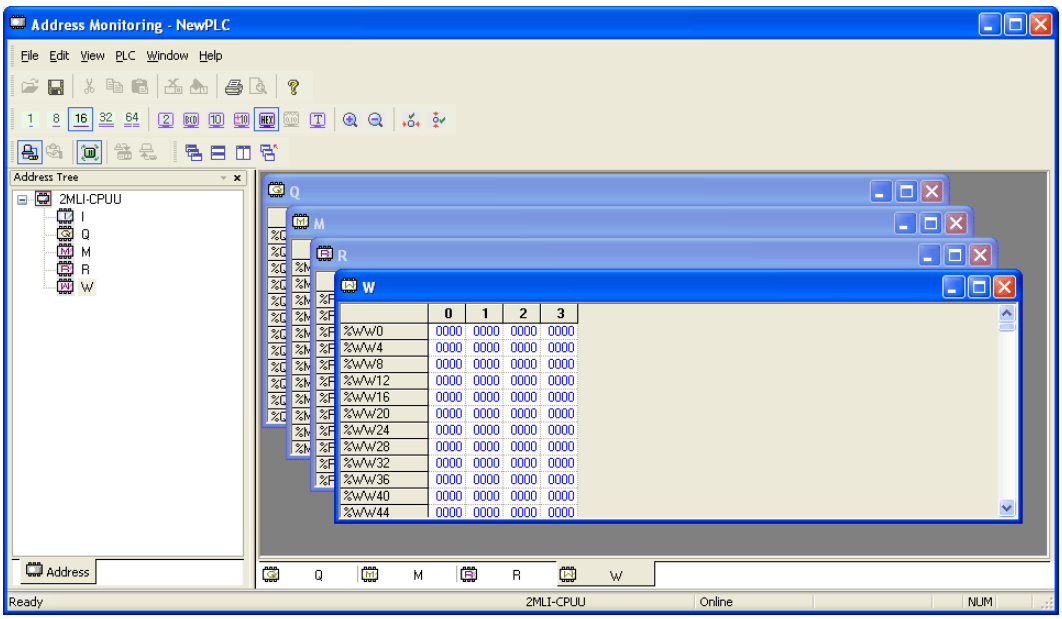


Figure 4-5 Address Monitoring window

The address information window displays all the address areas in the PLC, based on CPU type.

Address Tree window, double-click the address icon (Example: I. Q, M, R, W) or right-click address icon and click **Open Address**. The address's dialog box appears on the right plane.

ATTENTION

- To start address monitoring, SoftMaster must be Online with PLC and the monitoring must be ON.
- If monitoring mode is OFF, the address displays the previous data value. The data value is initialized to 0.

Address areas

Address areas are necessary for effective and correct control of various types of data. Based on the PLC series and the CPU type, PLC provides various address areas of data to manage the data effectively.

Data size and display format

Based on the PLC series and the CPU type, data is displayed on the window in the following ways.

- **Data Size**: Data size of the address is displayed in 1 bit, 8 bit, 16 bit, 32 bit, or 64 bit. To display the data size of the address, from the **Address Monitoring** window, choose **View** > **View Options** and select the required data size.
- **Display Format**: Address data can also be displayed in binary, BCD, unsigned decimal, signed decimal, hexadecimal, real, and text format. To set the address format of the data, from the **Address Monitoring** window, choose **View** > **View Options** and select the required format.

Fill data area

To set the data size and the display format for a selected cell area, select the required cell area and choose **Edit** > **Fill Data Area**.

Write operation

This operation is used to transfer the address data saved from online computer to PLC. Perform the following steps to transfer the saved address data from an online PC to PLC.

Step	Action
1	Ensure PLC is connected and the monitoring mode is inactive.
2	In the SoftMaster window, click **Monitor** > **Address Monitoring**. The **Address Monitoring – New PLC** window appears.
3	Choose **PLC** > **Write to PLC**. The **Write to PLC** dialog box appears.
4	From the **Address Area**, click the address that must be written on to the PLC.
5	Click **OK**. The selected address is written on to the PLC

ATTENTION

F address's exclusive Read areas cannot be written on PLC. Exclusive read areas are based on the type of CPU.

In addition, you can also write a selected area of address data on the PLC.

Perform the following steps to write the address data of a selected area to PLC.

1. Select the area to be written on PLC.
2. Click **PLC** > **Write Selected Area to PLC**.
   A confirmation message appears, prompting you to confirm if you want to write the selected area on the PLC.
3. Click **Yes**.
   The selected area is written on to the PLC.

Read operation

This operation is used to read the address data saved from PLC to online computer. Perform the following steps to read a saved address data from PLC.

Step	Action
1	Ensure PLC is connected and the monitoring mode is inactive.
2	In the SoftMaster window, click **Monitor** > **Address Monitoring**.
	The **Address Monitoring – New PLC** window appears.
3	Click **PLC** > **Read from PLC**.
	The **Read from PLC** dialog box appears.
4	From the **Address Area**, click the address that must be read from the PLC.
5	Click **OK**.
	The selected address is read from the PLC.

4.14 Monitoring the special module

Perform the following steps to monitor the special module installed on the PLC.

Step	Action
1	In the **SoftMaster** window, choose **Monitor** > **Special Module Monitoring**.
	The **Special Module List** dialog box appears. It displays the list of special module currently installed on the PLC system.
2	Select a module from the list and click **Monitor**.
	The **Special Module Monitoring** dialog box appears.
3	Set the values for the special module from the **Setting Value**/**Current Value** field.
4	To monitor the special module, click **Start Monitoring**.
	The maximum and minimum values of the channels appear.

Step	Action
5	Click **Reset max/min value** or change the parameter value for the special module if required and click **Test**. The testing operation of applicable special module begins and the parameter information is directly transferred to the module to display its result on the **Special Module Monitoring** dialog box for the user to confirm. **ATTENTION** In **Special Module Monitoring** dialog box, you can directly change the parameter value saved in the special module while checking the test operation and its status of the applicable module.
6	Click **Close**.

ATTENTION

- Select the HS counter module on the special module window to write HS counter Flag monitoring and instruction functions.
- FLAG Monitor field is available and applicable only to HS counter module.
- Flag monitoring function is used to run instructions for HS counter module. You can check the instruction and enter signal status along with HS counter monitoring/test dialog box, as well as, Flag monitoring dialog box displays at the same time.
- You can confirm HS counter status of input contact point signal (ON/OFF) through the Flag monitoring dialog box.
- You can initiate the instruction for HS counter operation and additional functions at the Flag monitoring dialog box. If the instruction is correctly run, the status of the applicable instruction displays as ON/OFF.

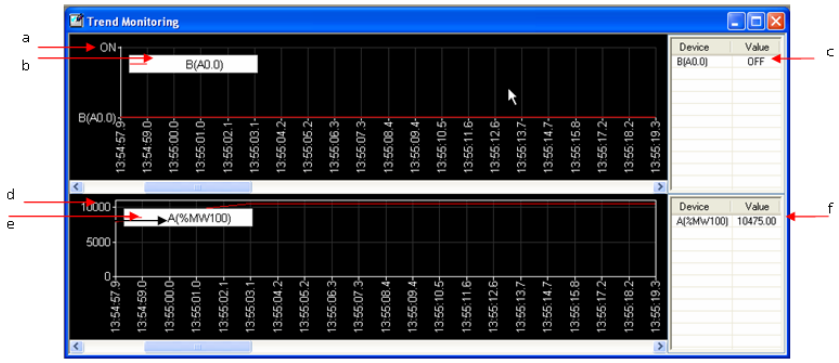
4.15 Trend monitoring

Trend monitoring is used to read the data periodically from the connected PLC and to display in a graphical format. The trend monitoring window is composed of bit graph and trend graph. In the bit graph, bit address's On/Off status displays in stair-shaped graph. In trend graph, the variation trend of the data displays with the address value converted from word to data format specified.

Perform the following steps to configure trend monitoring.

Step	Action
1	In the **SoftMaster** window, choose **Monitor** > **Trend Monitoring**.

The **Trend Monitoring** window appears.



The description of the **Trend Monitoring** window is as follows:

a) **Bit graph**: displays the data of bit address.

b) **Bit graph index**: displays the bit graph and graph colors.

c) **Bit graph current value**: displays the current value of the bit address.

d) **Trend graph**: displays the data of word address.

e) **Trend graph index**: displays the word address and graph colors.

f) **Trend graph current value**: displays the current value of word address.

ATTENTION

The data displayed in the trend monitor may be different with the actual data. In order to monitor accurate timing, use the data trace function.

Step	Action

For trend settings

2 Choose **Graph** > **Trend Settings**.

The **Trend Setup** dialog box appears. It is used to enter the bit address.

3 In the **Bit address** tab, enter the address of bit type.

Or

Double-click the variable column to select the declared address on the Variable/Comment window.

ATTENTION

A maximum of eight bit addresses can be registered.

For trend graph setting

4 Click **Trend graph** tab in the **Trend Setup** dialog box.

5 Enter the address of word type.

Or

Double-click the variable column to select the declared address on the Variable/Comment window.

6 Click the **Type** column to select the data type.

ATTENTION

A maximum of four trend addresses can be registered. Supported data types are as follows.

Type	Size
BIT	1 bit
BYTE	1 byte
WORD	2 bytes
DWORD	4 bytes
LWORD	8 bytes
REAL	4 bytes

Step	Action

LREAL	8 bytes
INT	2 bytes
DINT	4 bytes
LINT	8 bytes

For graph settings

7 Choose **Graph** > **Graph Settings**.

The **Graph Setup** dialog box appears.

8 To display XY grid on the window, click **Show grid**.

9 To display the X axis data on the window, click **Show X axis data**.

The X axis data options are enabled.

10 Choose the required time format for X axis data.

11 In **Minimum value** box and **Maximum value** box, set the maximum/minimum range for the graph.

12 From the **Bit graph legend** list, choose the position of bit graph index. No Index, Left Upper, Right Upper, Left Bottom, and Right Bottom are available for the Bit Index Position.

13 From the **Trend graph legend** list, choose the position of trend graph index. No Index, Left Upper, Right Upper, Left Bottom, and Right Bottom are available for the Trend Index Position.

14 In the **Color** box, set the color for general graph, Bit Graph, and Trend Graph.

15 Click **Apply** and then click **OK**.

ATTENTION

Scroll synchronization is used to synchronize the bit graph with the trend graph in time axis. It is useful in monitoring the bit graph and the trend graph data simultaneously. It can be done by choosing **Graph** > **Synchronize Scrolling**.

4.16 Monitoring PID

PID control

PID Control compares the value measured at detection (process value) to the predetermined value. It adjusts the outputs (control signal) to eliminate error, if any, between the two values, making the current value to match the target value. In addition it maintains the state of an object to control, be a pre-determined value (target value).

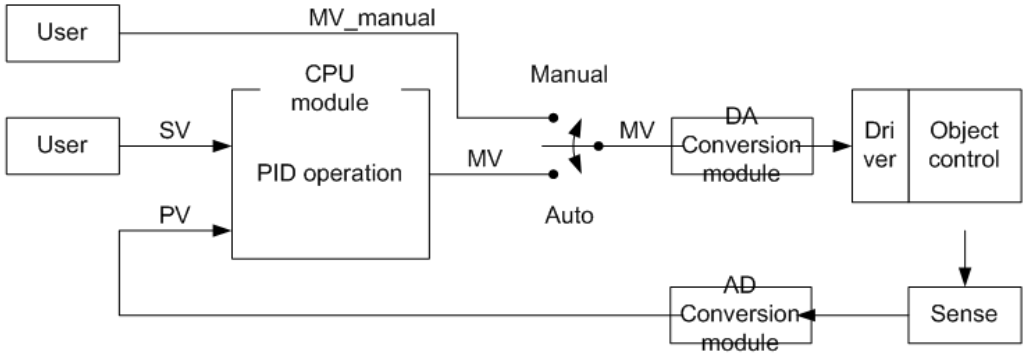


Figure 4-6 Function of PID

As shown in the figure, PLC functions as a controller, in an entire control system, while the sensor and driver are used to detect an object to control and drive the system, respectively.

When a sensor detects the current state of an object to control and delivers it to a control, PLC executes an operation of output and delivers it to a driver. Meanwhile, a driver drives the object according to the output. Finally, a sensor detects the changed state and re-sends it to the PLC, forming a closed loop.

A procedure circulating a control loop repeats at the unit of several seconds and hundreds of microseconds and the time is called control cycle.

Features of built-in PID function

The following are the features of PID function for ML CPU.

- It can execute precise control operation.
- It has a fast operation cycle up to 0.6ms.
- It can operate totally 256 loops by using 32 loops in 8 blocks.

- Symbol function facilitates setting and monitoring.
- It supports forward/reverse operation process.
- Strong dual anti-windup prevents effective over/under shoot.
- It may be operated by external device (HMI).
- It protects the system by restricting the maximum variance of PV.
- It protects the drive by restricting the maximum variance, maximum value and minimum value of MV.
- Auto-tuning function is used for PID control.
- Cascade PID control is available.

ATTENTION

For further information about PID monitoring refer *MasterLogic PLC Instruction List User's Guide*.

4.17 Monitoring SOE

The SOE monitor is an exclusive software package which runs on a PC platform and communicates with the CPU of ML200 series for easy and fast operation of 2MLF-SOEA. The major functions of the SOE monitor are as follows:

- Read/save event history
- Delete event history
- View module parameter setting
- Save event history in an Excel file

Characteristics of SOE monitor

The following are the characteristics of SOE.

- Operates and monitors the 2MLF-SOEA module.
- Provides a function that enables independent operation of the SOE monitor, regardless of the SoftMaster.
- Enables data monitoring and saving.

The 2MLF-SOEA Module (event input module) is used for recording of events entered from outside. The event input module is a data recording device which can record event information (time and state) in 1ms resolution. The event input module is not a program device or external device used in the CPU. Using the SOE monitor, the event input is available only for monitoring and file saving.

- **ML200 IEC and ML200R**: Maximum of 3000 events can be saved in the order of occurrence.
- **2MLF-SOEA module**: Maximum of 300 events can be saved in the order of occurrence.

Files created in the SOE monitor

When you create and edit a project, the files having the following extensions are created.

- <Name>.set: the log file for the event the user has created. This file is created for saving the event.
- <Name>.xls: the module event file created by the user. Event record is saved in an Excel file.

Configure SOE monitor

The SOE Monitoring window displays the 2MLF-SOEA module SOE event history automatically when connected with PLC CPU.

The SOE monitor can be configured in the following two ways.

- In the **SoftMaster window**, choose **Monitor** > **SOE Monitoring**.
- Choose **Start** > **Programs** > **SoftMaster** > **SOE Monitoring**.

The **SOE Monitoring** window appears.

The SOE event history in the SOE Monitoring window displays the following:

- **CPU event history**: used to select the event saved in the CPU module.
- **Module event history**: used to select the event saved in the SOE module.

Double-click the **CPU event history** or **Module event history** to activate the event monitor dialog box.

Perform the following steps to set Basic and I/O parameters for SOE modules.

Step	Action
	Basic parameter setting
1	In the SoftMaster window, under **Project Window**, double-click **Basic Parameter**. The **Basic Parameter Setting** dialog box appears.
2	In **Basic Operation Setup** tab, under **SOE History** field, choose any of the following: • **Save the latest SOE events**: To save the most recent SOE events. If there are more than 3000 events, the oldest event is deleted and the new event is saved. • **Save the first SOE events**: To save the first SOE event. If there are more than 3000 events, no new events will be saved.
3	Click **OK**.
	I/O parameter setting
4	In the SoftMaster window, under **Project Window**, double-click **I/O Parameter**. The **I/O Parameter Setting** screen appears.
5	In **I/O Parameter Setting**, under **Module,** click the slot where the base module is installed / mounted. For example, the 2MLF-SOEA module is installed on Base No. 0 and Slot No. 4.
6	Under **Module,** from the drop-down module list, double-click **Special Module List** > **SOE Module** > **2MLF-SOEA**. The **2MLF-SOEA** is selected.
7	From **Module**, select **2MLF-SOEA** and click **Details**. The **SOE Module** dialog box appears.
8	In **Input Filter** box, set the time which enables an event to be identified as an effective input data. The value for the Input Filter must be between 1ms ~ 100ms.

Step	Action
9	In **SOE History** field, choose any of the following: • **Reset with recent history**: To save the most recent events. If the events exceed 300, the oldest event is deleted and the last one is saved. • **Retain initial history**: To retain the initial event. If the events exceed 300, the last one will not be saved.
10	To set up the input condition of the event, in **Event setting details** field, perform the following: a) Under **Type**, click **Rising event** / **Falling event** for setting event conditions for each input contact point. b) Under **Chattering**, set the **Time** and **Event (No)** for processing the abnormal signals that are not related with event as chattering.
11	Click **OK** twice. A confirmation message appears.
12	Click **Yes**. The **Register Special Module Variables** dialog box appears. In the right pane, the variable details for the selected base are displayed. **ATTENTION** You can also navigate to the **Register Special Module Variables** dialog box by performing the following steps. 1. From the toolbar, click **Edit** > **Register Special/Communication Module Variables**. 2. Click **Yes**. The **Register Special Module Variables** dialog box appears.
13	Select the required variable type and click **OK**. To verify if the selected I/O parameters settings are applied, in the **Project Window**, double-click the **Global Variables/Addresses**, and then verify the flags added in the Global Variables/Address window.

Chatter settings

Chatter setting enables the module to identify an event repeated many times during a short period of time as a non effective event (chattering). Some sensors using mechanical contacts may cause chattering, which can be eliminated with this function.

Following are the key setting items for chatter settings.

- **Number of events**: The number of events must be between 2~127 (‘0’: detection is disabled).
- **Event number**: Enter the number of events including the first effective signal. A minimum value of two events must be entered.
- **Chatter detection time (duration)**: If the chatter detection time is passed from the time the first effective event was detected, the chatter detection function for the specific event frequency is terminated, even if the set-up number of chattering is not completed.
- **Minimum chatter detection time (duration)**: This value is co-related with the entered chattering event number.

Once an event passes an input filter, it must satisfy the following criteria.

(Number of Events × Input Filter Value) ＜ Chatter Detection Time (Duration)

or

Input Filter Value ＜ (Chatter Detection Time (Duration) / Number of Events)

For example

If, chatter detection time = 30ms, number of chattering events = 5,

30ms ÷ 5 = 6ms,

Therefore, the input filter must be less than 6ms.

Example for chatter setting

Condition: Input filter = 1ms, Detail event setting = ‘Rise’ event, Chatter event = 4, Chatter time: 8ms.

Sequence diagram of event occurrence is as follows:

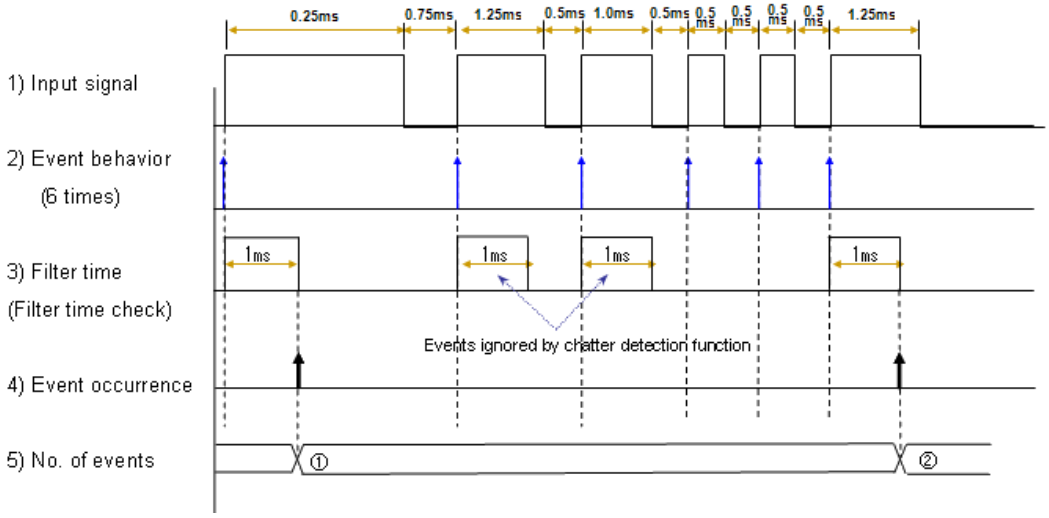


Figure 4-7 Sequence diagram of event occurrence

The explanation for the sequence diagram of event occurrence is as follows:

- Chatter time measurement begins from the recognition of an event.
- Two of the four events passing the filter are ignored by chatter detection function. The last event which enters after expiration of the chatter detection time is recorded normally as the first event of a new period.

Event history monitor

The events entered into the CPU and event input modules can be monitored with the SOE monitor.

Perform the following steps to monitor event input modules with SOE monitor.

Step	Action
1	To connect to the PLC, choose **Online** > **Connect**. The **Connect** dialog box appears and the connection is established with the PLC.

ATTENTION

The SOE Monitoring menu is activated only after connecting to PLC.

Step	Action
2	In the SoftMaster window, choose **Monitor** > **SOE Monitoring**. The **SOE Monitoring** window appears.
3	Choose **Online** > **Connect**. The information about the event input module connected to the system appears.
4	To activate the event monitor dialog box, double-click the **CPU event history** or **Module event history**.
5	Double-click **CPU Event History** and choose **Online** > **Refresh Event**. The event history of the input module stored in the CPU module appears.
6	Double-click **Module Event History** and choose **Online** > **Refresh Event**. The event history information about the input module stored in the SOEA module appears.
7	To search the behavior of a specific event, choose **View** > **Filtering**. The **Event Filtering** dialog box appears.
8	Click **Specify Event Occurred Position** and choose the bit at which the event has occurred.
9	Click **Event Type** and choose the input condition at which the event has occurred. **ATTENTION** Perform the following steps for CPU event history filtering. 1. To view only the CPU event history filtering, click **Show SOE installed position only**. 2. In **Base** and **Slot** fields, select the base and slot.
10	From the **Begin** list and **End** list, choose **The first event** or **Occurred time**.
11	Click **Filtering**. The filtered information appears on the **SOE Monitoring** window.

5. PLC Communication

5.1 Working with SoftMaster network manager

SoftMaster-NM is dedicated software for communication modules. It is used for setting up parameters of communication modules such as FEnet, Snet, DeviceNet and Profibus-DP. It is also used for managing and diagnosing communication modules.

A basic program tool is required to setup, control and manage the network using Ethernet communication. SoftMaster-NM is used to setup and manage all the communication parameters including system parameters, service parameters, and module and network diagnostics as well.

Configure Serial interface module

Snet I/F module establishes communication with various devices such as PLCs, computers, and so on, which use different types of serial communication protocols. It integrates many different devices supporting ASCII communications in the MasterLogic PLC network. In addition, it emulates a communication modem to control a remote PLC.

Perform the following steps to configure serial interface module when the PLC is disconnected (Offline) from SoftMaster-NM.

Step	Action
1	In the **SoftMaster Window**, click **Tools** > **Network Manager**.
	The **SoftMaster NM** window appears.
2	Choose **File** > **New**.
	The **New NM Project** dialog box appears.
3	Enter the NM Project name and select the other details as per requirement, and click **OK**.
	The NM project with the specified name appears in the **Project Window**.
4	From the **Project Window**, click the **Standard settings** and select the base module as per requirement.
5	Right-click the selected base module and then click **Properties**.
	The **Communication Module Setting** dialog box appears.
6	From the **Type** list, select **Snet**.

Step	Action
7	From the **Slot** list, choose the slot as per requirement.
8	Click **OK**.
9	Double-click the newly configured Snet module. The **Standard Settings – Snet** dialog box appears.
10	Under **Communication settings**, perform the following: a) From the **Type** list, choose the communication type for both the channels as per requirement. b) From the **Speed** list, choose the communication speed for both the channels as per requirement. c) From the **Data bit** list, choose the bit size for both the channels as per requirement. d) From the **Stop bit** list, choose the value for both the channels as per requirement. e) Form the **Parity bit** list, choose the parity bit for both the channels as per requirement. f) From the **Modem type** list, choose the type of modem for both the channels as per requirement. g) In the **Station #** box, enter the station number for both the channels.  **ATTENTION** The following are the basic values for the Communication Module Setting. • Data bit = 8 • Stop bit = 1 • Parity bit = NONE • Modem type = Null modem The following three types of parity bit can be specified for Snet I/F module. • None: When the parity bit is not used. • Even: To maintain even number of 1's. If the number of 1 bit in one byte is even, 0 is sent as the parity bit.

Step	Action
	• Odd: To maintain odd number of 1's. If the number of 1 bit in one byte is odd, 0 is sent as the parity bit.
11	Under **Time settings**, set the **Waiting time** for both the channels.
12	Under **Active mode**, from the operation mode list, choose the operation mode for both the channels.
13	Click **OK**.
14	Choose **Online** > **Connect**. The **Connect** dialog box appears and the connection with the PLC is established.
15	To download the communication setting onto the Snet module, choose **Online** > **Write Parameter**. The **Write parameter** dialog box appears.
16	Select the communication card for executing the write operation and click **OK**. The **Basic setting** dialog box appears.
17	Specify Snet for each base and slot and then click **Confirm**. **ATTENTION** The specified communication parameters are not applied to Snet module even after being downloaded. Reset the communication module for initialization and normal operation based on the specified communication parameters.
18	To reset the communication module, choose **Online** > **Reset** > **Reset Individual Module**.

When SoftMaster-NM is online with the PLC CPU, online registration method is used.

Perform the following steps to configure serial interface module when the PLC is connected (Online) to SoftMaster-NM.

Step	Action
1	Connect the PLC CPU to the installed communication module.
2	To set the connection settings, choose **Online** > **Connection Setting**. The **Online Settings** dialog box appears. **ATTENTION** For further information about connection settings, refer to Connecting SoftMaster to PLC.
3	Choose **Online** > **Read IO Information**. A list of communication modules are automatically displayed in main base and extended base. **ATTENTION** An error message appears prompting you to update if, • The module registered in offline mode is different from the online mode of the presently connected PLC. • The module registered in offline mode is different from the type of the communication module configured in the previous project.

REFERENCE - INTERNAL

For more information about Snet I/F modules, refer to the *Serial Communication I/F Module User's Guide*.

Configure Ethernet interface module

FEnet I/F module allows data communication between higher-level system such as host PC and PLC, or between PLCs connected with electric or optical media (10/100BASE-TX, 100BASE-FX).

The following are the two ways to configure Ethernet interface module.

- Default setting that defines IP address for CPU A and CPU B (Physical devices).

- **One IP solution** that defines the IP address for Master CPU and Standby CPU.

ATTENTION

One IP Solution is applicable only for ML200R.

When using **ONE IP Solution**

- IP address should be an even number. This IP address becomes IP address of master base FEnet module and master base FEnet module's IP address + 1, becomes IP address of standby base FEnet module.
- In case of master conversion, master base FEnet module and standby FEnet module change each other's IP address so as to maintain the IP always fixed for Master CPU and Standby CPU.

ATTENTION

For more information about FEnet I/F module, refer to the *Fast Ethernet I/F Module User's Guide*.

Perform the following steps to configure Ethernet interface module when the PLC is not connected (Offline) to the SoftMaster-NM.

Step	Action
1	In the **SoftMaster Window**, click **Tools** > **Network Manager**.
	The **SoftMaster NM** window appears.
2	Choose **File** > **New**.
	The **New NM Project** dialog box appears.
3	Enter the name and select the other details as per requirement, and click **OK**.
	The NM project with the specified name appears in the **Project Window**.
4	From the **Project Window**, select the base module as per requirement.
5	Right-click the selected base module and click **Properties**.
	The **Communication Module Setting** dialog box appears.
6	From the **Type** list, choose **FEnet**.
7	From the **Slot** list, choose the slot as per requirement.

Step	Action
8	Click **OK**.
9	Double-click the newly configured FEnet module. The **Standard Settings** dialog box appears.
10	Under **TCP/IP settings**, perform the following:

ATTENTION

- You can select **ONE IP Solutions** as per your requirement.

a) Under **HS link Station #**, enter the station number for HS link communication between Honeywell PLC's FEnet I/F modules.

b) From the **Media** list, choose the media as per requirement.

- AUTO (TP/CAT5): Automatically detects the media currently installed.
- 10M/HALF: 10Mbps Half Duplex electric
- 10M/FULL: 10Mbps Full Duplex electric
- 100M/HALF: 100Mbps Half Duplex electric
- 100M/FULL: 100Mbps Full Duplex electric
- FX/100M/HALF: 100Mbps Half Duplex optical
- FX/100M/FULL: 100Mbps Full Duplex optical

c) Under **IP address**, enter the IP address for the requisite FEnet I/F module.

d) To verify if destination station is on the same network of the requisite station, in **Subnet mask** box, enter the IP address.

e) To transmit/receive data through the public network or a different network from where the requisite FEnet module is installed, in the **Gateway** box, enter the IP address of the gateway or router.

f) In **DNS server** (Domain Name Server) box, enter the IP address of domain.

g) To assign dynamic IP address, select **DHCP**.

Step	Action
	ATTENTION Select **DHCP** option when IP address is not fixed but assigned as a dynamic IP. The dynamic IP is used for ADSL communication. IP address of the destination station. • If the client uses MLDP, specify IP address of the server equipment. • If a dynamic IP address has been assigned to the server by means of DHCP, the communication is unavailable.
11	In the **Reception waiting time** box, enter the waiting time for resetting the channel when any error occurs in the destination station or if the cable is disconnected. **ATTENTION** If there is no request during the specified time from the host PC or MMI connected for dedicated communication, Reception waiting time ends the dedicated service connection regardless of normal ending procedures. The range for **Reception waiting time** is 2 ~ 255 seconds.
12	In the **# of Dedicated Connections** box, enter the number of TCP dedicated services accessible at a time. Maximum number of TCP dedicated services (1–16) accessible at a time.
13	Under **Driver(server) settings**, from the **Driver** list, choose the driver as per requirement.
14	To enable the host table, under **Host table settings**, select **Enable host table**. **ATTENTION** If **Enable host table** is selected, only the client address registered in the host table are allowed to communicate on the network.
15	Click **OK**.

Perform the following steps to configure Ethernet interface module when the PLC is connected (Online) to SoftMaster-NM.

Step	Action
1	Connect SoftMaster-NM and PLC on which the communication module is installed.
2	After the connection is complete, choose **Online** > **Read IO Information**. The communication modules installed on the applicable PLC are searched and configured automatically. For example, If FEnet is installed on Slot 2 of Base 0, applicable communication module will be automatically searched and configured.

ATTENTION

An error message prompting you to update appears if

- The module registered in offline mode is different from the online mode of the presently connected PLC.
- The module registered in offline mode is different from the type of the communication module configured in the previous project.

Configure P2P communication

P2P service uses Master operation of the communication module. It is accomplished through parameter setting with function blocks. P2P service executes client operation of the communication module as realized with parameters set with instruction blocks.

The following table displays the P2P commands available in FEnet I/F module and Snet I/F module.

Table 5 P2P commands

FEnet I/F module	Snet I/F module
Read	Read
Write	Write
Send	Send
Receive	Receive
ESend	

EReceive	

The registration and editing of P2P service parameters is executed in SoftMaster-NM where a maximum of eight P2P parameters can be setup. Each P2P parameter is composed up to 64 P2P blocks.

You can setup multiple P2P parameters for an identical communication module. However, 'Enable' option is available only for one parameter among the multiple P2P parameters for the identical communication module.

A maximum of 64 P2P blocks can be registered and edited. Separate frame registration is available for each driver. The following table describes the P2P parameter options available for FEnet I/F module and Snet I/F module.

Table 6 P2P parameter options

Parameter options	FEnet I/F module	Snet I/F module
P2P channel	Used to set the following: • Logical channel of P2P Service (IP, PORT, dedicated driver). • User-defined frame, MLDP client and MODBUS TCP client setting. • Communication device setting which uses protocol other than MLDP/MODBUS TCP.	Used to set the following: • The communication protocol of the P2P service to be executed. • MLDP/Modbus Note: You have to do separate setting for respective channels. This is applicable only if basic setting's 'P2P driver' is None.
P2P block	There are 64 P2P blocks setting. Used to set each of the 64 P2P blocks separately, based on specified MLDP client of P2P channel.	There are 64 P2P blocks setting, you can set each of the 64 P2P blocks separately.
User frame definition	Used to register the user-defined frames.	Used to register the user-defined frames.
E-mail	Used to transmit and receive frames through e-mail. The frames must be registered before transmitting or	

Parameter options	FEnet I/F module	Snet I/F module
	receiving them through e-mail.	

Configuring P2P parameter

To use P2P service, the user needs to configure/set the desired operation on the P2P parameters window.

Perform the following steps to set the P2P parameters for FEnet I/F module and Snet I/F module.

Step	Action
1	In the **SoftMaster-NM** window, click **P2P** tab. The P2P parameters appear in the **Project Window**. A maximum of eight parameters are available for P2P setting.
2	Double-click the P2P parameter, as per requirement. The **Communication Module Setting** dialog box appears.
3	Enter the module **Type**, **Base** and **Slot** number where the module is installed.
4	Click **OK**. The P2P setting for the selected module appears in the Project Window.

ATTENTION

For more information about P2P parameter setting for FEnet I/F module and Snet I/F module, refer to *Fast Ethernet I/F Module user's guide* and *Serial Communication I/F Module User's Guide*.

Configure HSL (High-speed Link) communication

HS link is a communication method between MasterLogic PLC communication modules and the slave modules, for sending and receiving data with HS link parameters. This service allows using SoftMaster-NM to exchange data between the modules through parameters setting like Send/Receive data size, communication period, and Send/Receive area to save data through its transmission service function.

Twelve HS links are available for MasterLogic PLC series PLC and parameters settings are available for the communication modules installed on the basic or extended base.

ATTENTION

For more information about configuring HS Link parameters, refer to *Fast Ethernet I/F Module User's Guide.*

Configure Profibus communication

Profibus-DP (Decentralized Peripherals) Master I/F module (referred to as Pnet I/F module) is one of the communication modules of MasterLogic PLC system. It uses Token Ring topology to control the communication and to configure the network.

High-speed Link is a communication link type between MasterLogic PLC communication module (For example, Pnet I/F module) and slave modules. It is used to exchange data with the destination stations periodically.

ATTENTION

For more information about Profibus communication, refer to *Profibus-DP Pnet IF Module User's Guide*.

6. Working with SoftMaster-SIM for simulation

6.1 Overview

SoftMaster-SIM is a simulated PLC for MasterLogic PLC series. Using SoftMaster-SIM you can run your program without the PLC, or debug a PLC program using input condition setting or module simulation function.

6.2 Features of SoftMaster-SIM

Following are the features of SoftMaster-SIM.

- **Program simulation**: You can simulate the program written by LD/SFC/ST in the SoftMaster. It supports online editing and debugging function, through which you can edit the program during RUN mode and trace it as a step unit.
- **PLC online function**: You can use program monitoring function and online diagnosis function such as system monitoring, address monitoring, trend monitoring, data trace, and custom events.
- **Module simulation**: You can use the simulation function to set the input value of each module and simulate the digital I/O module, A/D conversion module, D/A conversion module, counter, temperature control module.
- **I/O input condition setting**: You can set the address value by setting specific address value or channel value of the module as input condition. If you use I/O input condition setting, it is not necessary to write other program to test PLC program.

6.3 System configuration for SoftMaster-SIM

Following are the system configuration requirements for the SoftMaster-SIM.

- **Minimum specification**: Pentium 3900MHz, RAM 256MB.
- **Recommended specification**: Pentium 4, 1.5GHz, RAM 512MB and more.

ATTENTION

- If you are using minimum specification system configuration, the fixed period scan may not operate properly, as the scan period may be longer than the fixed period, which might lead to disconnection.
- Despite using the recommended specification, the fixed period scan may not operate properly due to heavy system load.
- Regardless of system specification, based on the user setting like system's SLEEP mode, disconnection can occur.

6.4 Configuring SoftMaster-SIM

Perform the following steps to configure the SoftMaster-SIM.

Step	Action
1	Choose **Start** > **Programs** > **SoftMaster**. The **SoftMaster** window appears.
2	Choose **Project** > **New Project**. The **New Project** dialog box appears.
3	In the **New Project** dialog box, type the following details: • **Project name**: Type the project name. • **File directory**: The directory path is selected, by default. If you want to change the directory path, click **Select Folder** and select the required path. • **PLC Series**: Select the PLC from the available list. • **CPU type**: From the drop-down list select a CPU type. • **Program Name**: Type a name for the program. • **Program language**: Select a program from the available list. • **Project description**: Type a description for the project that is created.
4	Click **OK**.
5	Write a program that can be executed through the SoftMaster-SIM.
6	Choose **Tools** > **Start Simulator**. The **SoftMaster-SIM** window appears.

Step	Action
	When the SoftMaster-SIM is executed, the program is automatically downloaded into SoftMaster-SIM, and the status becomes online, connection, and stop.
7	Choose **Online** > **Change Mode** > **Run**. The downloaded program is executed.
8	The SoftMaster-SIM contains the following: • **Channel List**: Displays favorite channels according to module and channel. In case of a module, it displays only module set in I/O parameter. For example in a module, B0 means base number and S00 means slot number. For more information on monitoring the Channel List, refer section Monitor the channel. • **I/O Condition**: Displays single I/O condition and continuous I/O condition. For more information on configuring I/O conditions, refer section I/O Condition. **Status of the simulator display**: The following table provides the details of the simulators status.

Status	Description	Window
Initial conditions	Displays initial status. It indicates the connection by simulator is not available.	
Connection available	It indicates connection is ready and red LED is turned on.	
Single I/O condition execution	It indicates the Single I/O condition is under execution. During execution, green LED flickers.	
Continuous I/O condition execution	It indicates the Continuous I/O is under execution. During execution, yellow LED flickers.	

Monitor the channel

Perform the following steps to monitor the channel.

Step	Action
1	Expand the Channel List. From the Channel List tree view, double-click the channel that you want to read. The details of the channel are displayed on the right pane. If you want to use a specific channel as favorite channel, select the **Favorite Channel** check box.
2	a) Choose **Tools** > **Start Channel Monitoring**. b) From the **Channel List**, double-click a channel to modify the current value. c) In the selected channel, move to the cursor to the **Channel Value** column. d) Double-click or press **Enter**. The **Channel Value Modification** dialog box appears. • **Module Name**: Displays the name of the module. • **Channel Name**: Displays the name of the channel. • **Channel Type**: Displays the data type of the selected channel. • **Input Value**: Value provided by the user. If the value displayed is not bit type, type the correct value. • **Bit Value**: Displays ON\OFF status. **ATTENTION** If the selected channel is of output type, you cannot modify the Output channel values.
3	To stop the channel monitoring, choose **Tools** > **Stop Channel Monitoring**.

I/O Condition

I/O condition is used to write a specific value to specific address when specific condition is met by user input.

For example, if address %IX0.0.0 becomes 1, set address %MX0~%MX100 as 1. The user should modify address value periodically by using the 'monitor current value of SoftMaster' or write other PLC program to test PLC program. SoftMaster-SIM reflects the data yielded to a module or entered from a module to a program.

There are two types I/O conditions are available in the SoftMaster-SIM application.

1. Single I/O Condition
2. Continuous I/O Condition

Some of the basic functions that you can perform for the single and continuous I/O conditions are, cut, copy, paste, delete, insert line, and delete line.

Condition expression

The following table displays the condition expression used in the single input condition and continuous condition. One condition expression can consists of more than one condition or can be a combination of conditions.

Type	Operator	Priority	Contents
Comparison	==	4	Equal
	!=	5	Not equal
	>	6	Greater than
	>=	7	Greater than or equal to
	<=	8	Less than or equal to
	<	9	Less than
Numerical operation	+	2	Add
	-	3	Subtract
	*	0	Multiply
	/	1	Division

Type	Operator	Priority	Contents
Bit operation	&	12	Bit multiply
	|	13	Bit sum
	^	14	Exclusive bit sum
Logical operation	&&	10	Logical multiply
	||	11	Logical sum
Miscellaneous	(		
	)		

For example, if you write ‘address %MW0 is larger than 100 and %M10 is on’ as condition expression, the condition expression is as follows:

(%MW0 > 100) && (%MX10 == TRUE)

It supports five addresses such as %I, %Q, %M, %R, %W.

Configuring Single I/O Condition

Perform the following steps to configure single I/O condition.

Step	Action
1	Launch SoftMaster-SIM. The **SoftMaster-SIM** window appears.
2	Expand **CPU**, and click to expand the **I/O Condition**.
3	In the left-pane, double-click the **Single I/O Condition**. The **Single I/O Condition** window appears.
4	Double-click the I/O condition. The **Single I/O Condition** dialog box appears.
5	Click **Basic Settings** tab and enter the following details. a) Under **Basic Setting**, select the **Use condition** checkbox. The Use condition option helps to decide the use of I/O condition. If you do not select this option, SoftMaster-SIM does not use the condition set by user.

Step	Action
	b) Type the I/O condition name and provide the description of I/O condition.
	c) Under the **Execution Option**, select one of the following:
	– **Always execute** regardless of condition set by user, the program is executed.
	– **Execution by button** to execute the output setting.
	– **Execution by condition expression** to execute the output setting when it satisfies the condition expression set by the user.
	d) **View Channel Browser**: This option is enabled only when **Execution by condition expression** is selected. It displays the channel browser.
6	Click **Output Setting** tab and then click **View Channel Browser**.
	The **Channel Selection Window** appears.
	a) Expand the **Channel List** in the left pane.
	b) Double-click the required channel from the list.
	c) In the right pane, select a channel, and then click **Select**. The selected channel name is displayed in the **Address/Channel** field of the **Output Setting** tab.
	d) Type the set value for the selected **Address/Channel**.
	e) Click **OK**.
7	To modify or edit the details the Single I/O Condition,
	a) Select a condition to modify in the Single I/O Condition window.
	b) Choose **Edit** > **Properties**. The **Single I/O Condition** dialog box appears.
	c) Modify the required information.
	d) Click **OK**.

Configuring Continuous I/O Condition

Perform the following steps to configure the continuous I/O condition.

Step	Action
1	Launch SoftMaster-SIM. The **SoftMaster-SIM** Window appears.
2	Expand **CPU**, and click to expand the **I/O Condition**.
3	In the left pane, double-click the **Continuous I/O Condition**. The **Continuous I/O Condition** window appears.
4	Double-click the I/O condition. The **Continuous I/O Condition** dialog box appears.
5	Click **Basic Settings** tab and enter the following details. a) Under **Basic Setting**, select **Use condition** checkbox: The Use condition option helps to decide the use of I/O condition. If you do not select this option, SoftMaster-SIM does not use the condition set by user. b) Type the I/O condition name and provide the description of I/O condition. c) Under the **Execution** Option, select one of the following: – **Always execute** regardless of condition set by user, the program is executed. – **Execution by button** to execute the output setting. – **Execution by condition expression** to execute the output setting when it satisfies the condition expression set by the user. d) **View Channel Browser**: This option is enabled only when **Execution by condition expression** is selected. It displays the channel browser. e) Click **OK.**
6	Click **Output Setting** tab and then select the following as per requirement. a) **Repeated Execution** to enter the output value repeatedly. b) **Ignore Condition while execution** to check the operating condition. By default this option is selected.
7	Click **Output Setting**. The **Continuous Value Setting** dialog box appears.

Step	Action
	a) Click **Channel/Address**. The **Channel/Address Name** dialog box appears.
	b) Click **View Channel Browser**. The **Channel Selection Window** appears.
	c) Double-click a channel from the **Channel List** and then select a channel in the right pane.
	d) Click **Select**.
8	To enter the values in the Continuous Value Setting, place the cursor in the required cell and type the value.
9	To autofill the value, in the **Continuous Value Setting** dialog box, select the area to be copied.
	a) Move the cursor to the corner, cursor changes to a + symbol.
	b) Drag the cursor down, by pressing the left mouse button.
	c) Click **OK**.
	ATTENTION You can use control key to auto fill the values, by typing the value in the mouse drag direction.
10	Click **OK**.

ATTENTION

- To start the monitoring of I/O conditions:
  - Choose **Start Channel Monitoring** > **Use Single I/O Condition** or **Use Continuous I/O Condition**.
- To end the monitoring of I/O condition:
  - Choose **Stop Channel Monitoring** > **Use Single I/O Condition** or **Use Continuous I/O Condition**.

Module simulation

Following are the two simulation function for the I/O module supported by SoftMaster-SIM.

- **Digital I/O module**: It supports I/O function for I or Q area.
- **Special module**: It supports monitoring function such as analog input or output value monitoring.

All simulation function in the SoftMaster-SIM uses information present in the I/O parameter. Hence, ensure that you set each module in the I/O parameter to simulate module and reflect the same in the program.

For example, to simulate the following PLC system, set the I/O parameter as:

Base	Slot	Module name	Module type
Basic base	0	2MLI-D21A	DC 2, 4V input 8 points
Basic base	1	2MLF-AV8A	Voltage type A/D conversion module (8 channels)
Basic base	2	2MLF-HO2A	Open collector type high speed module (2 channels)

ATTENTION

To apply I/O parameter, download I/O parameter to SoftMaster-SIM from SoftMaster. In case the module has been changed, start the SoftMaster-SIM module and execute the SoftMaster-SIM again.

Digital I/O module

In the digital I/O module's simulation, you can change the contact point's current value or you can check if the output is normal. According to I/O module setting in I/O parameter, digital I/O module has the following characteristics.

	Setting I/O module	Not setting I/O module
Modification of input value	Modified current value of the monitor is available.	Modified SoftMaster-SIM channel value is available.
Modification of output value	Not available	Not available
Forced I/O input	Applied	Not applied

Analog input module (A/D conversion module)

SoftMaster-SIM supports the 2MLF-AV8A (Voltage type 8 channel), and 2MLF-AC8A (Current type 8 channel) analog input modules.

SoftMaster-SIM supports four types of input voltage range and digital data output format and two types of input current range.

Input voltage range	Input current range	Digital data output format
1 ~ 5V	4 ~ 20mA	0 ~ 16000
0 ~ 5V	0 ~ 20mA	-8000 ~ 8000
0 ~ 10V		1000 ~ 5000
-10 ~ 10V		0 ~ 10000 (%)

SoftMaster-SIM supports the following analog input parameters.

- Operation channel
- Input voltage(current) range
- Output data type
- Filter constant
- Filter process
- Average method
- Average value

ATTENTION

For more information about analog module's parameter setting and how to use the program, refer to respective module user's guide.

Analog output module (D/A conversion module)

SoftMaster-SIM supports the following analog output module.

- 2MLF-DV4A (Voltage type 4 channel)
- 2MLF -DV8A (Voltage type 8 channel)
- 2MLF -DC4A (Current type 4 channel)
- 2MLF -DC8A (Current type 8 channel)

SoftMaster-SIM supports the following voltage (current) range and input data type.

Input data type	Output voltage range	Output current range
0 ~ 16000	1 ~ 5V	4 ~ 20mA
-8000 ~ 8000	0 ~ 5V	0 ~ 20mA
1000 ~ 5000	0 ~ 10V	-
0 ~ 10000 (%)	-10 ~ 10V	-

SoftMaster-SIM supports the following analog output parameter.

- Operation channel
- Output voltage (current) range
- Input data type

ATTENTION

For more information about analog module's parameter setting and how to use the program, refer to respective module user's guide.

High-speed counter module (HSC module)

High-speed counter simulation, compare the input count value with parameter setting value and use it as comparison output signal. You can change the current count value, in the SoftMaster-SIM Channel List.

The SoftMaster-SIM supports the following high-speed counter module.

- 2MLF -HO2A (Open collector 2 channel)
- 2MLF -HD2A (Open driver 2 channel)

The SoftMaster-SIM supports the following high-speed counter parameter.

- Preset
- Comparison output 0 mode
- Comparison output 1 mode
- Comparison output 0 minimum setting value
- Comparison output 0 maximum setting value
- Comparison output 1 minimum setting value
- Comparison output 0 maximum setting value
- Output status setting

ATTENTION

For more information about High-speed counter module and how to use the program, refer to *High-speed Link Module user's guide*.

RTD module

The SoftMaster-SIM supports the 2MLF -RD4A (4 channel) RTD module. You can change the temperature input value in the SoftMaster-SIM Channel List.

The SoftMaster-SIM supports the following temperature input parameter.

- Operation channel
- Sensor type
- Temperature unit

ATTENTION

For more information about RTD module's parameter setting and how to use the program, refer to *RTD module user's guide*.

6.5 Limitations

SoftMaster-SIM has the following limitations in comparison with real PLC.

Watchdog timer

For ML CPU PLC series, you can set watchdog timer to prevent the error. But in SoftMaster-SIM, it does not work properly because scan time in SoftMaster-SIM is longer than PLC.

Communication module

SoftMaster-SIM does not support function related with communication module. So the following function block does not work and it is saved in SoftMaster-SIM.

Category	Name	Function
Station address setting	P2PSN	Sets other station address
Reading area setting (BOOL)	P2PRD_BOOL	Sets BIT data reading area
Reading area setting (BYTE)	P2PRD_BYTE	Sets BYTE data reading area
Reading area setting (WORD)	P2PRD_WORD	Sets WORD data reading area
Reading area setting (DWORD)	P2PRD_DWORD	Sets DWORD data reading area
Reading area setting (LWORD)	P2PRD_LWORD	Sets LWORD data reading area
Writing area setting (BOOL)	P2PWR_BOOL	Sets BIT data writing area
Writing area setting (BYTE)	P2PWR_BYTE	Sets BYTE data writing area
Writing area setting (WORD)	P2PWR_WORD	Sets WORD data writing area

Category	Name	Function
Writing area setting (DWORD)	P2PWR_DWORD	Sets DWORD data writing area
Writing area setting (LWORD)	P2PWR_LWORD	Sets LWORD data writing area

7. Maintenance and troubleshooting

7.1 Resetting PLC

This function is used to reset the PLC. You can reset the PLC using the Reset PLC dip switch in the CPU module.

Perform the following steps to reset the PLC.

Step	Action
1	To connect to PLC, click **Online** > **Connect**. The **Connect** dialog box appears and the connection is established with the PLC.
2	Choose **Online** > **Reset PLC**. The **Reset PLC** dialog box appears.
3	You can either choose to perform a reset or an overall reset. • **Reset**: clears all error/warning information during power ON. Error/warning may occur based on the situation. • **Overall reset**: clears error/warning information; latch 1 area data, I/O skip, error mask, and forced I/O setting area to allow power ON.  **ATTENTION** Whenever you reset the PLC, the PLC is OFF and then turn ON again.
4	Click **OK**.

7.2 Checking CPU performance

SoftMaster enables you to check the scan time of the PLC and memory application status.

Perform the following steps to check the scan time and memory application status of PLC.

Step	Action
1	To connect to PLC, click **Online** > **Connect**. The **Connect** dialog box appears and the connection is established with the PLC.
2	Choose **Online** > **PLC Information**. The **PLC Information** dialog box appears.
3	Click the **Performance** tab. The CPU performance details appears.
4	To view details about the Program Memory used, click **Details**. The list of all saved programs and their size appears.

7.3 Checking PLC history

When you connect to the PLC, it displays the history data of error/warning, change mode, and shut down logs saved in the PLC.

Perform the following steps to check the PLC history.

Step	Action
1	To connect PLC, click **Online** > **Connect**. The **Connect** dialog box appears and the connection is established with the PLC.
2	Choose **Online** > **PLC History.** The **PLC History** page appears.
3	Select the **Error Log** tab. The **Error Log** page appears.

Step	Action
4	Click the **Mode Log** tab. The **Mode Change Log** page appears which displays the Mode Change Log of PLC operation modes.
5	Click the **Shut Down Log** tab. The **Shut Down Log** page appears which displays the Shut down Log history of the PLC. The shut down log also displays the base number where the power shut down has occurred.
6	Click the **System Log** tab. The **System Log** page appears which displays the history of tasks run by SoftMaster when the PLC is running.

ATTENTION

- History data is arranged in chronological sequence.
- The history is saved as .csv file. This file can be opened in Microsoft Excel or other String editing programs.
- Double-click the first column of the list to change sequence in ascending/descending order.
- A maximum of 100 history data are displayed. Click **Read All** to read more PLC histories. If the number of items in history is less than 100, the **Read All** is disabled.

7.4 Checking PLC error/warning

Using this option, you can check the error/warning and the log of earlier errors saved in PLC.

Perform the following steps to check the PLC error/warnings.

Step	Action
1	To connect to PLC, click **Online** > **Connect**. The **Connect** dialog box appears and the connection is established with the PLC.
2	Choose **Online** > **PLC Errors/Warnings**. The **PLC Error/Warning** page appears. **ATTENTION** • In case of an error/warning while the connecting or Online, the Error/Warning page appears. • If the error is an I/O parameter issue, I/O installation error, fuses error, I/O Read/Write error, special communication module error, the applicable error slot information is displayed. • When a Program Error (the error that occurs when the PLC mode is changed from Stop to Run) or Execution Program Error (when PLC is in Run mode) occurs, and if the SM project and the downloaded PLC program are same, double-click the area of program name to move to the corresponding step in the program.

7.5 Debugging

Perform the following steps to start debugging.

Step	Action
1	Launch SoftMaster application. The **SoftMaster** window appears.
2	Create a new project.
3	Choose **Online** > **Connect** to connect the PLC.
4	Choose **Online** > **Write** to download the program to PLC.
5	Choose **Debug** > **Start Debugging**.

ATTENTION

- Debug is unavailable if PLC operation is in Run mode.
- Debug is available only when PLC is in online mode.
- Debug function is available only when the SoftMaster program and PLC program are identical. If they are not identical, download the applicable program.
- Monitoring function is also available in Debug mode.
- If an error occurs in the PLC, Debug instructions do not work normally. Clear the error to run the Debug instruction.
- To stop debugging, choose **Debug** > **Stop Debugging**.

Debug LD program

This is used to specify the functions to debug the LD program.

Following are the functions available to debug the LD program: Go, Step Over, Step Into, Step Out, Go to Cursor, Set/Remove Breakpoints, Breakpoints List, and Breakpoint Conditions.

The following table provides the description and steps that you need to perform to debug the LD program.

Option	Procedure	Description
Go	Choose **Debug** > **Go**. The program runs until the breakpoint condition is reached.	It is used to run the program up to the specified breakpoint.
Step Over	Choose **Debug** > **Step Over**.	It is used to run the program to the next step. Unlike Step Into, even if the current step is an application instruction CALL, it does not enter the subroutine block.
Step Into	Choose **Debug** > **Step Into**.	It is used to run the program to the next step. If the current step is an application instruction CALL and if the running condition satisfied, it enters the subroutine block. If there is no CALL instruction or if the CALL running condition is not satisfied, the program runs to the next step.
Step Out	Choose **Debug** > **Step Out**.	It is used to step out from the subroutine block when the Step into function is executed. If the currently debugged step is not inside the subroutine block, the program runs to the next step.
Go to Cursor	Click **Debug** > **Go to the Cursor**.	It is used to run the program up to the cursor position.
Set/Remove Breakpoints	Choose **Debug** > **Set/Remove Breakpoints**.	It is used to set or remove the breakpoint per step. The breakpoint cannot be set on the area specified by a Block Mask instruction. Application instruction sets the breakpoint on the instruction string area.
Breakpoints List	Choose **Debug** > **Breakpoints List**. A maximum of 62 Breakpoints can be registered in the PLC.	The list shows all the Breakpoints being used in the program, where you can decide to use or delete the Breakpoint. The options available in the Breakpoint list are: **Use**: Select this checkbox to delete the

Option	Procedure	Description
		Breakpoint. **Program**: Displays the program where breakpoint is used. **Step**: Displays the step where the breakpoint occurs. **Count**: Displays the number of times the step runs, where the breakpoint occurs, and the PLC stops. (Example: if the breakpoint is set inside, FOR 20 ~NEXT with the number of times 10, FOR 20 ~NEXT is run 10 times and then it stops.) **Select All**: Checks all the listed items. **Reset**: Cancels all the items that were previously allowed. **Go to**: Moves to the selected breakpoint position. **Remove**: Deletes the selected breakpoints from the list. **Remove All**: Deletes all the breakpoints from the list.
Breakpoint Conditions	Variable Breakpoint: a) Choose **Debug** > **Breakpoint Conditions**. The **Break condition** dialog box appears. b) Click **Variable Breakpoint**. c) To set the variable break run, choose **Debug** > **Go**.	The options available in the Variable Breakpoint are: • **Use the address as a variable breakpoint**: Select this check box to use the variable break. • **Variable**: Displays the variable name used for variable break. • **Program**: Displays the program name of the variable used for variable break. • **Address**: Displays the address name if the variable's memory is allocated in the local variable. • **Comment**: Displays the comment if the variable's comment is declared in the local variable.

Option	Procedure	Description
		• **Value Condition**: Select this check box to enter the value condition. d) **Value**: Once the specified address value is reached, the break is engaged. The maximum/minimum value is based on the variable type. e) **Select Variable**: Finds a specific variable on the variable list. f) **Condition**: Makes the break engaged when writing the value or reading the value from address.
	Scan Breakpoint: a) Choose **Debug** > **Breakpoint Conditions**. The **Breakpoint Conditions** dialog box appears. b) Click **Scan Breakpoint**. c) Select **Use scan breakpoint** checkbox. d) From **Scan Count** list, select the scan time. The available scan time value is between 1 and 2147483647. e) To apply the scan break, choose **Debug** > **Go**.	This function is used to run the PLC as many times as the scan times specified, and apply the break.

ATTENTION

- Among variable types, BYTE, NIBBLE, and STRING do not support the variable break instruction.
- When the PLC is in debug mode, the meeting of any one condition (breakpoint, variable break, scan break, and so on), applies the break.
- Click the program name to move to the program position where the variable break is applied.
- If the value is changed in another application programs (such as address monitor) other than the specified program, movement to the program position where the variable break is applied may not be possible.

7.6 Understand diagnostics information

Scan Watchdog timer

Watchdog Timer (WDT) is a function run by the CPU module that detects program congestion through hardware and software errors of the PLC. The following are the functions of WDT.

- WDT is a timer used to detect an operation delay from abnormal user program. The detection time of WDT is set in the basic parameter of SoftMaster.
- WDT monitors any scan overtime during operation and if it detects any overtime delay, it immediately stops the PLC operation and turns off every output.
- If the excess of Scan WDT is expected during program processing of the specific part while executing the user program (FOR ~ NEXT instruction, CALL instruction), clear the timer by using 'WDT' instruction.
- The 'WDT' instruction initializes the elapsed time of Scan WDT and starts the time measurement from zero again.
- Use the following method to clear the error state of watchdog.
  - Power reset, operation of manual reset switch.
  - Mode conversion to STOP mode.

ATTENTION

The range of WDT is 10 ~ 1000ms.

Check I/O module

This function is used for checking the error state of an I/O module during the beginning of an operation or during an operation and performs the following:

- In case the module installed physically is not as per the module type configured in the software (I/O parameter settings), then it shows an error.
- In case the I/O module is removed or error occurs during operation, the error is detected and indicated by the warning lamp (ERR) and the CPU module ceases to operate.

Check battery voltage

The CPU module is capable of detecting a battery voltage drop below the memory backup voltage. On detecting a low-battery level, the low-battery warning lamp (BAT), located at the front of the CPU module glows.

7.7 Diagnosing faults of an external device

All the errors in an external device (devices wired to I/O modules) are detected by CPU and are available in a flag as a real-time value. This flag enables the indication of an external device error without preparing a complicated program.

Detection/classification of external device fault

The errors in an external device are detected by the user program. They are classified as:

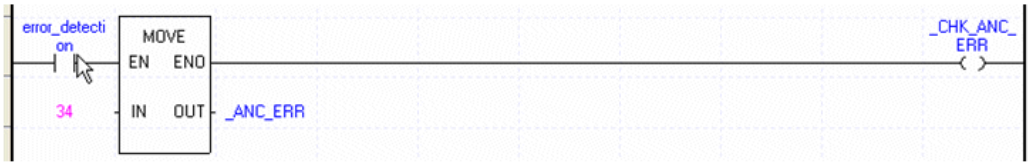
- 'Non-Fatal Error' (warning) that continues the PLC operation. It only gives an indication about the error state according to the contents of detected error.
- 'Fatal Error' that stops the PLC operation. For fatal error, '_ANC_ERR' flag is used and for non-fatal error, '_ANC_WAR' flag is used.

Handle a fatal error in an external device

The following describes the ways to handle fatal error in an external device.

- In a user program, if a fatal error of external device is detected, the error type can be set by a user program. For this, the user needs to write the value except '0' in the system flag, '_ANC_ERR'. While checking scan program completion time, if any error occurs, it is indicated in the system representative error flag '_ANNUM_ER' of '_CNF_ER'. PLC then shuts off all output modules and gives an error.
- If case of an error, a user can find the cause by using SoftMaster or by monitoring the '_ANC_ERR' flag.

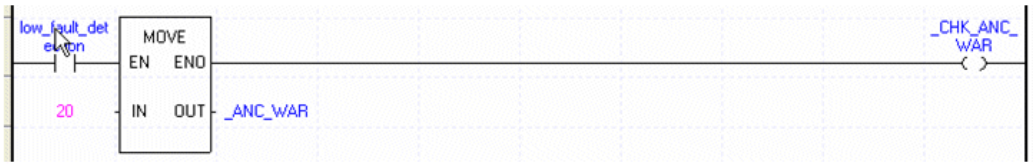
- The ERR LED, P.S LED, and CHK LEDs are turned ON by the fatal fault error flag of an external device. The LEDs can be turned OFF by resetting the PLC. Turn the PLC OFF and then ON to turn off the LEDs.



Handle a non-fatal error in an external device

The following describes the ways to handle a non-fatal error in an external device.

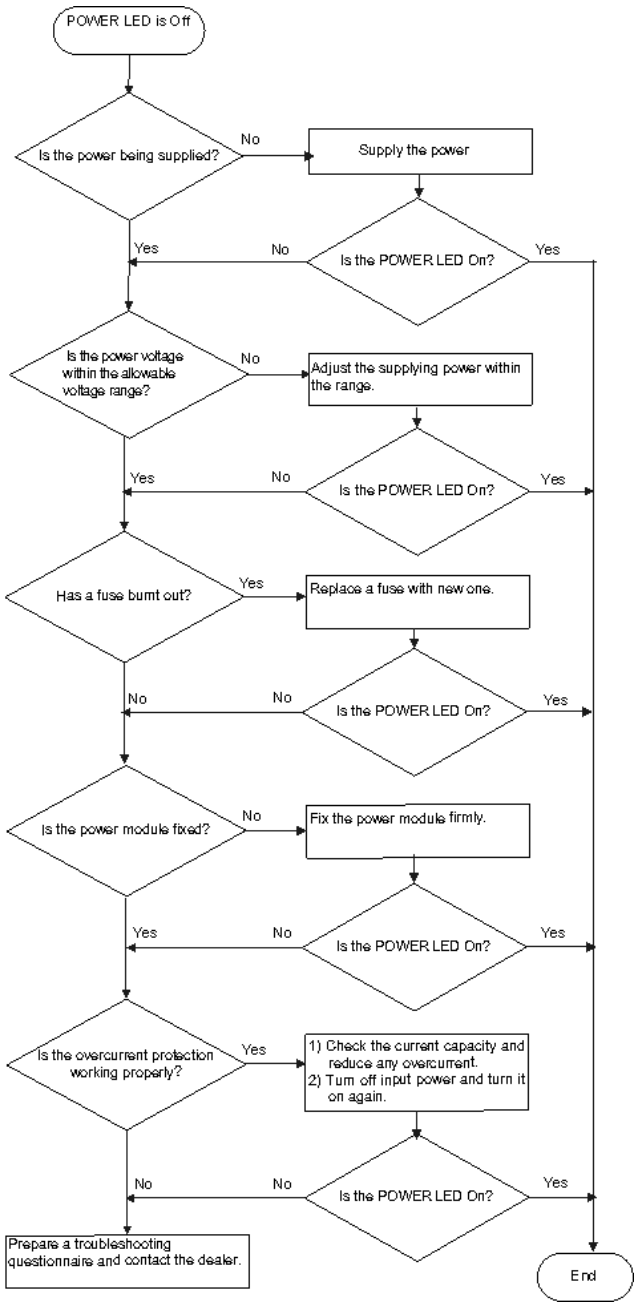
- When a non-fatal error (warning) in an external device occurs, select the flag of the corresponding position as ON '_ANC_WB' according to user identification from system flag. At the end of the scan program, if a warning is detected when checking from '_ANC_WB [0]', it is indicated by the system representative error flag, '_ANNUN_WR' of '_CNF_WAR'. The number of non-fatal error of external device is recorded in the order of occurrence from '_ANC_WAR [0]' to '_ANC_WAR [7]'.
- If any error occurs, a user can find the cause of that error using SoftMaster or the cause of warning by monitoring '_ANC_WAR' and '_ANC_WB' flags directly.
- If the non-fatal error of external device is released, from '_ANC_WB[n]' after performing the user program, it is automatically removed from the '_ANC_WAR[n]' flag and if all are released, '_ANNUN_WR' system flag '_CNF_WAR' is reset.



7.8 Understand LED indications and actions

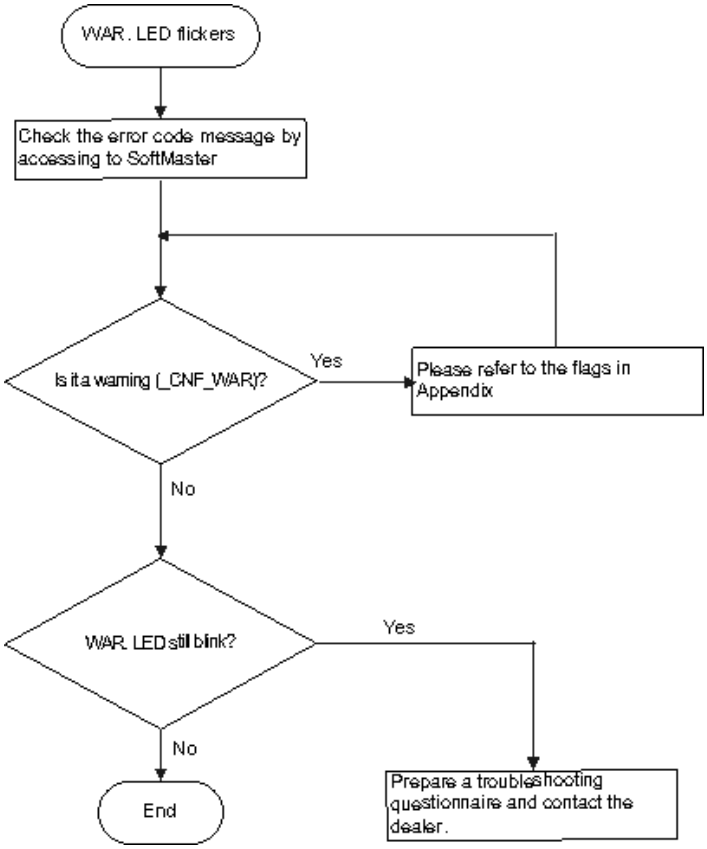
When POWER LED is OFF

The following flow chart describes the sequence of steps to be taken, if the POWER LED is OFF.


POWER LED is Off
Is the power being supplied?
No
Supply the power
Is the POWER LED On?
Yes
No
Yes
Is the power voltage within the allowable voltage range?
No
Adjust the supplying power within the range.
Is the POWER LED On?
Yes
No
Yes
Has a fuse burnt out?
Yes
Replace a fuse with new one.
Is the POWER LED On?
No
No
Yes
Is the power module fixed?
No
Fix the power module firmly.
Is the POWER LED On?
Yes
No
Yes
Is the overcurrent protection working properly?
Yes
1) Check the current capacity and reduce any overcurrent.
2) Turn off input power and turn it on again.
Is the POWER LED On?
No
No
Yes
Prepare a troubleshooting questionnaire and contact the dealer.
End

When WAR (Warning) LED is ON

The following flow chart describes the orders of taking a measure if WAR.LED is On, when turning it on, and starting operation or operating.



ATTENTION

If warning error occurs, the PLC system does not stop. But it is necessary to check the error message and take a corrective measure or it may cause an error.

The flowchart describes the measure when WAR.LED is on because redundant system runs in single or configure b line mode.

In case system is configured as ring, basic base and extension base is displayed by ring like structure. In case system is configured as line, disconnection between bases is displayed. This can be checked by LED. In case system starts with line topology, RING LED turns off. In case it starts with ring topology and it changes the topology to line, RING LED flickers

The following figure illustrates the CPU module LED.

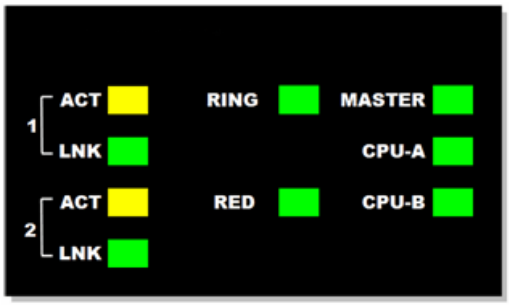


Figure 7-1 CPU module LED

The following figure illustrates the extension drive LED.

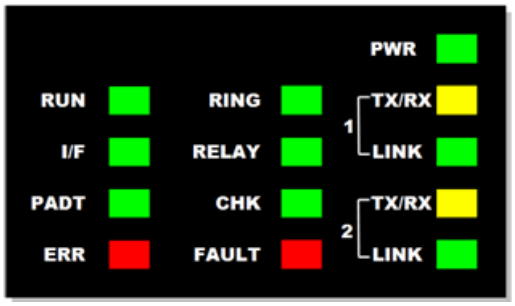


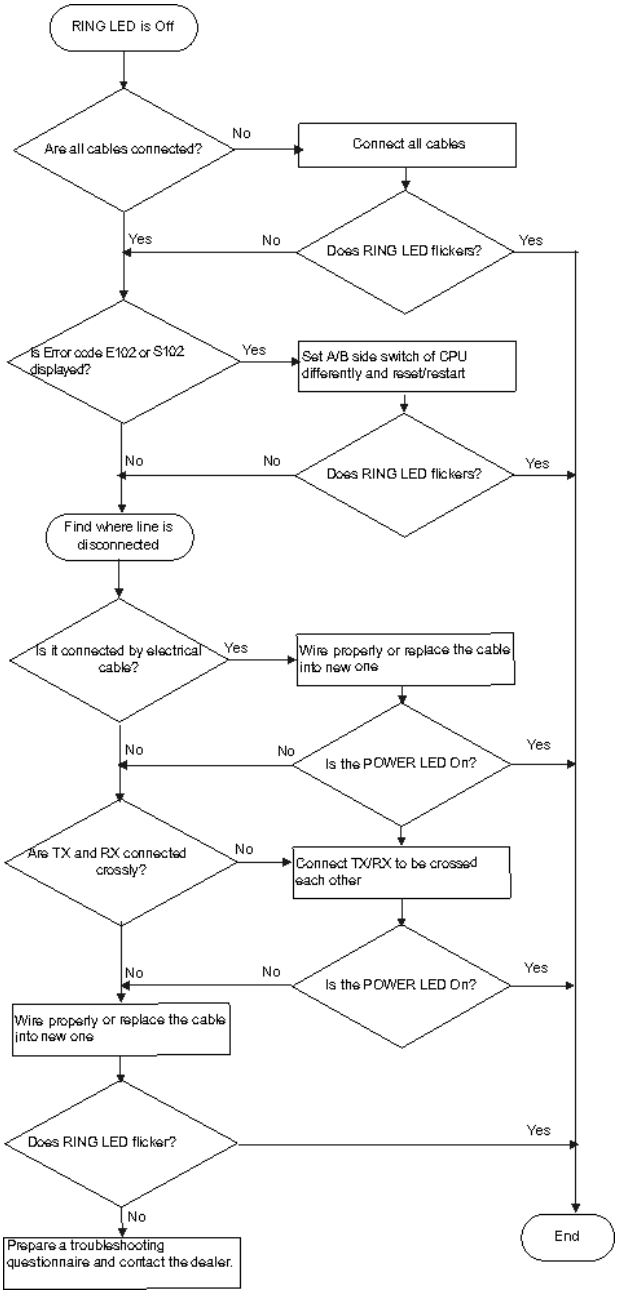
Figure 7-2 Extension drive LED

ATTENTION

Since optical cable consists of two couples unlike electrical cable, TX and RX can be changed in case of installation.

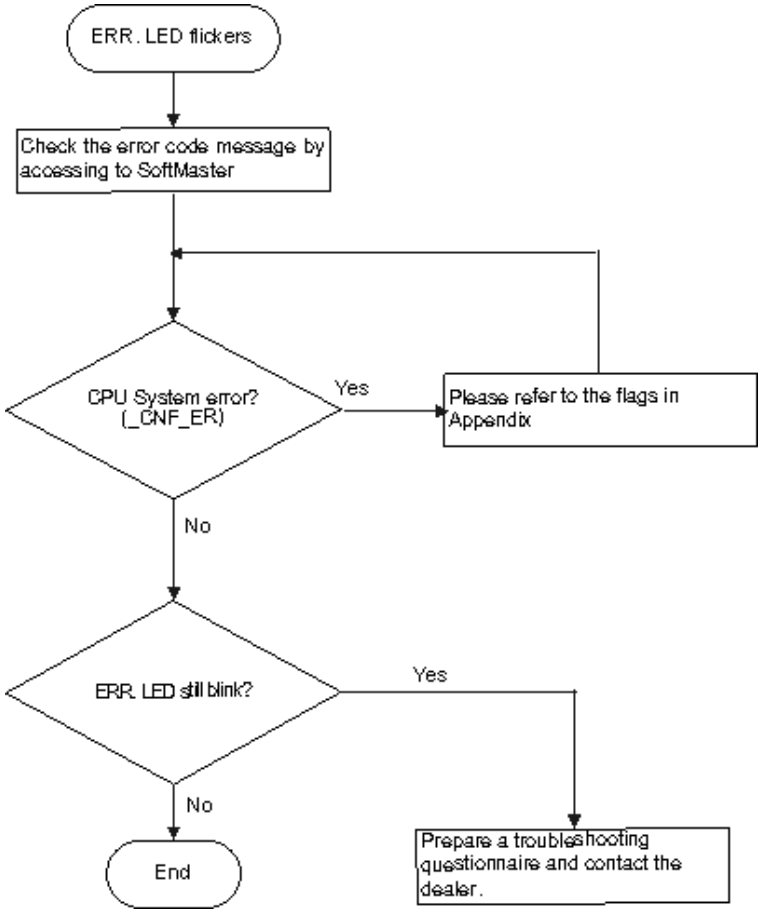
Make sure that direction of TX and RX does not change (TX should be connected with RX, and RX with TX.).

The following figure depicts the sequence of recommended steps, if RING LED is OFF or flickers when turning it ON, starts operation.


RING LED is Off
Are all cables connected?
No
Connect all cables
Does RING LED flickers?
Yes
No
Yes
Is Error code E102 or S102 displayed?
Yes
Set A/B side switch of CPU differently and reset/restart
Does RING LED flickers?
No
No
Yes
Find where line is disconnected
Is it connected by electrical cable?
Yes
Wire properly or replace the cable into new one
Is the POWER LED On?
No
No
Yes
Are TX and RX connected crossly?
No
Connect TX/RX to be crossed each other
Is the POWER LED On?
No
No
Yes
Wire properly or replace the cable into new one
Does RING LED flicker?
Yes
No
Prepare a troubleshooting questionnaire and contact the dealer.
End

When ERR. LED is ON

The following flowchart describes the sequence of steps to be taken if the ERR. LED is ON.

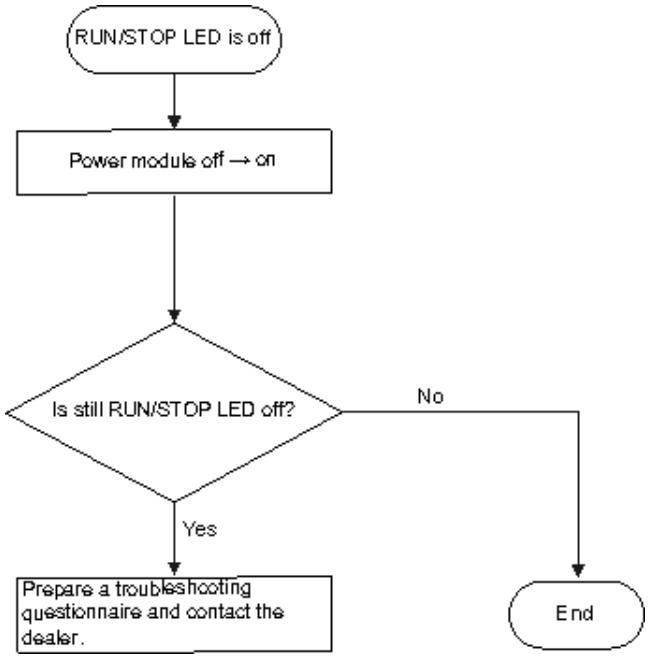


ATTENTION

If a warning is displayed, the PLC system does not stop. However, it is necessary to check the warning message and take a corrective action as sometimes, it may cause an error.

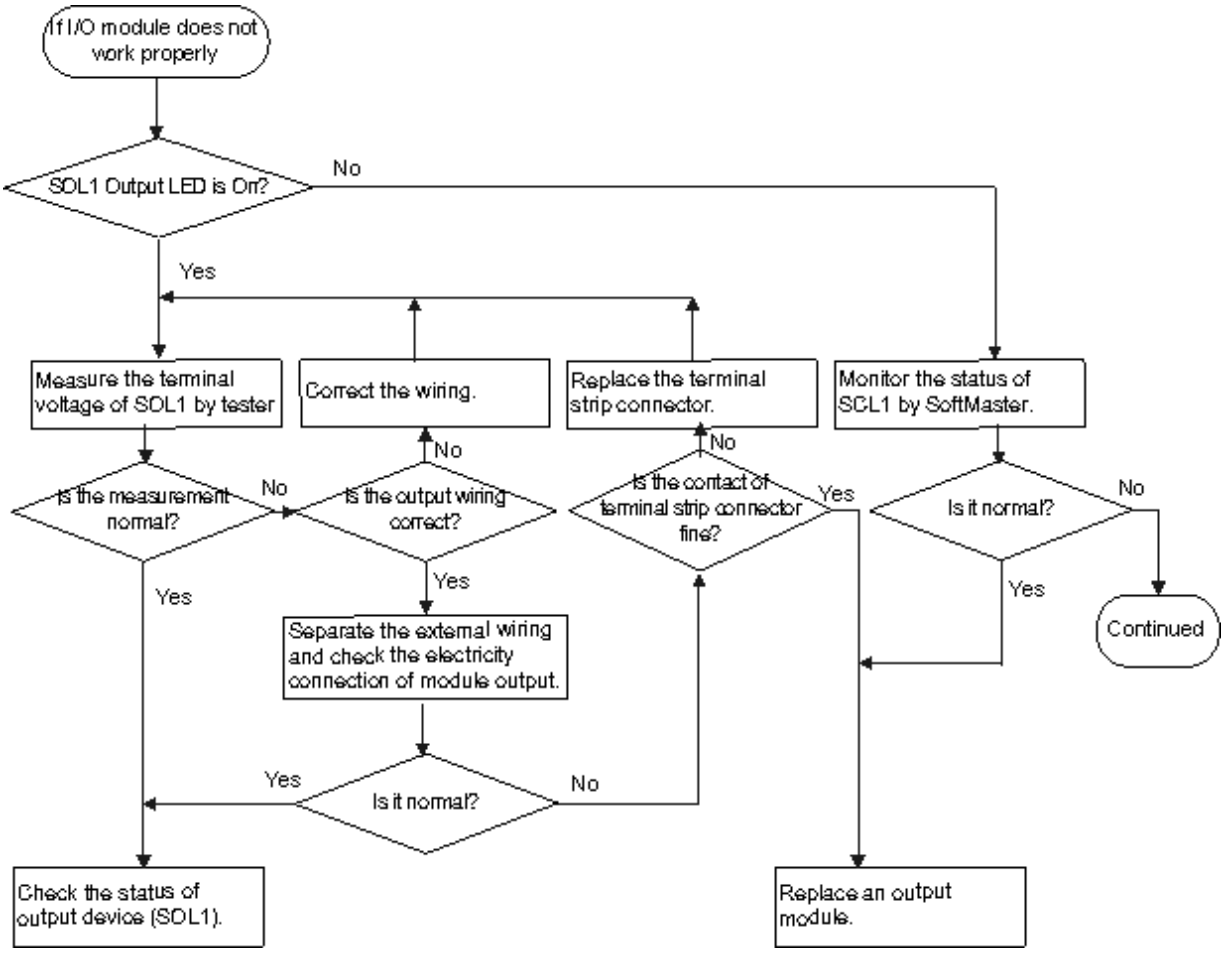
When RUN/STOP LED is OFF

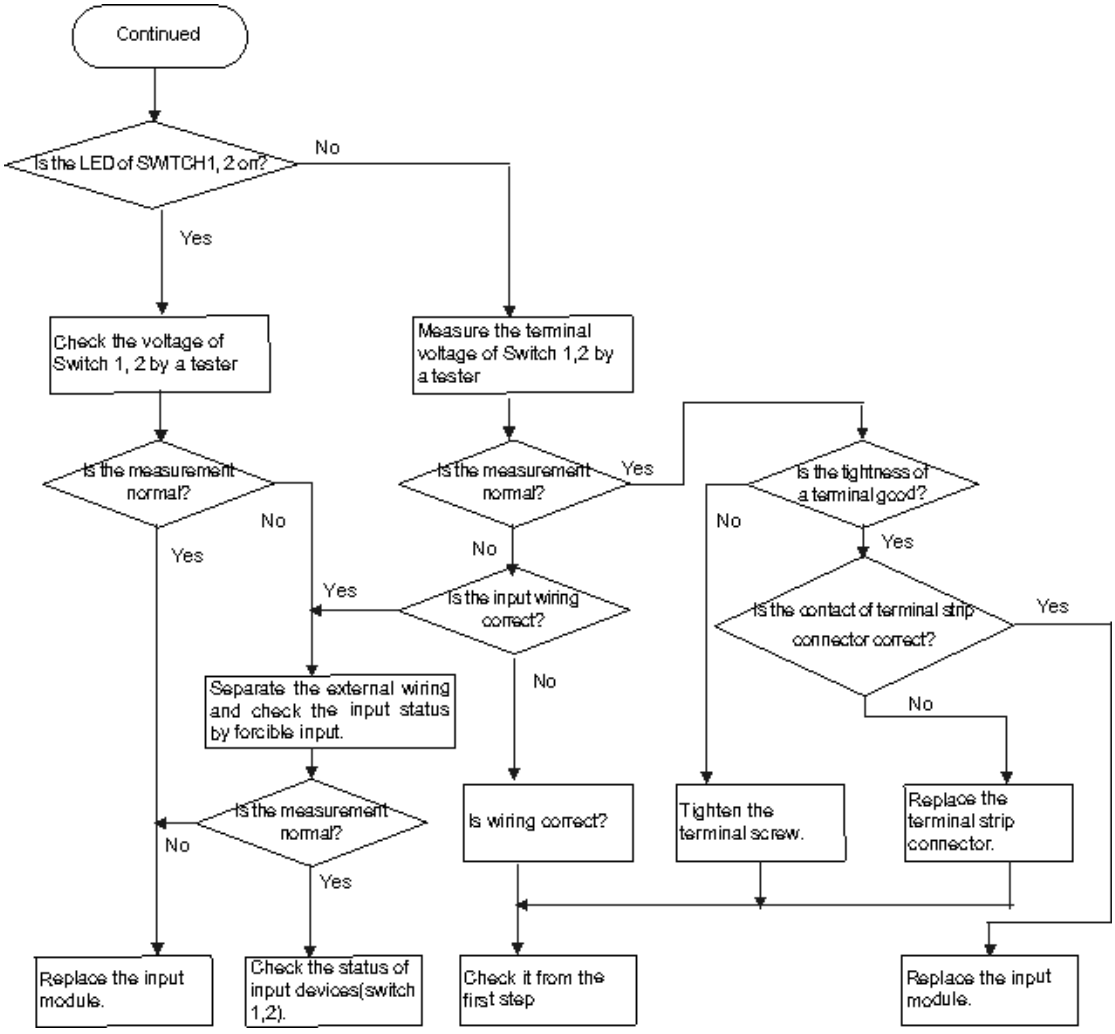
The following flowchart describes the sequence of steps to be taken if RUN/STOP LED is OFF.



When I/O module does not function properly

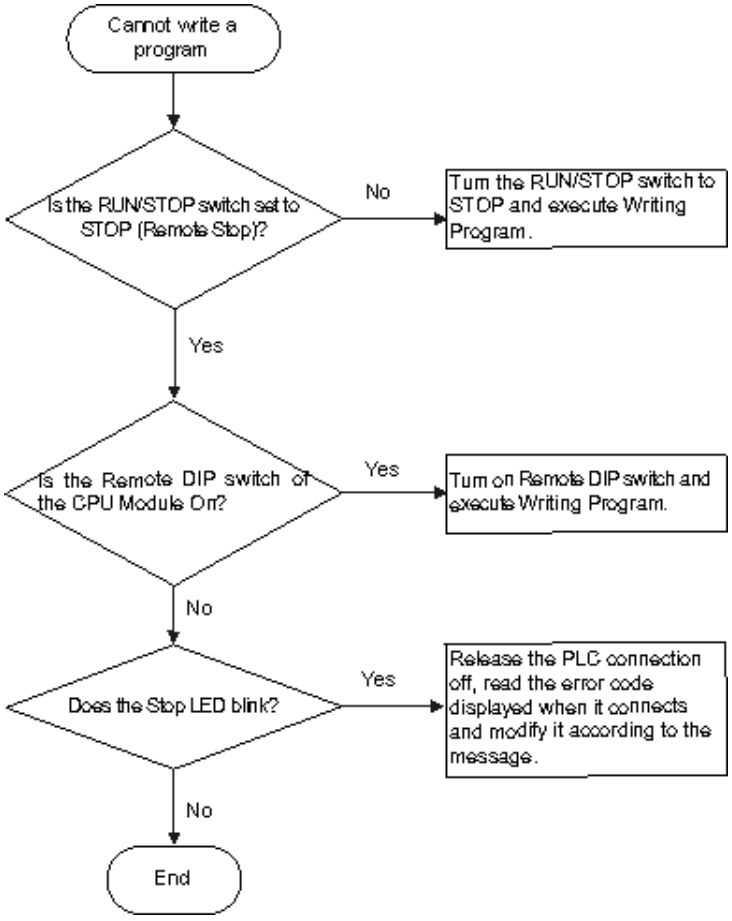
The following flowchart describes the procedure to be followed when I/O module does not function normally during operation, as shown in the following program example.




Continued
Is the LED of SWITCH1, 2 on?
No
Yes
Check the voltage of Switch 1, 2 by a tester
Measure the terminal voltage of Switch 1,2 by a tester
Is the measurement normal?
No
Yes
Is the measurement normal?
Yes
No
Is the input wiring correct?
Yes
No
Is the tightness of a terminal good?
No
Yes
Is the contact of terminal strip connector correct?
Yes
No
Separate the external wiring and check the input status by forcible input.
Is the measurement normal?
No
Yes
Is wiring correct?
Tighten the terminal screw.
Replace the terminal strip connector.
Replace the input module.
Check the status of input devices(switch 1,2).
Check it from the first step
Replace the input module.

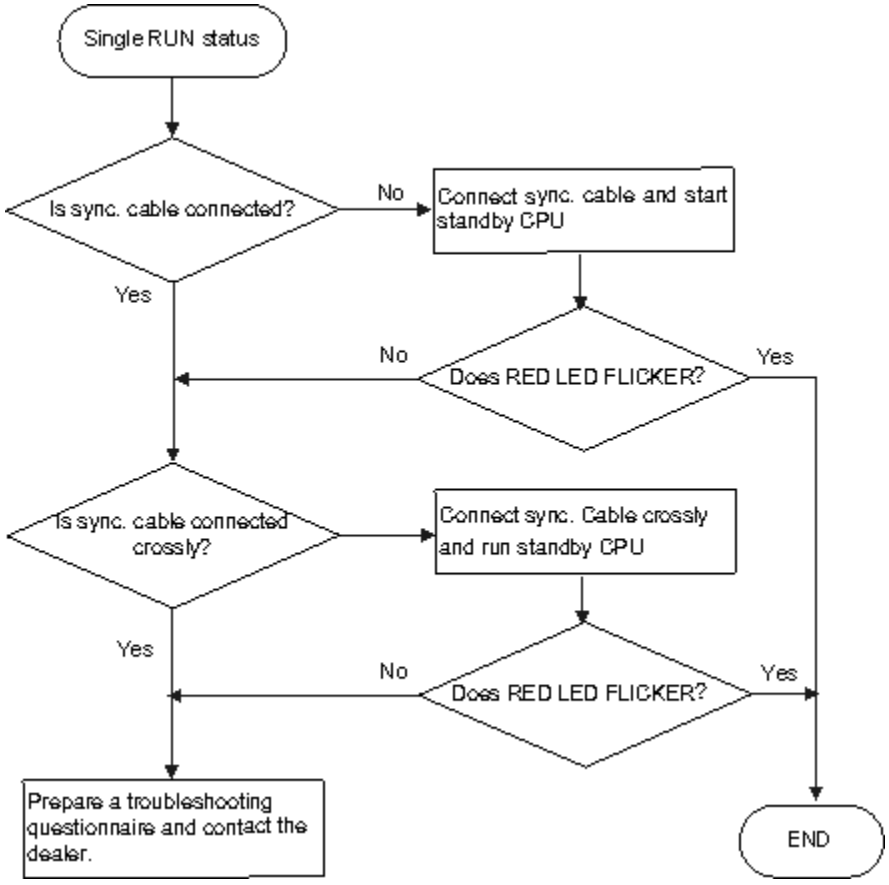
When writing a program to the CPU fails

The following flowchart describes the sequence of steps when writing a program to the CPU module fails.



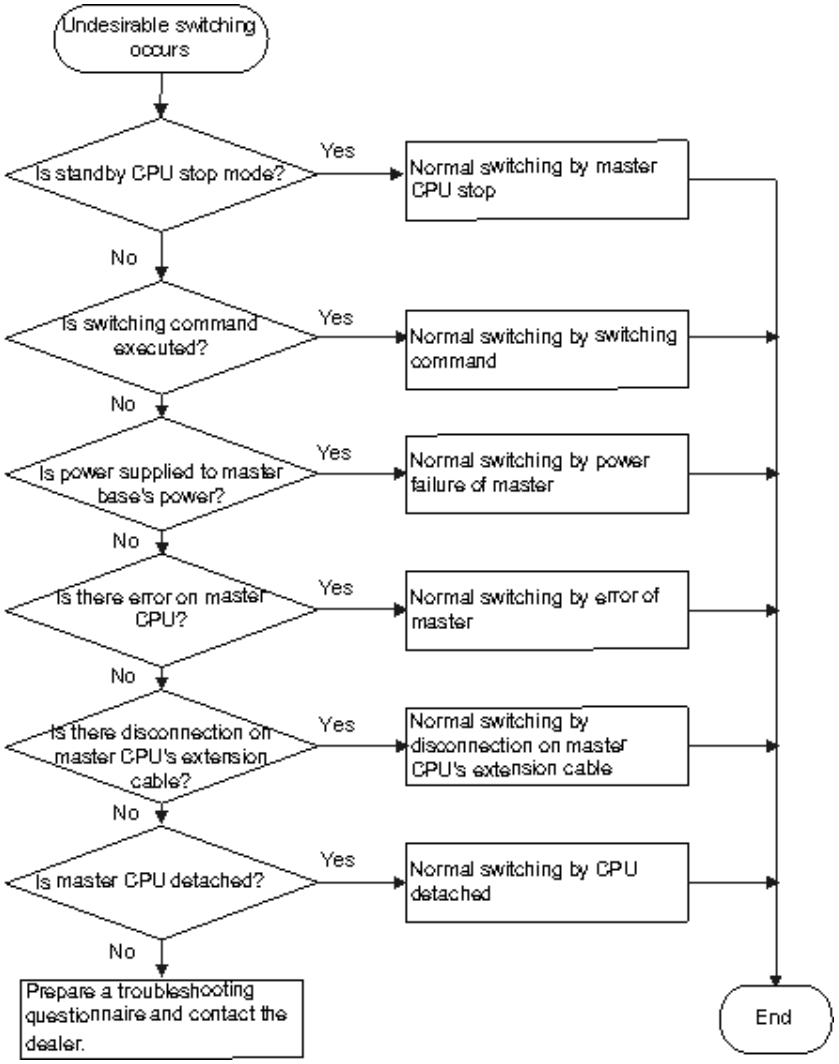
When sync. Cable is not installed properly

The following flowchart describes the sequence of steps to be taken if the cable is not installed properly.

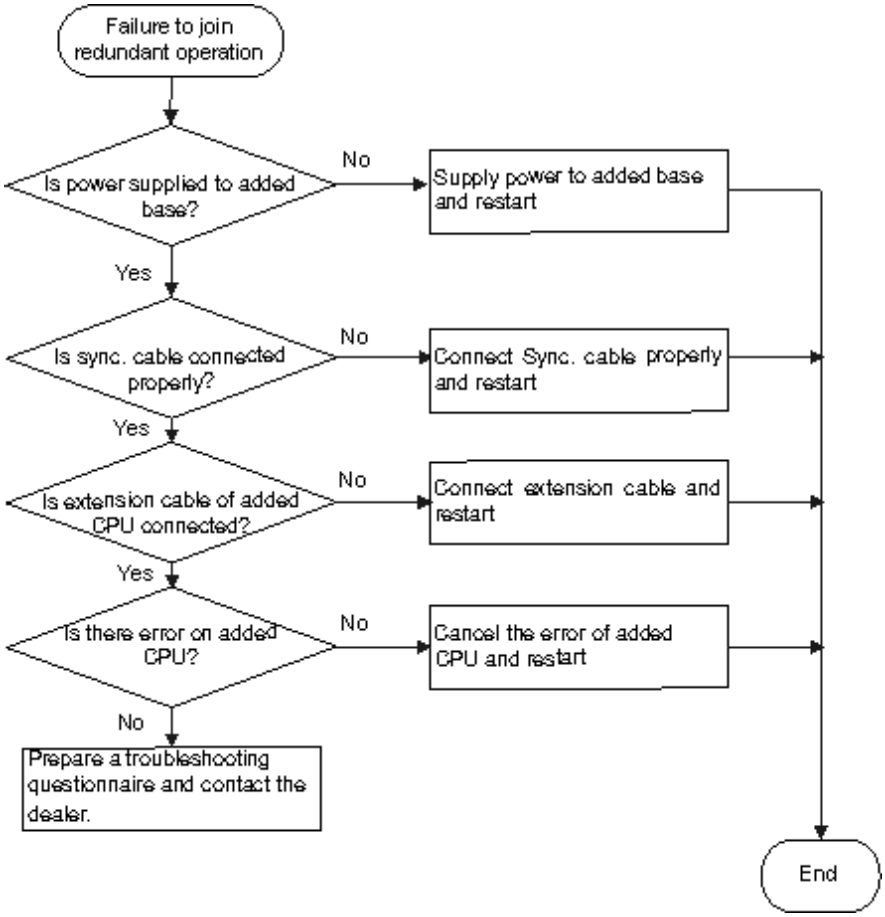


When undesirable master switching occurs

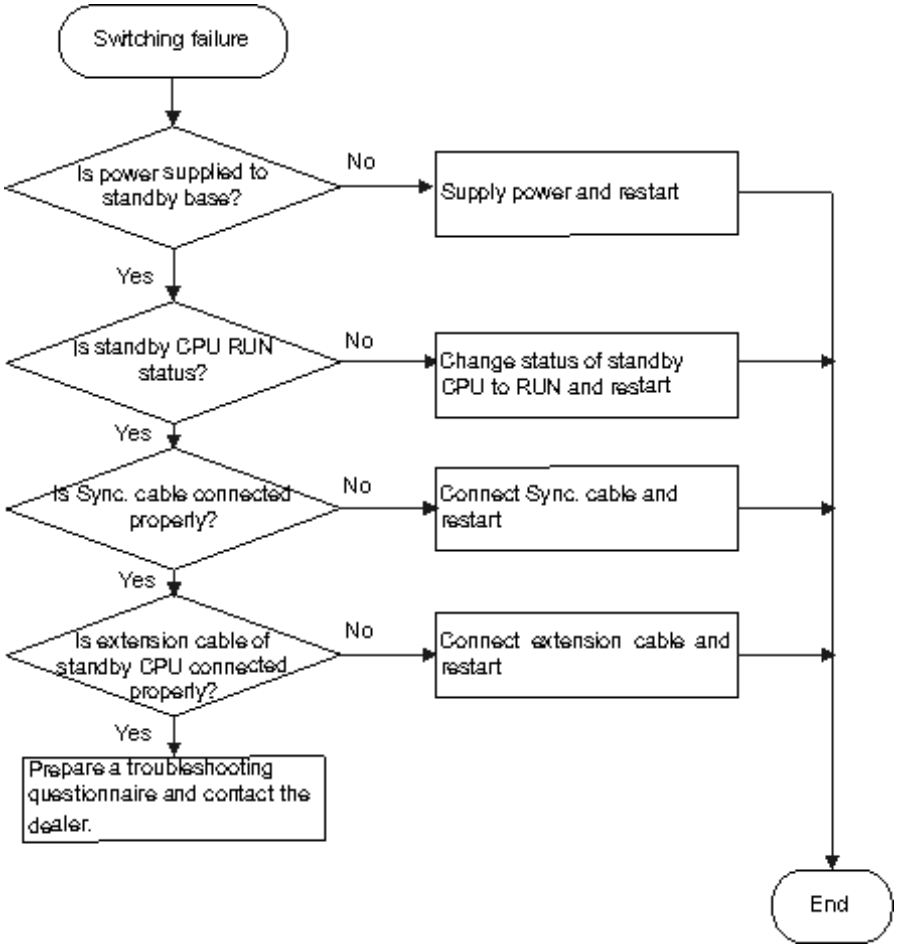
The following flowchart describes the sequence of steps to be taken if an undesirable master switching occurs.



When newly added CPU does not join redundant operation

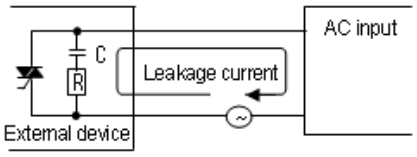
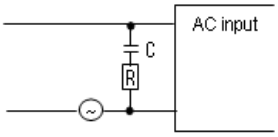


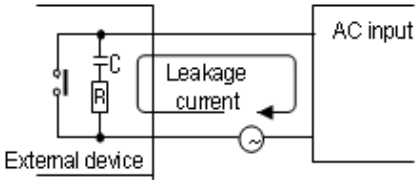
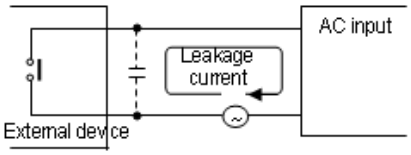
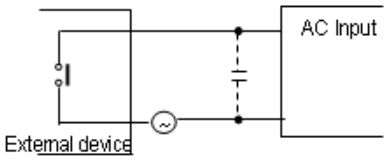
When failing to switchover to master

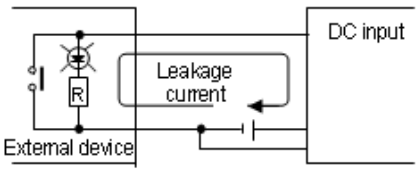
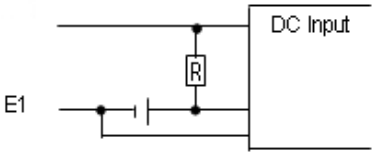
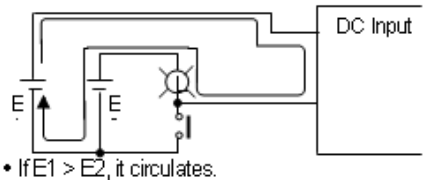
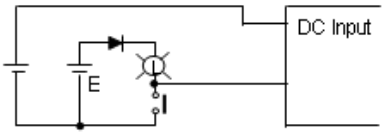


7.9 Fixing common problems

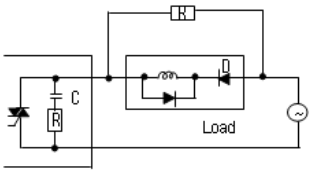
The followings table describes the examples of common faults and the recommended measures of an input circuit.

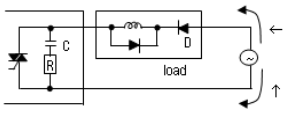
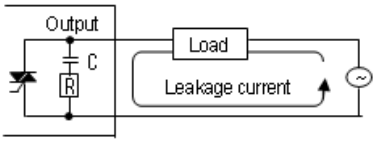
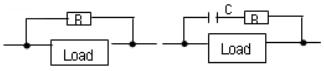
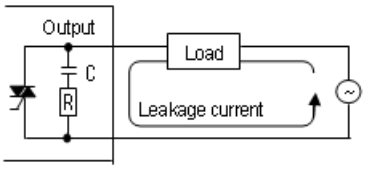
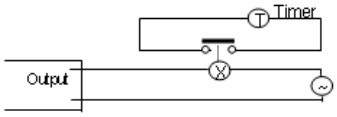
<table>
<tr><th>Diagnostic check</th><th>Cause</th><th>Solution</th></tr>
<tr><td>Input signal cannot be off</td><td>Due to leakage current of an external device. (if operating by proximate switch)
 
</td><td rowspan="2">• Connect a proper resistor (R) or capacitor (C) so that the voltage between terminals of input module is lower than the return voltage.
 

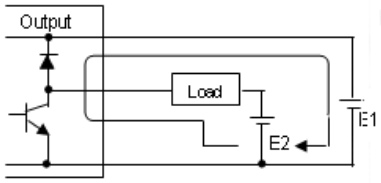
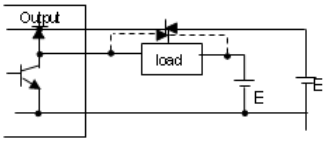
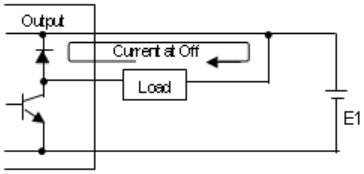
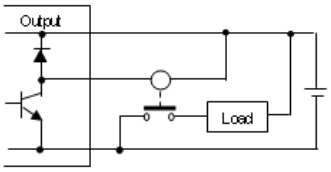
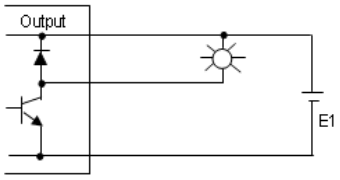
• CR value is determined by the value of leakage current.
– Recommended value C: 0.1 ~ 0.47μF
R : 47 ~ 120Ω (1/2W)
• Alternatively, separate a circuit completely and install another display circuit.</td></tr>
<tr><td>Input signal cannot be off (it could be that a neon lamp is still ON)</td><td>Due to leakage current of an external device (if operating by a limit switch with neon lamp)
 
</td></tr>
<tr><td>Input signal cannot be off</td><td>Due to leakage current from the capacitor between wires of wiring cable.
 
</td><td>Install the power supply on an external device as in the following figure.
 
</td></tr>
</table>

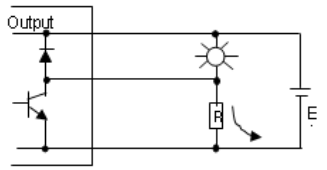
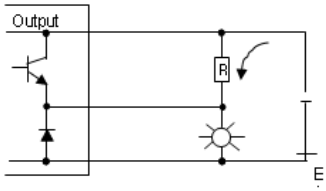
Diagnostic check	Cause	Solution
Input signal cannot be off	Due to leakage current of an external device (if operating by a switch with LED mark) 	Connect a proper resistor so that the voltage between input module terminal and common terminal is higher than off voltage as in the following figure. 
Input signal cannot be off	Due to current is circulated using multiple power sources. 	• Change to singular power • Connect to a circulating current preventive diode as in the following figure. 

The followings table describes the examples of common faults and the recommended measures of an output circuit.

Diagnostic check	Cause	Solution
Excessive voltage is allowed to load when output contact is off	• Due to half-wave rectification (solenoid valve may have it) in the voltage load. • If the polarity is ←, C is charged while the voltage + power charged to C is allowed to both ends of diode (D). When the polarity is ↑. The maximum voltage is approx. 2√2.	Connect a dozens to several hundred kΩ resistor to a load in parallel. 

Diagnostic check	Cause	Solution
	 Note: In this case, the output element does not have any problem. But, the performance of diode (D) in load may be reduced, and it may leads to trouble.	
Load cannot be off	Due to 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 capacity of cables. 
Abnormal time when load is a C-R type timer	Due to leakage current from surge absorbing circuit connected to an output element in parallel. 	• Operate the C-R type timer by mediating a relay. • Use any other timer which acts like a C R type timer. Note: A timer's internal circuit may have half-wave rectification. 
Load cannot be off (DC)	Due to current circulated from two different power sources.	• Adjust plural to singular power source. • Connect to circulating current preventive diode (figure below).

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

Diagnostic check	Cause	Solution
		 Sink type transistor output  source type transistor output

7.10 Error codes list

The following table describes the error codes.

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 backup flash.	Fault	ERR : On	Reset converting to RUN mode
23	If a program to execute is not normal	• Operate after 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 any fault is found, replace the CPU module.	STOP	ERR : On	Reset converting to RUN mode

Code	Error causes	Measures (restart mode after the measure)	Operation Status	LED Status	Diagnostic Timing
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 scan ends
32	Fuse of a module holding a fuse is burnt out during operation	Check the position of a slot of which fuse is burnt out by SoftMaster, replace a fuse and restart (according to parameter). Reference flag: fuse disconnection error flag	STOP (RUN)	ERR : On (P.S. : On)	When scan ends

Code	Error causes	Measures (restart mode after the measure)	Operation Status	LED Status	Diagnostic Timing
33	I/O 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 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 scan ends
39	CPU is incompletely closed or in trouble	System is closed abnormally due to noise or abnormal hardware • Contact A/S service if it still exists after turning it on again. • Take a measure against noise.	STOP	RUN: On ERR : On	Always
40	The scan time of a program exceeds the scan delay watchdog time designated by parameter during operation	Check the scan delay watchdog time designated by parameter, modify parameter or program, and restart.	STOP	RUN: On ERR : On	When program is executed

Code	Error causes	Measures (restart mode after the measure)	Operation Status	LED Status	Diagnostic Timing
41	Operation error while executing user program	Eliminating an operation error → reload the program and restart (check). If STOP: Check the details of 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	External device error 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 and turn it on again.	STOP	RUN: On ERR : On	When program is executed
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 expansion cable as ring topology	STOP, RUN	E103	Execute program

Code	Error causes	Measures (restart mode after the measure)	Operation Status	LED Status	Diagnostic Timing
		and position the detached base correctly. For information of detached base, refer to CPU error log.			
104	System configuration error	Check for dual IO link redundancy configuration and ring topology • Check redundancy drive module station number. • Check operating system version of extension drive module and extension manager.	STOP	E104	When scan ends, turn it on
300	Redundancy system synchronous operating error.	During redundancy operating, synchronization error occurs	STOP	E300	Switch to redundancy operation
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	STOP	E301	Start standby operation

Code	Error causes	Measures (restart mode after the measure)	Operation Status	LED Status	Diagnostic Timing
		power cut) • restart standby CPU through reset switch or by changing operation mode from STOP to RUN.			
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 CPU Operation can be checked at the A/S Service Center.
- The other errors can be checked by using the error log in SoftMaster.

8. Appendix

8.1 Flag list

User flags

Address	Flag Name	Type	Write	Contents	Description
%FX6144	_T20MS	BOOL	-	20ms cycle clock	
%FX6145	_T100MS	BOOL	-	100ms cycle clock	
%FX6146	_T200MS	BOOL	-	200ms cycle clock	
%FX6147	_T1S	BOOL	-	1s cycle clock	
%FX6148	_T2S	BOOL	-	2s cycle clock	
%FX6149	_T10S	BOOL	-	10s cycle clock	
%FX6150	_T20S	BOOL	-	20s cycle clock	
%FX6151	_T60S	BOOL	-	60s cycle clock	
%FX6153	_ON	BOOL	-	Always ON	Used when writing user program.
%FX6154	_OFF	BOOL	-	Always OFF	Used when writing user program.
%FX6155	_1ON	BOOL	-	1st scan ON	Only 1st scan ON after operation start.
%FX6156	_1OFF	BOOL	-	1st scan OFF	Only 1st scan OFF after operation start.
%FX6157	_STOG	BOOL	-	Reversal every scan	On/Off reversed flag per every scan when user program is working. (On state for first scan).
%FX6163	_ALL_OFF	BOOL	-	All output Off	‘On’ only in case of all output is ‘Off’.
%FX30720	_RTC_WR	BOOL	OK	RTC data writing	RTC data writing.
%FX30721	_SCAN_WR	BOOL	OK	Scan value initialization	Initialize the scan value.
%FX30722	_CHK_ANC_ERR	BOOL	OK	Request of the external heavy fault	Request of heavy fault detection from external device.
%FX30723	_CHK_ANC_WAR	BOOL	OK	Request of the external light fault	Request of light fault detection from external device.

Address	Flag Name	Type	Write	Contents	Description
%FX30724	_MASTER_CHG	BOOL	OK	Switchover Master	To change Standby as a Master.
%FW3860	_RTC_TIME_USER	ARRAY[0..7] OF BYTE	OK	User-Define Time	To set user-defined time.

System error flags

Address	Flag Name	Type	Bit Location	Contents	Description
%FD65	_CNF_ER	DWORD		System error (heavy fault error)	Handles error flags about non-operation fault error as below.
%FX2081	_IO_TYER	BOOL	BIT 1	Error when module type mismatched	Representative flag displayed when I/O configuration parameter for each slot is not matched with practical module configuration or a specific module is applied in the wrong location. (Refer '_IO_TYER_N, _IO_TYER[n]')
%FX2082	_IO_DEER	BOOL	BIT 2	Module detachment error	Representative flag displayed when the module configuration for each slot is changed while running. (Refer '_IO_DEER_N, _IO_DEER[n]')
%FX2083	_FUSE_ER	BOOL	BIT 3	Fuse cutoff error	Representative flag displayed when the fuse of module is cut off. (Refer '_FUSE_ER_N, _FUSE_ER[n]')
%FX2086	_ANNUM_ER	BOOL	BIT 6	Heavy fault detection error in external device	Representative flag displayed when heavy fault error detected by user program is recorded in '_ANC_ERR[n]'.
%FX2088	_BPRM_ER	BOOL	BIT 8	Basic parameter error	It is abnormal to the basic parameter.
%FX2089	_IOPRM_ER	BOOL	BIT 9	I/O parameter error	It is abnormal to the I/O configuration parameter.
%FX2090	_SPPRM_ER	BOOL	BIT 10	Special module parameter	It is abnormal to the special module parameter.

Address	Flag Name	Type	Bit Location	Contents	Description
				error	
%FX2091	_CPPRM_ER	BOOL	BIT 11	Communication module parameter error	It is abnormal to the communication module parameter.
%FX2092	_PGM_ER	BOOL	BIT 12	Program error	Indicates that there is problem with user-made program checksum.
%FX2093	_CODE_ER	BOOL	BIT 13	Program code error	Indicates that while user program is running, the program code cannot be interpreted.
%FX2094	_SWDT_ER	BOOL	BIT 14	CPU abnormal ends	Displayed when the saved program gets damages by an abnormal end of CPU or program cannot work.
%FX2095	_BASE_POWER_ER	BOOL	BIT 15	Power error	Indicates that base power is abnormal.
%FX2096	_WDT_ER	BOOL	BIT 16	Scan watchdog error	Indicates that the program scan time exceeds the scan watchdog time specified by a parameter.
%FX2097	_BASE_INFO_ER	BOOL	BIT 17	Wrong base information	Wrong information for main base.
%FX2102	_BASE_DEER	BOOL	BIT 22	Extension base detach error	Extension base is detached.
%FX2103	_DUPL_PRM_ER	BOOL	BIT 23	Error in the redundancy parameter	Error in the redundancy parameter.
%FX2104	_INSTALL_ER	BOOL	BIT 24	Module install error	Wrong module installed in main/extension base.
%FX2105	_BASE_ID_ER	BOOL	BIT 25	Duplicate extension base number error	Duplicate number for extension base.
%FX2106	_DUPL_SYNC_ER	BOOL	BIT 26	Synchronization error	Error in the synchronization between master and standby CPU.
%FX2107	_AB_SIDEKEY_ER	BOOL	BIT 27	Duplicate key settings for A/B SIDE	Duplicate key settings for CPU side (that is, A/B SIDE).
%FX2110	_BASE_AB_ER	BOOL	BIT 30	Base abnormal configuration	Configure extension cable as Ring Topology and position detached base correctly. For information of detached base,

Address	Flag Name	Type	Bit Location	Contents	Description
					refer to CPU error logs.

Standby CPU flag

Address	Flag Name	Type	Bit Location	Contents	Description
%FD129	_SB_CNF_ER	DWORD		System error(heavy fault error)	Handles error flags about non-operation fault error as below.
%FX4129	_SB_IO_TYER	BOOL	BIT 1	Error when module type mismatched	Representative flag displayed when I/O configuration parameter for each slot is not matched with practical module configuration or a specific module is applied in the wrong location. (Refer '_IO_TYER_N, _IO_TYER[n]')
%FX4130	_SB_IO_DEER	BOOL	BIT 2	Module detachment error	Representative flag displayed when the module configuration for each slot is changed while running. (Refer '_IO_DEER_N, _IO_DEER[n]')
%FX4131	_SB_FUSE_ER	BOOL	BIT 3	Fuse cutoff error	Representative flag displayed when the fuse of module is cut off. (Refer '_FUSE_ER_N, _FUSE_ER[n]')
%FX4134	_SB_ANNUM_ER	BOOL	BIT 6	Heavy fault detection error in external device	Representative flag displayed when heavy fault error detected by user program is recorded in '_ANC_ERR[n]'.
%FX4136	_SB_BPRM_ER	BOOL	BIT 8	Basic parameter error	It is abnormal to the basic parameter.
%FX4137	_SB_IOPRM_ER	BOOL	BIT 9	I/O parameter error	It is abnormal to the I/O configuration parameter.
%FX4138	_SB_SPPRM_ER	BOOL	BIT 10	Special module parameter error	It is abnormal to the special module parameter.
%FX4139	_SB_CPPRM_ER	BOOL	BIT 11	Communication	It is abnormal to the communication

Address	Flag Name	Type	Bit Location	Contents	Description
				module parameter error	module parameter.
%FX4141	_SB_CODE_ER	BOOL	BIT 13	Program error	Indicates that there is problem with user-made program checksum.
%FX4142	_SB_SWDT_ER	BOOL	BIT 14	CPU abnormal ends.	Displayed when the saved program gets damaged by an abnormal end of CPU or program cannot work.
%FX4143	_SB_BASE_POWER_ER	BOOL	BIT 15	Power error	Indicates that base power is abnormal.
%FX4144	_SB_WDT_ER	BOOL	BIT 16	Scan watchdog error	Indicates that the program scan time exceeds the scan watchdog time specified by a parameter.
%FX4145	_SB_BASE_INFO_ER	BOOL	BIT 17	Base information error	Wrong base information.
%FX4150	_SB_BASE_DEER	BOOL	BIT 22	Extension base detach error	Extension base is detached.
%FX4151	_SB_DUPL_PRM_ER	BOOL	BIT 23	Error in the redundancy parameter	Error in the redundancy parameter.
%FX4152	_SB_INSTALL_ER	BOOL	BIT 24	Module install error	Wrong module installed in main/extension base.
%FX4153	_SB_BASE_ID_ER	BOOL	BIT 25	Duplicate extension base number error	Duplicate number for extension base.
%FX4154	_SB_DUPL_SYNC_ER	BOOL	BIT 26	Synchronization error	Error in the synchronization between master and standby CPU.
%FX4156	_SB_CPU_RUN_ER	BOOL	BIT 28	Standby CPU run error	Standby CPU fails to operate in redundancy mode when master CPU fails.
%FX4158	_SB_BASE_AB_ER	BOOL	BIT 30	Base abnormal configuration	Configure extension cable as Ring Topology and position detached base correctly. For information of detached base, refer to CPU error logs.

Master CPU error flags

Address	Flag Name	Type	Write	Contents	Description
%FW424	_IO_TYERR	ARRAY[0..31] OF WORD	-	Error when Module type mismatched	Representative flag displayed when I/O configuration parameter for each slot is not matched with practical module configuration or a specific module is applied in the wrong location.
%FW456	_IO_DEERR	ARRAY[0..31] OF WORD	-	Module detachment error	Representative flag displayed when the module configuration for each slot is changed while running.
%FW488	_FUSE_ERR	ARRAY[0..31] OF WORD	-	Fuse cutoff error	Representative flag displayed when the fuse of module is cut off.
%FD83	_BASE_DEERR	DWORD	-	Extension base detach error	Indicate detached base.
%FD574	_BASE_POWER_FAIL	DWORD	-	Base information with power error	Indicate base number with power failure.
%FW416	_IO_TYER_N	WORD	-	Slot number of mismatched module type	When I/O configuration parameter for each slot is not matched with practical module configuration or a specific module is applied in the wrong position, this is displayed as the lowest slot number after detecting these mismatch error in slot locations.
%FW417	_IO_DEER_N	WORD	-	Slot number of module detachment	When slot module configuration is changed while the PLC is running, this is displayed as the lowest slot number after detecting the detachment error in slot locations.
%FW418	_FUSE_ER_N	WORD	-	Slot number of fuse cut off	When a fuse equipped to module is cut off, this is displayed as the lowest slot number after detecting this error in slot locations.
%FW1922	_ANC_ERR	WORD	OK	Heavy fault information of external device	Heavy fault of external device is detected by user program, and that error is saved at this zone as numbers which can identify 16 error types.
%FX10849	_IO_ER_PMT	BOOL	-	Status of Ignoring IO module error	ON when set to ignore IO module error.
%FX10851	_CP_ER_PMT	BOOL	-	Status of Ignoring communication module error	ON when set to ignore communication module error.

Address	Flag Name	Type	Write	Contents	Description
%FX10850	_SP_ER_PMT	BOOL	-	Status of Ignoring special module error	ON when set to ignore special module error.
%FX10848	_FUSE_ER_PMT	BOOL	-	Status of Ignoring fuse error	ON when set to ignore fuse module error.
%FX2111	_SYS_CON_ER	BOOL	BIT 31	System configuration error	Abnormal system configuration Master/Standby one ring or line configuration • Duplicated station number of extension base or • Station number more than specification • Different station number in same base
%FX2138	_SYS_CON_WAR	BOOL	BIT 26	System configuration warning	Extension redundancy system configuration warning • Master/standby ring changes into line • Master normal but standby error If Master ring is ok and Standby ring has faulty expansion drive or wrong station number settings, there will be an error generated in the Standby ring and warning message in the Master ring.

Standby CPU error flag

Address	Flag Name	Type	Write	Contents	Description
%FD147	_SB_BASE_DEERR	DWORD	-	Extension base detach error	Indicate detached base.
%FW588	_SB_IO_TYERR	WORD	-	Module type error	Module type error for n step of extended base.
%FW589	_SB_IO_DEERR	WORD	-	Module detachment error	Module detachment error for n step of extended base.

System warning flags (master CPU)

Address	Flag Name	Type	Bit Location	Contents	Description

Address	Flag Name	Type	Bit Location	Contents	Description
%FD66	_CNF_WAR	DWOR		System warning	Representative flag displaying the system warning state.
%FX2112	_RTC_ER	BOOL	BIT 0	RTC error	Indicates that RTC data is abnormal.
%FX2114	_BASE_EXIST_WAR	BOOL	BIT 2	Base not in operation	Indicate base that is not in operation.
%FX2115	_AB_SD_ER	BOOL	BIT 3	Stop by operation error	Stopped by abnormal operation.
%FX2116	_TASK_ER	BOOL	BIT 4	Task collision	It is collided to the task.
%FX2117	_BAT_ER	BOOL	BIT 5	Battery error	It is the error in the battery state.
%FX2118	_ANNUM_WAR	BOOL	BIT 6	External device fault	Indicates that the light fault in the external device is detected.
%FX2120	_HS_WAR	BOOL	BIT 8	High-speed link parameter error	It is abnormal to the high-speed link parameter.
%FX2121	_REDUN_WAR	BOOL	BIT 9	Redundancy configuration warning	System is not in redundancy mode (not in Single CPU mode).
%FX2122	_OS_VER_WAR	BOOL	BIT 10	Warning for O/S version mismatch	OS version between CPU, Network, and Extension Driver is different.
%FX2123	_RING_WAR	BOOL	BIT 11	Warning for ring topology	Ring Topology is not established.
%FX2132	_P2P_WAR	BOOL	BIT 20	P2P parameter error	It is abnormal to the P2P parameter.
%FX2140	_CONSTANT_ER	BOOL	BIT 28	Fixed cycle fault	Fixed cycle fault.
%FX2141	_BASE_POWER_WAR	BOOL	BIT 29	Abnormal power module	One of the two power modules has an error or turned off.
%FX2142	_BASE_SKIP_WAR	BOOL	BIT 30	Base skip warning	When base skip is disabled, IO parameter and hardware configuration is different.
%FX2143	_BASE_NUM_OVER_WAR	BOOL	BIT 31	Base number config error	Base number of extension driver is not

Address	Flag Name	Type	Bit Location	Contents	Description
					within 1 ~ 31

System warning flags (standby CPU)

Address	Flag Name	Type	Bit Location	Contents	Description
%FD130	_SB_CNF_WAR	DWORD		System warning	Representative flag displaying the system warning state.
%FX4160	_SB_RTC_ER	BOOL	BIT 0	RTC error	Indicates that RTC data is abnormal.
%FX4162	_SB_BASE_EXIST_WAR	BOOL	BIT 2	Base not in operation	Indicate base that is not in operation.
%FX4163	_SB_AB_SD_ER	BOOL	BIT 3	Stop by operation error	Stopped by abnormal operation.
%FX4164	_SB_TASK_ER	BOOL	BIT 4	Task collision	It is collided to the task.
%FX4165	_SB_BAT_ER	BOOL	BIT 5	Battery error	It is the error in the battery state.
%FX4166	_SB_ANNUM_WAR	BOOL	BIT 6	External device fault	Indicates that the light fault in the external device is detected.
%FX4168	_SB_HS_WAR	BOOL	BIT 8	High-speed link parameter error	It is abnormal to the high-speed link parameter.
%FX4170	_SB_OS_VER_WAR	BOOL	BIT 10	Warning for O/S version mismatch	OS version between CPU, Network, extension Driver is different.
%FX4171	_SB_RING_WAR	BOOL	BIT 11	Ring topology warning	Connect extension cable and establish ring topology.
%FX4180	_SB_P2P_WAR	BOOL	BIT 20	P2P parameter error	It is abnormal to the P2P parameter.
%FX4188	_SB_CONSTANT_ER	BOOL	BIT 28	Fixed cycle fault	Fixed cycle fault.

Address	Flag Name	Type	Bit Location	Contents	Description
%FX4189	_SB_BASE_POWER_WAR	BOOL	BIT 29	Warning for ring topology	Ring topology is not established.
%FX4190	_SB_BASE_SKIP_WAR	BOOL	BIT 30	Base skip warning	When base skip is disabled, IO parameter and hardware configuration is different.
%FX4191	_SB_BASE_NUM_OVER_WAR	BOOL	BIT 31	Base number config error	Base number of extension driver is not within 1 ~ 31.

Communication warning flags (Master CPU)

Address	Flag Name	Type	Write	Contents	Description
%FX2624	_HS_WARN	ARRAY[0..11] OF BOOL	-	High-speed link parameter error	It is abnormal to the high-speed link parameter n (n: 1~12).
%FX2640	_P2P_WARN	ARRAY[0..7] OF BOOL	-	P2P parameter error	It is abnormal to the P2P parameter n (n: 1~8).
%FD587	_BASE_ACPF_WAR	DWORD	-	Momentary power loss warning	Indicate base with momentary power loss.
%FW164	_HS_WAR_W	WORD	-	High-speed link parameter error	It is abnormal to the high-speed link parameter n (n: 1~12).
%FW165	_P2P_WAR_W	WORD	-	P2P parameter error	It is abnormal to the P2P parameter n (n: 1~8).
%FW1923	_ANC_WAR	WORD	-	Heavy fault information of external device	Heavy fault of external device is detected by user program, and that error is saved at this zone as numbers which can identify 16 error types.
%FW601 %FW631	_BASE_INFO[0] _BASE_INFO[31]	WORD	-	Abnormal base power module	Indicates abnormal redundancy power module Ex) error in left power module on expansion base 16#010C: 01 → left power module 0C → 12-slot expansion base

Communication warning flags (standby CPU)

Address	Flag Name	Type	Write	Contents	Description
%FX4672	_SB_HS_WARN	ARRAY[0..11] OF BOOL	-	High-speed link parameter error	It is abnormal to the high-speed link parameter n (n: 1~12).
%FX4688	_SB_P2P_WARN	ARRAY[0..7] OF BOOL	-	P2P parameter error	It is abnormal to the P2P parameter n (n: 1~8).
%FW292	_SB_HS_WAR_W	WORD	-	High-speed link parameter error	It is abnormal to the high- speed link parameter n (n: 1~12).
%FW293	_SB_P2P_WAR_W	WORD	-	P2P parameter error	It is abnormal to the P2P parameter n (n: 1~8).

System operation flags (master CPU)

Address	Flag Name	Type	Bit Location	Contents	Description
%FD64	_SYS_STATE	DWORD		PLC mode and operation status	
%FX2048	_RUN	BOOL	BIT 0	Run	
%FX2049	_STOP	BOOL	BIT 1	Stop	
%FX2050	_ERROR	BOOL	BIT 2	Error	
%FX2051	_DEBUG	BOOL	BIT 3	Debug	
%FX2052	_LOCAL_CON	BOOL	BIT 4	Local control	Indicates operation mode changeable state only by the mode key and SoftMaster.
%FX2054	_REMOTE_CON	BOOL	BIT 6	Remote mode On	It is remote control mode.
%FX2058	_RUN_EDIT_DONE	BOOL	BIT 10	Editing during Run	Edit is done during Run.
%FX2059	_RUN_EDIT_NG	BOOL	BIT 11	Editing during Run	Edit is ended abnormally during Run.
%FX2060	_CMOD_KEY	BOOL	BIT 12	Operation mode change	Operation mode changed by key.
%FX2061	_CMOD_LPADT	BOOL	BIT 13	Operation mode change	Operation mode changed by local PADT.
%FX2062	_CMOD_RPADT	BOOL	BIT 14	Operation mode change	Operation mode changed by remote PADT.

Address	Flag Name	Type	Bit Location	Contents	Description
%FX2063	_CMOD_RLINK	BOOL	BIT 15	Operation mode change	Operation mode changed by remote communication module.
%FX2064	_FORCE_IN	BOOL	BIT 16	Forced input	Forced On/Off state about input contact.
%FX2065	_FORCE_OUT	BOOL	BIT 17	Forced output	Forced On/Off state about output contact.
%FX2066	_SKIP_ON	BOOL	BIT 18	Input/output skip	I/O skip on execution.
%FX2067	_EMASK_ON	BOOL	BIT 19	Fault mask	Fault mask on execution.
%FX2069	_USTOP_ON	BOOL	BIT 21	Stopped by STOP function	Stopped after scan completion by 'STOP' function while RUN mode operation.
%FX2070	_ESTOP_ON	BOOL	BIT 22	Stopped by ESTOP function	Instantly stopped by 'ESTOP' function while RUN mode operation.
%FW192	_SL_OS_VER	ARRAY[0..31] OF WORD	-	OS version of extension driver	Indicate O/S version of installed extension driver.
%FW600	_BASE_INFO	ARRAY[0..31] OF WORD	-	Base information	Indicate number of slots in a base.
%FB12	_RTC_TIME	ARRAY[0..7] OF BYTE	-	Current Time	Indicate current time.
%FX2072	_INIT_RUN	BOOL	-	Initialization task on execution	User-defined initialization program on execution.
%FX2074	_AB_SIDE	BOOL	-	CPU side	CPU side (A-SIDE: ON, B-SIDE: OFF).
%FX2076	_PB1	BOOL	-	Program code 1	Select program code 1.
%FX2077	_PB2	BOOL	-	Program code 2	Select program code 2.
%FX30736	_INIT_DONE	BOOL	OK	Initialization task execution completion	If this flag is set by user's initial program, it is started to execution of scan program after initial program completion.
%FW584	_RTC_DATE	DATE	-	Current date of RTC	Indicated on the basis of 1 Jan1984.
%FD67	_OS_VER	DWORD	-	OS version	Indicates OS version number.
%FD68	_OS_DATE	DWORD	-	OS date	Indicates OS distribution date.

Address	Flag Name	Type	Bit Location	Contents	Description
%FD69	_CP_OS_VER	DWORD	-	OS version of extension manager	OS version of extension manager.
%FD573	_OS_TYPE	DWORD	-		
%FW1081	_FALS_NUM	INT	-	FALS no	Indicates the number of False.
%FD293	_RTC_TOD	TIME_OF_DAY	-	Current time of RTC (unit : ms)	Indicates a data for the time of the day on the basis of 00:00:00 (unit: ms).
%FD582	_RUN_EDIT_CNT	UDINT	-	Online edit count	Online edit count.
%FW140	_AC_F_CNT	UINT	-	Indicates momentary shutdown times	Indicates the instant power off count during the RUN mode operation.
%FW158	_POWER_OFF_CNT	UINT	-	Power Off count	Indicate no of power failure.
%FW386	_SCAN_MAX	UINT	OK	Maximum scan time	Indicates maximum scan time during operation Unit: 0.1ms.
%FW387	_SCAN_MIN	UINT	OK	Minimum scan time	Indicates minimum scan time during operation Unit: 0.1ms.
%FW388	_SCAN_CUR	UINT	OK	Current scan time	Indicates current scan time during operation Unit: 0.1ms.
%FW585	_RTC_WEEK	UINT	-	Current day of the week of RTC	Indicates a day of the week. (0: Mon. 1: Tue. 2: Wed. 3: Thu. 4: Fri. 5: Sat. 6: Sun).
%FW141	_CPU_TYPE	WORD	-	CPU Type Information. (ML200R - 0xA801)	Indicates the operation mode and operation state information.
%FW633	_RBANK_NUM	WORD	-	Active block no.	Indicates active block number
%FD125	_BASE_SKIP_INFO	DWORD	-	Base skip information	Indicates base skip information.
%FD124	_BASE_EMASK_INFO	DWORD	-	Base fault mask information	Indicates base fault mask information.
%FW1372	_SLOT_EMASK_INFO	ARRAY[0..31] OF	-	Slot fault mask information	Indicates slot fault mask information.

Address	Flag Name	Type	Bit Location	Contents	Description
		WORD			
%FW1404	_SLOT_SKIP_INFO	ARRAY[0..31] OF WORD	-	Slot skip information	Indicates slot skip information.

System operation flags (Standby CPU)

Address	Flag Name	Type	Bit Location	Contents	Description
%FD128	_SB_SYS_STATE	DWORD		System state information	
%FX4096	_SB_RUN	BOOL	BIT 0	Run	
%FX4097	_SB_STOP	BOOL	BIT 1	Stop	
%FX4098	_SB_ERROR	BOOL	BIT 2	Error	
%FX4100	_SB_LOCAL_CON	BOOL	BIT 4	Local control	Local control.
%FX4102	_SB_REMOTE_CON	BOOL	BIT 6	Remote mode ON	Remote mode ON.
%FX4106	_SB_RUN_EDIT_DONE	BOOL	BIT 10	Editing during Run	Edit is done during Run.
%FX4107	_SB_RUN_EDIT_NG	BOOL	BIT 11	Editing during Run	Edit is ended abnormally during Run.
%FX4108	_SB_CMOD_KEY	BOOL	BIT 12	Operation mode change	Operation mode changed by key.
%FX4109	_SB_CMOD_LPADT	BOOL	BIT 13	Operation mode change	Operation mode changed by local PADT.
%FX4110	_SB_CMOD_RPADT	BOOL	BIT 14	Operation mode change	Operation mode changed by Remote PADT.
%FX4111	_SB_CMOD_RLINK	BOOL	BIT 15	Operation mode change	Operation mode changed by remote communication module.
%FX4112	_SB_FORCE_IN	BOOL	BIT 16	Forced Input	Forced On/Off state about input contact.
%FX4113	_SB_FORCE_OUT	BOOL	BIT 17	Forced Output	Forced On/Off state about output contact.
%FX4114	_SB_SKIP_ON	BOOL	BIT 18	Input/output Skip	I/O skip on execution.

Address	Flag Name	Type	Bit Location	Contents	Description
%FX4115	_SB_EMASK_ON	BOOL	BIT 19	Fault mask	Fault mask on execution.
%FX4117	_SB_USTOP_ON	BOOL	-	Stopped by STOP function	Stopped after scan completion by 'STOP' function while RUN mode operation.
%FX4118	_SB_ESTOP_ON	BOOL	-	Stopped by ESTOP function	Instantly stopped by 'ESTOP' function while RUN mode operation.
%FD131	_SB_OS_VER	DWORD	-	OS version	Indicates OS version number.
%FD132	_SB_OS_DATE	DWORD	-	OS date	Indicates OS distribution date.
%FD133	_SB_CP_OS_VER	DWORD	-	OS version of extension manager	OS version of extension manager.
%FW286	_SB_POWER_OFF_CNT	UINT	-	Power off count	Indicates number of power failure.
%FW269	_SB_CPU_TYPE	WORD	-	CPU type information. (ML200R - 0xA801)	Indicates the operation mode and operation state information.
%FW632	_SB_BASE_INFO	WORD	-	Base information	Indicates number of slots in a base.

Redundant operation flags

Address	Flag Name	Type	Bit Location	Contents	Description
%FD0	_REDUN_STATE	DWORD		Redundant operation information	
%FX0	_DUAL_RUN	BOOL	BIT 0	Redundant RUN	CPUA and CPUB are in normal operation.
%FX1	_RING_TOPOLOGY	BOOL	BIT 1	Ring topology	Ring topology is established.
%FX2	_LINE_TOPOLOGY	BOOL	BIT 2	Line topology	Extension base is in line topology.
%FX4	_SINGLE_RUN_A	BOOL	BIT 4	A-SIDE single RUN mode	Only CPUA is in RUN mode.
%FX5	_SINGLE_RUN_B	BOOL	BIT 5	B-SIDE single RUN mode	Only CPUB is in RUN mode.
%FX6	_MASTER_RUN_A	BOOL	BIT 6	A-SIDE is master and RUN (in the	In redundant operation, CPUA is

Address	Flag Name	Type	Bit Location	Contents	Description
				presence of standby CPU)	Master and in RUN mode.
%FX7	_MASTER_RUN_B	BOOL	BIT 7	B-SIDE is master and RUN (in the presence of standby CPU)	In redundant operation, CPUB is Master and in RUN mode.
%FX2016	_EXT_REDUN	BOOL	-	-	Extension redundancy system. Flag shows if the Master CPU is with dual IO link or normal IO link.
%FX2017	_SB_EXT_REDUN	BOOL	-	-	Standby: extension redundancy system. Flag shows if the Standby CPU is with dual IO link or normal IO link.
%FW1458	_SL_OS_VER_B	ARRAY [0.31] of WORD	-	-	Extension drive module OS version (B-side)
%FX4080	_SB_RING_TOPOLOGY	BOOL	-	-	Standby: Status of ring topology
%FX4081	_SB_LINE_TOPOLOGY	BOOL	-	-	Standby : Status of line topology

Calculation error flags

Address	Flag Name	Type	Write	Contents	Description
%FX672	_ARY_IDX_ERR	BOOL	OK	Overflow error flag array index range	Error flag displayed when exceeding the setting array numbers.
%FX704	_ARY_IDX_LER	BOOL	OK	Overflow error latch flag array index range	Error latch flag displayed when exceeding the setting array numbers.
%FX6160	_ERR	BOOL	OK	Operation error flag	Operation error flag on the basis of operation function (FN) or function block (FB) is renewed every time operation works.
%FX6165	_LER	BOOL	OK	Operation error latch flag	Operation error latch flag on the basis of program block (PB), the error indication which occurs while program block running keeps until the program ends. It is available to delete by a program.

Operation mode key switch

Address	Flag Name	Type	Write	Contents	Description
%FX291	_REMOTE_KEY	BOOL	-	Remote key switch status information	CPU key switch status information - (OFF in Remote mode, ON not in remote mode).
%FX294	_STOP_KEY	BOOL	-	STOP key switch status information	CPU key switch status information - (OFF in STOP mode and ON not in STOP mode).
%FX295	_RUN_KEY	BOOL	-	RUN key switch status information	CPU key switch status information - (OFF in RUN mode and ON not in RUN mode).

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