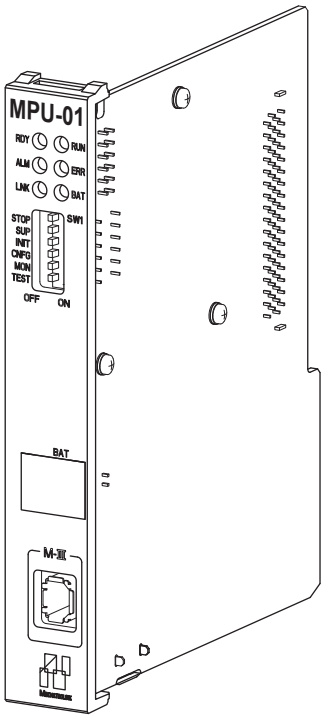
YASKAWA

Machine Controller MP2000 Series

MPU-01 Multiple-CPU Module
USER'S MANUAL

Model: JAPMC-CP2700-E



MANUAL NO. SIEP C880781 05C

Using this Manual

Read this manual to ensure correct usage of the MP2000-series Machine Controller (hereinafter referred to as Machine Controller unless otherwise specified). Keep this manual in a safe place so that it can be referred to whenever necessary.

■ Manual Configuration

Read the chapters of this manual as needed.

Chapter \ Purpose		Selecting Models and Peripheral Devices	System Design	Panel Configuration and Wiring	Trial Operation	Maintenance and Inspection
1	Overview	✓				
2	Mounting and Connecting MPU-01 Module		✓	✓	✓	✓
3	Specifications of MPU-01 Module	✓	✓	✓	✓	✓
4	Details of MPU-01 Module	✓	✓	✓	✓	✓
5	System Startup and Sample Program				✓	
6	Troubleshooting				✓	✓

■ Symbols Used in this Manual

The symbols used in this manual indicate the following type of information.

• This symbol is used to indicate important information that should be memorized or minor precautions, such as precautions that will result in alarms if not heeded.

■ MPE720 Engineering Tool Version Number

In this manual, the operation of MPE720 is described using screen captures of MPE720 version 7.

For this reason, the screen captures and some descriptions may differ for MPE720 version 5 or version 6.

■ Terms Used to Describe “Torque”

Although the term “torque” is commonly used when describing rotary servomotors and “force” is used when describing linear servomotors, this manual uses “torque” when describing both (excluding parameters).

■ Indication of Reverse Signals

In this manual, the names of reverse signals (ones that are valid when low) are written with a forward slash (/) before the signal name, as shown in the following example:

Notation Examples

- $\overline{\text{S-ON}}$ = /S-ON
- $\overline{\text{P-CON}}$ = /P-CON

■ Related Manuals

The following table lists the manuals relating to the MP2000-series Machine Controllers. Refer to these manuals as required.

Manual Name	Manual Number	Contents
Machine Controller MP2100/MP2100M User's Manual Design and Maintenance	SIEP C880700 01	Describes how to use the MP2100 and MP2100M Machine Controllers.
Machine Controller MP2200 User's Manual	SIEP C880700 14	Describes how to use the MP2200 Machine Controller and the modules that can be connected.
Machine Controller MP2300 Basic Module User's Manual	SIEP C880700 03	Describes how to use the MP2300 Basic Module and the modules that can be connected.
Machine Controller MP2310 Basic Module User's Manual	SIEP C880732 01	Describes how to use the MP2310 Basic Module and the modules that can be connected.
Machine Controller MP2300S Basic Module User's Manual	SIEP C880732 00	Describes how to use the MP2300S Basic Module and the modules that can be connected.
Machine Controller MP2000 Series Machine Controller System TROUBLESHOOTING MANUAL	SIEP C880700 40	Describes the troubleshooting of the MP2000-series Machine Controller.
Machine Controller MP2000 Series Communication Module User's Manual	SIEP C880700 04	Provides the information on the Communication Module that can be connected to MP2000-series Machine Controller and the communication methods.
Machine Controller MP2000 Series SVC-01 Motion Module User's Manual	SIEP C880700 41	Describes the functions, specifications, and application methods of the MP2000 Series Motion Module, SVC-01 Module.
System Integrated Engineering Tool MPE720 Version 7 USER'S MANUAL	SIEP C880761 03	Describes the operating procedures for MPE720 Ver.7, which is used as the engineering tool for controllers.
Engineering Tool for MP2000 Series Machine Controller MPE720 Version 6 User's Manual	SIEP C880700 30	Describes how to install and operate the programming tool MPE720 version 6 for MP2000-series Machine Controllers.
Machine Controller MP900/MP2000 Series MPE720 Software for Programming Device User's Manual	SIEP C880700 05	Describes how to install and operate the MP900-/MP2000-series programming system (MPE720).
Machine Controller MP2000 Series USER'S MANUAL LADDER PROGRAMMING	SIE-C887-1.2	Describes the instructions used in MP2000 ladder programming.
Machine Controller MP2000 Series USER'S MANUAL for Motion Programming	SIEP C880700 38	Describes the instructions used in MP2000 motion programming.

■ Copyrights

Safety Information

The following conventions are used to indicate precautions in this manual. These precautions are provided to ensure the safe operation of the MP2000-series Machine Controller and connected devices. Information marked as shown below is important for the safety of the user. Always read this information and heed the precautions that are provided. The conventions are as follows:

⚠ WARNING

Indicates precautions that, if not heeded, could possibly result in loss of life, serious injury, or property damage.

⚠ CAUTION

Indicates precautions that, if not heeded, could result in relatively serious or minor injury, or property damage.

If not heeded, even precautions classified under ⚠ CAUTION can lead to serious results depending on circumstances.

PROHIBITED

Indicates prohibited actions. Specific prohibitions are indicated inside ⃠.

For example,  indicates prohibition of open flame.

MANDATORY

Indicates mandatory actions. Specific actions are indicated inside ●.

For example,  indicates mandatory grounding.

Safety Precautions

The following precautions are for checking products on delivery, storage, transportation, installation, wiring, operation, inspection, and disposal. These precautions are important and must be observed.

■ General Precautions

⚠ WARNING

- Before connecting the machine and starting operation, ensure that an emergency stop procedure has been provided and is working correctly.

  There is a risk of injury.
- Do not remove cables while power is being supplied.

  There is a risk of accidents and electric shock.
- Observe all procedures and precautions given in this manual for trial operation.

  Operating mistakes while the servomotor and machine are connected may damage the machine or even cause accidents resulting in injury or death.
- Do not remove the rear cover, cables, connector, or options while power is being supplied.

  There is a risk of electrical shock.
- Do not damage, pull on, apply excessive force to, place heavy objects on, or pinch cables.

  There is a risk of electrical shock, operational failure or burning of the Machine Controller.
- Do not approach the machine when an instantaneous power failure has occurred since the MPU-01 Module and machine connected to it may restart suddenly when the power is recovered. Secure the safety of people around the machine when the machine restarts.

  There is a risk of injury.
- Do not attempt to modify the Machine Controller in any way.

  There is a risk of injury or device damage.
- Do not allow installation, disassembly, or repairs to be performed by anyone other than specified personnel.

  There is a risk of electrical shock or injury.
- Always turn the power OFF before opening the main body cover.

  There is a risk of electric shock and injury.
  The Machine Controller contains high-voltage components that are dangerous while power is being supplied.
- If foreign matter (metal pieces, water, and other liquids) enters the device, immediately disconnect the power supply cable of the MPU-01 Module immediately and contact your nearest Yaskawa representative or Yaskawa.
- Install the MPU-01 Module correctly in an appropriate location by referring to *Chapter 2 Mounting and Connecting MPU-01 Module* in this manual.
- The MPU-01 Module is not intended for use in applications that require an extremely high degree of reliability and safety, such as aircraft, aerospace, mainline communication, atomic power control, or life-sustaining medical treatment. The MPU-01 Module cannot be used for these applications.
- When using the MPU-01 Module in applications that require an extremely high degree of reliability and safety in functionality and accuracy, such for as transportation (e.g., railways, automobiles, or shipping), disaster prevention, crime prevention, safety, and medical treatment not involving serious risk to life, or when an extremely high degree of reliability and safety is required, safety must be designed in all devices in the system into which the MPU-01 Module is built, including but not limited to redundant settings and malfunction prevention settings.

■ Storage and Transportation

⚠ CAUTION

- Do not store or install the Machine Controller in the following locations.

  There is a risk of fire, electrical shock, or device damage.
  - Direct sunlight
  - Ambient temperature exceeds the storage or operating conditions
  - Ambient humidity exceeds the storage or operating conditions
  - Rapid changes in temperature or locations subject to condensation
  - Corrosive or flammable gas
  - Excessive dust, dirt, salt, or metallic powder
  - Water, oil, or chemicals
  - Vibration or shock
- Do not overload the Machine Controller during transportation.

  There is a risk of injury or an accident.
- If disinfectants or insecticides must be used to treat packing materials such as wooden frames, pallets, or plywood, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used.

  Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.

  If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogen, which includes chlorine, fluorine, bromine, or iodine can contribute to the erosion of the capacitors.

■ Installation

⚠ CAUTION

- Never use the Machine Controller in locations subject to water, corrosive atmospheres, or flammable gas, or near burnable objects.

  There is a risk of electrical shock or fire.
- Do not step on the Machine Controller or place heavy objects on the Machine Controller.

  There is a risk of injury.
- Do not block the air exhaust port or allow foreign objects to enter the Machine Controller.

  There is a risk of element deterioration inside, an accident, or fire.
- Always mount the Machine Controller in the specified orientation.

  There is a risk of an accident.
- Do not subject the Machine Controller to strong shock.

  There is a risk of an accident.

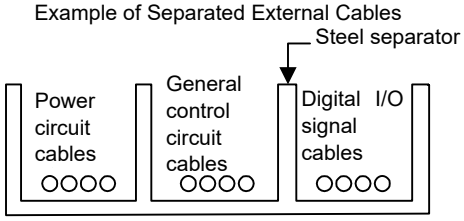
■ Selecting, Separating, and Laying External Cables

⚠ CAUTION

- Consider the following items when selecting the I/O signal lines (external cables) to connect the MPU-01 Module to external devices.
  - Mechanical strength
  - Noise interference
  - Wiring distance
  - Signal voltage, etc.
- Separate the I/O signal lines from the power lines both inside and outside the control box.

  In this way you can minimize the effects of noise due to power lines.
  If the I/O signal lines and power lines are not separated properly, malfunctioning may result.

Example of Separated External Cables



■ Wiring

⚠ CAUTION

- Check the wiring to be sure it has been performed correctly.

  There is a risk of motor overrun, injury, or an accident.
- Always use a power supply of the specified voltage.

  There is a risk of burning.
- In places with poor power supply conditions, take all steps necessary to ensure that the input power supply is within the specified voltage range.

  There is a risk of device damage.
- Install breakers and other safety measure to provide protection against shorts in external wiring.

  There is a risk of fire.
- Provide sufficient shielding when using the Machine Controller in the following locations.

  There is a risk of device damage.
  - Noise, such as from static electricity
  - Strong electromagnetic or magnetic fields
  - Radiation
  - Near to power lines
- When connecting the battery, connect the polarity correctly.

  There is a risk of electric shock, battery damage or explosion.
- The battery must always be replaced while power is being supplied to the MPU-01 Module.

  If power to the MPU-01 Module is turned OFF when the battery is replaced, data stored in the memory in the MPU-01 Module may be lost.
- Only qualified safety-trained personnel should replace the battery.

  If the battery is replaced incorrectly, machine malfunction or damage, electric shock, or injury may result.
- When replacing the battery, do not touch the electrodes.

  Static electricity may damage the electrodes.

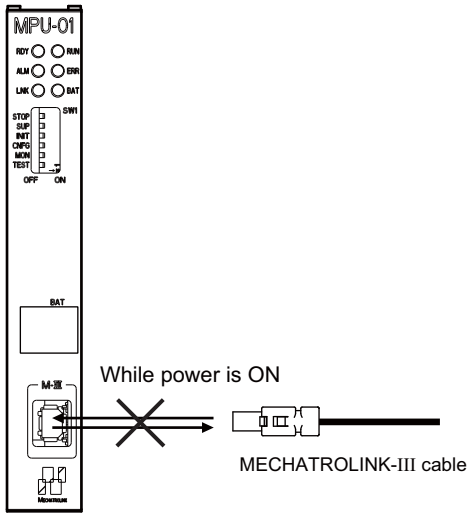
■ Wiring

(cont'd)

⚠ CAUTION

- Do not connect or disconnect a MECHATROLINK-III cable while power is being supplied.

  There is a risk of electric shock or malfunction of the MPU-01 Module. It is very dangerous and must not be attempted.



■ Disposal Precautions

⚠ CAUTION

- Dispose of the Machine Controller as general industrial waste.

■ General Precautions

Observe the following general precautions to ensure safe application.

- The products shown in illustrations in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual.
- The drawings presented in this manual are typical examples and may not match the product you received.
- If the manual must be ordered due to loss or damage, inform your nearest Yaskawa representative or one of the offices listed on the back of this manual.

Warranty

(1) Details of Warranty

■ Warranty Period

The warranty period for a product that was purchased (hereinafter called “delivered product”) is one year from the time of delivery to the location specified by the customer or 18 months from the time of shipment from the Yaskawa factory, whichever is sooner.

■ Warranty Scope

Yaskawa shall replace or repair a defective product free of charge if a defect attributable to Yaskawa occurs during the warranty period above. This warranty does not cover defects caused by the delivered product reaching the end of its service life and replacement of parts that require replacement or that have a limited service life.

This warranty does not cover failures that result from any of the following causes.

1. Improper handling, abuse, or use in unsuitable conditions or in environments not described in product catalogs or manuals, or in any separately agreed-upon specifications
2. Causes not attributable to the delivered product itself
3. Modifications or repairs not performed by Yaskawa
4. Abuse of the delivered product in a manner in which it was not originally intended
5. Causes that were not foreseeable with the scientific and technological understanding at the time of shipment from Yaskawa
6. Events for which Yaskawa is not responsible, such as natural or human-made disasters

(2) Limitations of Liability

1. Yaskawa shall in no event be responsible for any damage or loss of opportunity to the customer that arises due to failure of the delivered product.
2. Yaskawa shall not be responsible for any programs (including parameter settings) or the results of program execution of the programs provided by the user or by a third party for use with programmable Yaskawa products.
3. The information described in product catalogs or manuals is provided for the purpose of the customer purchasing the appropriate product for the intended application. The use thereof does not guarantee that there are no infringements of intellectual property rights or other proprietary rights of Yaskawa or third parties, nor does it construe a license.
4. Yaskawa shall not be responsible for any damage arising from infringements of intellectual property rights or other proprietary rights of third parties as a result of using the information described in catalogs or manuals.

(3) Suitability for Use

1. It is the customer's responsibility to confirm conformity with any standards, codes, or regulations that apply if the Yaskawa product is used in combination with any other products.
2. The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the customer.
3. Consult with Yaskawa to determine whether use in the following applications is acceptable. If use in the application is acceptable, use the product with extra allowance in ratings and specifications, and provide safety measures to minimize hazards in the event of failure.
   - Outdoor use, use involving potential chemical contamination or electrical interference, or use in conditions or environments not described in product catalogs or manuals
   - Nuclear energy control systems, combustion systems, railroad systems, aviation systems, vehicle systems, medical equipment, amusement machines, and installations subject to separate industry or government regulations
   - Systems, machines, and equipment that may present a risk to life or property
   - Systems that require a high degree of reliability, such as systems that supply gas, water, or electricity, or systems that operate continuously 24 hours a day
   - Other systems that require a similar high degree of safety
4. Never use the product for an application involving serious risk to life or property without first ensuring that the system is designed to secure the required level of safety with risk warnings and redundancy, and that the Yaskawa product is properly rated and installed.
5. The circuit examples and other application examples described in product catalogs and manuals are for reference. Check the functionality and safety of the actual devices and equipment to be used before using the product.
6. Read and understand all use prohibitions and precautions, and operate the Yaskawa product correctly to prevent accidental harm to third parties.

(4) Specifications Change

The names, specifications, appearance, and accessories of products in product catalogs and manuals may be changed at any time based on improvements and other reasons. The next editions of the revised catalogs or manuals will be published with updated code numbers. Consult with your Yaskawa representative to confirm the actual specifications before purchasing a product.

Contents

1

Overview

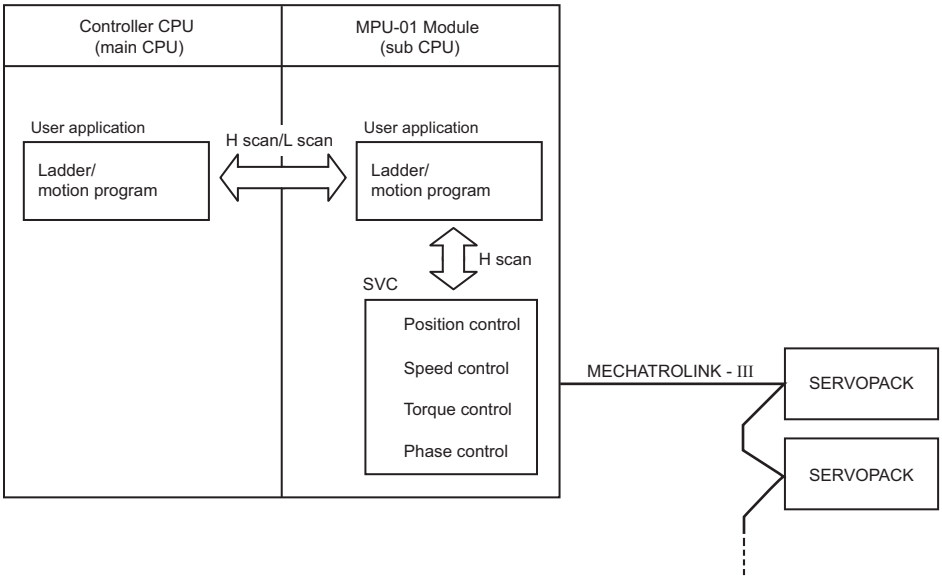
This chapter gives basic information on the MPU-01 Module, including an overview of the module's functions and specifications.

1.1 MPU-01 Module Overview and Features

1.1.1 Overview

The MPU-01 Module is an optional CPU module with a MECHATROLINK-III-compatible interface.

A single MPU-01 Module possesses programming functions for use with ladder programs, motion programs, and sequence programs equivalent to those of an MP2000/CPU module and the motion control functions equivalent to those of an SVC-01 Module. The functions of an MPU-01 Module are illustrated in the following diagram.



1.1.2 Features

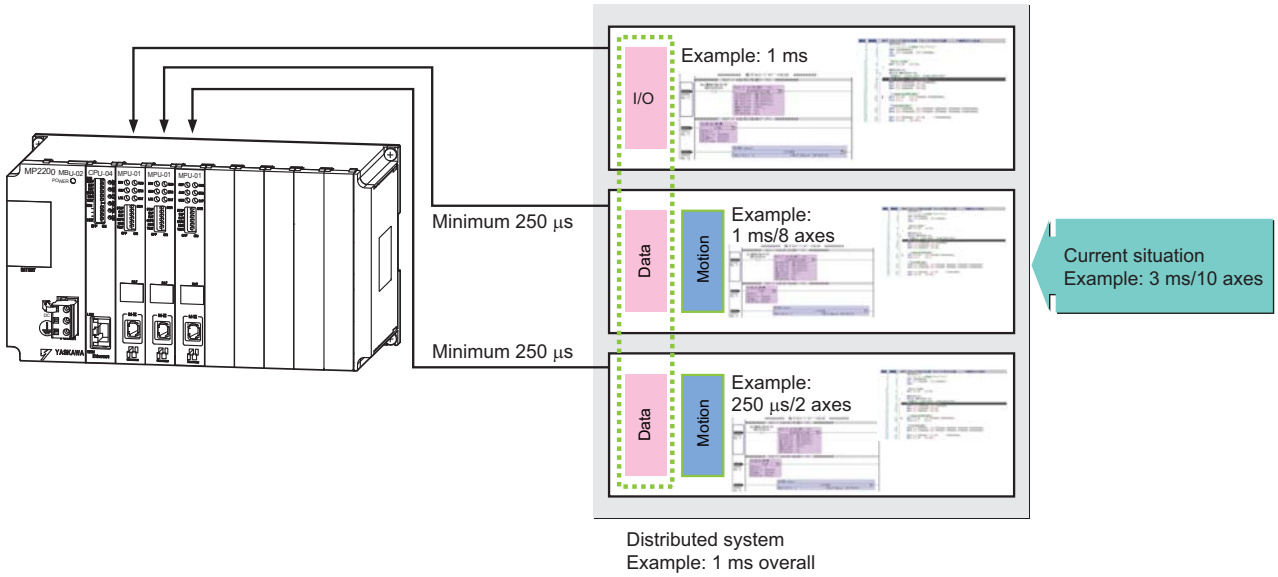
The features of the MPU-01 Module are explained below.

(1) Sub CPU of an MP2000 Series of Machine Controller

The MPU-01 Module is an optional module, and it has both CPU functions and the functions of a built-in SVC-01. The MPU-01 Module can be used with CPU-03 and CPU-04 of the MP2200 and with the MP2310, MP2300S (a controller with option slots and built-in Ethernet), and MP2100M.

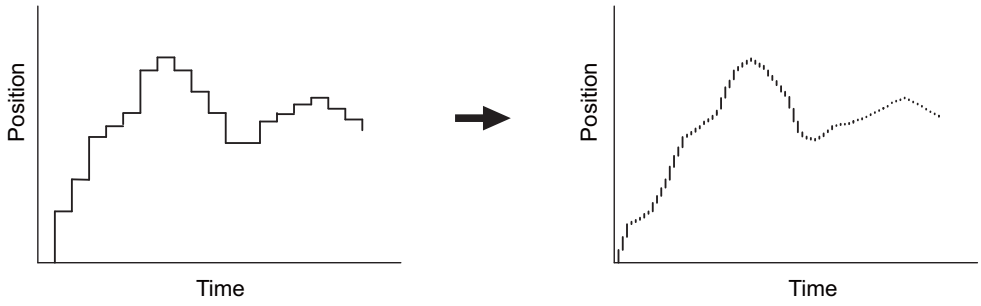
The application load on the main CPU can be distributed and the amount of memory can be expanded by adding the MPU-01 Module.

For connection examples with a SERVOPACK, refer to *1.4 Examples of System Configurations*.



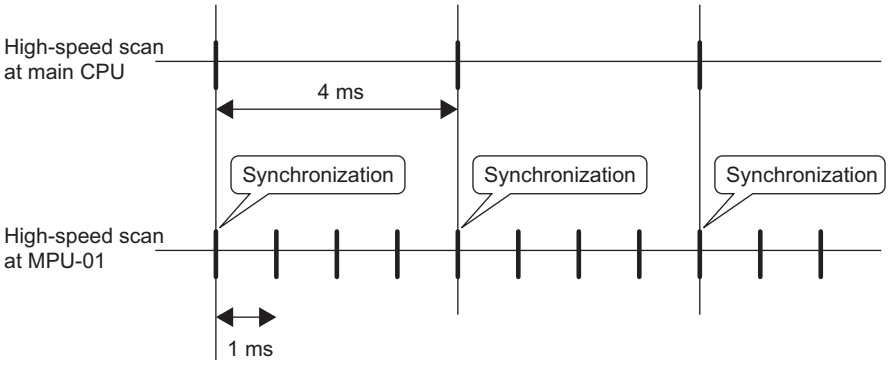
(2) Realizes a High-speed Scan of 0.25 ms, the fastest in the MP2000 Series

The realization of a high-speed scan of 0.25 ms enables control with even higher accuracy.



(3) Capable of Control in Complete Synchronization with the Main CPU

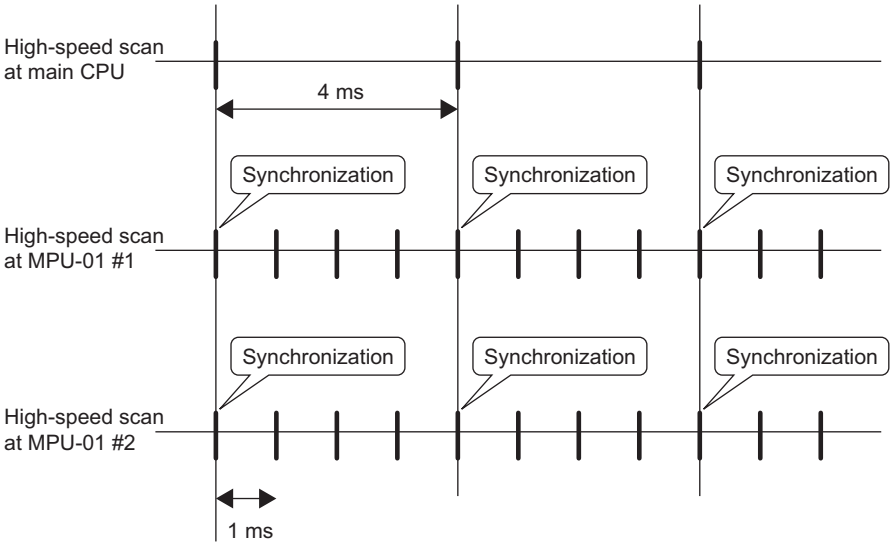
The MPU-01 Module has a hardware-based function that synchronizes it with the main CPU module. In the synchronized status, the start timing of the CPU high-speed scan and MPU-01 high-speed scan coincide as shown in the following figure, so no discrepancy exists.



(4) Synchronization among MPU-01 Modules possible

Even when multiple MPU-01 Modules are used, provided each of those MPU-01 Modules satisfies the synchronization conditions, processing can be performed with synchronization among the MPU-01 Modules.

In the synchronized state, the start timing of the CPU high-speed scan and the start timing of the high-speed scans of the MPU-01 Modules coincide, so there is no discrepancy.



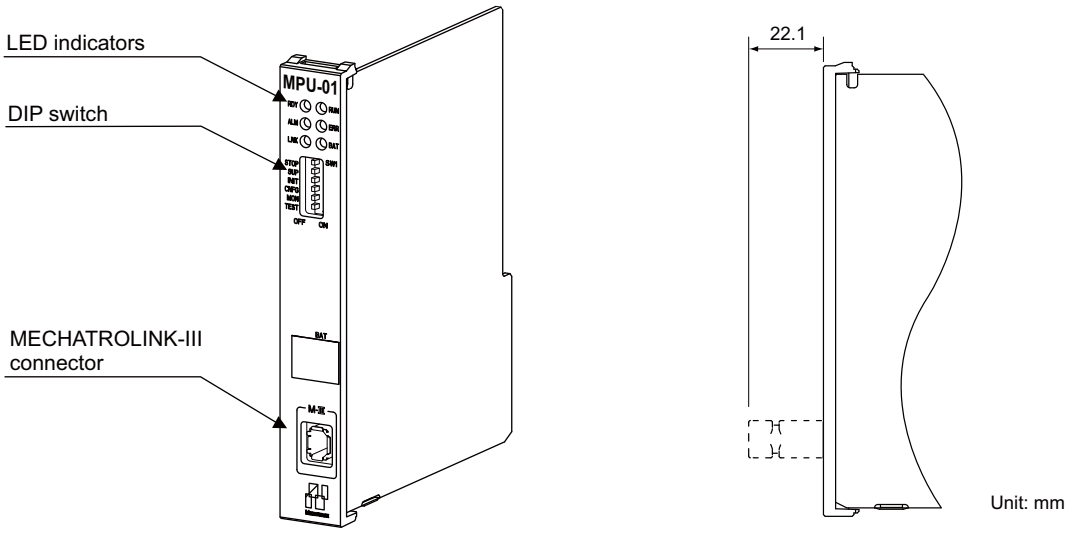
(5) Motion Parameters Interchangeable with SVC-01

The MPU-01 Module incorporates functions equivalent to those of the SVC-01. Ladder programs and motion programs created for an SVC-01 can be used without change.

1.2 Appearance, LED Indicators, and Switch Settings

1.2.1 External Appearance and External Dimensions

The following figure shows the external appearance of the MPU-01 Module and the external dimension of the connector.



1.2.2 Status Indicators (LEDs)

The following table shows the LED indicators that show the operating status of the MPU-01 Module and error information.

Indicators	Indicator Name	Color	Operating Status when Lit	Operating Status when Not Lit
RDY ◯ ◯ RUN ALM ◯ ◯ ERR LNK ◯ ◯ BAT	RDY	Green	Normal operation	Error
	RUN	Green	User program running	User program stopped
	ALM	Red	Alarm (lit or flashing)	Normal operation
	ERR	Red	Failure (lit or flashing)	Normal operation
	LNK	Green	Operating module currently connected to the M-III connector	M-III connector disconnected
	BAT	Red	Battery alarm in effect	Normal operation

1.2.3 MPU-01 Module Status Indication

The MPU-01 Module status is indicated by the combination of LED indicators as shown in the following table.

Status	LED Indicator						Indicator Details	Countermeasures
	RDY (Green)	RUN (Green)	ALM (Red)	ERR (Red)	LNK (Green)	BAT (Red)		
Normal Operation Status	○	○	●	●	○	○	Hardware reset status	Usually the CPU will start within 10 seconds. If these statuses continue for more than 10 seconds, either a program error or hardware failure has occurred. Refer to *Appendix C Checking MPU-01 Module Operating Status from Main CPU Module* and correct any system errors.
	○	○	○	○	○	○	Initialization	
	○	●	○	○	○	○	Drawing A (DWG.A) being executed.	
	●	○	○	○	○	○	User program stopped (Offline Stop Mode)	This occurs • When the stop operation is executed with MPE720 • When the STOP switch is turned ON This status does not indicate an error.
	●	●	○	○	○	○	User program being executed normally.	This is the normal status.

●: Lit, ○: Unlit, ★: Flashes, –: Not specified

(cont'd)

Status	LED Indicator						Indicator Details	Countermeasures
	RDY (Green)	RUN (Green)	ALM (Red)	ERR (Red)	LNK (Green)	BAT (Red)		
Errors	○	○	○	●	○	○	A serious error has occurred.	Refer to *When an Error (ERR) Occurs* in the manual for the MP2000-series Machine Controller that is connected to the MPU-01 Module.
	○	○	●	○	○	○	A serious error has occurred.	Refer to *6.2.4 If the ALM LED has Lit*.
	○	○	○	★	○	○	Software Error Number of LED flashes indicates error type: 2: System crash for main CPU 3: Address error (reading) exception 4: Address error (writing) exception 5: FPU exception 6: Illegal general command exception 7: Illegal slot command exception 8: General FPU inhibited exception 9: Slot FPU inhibited exception 10: TLB multibit exception 11: LTB error (read) exception 12: LTB error (write) exception 13: LTB protection violation (read) exception 14: LTB protection violation (write) exception 15: Initial page write exception	• When flashing twice Refer to *6.2.2 If the System Crashes due to a WDT Error*. • All other situations Refer to *6.2.3 If the System Crashes due to a System Error*.
	○	○	★	★	○	○	Hardware Error Number of LED flashes indicates error type: 2. RAM diagnostic error 3: ROM diagnostic error 4: CPU function diagnostic error 5: FPU function diagnostic error	A hardware error has occurred. Replace the Module.

●: Lit, ○: Unlit, ★: Flashes, –: Not specified

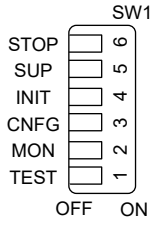
(cont'd)

Status	LED Indicator						Indicator Details	Countermeasures
	RDY (Green)	RUN (Green)	ALM (Red)	ERR (Red)	LNK (Green)	BAT (Red)		
Warnings	–	–	–	–	○	●	Battery alarm	The power of backup battery is low, and the backup battery must be replaced. Refer to *2.2.2 Replacing the Lithium Battery*. If no battery for backup is connected, make the following settings at MPE720. • When using MPE720 Ver.5 Set **Not connect** for **Battery Connection** in the system definition window. • When using MPE720 Ver.6 Select ***Environment Setting - Setup - System Setting***, and set **Not connect** for **Battery Connection**.
	●	●	●	○	○	○	Operation error I/O error	Refer to *6.2.4 If the ALM LED has Lit*.

●: Lit, ○: Unlit, ★: Flashes, –: Not specified

1.2.4 DIP Switch

These are the switches used to set the operating conditions for the MPU-01 Module. The details on each switch are given below.

Switch	Name	Status	Operating Mode	Default Setting	Details
	STOP	ON	User program stopped	OFF	Set to ON to stop the user program.
		OFF	User program running		
	SUP	ON	System use	OFF	Always set to OFF during normal operation.
		OFF	Normal operation		
	INIT	ON	Memory clear	OFF	Set to ON to clear the memory. If this switch is set to OFF, the program stored in flash memory will be executed.
		OFF	Normal operation		
	CNFG	ON	Self-configuration mode	OFF	Set to ON to execute self-configuration for connected devices.
		OFF	Normal operation		
	MON	ON	System use	OFF	Always set to OFF during normal operation.
		OFF	Normal operation		
	TEST	ON	System use	OFF	Always set to OFF during normal operation.
		OFF	Normal operation		

1.3 Connectable Devices, Cables, and Options

The MECHATROLINK-III-compatible devices, standard cables, accessories, and options that can be connected to the MPU-01 Module are indicated below.

1.3.1 Compatible SERVOPACKs

Model Number	Name
SGDV	Σ-V-series AC SERVOPACKs with MECHATROLINK-III Communications References
SGD7	Σ-7-series AC SERVOPACKs with MECHATROLINK-III Communications References
SGDX	Σ-X-series AC SERVOPACKs with MECHATROLINK-4/III Communications References

1.3.2 Compatible Inverters

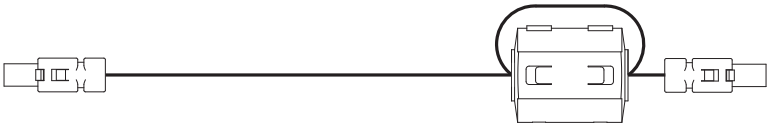
Model Number	Details
CIMR-A□ + SI-ET3	High Performance Vector Control Drive A1000 + MECHATROLINK-III Communication Option Card
CIMR-V□ + SI-ET3/V	Compact Vector Control Drive V1000 + MECHATROLINK-III Communication Option Card

1.3.3 Compatible Modules

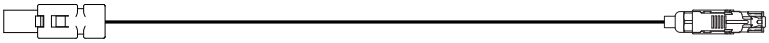
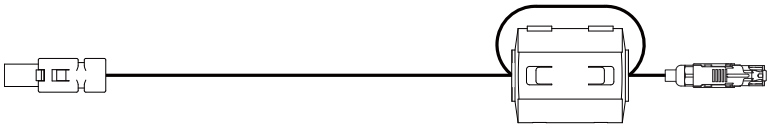
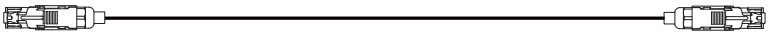
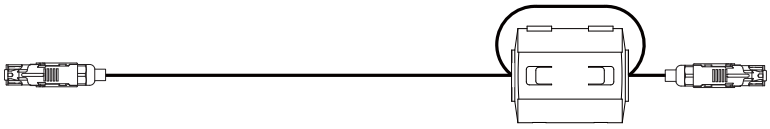
Model Number	Details
JAPMC-MC2320-E	SVC-01 Motion Module
JEPMC-MTD2310-E	64-point I/O Module 24 VDC, 64 inputs, 64 outputs
JEPMC-MTA2900-E	Analog Input Module Analog input, 8 channels
JEPMC-MTA2910-E	Analog Output Module Analog output, 4 channels
JEPMC-MTP2900-E	Pulse Input Module Pulse input, 2 channels
JEPMC-MTP2910-E	Pulse Output Module Pulse output, 4 channels

1.3.4 Standard Cables

■ Σ-V-Series/Σ-7-Series SERVOPACKs

Name and Specification/External View	Model Number	Length
MECHATROLINK-III Cable (MECHATROLINK-III Connector - MECHATROLINK-III Connector) 	JEPMC-W6012-A2-E	0.2 m
	JEPMC-W6012-A5-E	0.5 m
	JEPMC-W6012-01-E	1 m
	JEPMC-W6012-02-E	2 m
	JEPMC-W6012-03-E	3 m
	JEPMC-W6012-05-E	5 m
	JEPMC-W6012-10-E	10 m
	JEPMC-W6012-20-E	20 m
	JEPMC-W6012-30-E	30 m
	JEPMC-W6012-50-E	50 m
MECHATROLINK-III Cable (MECHATROLINK-III Connector - MECHATROLINK-III Connector, with Ferrite Core) 	JEPMC-W6013-10-E	10 m
	JEPMC-W6013-20-E	20 m
	JEPMC-W6013-30-E	30 m
	JEPMC-W6013-50-E	50 m
MECHATROLINK-III Cable (MECHATROLINK-III Connector - Loose Wires at the Other End) 	JEPMC-W6014-A5-E	0.5 m
	JEPMC-W6014-01-E	1 m
	JEPMC-W6014-03-E	3 m
	JEPMC-W6014-05-E	5 m
	JEPMC-W6014-10-E	10 m
	JEPMC-W6014-30-E	30 m
	JEPMC-W6014-50-E	50 m

■ Σ-X-Series SERVOPACKs

MECHATROLINK-III Cable (MECHATROLINK-III connector - RJ-45 connector on one end)*1 	JZSP-CM3RMM0-00P2-E	0.2 m
	JZSP-CM3RMM0-00P5-E	0.5 m
	JZSP-CM3RMM0-01-E	1 m
	JZSP-CM3RMM0-02-E	2 m
	JZSP-CM3RMM0-03-E	3 m
	JZSP-CM3RMM0-04-E	4 m
	JZSP-CM3RMM0-05-E	5 m
	JZSP-CM3RMM0-10-E	10 m
	JZSP-CM3RM00-20-E	20 m
	JZSP-CM3RM00-30-E	30 m
MECHATROLINK-III Cable (MECHATROLINK-III connector - RJ-45 connector on one end/with ferrite cores)*1 	JZSP-CM3RMM1-00P3-E	0.3 m
	JZSP-CM3RMM1-03-E	3 m
	JZSP-CM3RMM1-10-E	10 m
	JZSP-CM3RM01-20-E	20 m
	JZSP-CM3RM01-30-E	30 m
	JZSP-CM3RM01-50-E	50 m
MECHATROLINK Cable (RJ-45 connectors on both ends)*2 	JZSP-CM3RRM0-00P2-E	0.2 m
	JZSP-CM3RRM0-00P5-E	0.5 m
	JZSP-CM3RRM0-01-E	1 m
	JZSP-CM3RRM0-02-E	2 m
	JZSP-CM3RRM0-03-E	3 m
	JZSP-CM3RRM0-04-E	4 m
	JZSP-CM3RRM0-05-E	5 m
	JZSP-CM3RRM0-10-E	10 m
	JZSP-CM3RR00-20-E	20 m
	JZSP-CM3RR00-30-E	30 m
MECHATROLINK Cable (RJ-45 connectors on both ends/with ferrite cores)*2 	JZSP-CM3RRM1-00P3-E	0.3 m
	JZSP-CM3RRM1-03-E	3 m
	JZSP-CM3RRM1-10-E	10 m
	JZSP-CM3RR01-20-E	20 m
	JZSP-CM3RR01-30-E	30 m
	JZSP-CM3RR01-50-E	50 m

* 1. Use this cable when connecting the MPU-01 to Σ-X series SERVOPACKs with MECHATROLINK-4/III communications references.
* 2. Use this cable when connecting Σ-X series SERVOPACKs with MECHATROLINK-4/III communications references to each other.

1.3.5 List of Options and Accessories

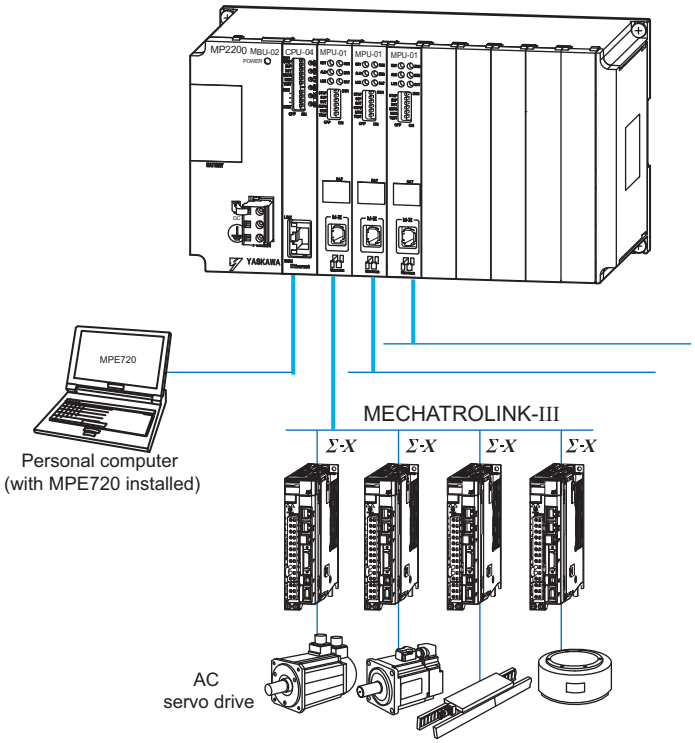
Name	Model	Details
Battery kit (packaged with MPU-01)	JEPMC-OP2700-E	Lithium battery Extension cable (1 m) Battery holder Clamp Mounting screw
Replacement battery (option)	JZSP-BA01	Lithium battery

Note: 1. For details on how to mount the battery kit, refer to *2.2.1 Procedure for Installing the Battery Kit*.
2. For details on how to replace the battery, refer to *2.2.2 Replacing the Lithium Battery*.

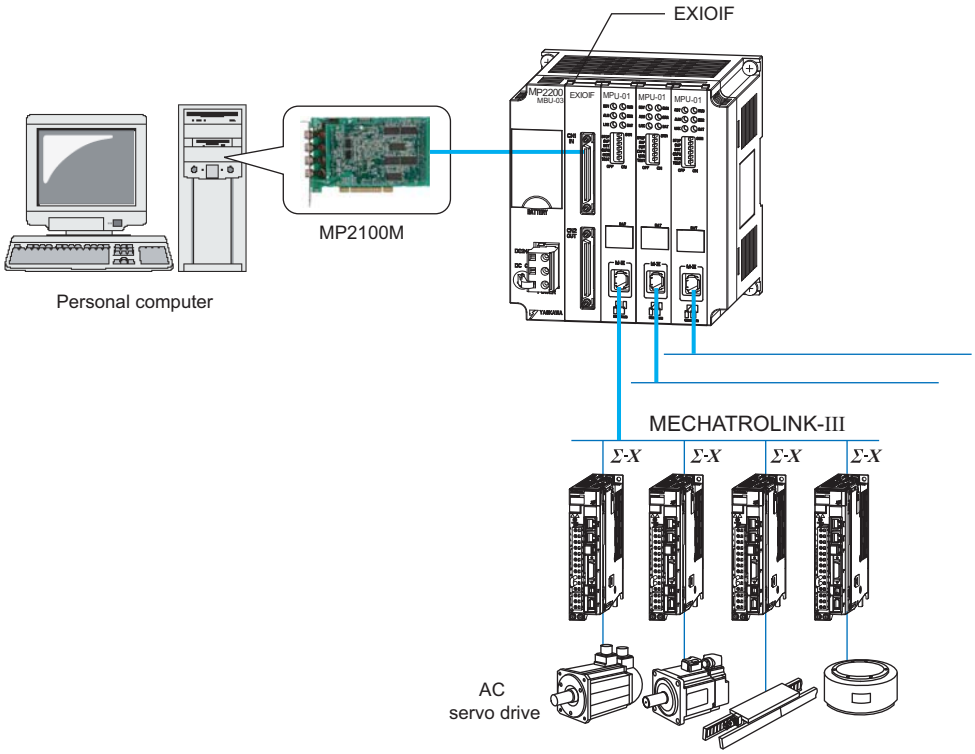
1.4 Examples of System Configurations

Some examples of system configurations using MPU-01 Modules are shown below.

- Example of MPU-01 with CPU-04 for the MP2200 Series



- Example of MPU-01 with MP2100M and Expansion Rack



2

Mounting and Connecting MPU-01 Module

This chapter explains how to mount an MPU-01 Module on a Machine Controller and how to remove it.

2.1 Mounting and Removing MPU-01 Module

This section explains how to mount and remove an MPU-01 Module.

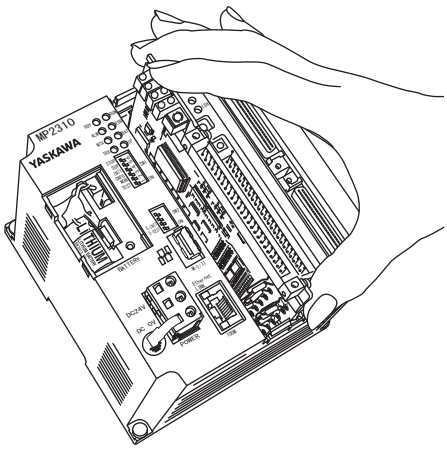
2.1.1 Mounting an MPU-01 Module

Mount an MPU-01 Module by using the following procedure.

- These diagrams show the procedure using the LIO-01 Module, but the procedure is the same for the MPU-01 Module.

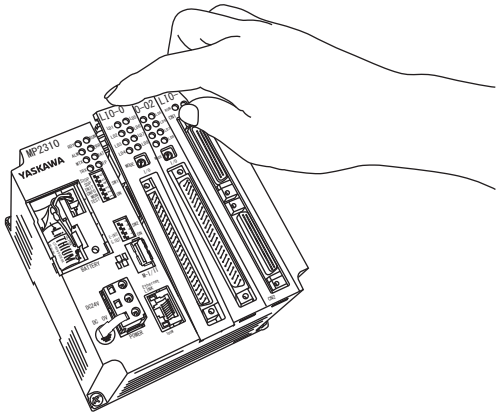
1. Hold the top and bottom of the Optional Module to be installed, line up the Module with the left side of the guide rail inside the option slot, and then insert the Module straight in.

- The FG bar inside and on the bottom may be damaged if the Module is not inserted along the guide rail.



2. After the Optional Module is completely inserted, place your hand on the front of the Optional Module and press the Optional Module firmly until it mates with the Mounting Base connectors in the Unit. The front of the Optional Module and the tabs will be aligned if the Optional Module has been installed properly.

3. Place the hole on the bottom of the panel of the Optional Module onto the tab on the bottom of the Unit. Next, hook the hole at the top of the panel of the Optional Module onto the tab on the Unit.



This completes the installation procedure.

- Always use Option Covers (model: JEPMC-OP2300) to cover unused slots.

2.1.2 Replacing and Adding an MPU-01 Module

Replace or add an MPU-01 Module by using the following procedure.

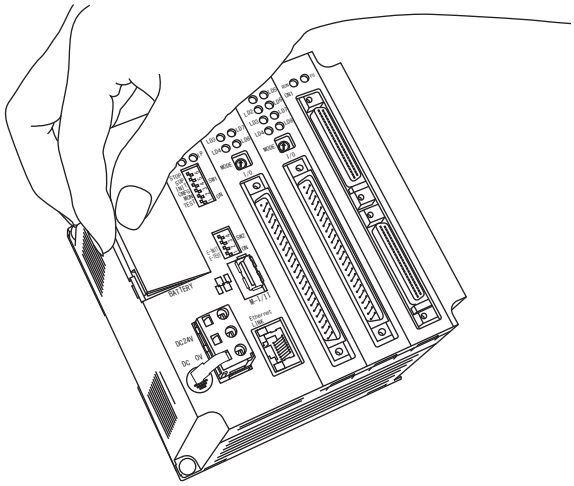
- These diagrams show the procedure using the LIO-01 Module, but the procedure is the same for the MPU-01 Module.

- Always create a backup before replacing or adding Optional Modules.
- Back up the program from the Machine Controller to the PC using the MPE720.

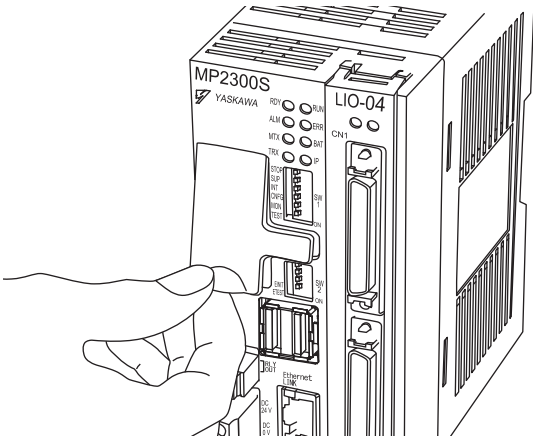
1. Turn OFF the power supply and disconnect all cables from the Machine Controller.

2. Pull the notch on the side toward you to remove the battery cover.

<MP2200/MP2300>

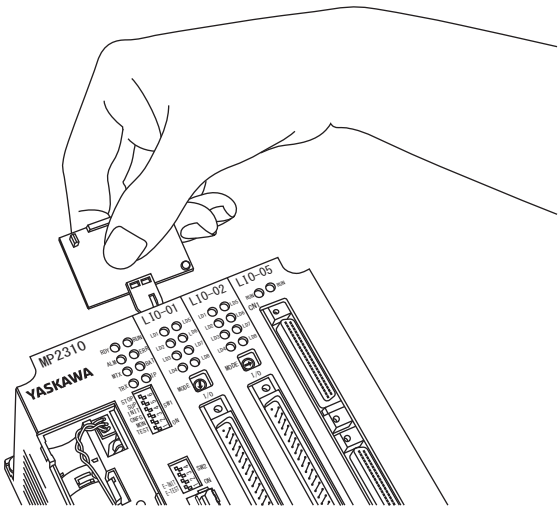


<MP2310/MP2300S>



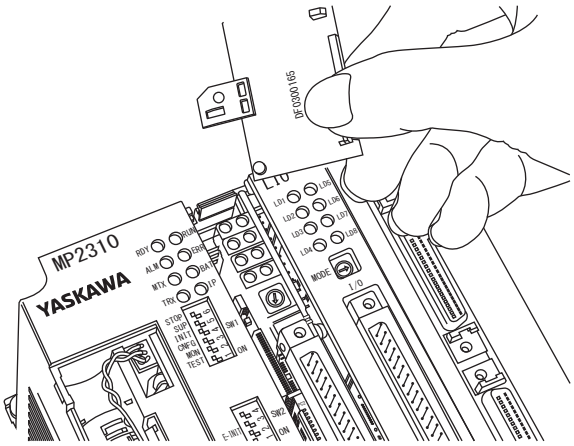
3. Insert the protruding part of the battery cover into the slot on top of the Optional Module panel to unhook the tab. Face the front of the battery cover toward you for this operation.

- Use the same method to remove the Option Cover from an unused slot before adding an Optional Module.

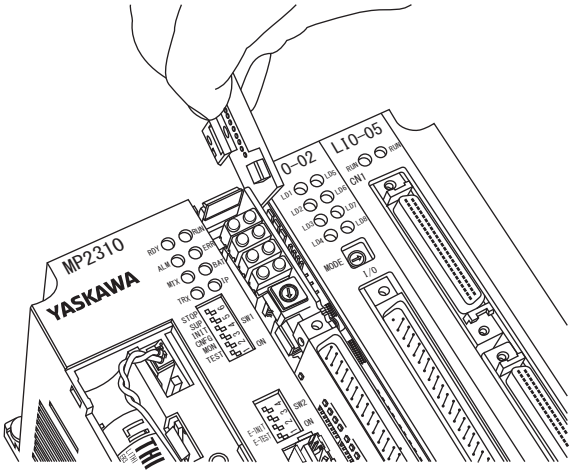


Unhook the bottom tab in the same way.

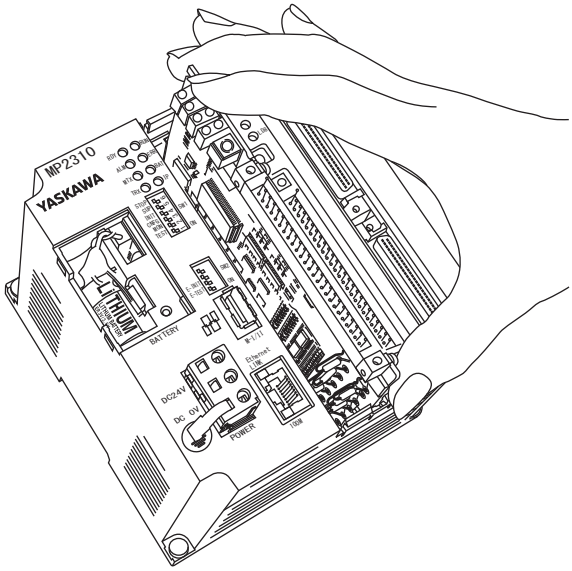
4. Pull the top of the Optional Module panel toward you and remove it. A notch on the Optional Module will be visible from the gap with the panel. Hook the round knob on the battery cover into the notch in the Optional Module.



5. Hold the center of the battery cover, and turn it around the round knob while pushing it toward the back to disconnect the Module from the Mounting Base connectors. Then, pull the Module forward.



6. Hold the Optional Module at the top and bottom and pull it straight out. Hold the edges of the Module and avoid touching the components on the Module.



- Put the Module that you removed into the bag that was supplied when you purchased it and store the Module in this bag.

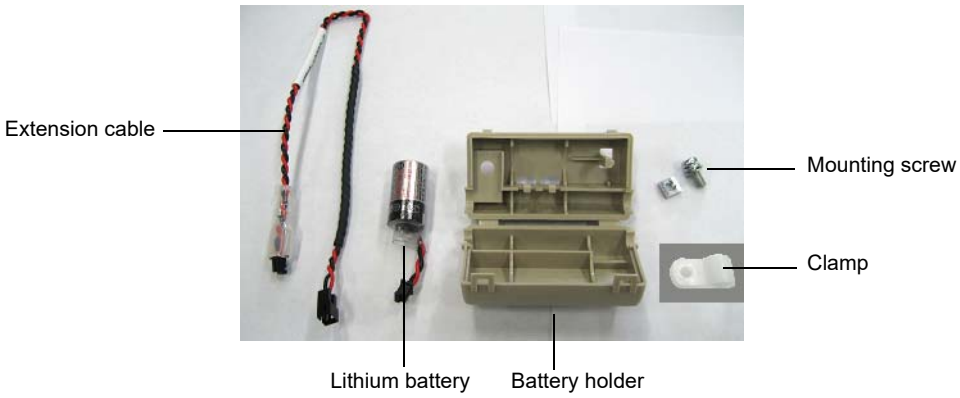
2.2 Installing the Battery Kit and Replacing the Battery

The MPU-01 Module, like other CPU modules, has an M register and calendar functions. A backup function is provided by means of a lithium battery to ensure that the data is not lost when the power is turned OFF.

To enable the backup function, secure the lithium battery to the MECHATROLINK-III cable using the battery kit (model: JEPMC-OP2700-E). Then, connect it to the MPU-01 Module.

The battery kit is a set comprising one lithium battery, one extension cable (1 m), one clamp, a battery holder and a mounting screw.

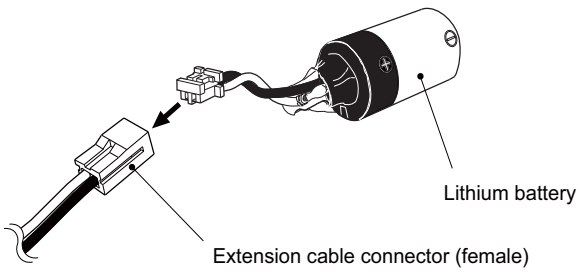
<Contents of the Battery Kit>



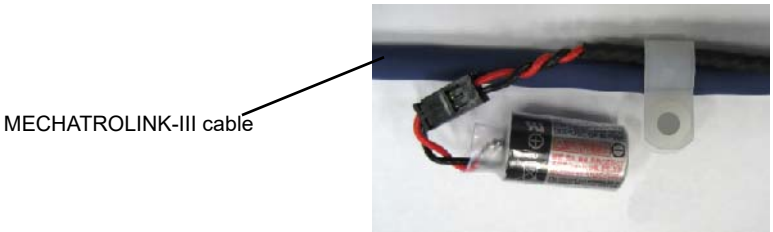
2.2.1 Procedure for Installing the Battery Kit

To install the battery kit, use the following procedure.

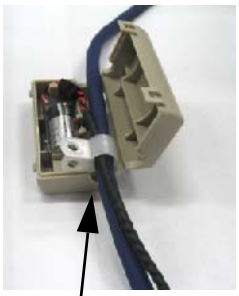
1. Insert the battery connector into the female connector on the extension cable.



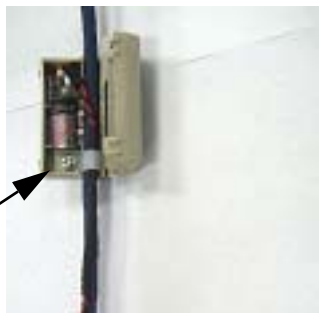
2. Bind the extension cable and MECHATROLINK-III cable together with the clamp.



3. Place the bound cables in the battery holder, and secure the clamp to the battery holder with the mounting screw.

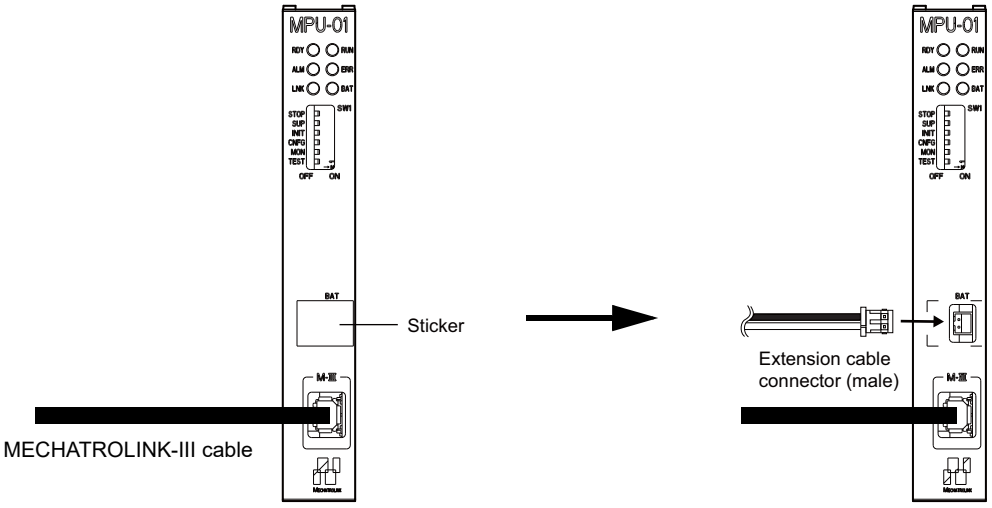


Insert the cables into the recess in the battery holder.



Secure with the mounting screw.

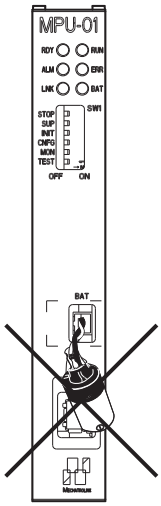
4. Close the cover of the battery holder.
5. Peel off the BAT sticker on the MPU-01 Module's faceplate, and insert the male connector of the extension cable into the BAT connector.



This completes the installation of the battery kit. Activate the battery backup function by referring to *2.2.3 Selecting the Battery Backup Function*.

- Connect Backup Battery

• Do not connect the lithium battery directly to the MPU-01 Module without the extension cable.
There is a risk of the battery falling if subject to shock or vibration.



2.2.2 Replacing the Lithium Battery

The lithium battery must be replaced if the BAT indicator on the MPU-01 faceplate is lit. Use the following procedure to replace the battery within two weeks of when the BAT indicator first lights.

The model number of the replacement battery is JZSP-BA01.

⚠ CAUTION

- When connecting the battery, connect the polarity correctly.

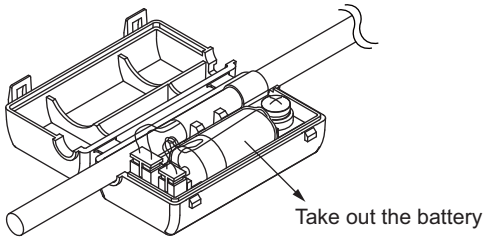
  There is a risk of electric shock, battery damage or explosion.
- The battery must always be replaced while power is being supplied to the MPU-01 Module.

  If power to the MPU-01 Module is turned OFF when the battery is replaced, data stored in the memory in the MPU-01 Module may be lost.
- Only qualified safety-trained personnel should replace the battery.

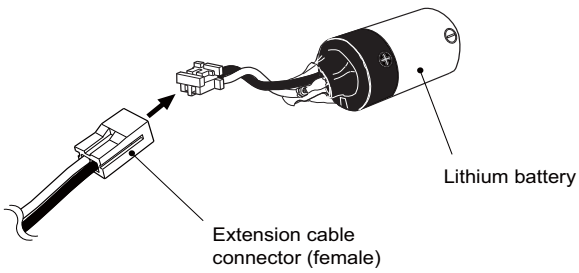
  If the battery is replaced incorrectly, machine malfunction or damage, electric shock, or injury may result.
- When replacing the battery, do not touch the electrodes.

  Static electricity may damage the electrodes.

1. Save the data stored in the MPU-01 Module in the hard disc of the connected personal computer.
   Use this saved data to recover data if any is lost during battery replacement.
   Note: For details on how to save the data, refer to *System Integrated Engineering Tool MPE720 Version 7 USER'S MANUAL* (Manual No.: SIEP C880761 03).
2. Check that the RDY LED at the MPU-01 Module lights in green.
3. Open the battery holder and take out the lithium battery.



4. Remove the battery's connector from the connector on the extension cable.



5. Insert the battery connector into the female connector on the extension cable. Then, place the new battery in the holder.
6. Check that the BAT LED on the MPU-01 Module's faceplate is not lit.

This completes the replacement of the battery.

2.2.3 Selecting the Battery Backup Function

The MPU-01 Module, like other CPU modules, has an M register and calendar functions. A backup function is provided by means of a lithium battery to ensure that the data is not lost when the power is turned OFF.

To enable the backup function, connect the battery kit provided as an accessory with the MPU-01 Module to the MPU-01 Module.

Note: For details on how to connect the battery kit, see *2.2.1 Procedure for Installing the Battery Kit*.

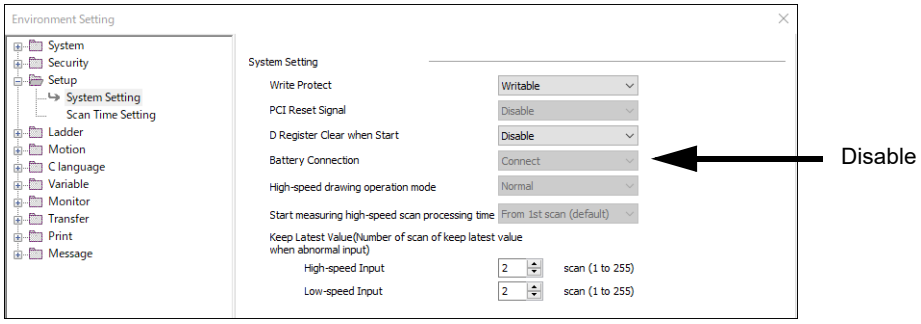
• Selecting the Battery Backup Function

The MPU-01 Module allows you to set whether or not a battery is connected.

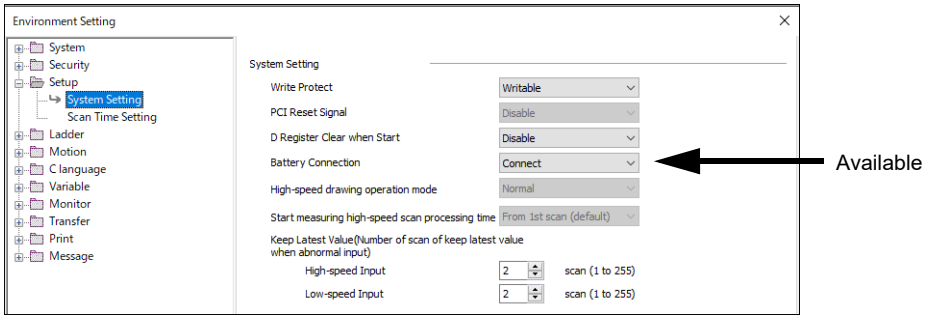
In MPE720 Ver.7, in a project file that was created with MPU-01 specified as the controller, select ***Scan Time Setting*** in the Start menu to display the **Environment Setting** dialog box, select ***Setup - System Setting*** in this dialog box, then select Connect or Not connect at **Battery Connection**.

Note: The default setting is **Connect**.

<For other CPU Modules>



<For MPU-01 Module>



The following table shows what operations can be carried out if a battery is connected and if it is not.

Setting	Operation
Connect (default)	• M register, S register and table data are backed up with the battery. • A check for the battery alarm is conducted at startup.
Not connect	• M register, S register and table data are not backed up with the battery (M register, S register and table data are initialized at startup). • No check for the battery alarm is conducted at startup.

3

Specifications of MPU-01 Module

This chapter explains the various specifications of the MPU-01 Module.

3.1 Applicable Machine Controllers for MPU-01 Module

The following table lists the MP2000-series Machine Controllers on which the MPU-01 Module can be mounted.

Name		Model	Max. No. of Connectable Modules	Applicable Version		Remarks
				CPU Module	MPE720	
MP2300		JEPMC-MP2300 (-E)	2 modules	Ver. 2.73 or later	Ver. 5.53 Ver. 6.23 Ver. 7.10 or later	–
MP2310		JEPMC-MP2310 (-E)	3 modules			–
MP2300S		JEPMC-MP2300S (-E)	1 module			–
MP2200 *1	CPU-03	JAPMC-CP2220-E	16 modules			The maximum number of connectable Modules is the total for the maximum expansion to four racks.*2
	CPU-04	JAPMC-CP2230-E				
MP2100M		JAPMC-MC2140 (-E)	14 modules			The maximum number of connectable Modules is the total for the maximum expansion to three racks.*2
MP2101M		JAPMC-MC2142-E				
MP2101TM		JAPMC-MC2142T-E				

* 1. Mount a CPU module on the following base units.

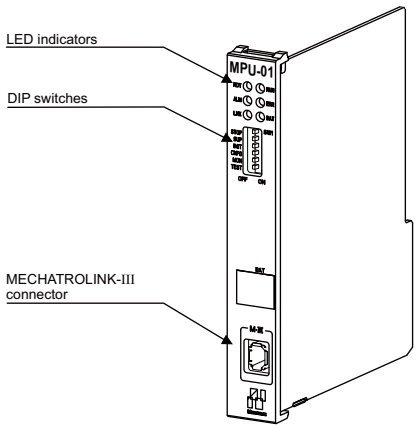
Name	Model	Remarks
MBU-01	JEPMC-BU2200 (-E)	100/200-VAC input base unit (9 slots)
MBU-02	JEPMC-BU2210 (-E)	24-VDC input base unit (9 slots)
MBU-03	JEPMC-BU2220-E	24-VDC input base unit (4 slots)

* 2. The following module or board is required between racks.

Name	Model	Remarks
EXIOIF	JAPMC-EX2200 (-E)	Inter-rack connection module
MP2100MEX	JAPMC-EX2100 (-E)	I/F board for MP2100M, MP2101M, and MP2101TM

3.2 Specifications of MPU-01 Module

3.2.1 Hardware Specifications

<table>
<tr><th colspan="3">Item</th><th>Specification</th></tr>
<tr><td colspan="3">Description</td><td>MPU-01</td></tr>
<tr><td colspan="3">Model Number</td><td>JAPMC-CP2700-E</td></tr>
<tr><td colspan="3">Module Appearance</td><td> 
</td></tr>
<tr><td colspan="3">Number of Modules that can be Mounted on a Machine Controller</td><td>MP2310: 3
MP2300S: 1
MP2200: 16
MP2100M: 14</td></tr>
<tr><td colspan="3">MECHATROLINK Motion Network</td><td>Motion network: 1 channel
Communication port: 1 port
SERVOPACK and I/O:
Up to 21 stations connectable (SERVOPACK for up to 16 axes)
Transmission speed: 100 Mbps</td></tr>
<tr><td colspan="3">Indicators</td><td>RDY (green), RUN (green), ALM (red), ERR (red), LNK (green), BAT (red)</td></tr>
<tr><td>Switches</td><td colspan="2">DIP Switch</td><td>STOP, SUP, INIT, CNFG, MON, TEST</td></tr>
<tr><td rowspan="6">Connectors</td><td rowspan="2">Mounted Item</td><td>Type</td><td>INDUSTRIAL MINI I/O</td></tr>
<tr><td>Part Name/ Manufacturer</td><td>1981386-1/TycoAMP</td></tr>
<tr><td rowspan="2">Fit Side</td><td>Type</td><td>INDUSTRIAL MINI I/O</td></tr>
<tr><td>Part Name/ Manufacturer</td><td>1981384-1/TycoAMP</td></tr>
<tr><td colspan="2">Device Code</td><td>M-III</td></tr>
<tr><td colspan="2">Connector Pinouts</td><td>
<table>
<tr><th>No.</th><th>Signal Name</th><th>I/O</th><th>Remarks</th></tr>
<tr><td>1</td><td>TXP</td><td>I/O</td><td>Sent signal +</td></tr>
<tr><td>2</td><td>TXN</td><td>I/O</td><td>Sent signal -</td></tr>
<tr><td>3</td><td>RXP</td><td>I/O</td><td></td></tr>
<tr><td>4</td><td></td><td>–</td><td>Received signal +</td></tr>
<tr><td>5</td><td></td><td>–</td><td></td></tr>
<tr><td>6</td><td>RXN</td><td>I/O</td><td>Received signal -</td></tr>
<tr><td>7</td><td></td><td>–</td><td></td></tr>
<tr><td>8</td><td></td><td>–</td><td></td></tr>
</table>
</td></tr>
<tr><td colspan="3">MECHATROLINK-III Standard Cable</td><td>JEPMC-W6012-**-E</td></tr>
<tr><td colspan="3">Dimensions/Mass</td><td>Height: 125 mm, Depth: 95 mm, Mass: 80 g</td></tr>
</table>

3.2.2 Operating Environment Specifications

Item		Specification
Environmental Conditions	Ambient Operating Temperature	0°C to 55°C (Standard installation orientation)
	Ambient Storage Temperature	-25°C to 85°C
	Ambient Operating Humidity	30% to 95% RH (with no condensation)
	Ambient Storage Humidity	5% to 95% RH (with no condensation)
	Pollution Level	Pollution level 2 (conforming to JIS B 3502)
	Corrosive Gas	There must be no combustible or corrosive gas.
	Operating Altitude	2,000 m above sea level or lower
Mechanical Operating Conditions	Vibration Resistance	Conforms to JIS B 3502. Vibration amplitude/acceleration: f = 16.7 Hz, Amplitude 14.7 m/s^2 10 ≤ f < 57 Hz, Single-amplitude of 0.075 mm 57 ≤ f ≤ 150 Hz, Fixed acceleration of 9.8 m/s^2 10 sweeps (1 sweep = 1 octave per minute) each in the X, Y, and Z directions
	Shock Resistance	Conforms to JIS B 3502. Peak acceleration of 147 m/s^2 (15G) twice for 11 ms each in the X, Y, and Z directions
Electrical Operating Conditions	Noise Resistance	Conforms to EN61000-6-2, EN61000-6-4, EN 55011 (Group 1, Class A).
Installation Requirements	Ground	Ground to 100 Ω max.
	Cooling Method	Natural cooling

3.2.3 Function Specifications

(1) CPU Function Specifications

Item			Details	Remarks
Compatibility with Option Modules			No	
Number of Controlled Axes	Number of Axes Controlled by Built-in SVC		16	
	Number of Virtual Axes (SVR) Controlled		16	
Scan Time Settings	High-speed Scan		0.25 ms, 0.5 ms to 32 ms (in 0.5 ms increments)	Same as the M-III communication cycle of the MPU-01 Module. The setting needs to be 1/N of the high-speed scan setting of the main CPU. If not, the internal scan processing of the MPU-01 Module will be executed asynchronously with the main CPU. • Refer to *D.4 Constraints on High-speed Scans* for details.
	Low-speed Scan		2.0 ms to 32 ms (in 0.5 ms increments)	When the power is turned ON, the calendar values of the main CPU are reflected at the MPU-01 Module.
Peripheral Devices	Calendar Function		Yes	When the power is turned ON, the time is set to that of the main CPU.
	CF Card		No	
Memory Capacity	SRAM (Battery Backup)		4 MB	Up to 3 MB can be used for battery backup of the table data.
	Flash Memory		16 MB	
	Program Capacity		11.5 MB	
User program	Ladder Programs		Supported	
	Motion Programs		Supported	
	Sequence Programs		Supported	
	C language Programs		Supported	
Interface with the Main CPU	I/O Registers	High-speed Scan	Motion registers (2048 W max.)	
		Low-speed Scan	I/O registers (1024 W max.)	
	Synchronous Scan		High-speed scan/low-speed scan	The low-speed scan is asynchronous.
	Maximum Number of Modules		16	

(2) SVC Function Specifications

Item			Details
MECHATROLINK Communication	Number of Communication Lines		One line
	Number of Communication Ports (Connectors)		1 port
	Terminating Resistance		Not necessary
	Baud Rate		100 Mbps
	Transmission Distance		Max. distance between stations 75 m
	Slave Function		Not supported
	Master Functions	Communication Interface	MECHATROLINK-III (2 : N synchronous)
		Baud Rate	100 Mbps
		Transmission Cycle	125 µs/250 µs/500 µs/1 ms
		Number of Link Communication Bytes	16, 32, 48, or 64 (Depends on the profile)
		Number of Connectable Stations	Up to 21 stations (SERVOPACK for up to 16 axes)
		C1 Messaging (Master Function)	Provided (selectable)
		Retry Function	Provided (selectable)
		Supported Slave Devices	Servo drive, I/O
		Event-driven Communication	Supported (selectable)
		Corresponding Profile	Servo M-III standard, I/O M-III standard
		Self-Configuration Function	Supported
Servo Control	I/O Registers		Input/output using motion registers
	Synchronous Scan		High-speed scan
	Operating Modes		Normal mode/simulation mode/transit command mode
	ABS Infinite Length Axis Selection		Supported
	ABS System Infinite Length Position Control Information LOAD		Supported
	Motion Commands		Equivalent to those of the SVC-01 Module • Interpolation Segment Distribution Processing (fixed parameter no.1, bit 8) is, however, not available.
I/O Control	I/O Registers		I/O Registers
	Synchronous Scan		High-speed scan/low-speed scan
	Automatic Recovery Function		Supported

(3) MECHATROLINK-III Communication Specifications

Item	Details
Connection Mode	Cascade*, Star, Point to Point
Transmission Cable	CAT5e STP (Shielded Twist Pair cable)
Connectors	RJ45 or an industrial mini connector made by TYCO AMP
Transmission Distance	Max. 4725 m (in a 62-station cascade connection)
Distance between Stations	Max. 75 m Min. 20 cm
Number of Connectable Stations	C1 master station = 1 station/C2 master station = max. 1 station/Slave station = max. 62 stations
Baud Rate	100 Mbps
Transmission System	4B/5B MULT-3
Types of Connected Station	C1 master station: Network control station C2 master station: Message master station Slave station
Control System	Master - Slave
Number of Bytes in the Information Field	16/32/48/64
Isolation for Transmission Path	Transformer

* In a cascade connection, arrange the nodes where synchronization is required within the first 21 stations.

(4) Specifications of Interface with the Engineering Tool

Item		Details
Communication Method (between Personal Computer and Main CPU)		Ethernet communication, PCI bus connection
Types of Supported Communication Ports		ETHERNET, PCI, PCI Express
Communication Method	Ethernet communication	LAN cable (cross cable, category: 5 or 5e)
	PCI bus	Personal computer general-purpose bus connection (PCI bus)
Method for Specifying MPU-01	Ethernet communication	Specify the MPUIF circuit number in the module configuration definitions at the main CPU side, or select with a module search.
	PCI bus	Specify the MPUIF circuit number in the module configuration definitions at the main CPU side.

3.3 Engineering Tool Specifications

Using the engineering tools indicated below, the ladder programs of MPU-01 Modules can be edited and defined.

- MPE720 Ver.5
- MPE720 Ver.6
- MPE720 Ver.7

In addition, the engineering tool indicated below can be used to operate SERVOPACKs connected to an MPU-01 Module.

- SigmaWin+
- SigmaWin+ Ver.7

The engineering tools above can be used on installing them in a personal computer.

The compatible versions of each engineering tool are shown below.

Engineering Tool	Model	Version
MPE720 Ver.5	CPMC-MPE720	Ver. 5.23 or later
MPE720 Ver.6	CPMC-MPE770	Ver. 6.23 or later
MPE720 Ver.7	CPMC-MPE780	Ver. 7.10 or later
SigmaWin+	JZSPWP002	Ver. 5.30 or later
SigmaWin+ Ver.7	–	Ver. 7.01 or later

• Do not use more than one computer running MPE720 per MPU-01 Module at one time.
If not, the performance of MPE720 might become unstable.

4

Details of MPU-01 Module

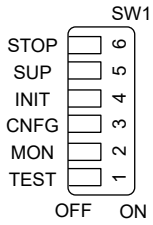
This chapter explains details on the functions of the MPU-01 Module.

4.1 Startup Sequence

This section explains the MPU-01 Module startup sequence together with the DIP switch settings.

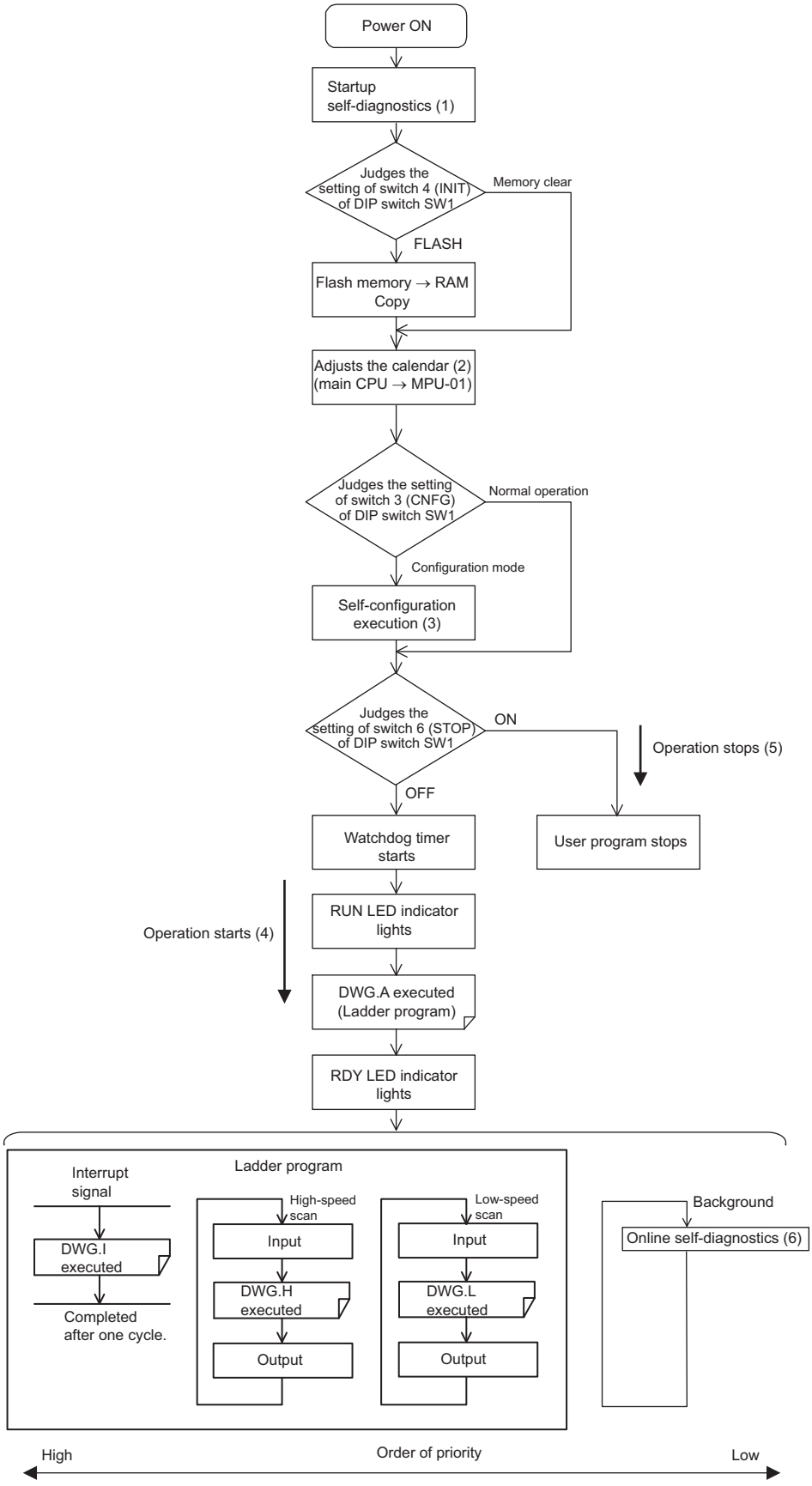
4.1.1 DIP Switch Settings

Set the DIP switch on the MPU-01 Module to control operations of the startup sequence. The six switches are provided on the DIP switch on the MPU-01 Module as shown in the figure below. The following table lists the functions of six switches.

Switch	Switch Name	Status	Operating Mode	Default Setting	Details
	STOP	ON	User program stopped	OFF	Set to ON to stop the user program.
		OFF	User program running		
	SUP	ON	System use	OFF	Always set to OFF during normal operation.
		OFF	Normal operation		
	INIT	ON	Memory clear	OFF	Set to ON to clear memory. If this switch is set to OFF, the program stored in flash memory will be executed.
		OFF	Normal operation		
	CNFG	ON	Self-configuration mode	OFF	Set to ON to execute self-configuration for connected devices.
		OFF	Normal operation		
	MON	ON	System use	OFF	Always set to OFF during normal operation.
		OFF	Normal operation		
	TEST	ON	System use	OFF	Always set to OFF during normal operation.
		OFF	Normal operation		

4.1.2 Startup Sequence

The startup sequence for the MPU-01 Module from the moment when the power has been turned ON is shown in the following flowchart.



* Refer to *4.1.3 Startup Sequence Operation Details* on the next page for details on (1) to (6).

4.1.3 Startup Sequence Operation Details

(1) Self-diagnosis at Startup

Self-diagnosis is performed on the following items after the power is turned ON.

- Read/write diagnosis of memory (RAM)
- System program (ROM) diagnosis
- Main processor (CPU) function diagnosis
- Floating Point Unit (FPU) function diagnosis

If diagnosis results in an error, the ALM and ERR LED indicators will flash red for the specified number of times. Refer to *1.2.3 MPU-01 Module Status Indication*.

(2) Adjusting the Calendar

The MPU-01 Module's calendar is set to the same time as the calendar of the main CPU.

(3) Self-configuration

Self-configuration automatically recognizes the connected Optional Modules, and automatically creates a definitions file. For details, refer to *4.4 Self-configuration*.

The RUN LED indicator will flash green during execution of self-configuration.

(4) Starting an Operation

When the STOP switch is set to OFF (RUN) or changed from ON (STOP) to OFF (RUN), the CPU starts the watchdog timer and then executes DWG.A (startup processing drawing) in the ladder program. Refer to *4.2.2 Execution Control of Drawings*.

First scan processing is executed once DWG.A has been completed and the high-speed or low-speed scan time has elapsed. System I/O are executed from the first scan.

(5) Stopping an Operation

MPU-01 stops motion control operation when the STOP switch is ON (STOP) and in the following circumstances.

Cause	Restart Method
Power supply turned OFF	Turn ON the power again.
Power interruption	
Fatal error	Check the LED indicator for the cause of the error and then turn the power OFF then ON.
STOP executed from MPE720	Execute RUN from MPE720.

(6) Online Self-diagnosis

Self-diagnosis is performed on the following items when the user logs on online.

- System program (ROM) diagnosis
- Main processor (CPU) function diagnosis
- Floating Point Unit (FPU) function diagnosis

If diagnosis results in an error, the ALM and ERR LED indicators will flash red a fixed number of times. Refer to *1.2.3 MPU-01 Module Status Indication*.

4.2 User Program

The user programs for machine control on an MPU-01 Module comprise ladder programs and motion programs. This section explains the basic operation of user programs.

For details on programming, refer to the following manuals.

- *Machine Controller MP2000 Series USER'S MANUAL LADDER PROGRAMMING* (Manual No: SIE-C887-1.2)
- *Machine Controller MP2000 Series USER'S MANUAL for Motion Programming* (Manual No: SIEP C880700 38)

4.2.1 Ladder Drawings (DWG)

Ladder programs are managed in units of ladder drawings, which are identified by drawing numbers. These drawings form the basis of user programs.

(1) Types of Drawings

Ladder drawings include parent drawings, child drawings, grandchild drawings, and operation error processing drawings. In addition to drawings, some functions can also be freely accessed from each drawing.

- **Parent Drawings**

  Parent drawings are automatically executed by the system program when the execution conditions, outlined in the table below, are met.

- **Child Drawings**

  Child drawings are executed by using a SEE command from a parent drawing.

- **Grandchild Drawings**

  Grandchild drawings are executed by using a SEE command from a child drawing.

- **Operation Error Processing Drawings**

  Operation error processing drawings are automatically executed by the system program when an operation error occurs.

- **Functions**

  Functions are executed from parent, child, and grandchild drawings using the FSTART command.

(2) Drawing Types and Order of Priority

Drawings are classified by their first letter (A, H, or L) based on the processing purpose. The following table outlines the order of priority and execution conditions for these drawings.

Type of Parent Drawing	Function	Priority	Execution Conditions	Max. No. of Drawings
DWG.A (Drawing A)	Startup processing	1	Power ON (Executed once only, when the power is turned ON)	64
DWG.H (Drawing H)	High-speed scan processing	2	Scheduled cycle startup (Executed during each high-speed scan of a scheduled cycle startup)	200
DWG.L (Drawing L)	Low-speed scan processing	3	Scheduled cycle startup (Executed during each low-speed scan of a scheduled cycle startup)	500

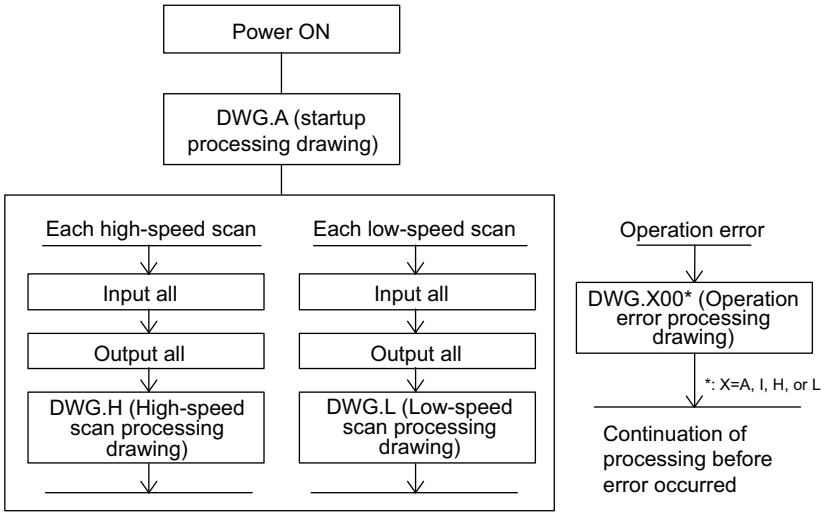
The following table provides details of the number of drawings for each drawing.

Drawing	Number of Drawings		
	DWG.A	DWG.H	DWG.L
Parent Drawings	1 (A)	1 (H)	1 (L)
Operation Error Processing Drawings	1 (A00)	1 (H00)	1 (L00)
Child Drawings	Total: 62 max.	Total: 198 max.	Total: 498 max.
Grandchild Drawings			

4.2.2 Execution Control of Drawings

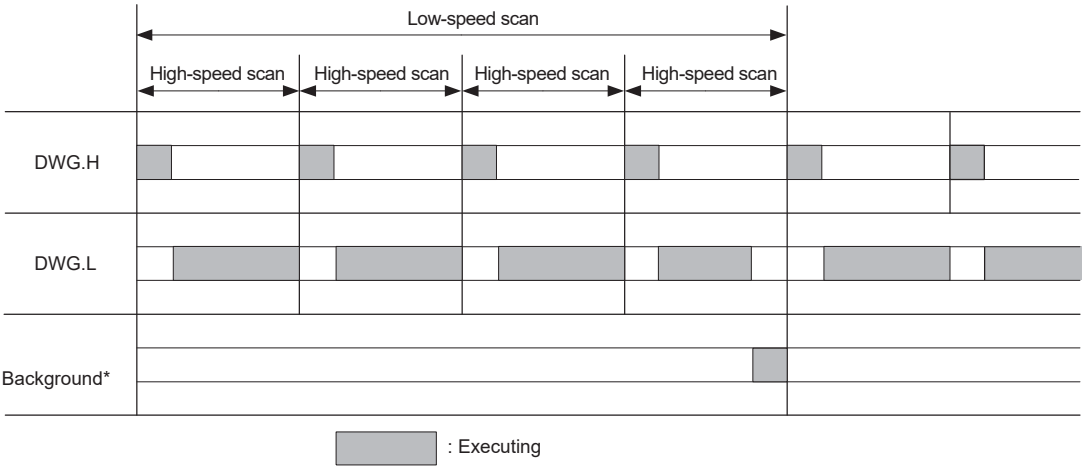
(1) Execution Control

The following table shows when each drawing is executed based on the order of priority.



(2) Execution Schedule for Scan Processing Drawings

The scan processing drawings are not executed simultaneously. As shown in the following figure, the execution of each drawing is scheduled based on the order of priority and time sharing.



* Background processing is used to execute internal system processing, e.g., communication processing.

Low-speed scan processing is executed in spare processing time of the high-speed scan. Set the time of the high-speed scan to approximately double the total execution time for DWG.H.

• The high-speed scans and low-speed scans of the MPU-01 Module differ from those of the other Machine Controllers of the MP2000 series in that each of the processes are carried out asynchronously.

4.2.3 Motion Programs

(1) Outline

Motion programs are programs written in a text-based language called motion language. Up to 256 motion programs can be created separate from ladder drawings.

The following table shows the two types of motion programs.

Type	Specification Method	Features	No. of Programs
Main Program	MPM□□□ (□□□ = 1 to 256)	Accessed from DWG.H	Up to 256 programs (including main and sub programs) can be created.
Subprogram	MPS□□□ (□□□ = 1 to 256)	Can be called from main programs	

- Specify a different MPM and MPS program number (□□□) between 1 and 256 for each program.
- The MPU-01 Module can execute up to 16 motion programs simultaneously. An alarm (no system work error*) will occur if 17 or more programs are executed simultaneously.

  * No system work error: Bit E of the leading word in the MSEE work registers

To specify a motion program, use either of the following two methods: direct specification of the program number or indirect specification by specifying the register number where the program number is stored.

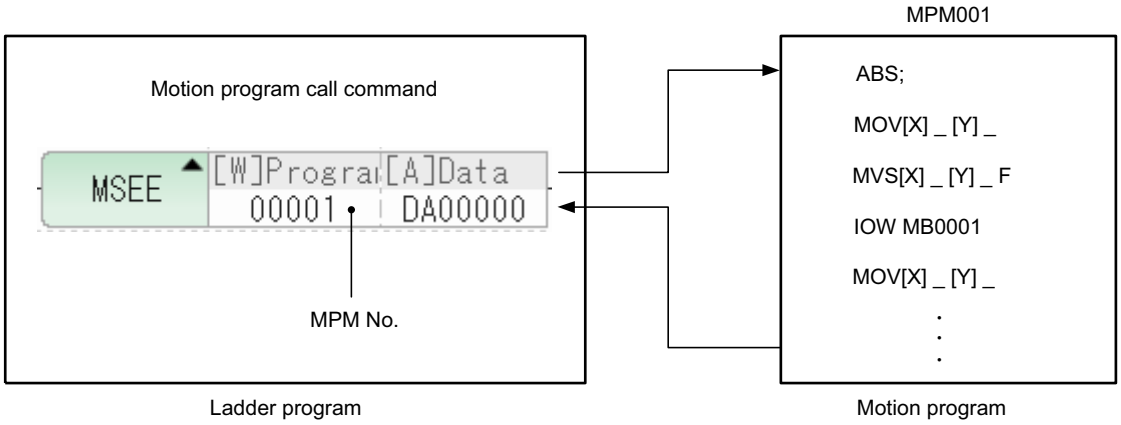


Fig. 4.1 Calling Motion Programs Using Direct Specification

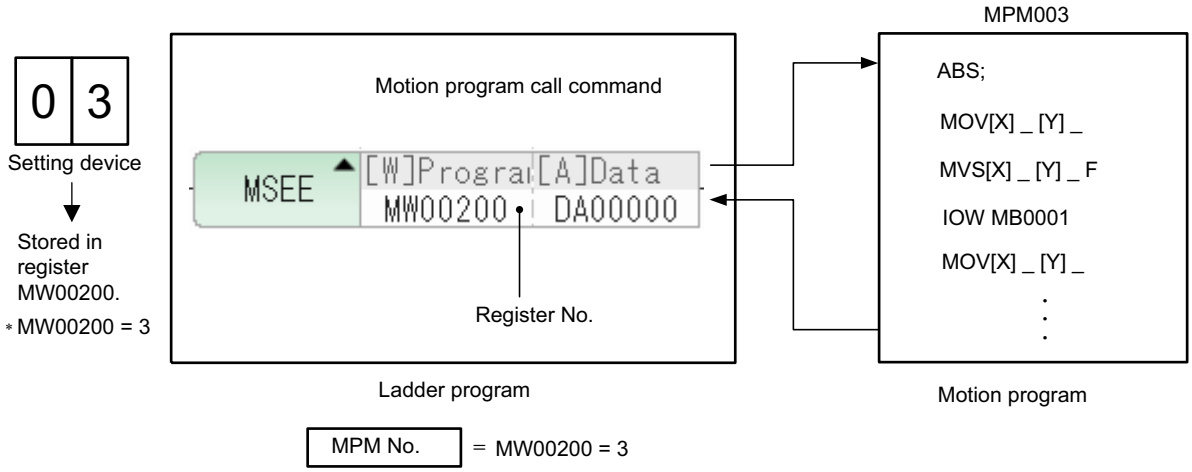


Fig. 4.2 Calling Motion Programs Using Indirect Specification

For the meaning of register numbers and how to interpret them, refer to *4.3 Registers*.

4.2.4 Functions

Functions are executed by calling them from parent, child, or grandchild drawings using the FSTART command.

Functions can be called from any drawing, and the same function can be called at the same time from different types of drawings and from different levels of drawings. Another completed functions can also be called from functions.

Using functions has the following advantages.

- Easier creation of user program components
- Easier writing and maintenance of user programs

Functions include standard system functions that are already in the system and user functions that are defined by the user.

(1) Standard System Functions

The transmission and other functions listed below are already created as standard system functions. Standard system functions cannot be changed by users.

Type	Name	Symbol	Contents
System functions	Counter	COUNTER	Incremental/decremental counter
	First in/first out	FINFOUT	First in/first out
	Trace function	TRACE	Data trace execution control
	Data trace read	DTRC-RD	Reads data from data trace memory to user memory
	Inverter trace read function	ITRC-RD	Reads trace data from inverter trace memory to user memory
	Message send	MSG-SND	Sends messages to external communication devices
	Message receive	MSG-RCV	Receives messages from external communication devices

(2) User Functions

The functions (programs) and the function definitions can be changed (programmed) freely by users.

The maximum number of user functions that can be defined is 500 drawings.

For details on defining functions, refer to the following manuals.

- *Machine Controller MP2000 Series USER'S MANUAL LADDER PROGRAMMING* (Manual No: SIE-C887-1.2)
- *Machine Controller MP2000 Series USER'S MANUAL for Motion Programming* (Manual No: SIEP C880700 38)

4.3 Registers

This section explains the types of registers used in MPU-01 Module user programs (mainly ladder programs).

4.3.1 DWG Registers

DWG registers are used by ladder programs (ladder drawings; DWG). Each drawing can use the registers outlined in the following table.

Type	Name	Specification Method	Range	Details	Characteristics
S	System registers	SB, SW, SL, SFnnnnn (SAnnnnn)	SW00000 to SW08191	Registers provided by the system. SW00000 to SW00049 are cleared to all zeros when the system starts.	Common to all drawings
M	Data registers	MB, MW, ML, MFnnnnn (MAnnnnn)	MW00000 to MW65534	Registers shared by all drawings. Used, e.g., as an interface between drawings.	
I	Input registers	IB, IW, IL, IFhhhh (IAhhhh)	IW0000 to IW7FFF	Registers used for input data.	
O	Output registers	OB, OW, OL, OFhhhh (OAhhhh)	OW0000 to OW7FFF	Registers used for output data.	
C	Constants registers	CB, CW, CL, CFnnnnn (CAnnnnn)	CW00000 to CW16383	Registers that can only be called from programs.	
#	# registers	#B, #W, #L, #Fnnnnn (#Annnnn)	#W00000 to #W16383	Call-only registers. Can be called only by corresponding drawing. The usage range is set by the user using MPE720.	Unique to each drawing
D *	D registers	DB, DW, DL, DFnnnnn (DAnnnnn)	DW00000 to DW16383	Internal registers unique to each drawing. Can be used only by corresponding drawing. The usage range is set by the user using MPE720.	

* Up to 32 D registers (32 words, DW0000 to DW0031) can be used when creating drawings, but this can be changed in the MPE720 Drawings Properties Window. Refer to the *Machine Controller MP900/MP2000 Series User's Manual MPE720 Software for Programming Device* (Manual No.: SIEP C880700 05) for details.

Note: 1. n: Decimal number; h: Hexadecimal number

2. B, W, L, F, and A: Data type (B: Bit, W: Integer, L: Double-length integer, F: Real number, A: Address.)

• When the battery backup function of the MPU-01 Module (refer to *2.2.3 Selecting the Battery Backup Function*) is used, S and M register data is held even when the MPU-01 power is turned OFF and ON. Other register data is saved to flash memory, so when the MPU-01 power is turned OFF to ON, data saved to flash memory is read and data not saved to flash memory before turning the power OFF is lost. When data is to be held even when the power is turned OFF and back ON, Yaskawa recommends using the battery backup function to write the data to the M registers.

4.3.2 Function Registers

The following table shows the registers that can be used with each function.

Type	Name	Specification Method	Range	Details	Characteristics
X	Function input registers	XB, XW, XL, XFnnnnn	XW00000 to XW00016	Input to functions Bit input: XB000000 to XB00000F Integer input: XW00001 to XW00016 Double-length integer input: XL00001 to XL00015	Unique to each function
Y	Function output registers	YB, YW, YL, YFnnnnn	YW00000 to YW00016	Output from functions Bit output: YB000000 to YB00000F Integer output: YW00001 to YW00016 Double-length integer output: YL00001 to YL00015	
Z	Internal function registers	ZB, ZW, ZL, ZFnnnnn	ZW0000 to ZW00063	Internal registers unique to each function. Can be used for function internal processing.	
A	External function registers	AB, AW, AL, AFhhhh	AW0000 to AW32767	External registers with the address input value as the base address. For linking with S, M, I, O, #, and DAnnnnn.	
#	# registers	#B, #W, #L, #Fnnnnn (#Annnnn)	#W00000 to #W16383	Call-only registers Can be called only from the relevant function. The usage range is set by the user using MPE720.	
D	D registers	DB, DW, DL, DFnnnnn (DAnnnnn)	DW00000 to DW16383	Internal registers unique to each function. Can be called only the relevant function. The usage range is set by the user using MPE720.	
S	System registers	SB, SW, SL, SFnnnnn (SAnnnnn)	Same as DWG registers These registers are shared by drawings and functions. Pay attention to how these registers are to be used when calling the same function from a drawing of a different priority level.		
M	Data registers	MB, MW, ML, MFnnnnn (MAnnnnn)			
I	Input registers	IB, IW, IL, IFhhhh (IAhhhh)			
O	Output registers	OB, OW, OL, OFhhhh (OAhhhh)			
C	Constants registers	CB, CW, CL, CFnnnnn (CAnnnnn)			

Note: 1. n: Decimal number; h: Hexadecimal number
2. B, W, L, F, and A: Data type (B: Bit, W: Integer, L: Double-length integer, F: Real number, A: Address.)
3. SA, MA, IA, OA, DA, #A, and CA registers can be used within functions.

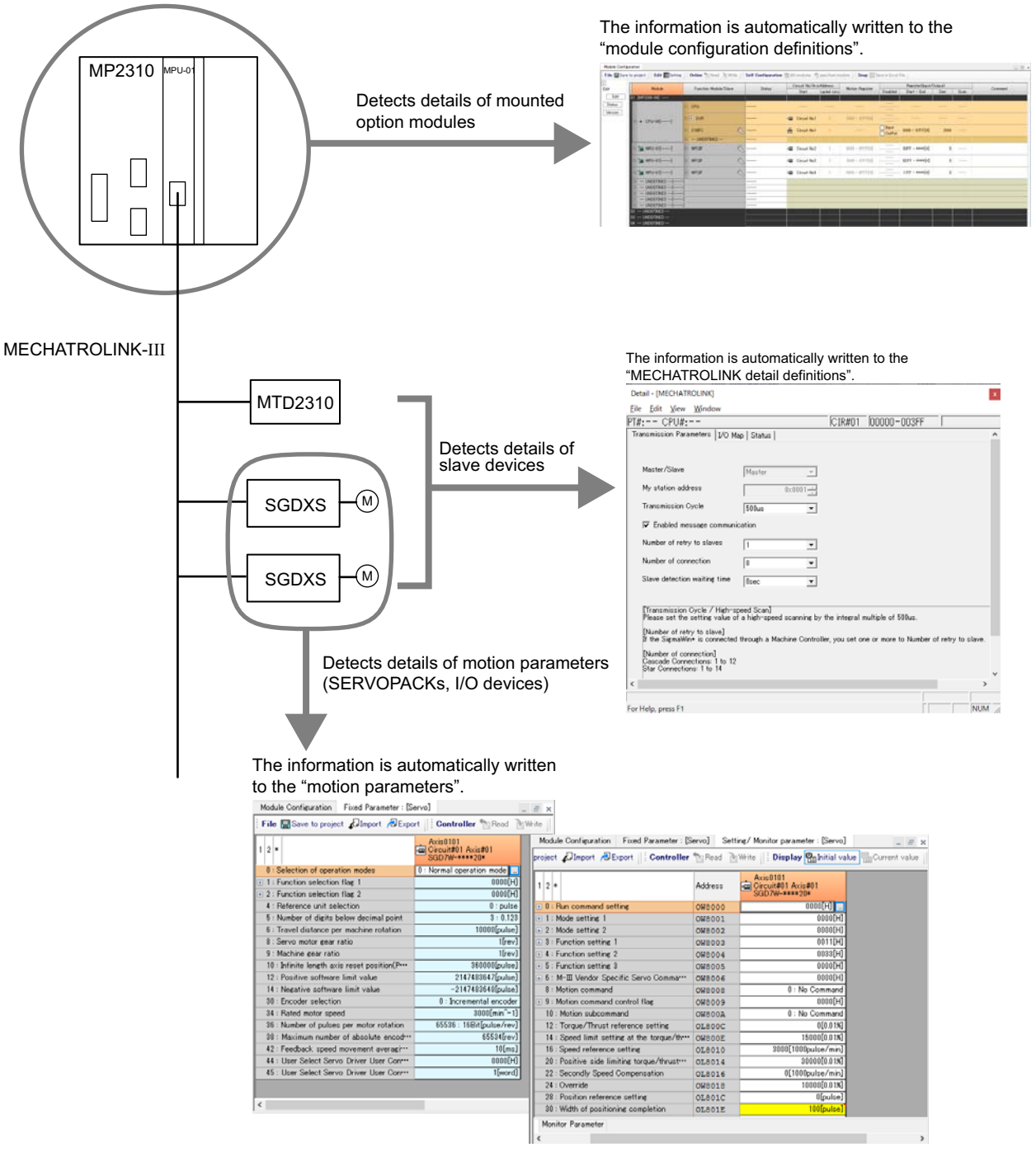
4.4 Self-configuration

Self-configuration is a function that automatically recognizes the slave stations connected to the MPU-01 Module and automatically creates the files for the module configuration definitions, detailed definitions of each module, and motion parameters. The self-configuration function greatly reduces the system startup time.

4.4.1 Overview

The following figure shows how the self-configuration function works.

<Execution of Self-configuration>



Self-configuration can be executed with the switch on the MPU-01 Module or from the MPE720.

4.4.2 How to Execute Self-configuration

To execute self-configuration, use either of the following two methods.

(1) Turning ON the Power after Setting the DIP Switch “CNFG”

Set the DIP switch “CNFG” on the MPU-01 to ON, and then turn ON the power to execute self-configuration. The setting of the DIP switch “INIT” causes some differences in the results of self-configuration.

CNFG	INIT	Result
ON	ON	• Module configuration definitions will be updated. • All the detected axes (slave devices) will be allocated to the module configuration definitions. • Some of the SERVOPACK parameters will be written in the motion parameters.
ON	OFF	• Module configuration definitions will be updated. • The axes that have already been allocated to the module configuration definitions will remain unchanged. Only the axes that are newly detected by self-configuration will be newly allocated. • The column showing the deleted axis will appear blank in the Module Configuration Definitions Window. • The motion parameters of the axes that have already been allocated to the module configuration definitions will not be updated.

After execution of self-configuration, be sure to save the results of self-configuration to the flash memory of the Machine Controller.

The DIP switches on the MP2100M are not typically used for self-configuration. Use the procedure described in *4.4.2 (2) Using an MPE720* to execute self-configuration.

(2) Using an MPE720

On the Module Configuration Definition Window in MPE720, click **All modules** next to **Self Configuration**, or select the module on which to perform self-configuration and then click **specified module**.

For information on how to open the Module Configuration Definition Window, refer to *4.4.3 (1) Module Configuration Definitions*.

The results of configuration will be as follows.

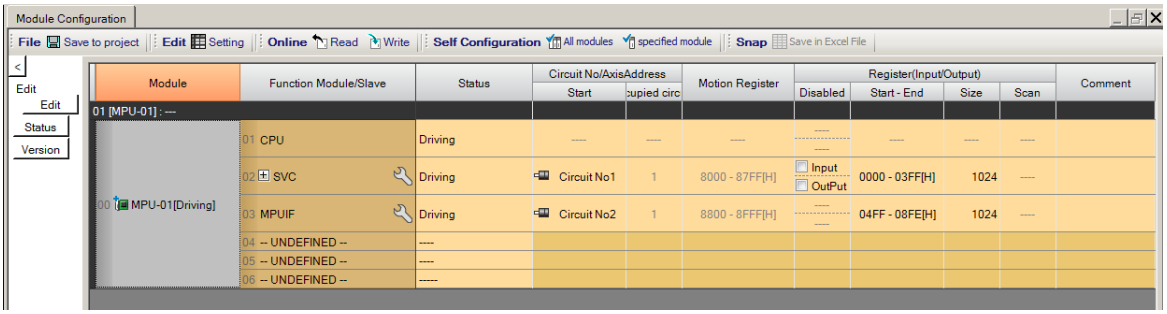
Menu	Result
Self Configure All Modules (Self-configuration for all modules)	• Module configuration definitions will be updated. • The axes that have already been allocated to the module configuration definitions will remain unchanged. Only the axes that are newly detected by self-configuration will be newly allocated. • The column showing the deleted axis will appear blank in the Module Configuration Definition Window. • Part of the SERVOPACK parameters will be written to motion parameters for only the axes that are newly detected. The motion parameters for axes that have already been allocated to the module configuration definitions will not be updated.
Module Self-configuration (Self-configuration for individual module)	• The slave devices (slave axes) of the selected module will be detected. • The axes that have already been allocated to the module configuration definitions will remain unchanged. Only the axes that are newly detected by self-configuration will be newly allocated. • The column showing the deleted axis will appear blank in the Module Configuration Definition Window. • Part of the SERVOPACK parameters will be written to motion parameters for only the axes that are newly detected. The motion parameters for axes that have already been allocated to the module configuration definitions will not be updated.

• The self-configuration of the MPU-01 Module has to be carried out separately from the self-configuration of the main CPU. When self-configuration of the main CPU is executed, self-configuration of the MPU-01 is not carried out automatically at the same time.

4.4.3 Automatically Generated Definition Data

The following data is generated automatically as a result of executing self-configuration.

(1) Module Configuration Definitions



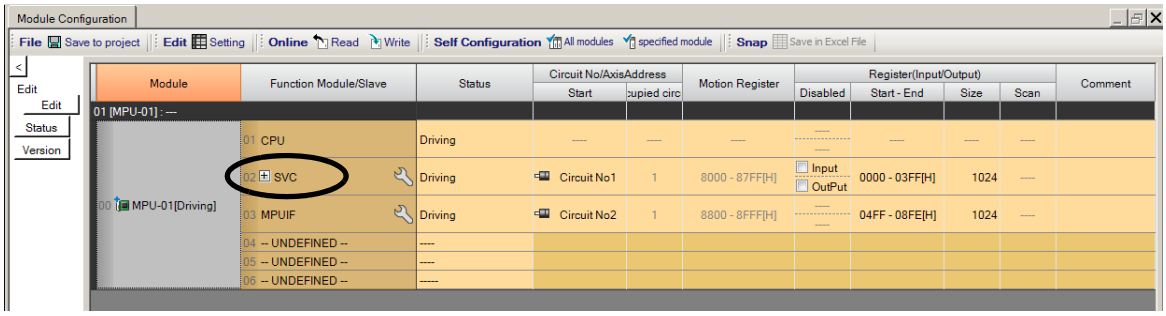
- For details on how to display the Module Configuration Definition Window, refer to *5.2.3 (3) Checking the MPUIF Detail Definitions in the Module Configuration Definition Window*.

Slot Number	1	2	3	4	5
Module Type	CPU (Allocated)	SVC (Allocated)	MPUIF (Allocated)	SVR (Allocated to UNDEFINED*)	M-EXECUTER (Allocated to UNDEFINED*)
Controller Number	–	Fixed as 01	Fixed as 01	–	–
Circuit Number	–	01	02	–	–
I/O Start Register	----	0000	----	----	----
I/O End Register	----	03FF	----	----	----
Disable Input	–	Input enabled (Enable)	–	–	–
Disable Output	–	Output enabled (Enable)	–	–	–
Motion Start Register	----	8000	8800	----	----
Motion End Register	----	87FF	8FFF	----	----

* When self-configuration is executed after allocating modules manually, the “module allocation” is not changed from the allocated modules.

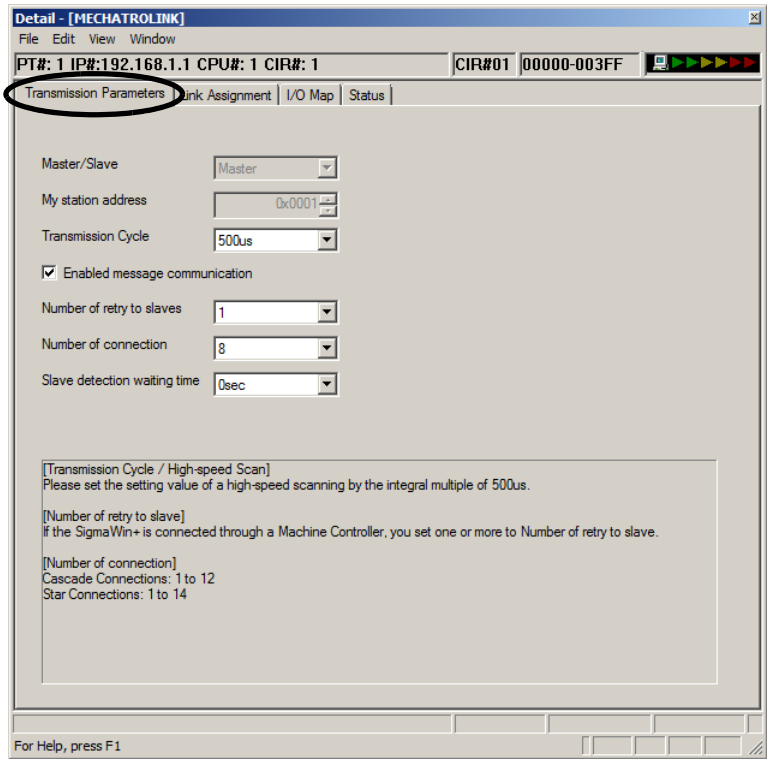
(2) MECHATROLINK Detail Definitions

Double-click the **SVC** cell in the Module Configuration Definition Window to display the MECHATROLINK detail definitions window.



(a) Transmission Parameters Tab

The parameters required to use the MECHATROLINK transmission system are displayed.



The items shown on the **Transmission Parameters** tab are as follows. For editable items, the settings can be changed. Always save the settings to the flash memory after changing them.

Item	Display during Self-configuration	Options and Precautions on Settings
Master/Slave	Displays whether the selected SVC Module is used as a master station or slave station.	Fixed as “Master”.
My Station Address (Local station address)	Displays the local station address set by using the rotary switches.	Fixed as 0x0001.
Communication Cycle	Displays the transmission cycle.	125 µs, 250 µs, 500 µs, 1 ms
Enabled Message Communication	If the checkbox is checked, it indicates that the message communication function is enabled.	This function is linked with the retry count. When the retry count is “0”, entering a check mark causes the retry count to change to “1”. Note that if a value higher than 1 has been set for the retry count, this checkbox is automatically checked.
Number of Retry to Slaves	Displays the maximum number of retries executed within one transmission cycle.	For the setting range, refer to • *Range of Retry Count Setting* below.
Number of Connection	Displays the number of slave stations that are connected.	Any required connected station can be set. For the setting range, refer to • *Range of Number of Connectable Stations Setting* below.
Slave Detection Waiting Time	0 sec	This item can be set only when “Master” is selected. Set the maximum value of time to continue detecting slave stations.
Message Field	Displays the precautions on high-speed scan time setting.	When the transmission cycle is 125 µs/250 µs, this becomes blank.

- Range of Retry Count Setting

Communication Cycle	Number of Slave Stations	Range
125 µs	1 to 4	0 to (5 - number of slave stations)
250 µs	1 to 8	0 to (9 - number of slave stations)
500 µs	1 to 15	0 to (15 - number of slave stations)
1 ms	1 to 21	0 to (23 - number of slave stations)

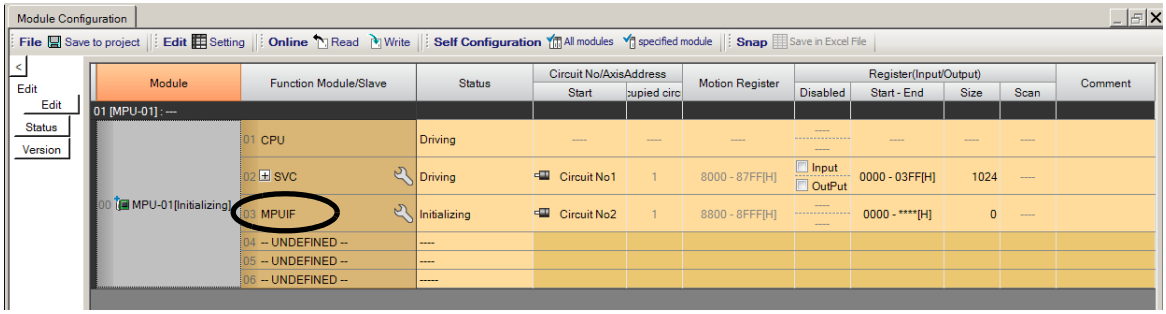
- Range of Number of Connectable Stations Setting

Communication Cycle	Number of Connectable Stations	
	Star Connection	Cascade Connection
125 µs	1 to 4	1 to 3
250 µs	1 to 8	1 to 7
500 µs	1 to 15	1 to 12
1 ms	1 to 21	1 to 21

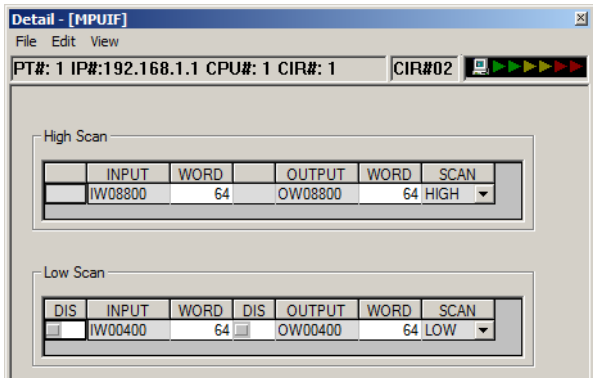
• If connecting a computer running SigmaWin+ to a Machine Controller being used with multiple SERVOPACKs, SigmaWin+ might not be used. If SigmaWin+ is necessary under such circumstances, directly connect the computer running SigmaWin+ to the CN7 connector on the each SERVOPACK or lengthen the communication cycle.

(3) MPUIF Detail Definitions

Double-click the **MPIIF** cell in the Module Configuration Definition Window to display the MPUIF detail definitions window.



Registers are displayed for the interface with the main CPU.



The items shown in the **MPUIF** detail definitions window are as follows. For editable items, the settings can be changed. Always save the settings to the flash memory after changing them.

- For High-speed Scanning

The start addresses and sizes of the I/O registers dedicated to high-speed scanning are indicated here.

Item	Meaning upon Self-configuration	Setting Made
INPUT	Start address of the input registers	Fixed as IW8800
WORD	Size of the input registers	64 words
OUTPUT	Start address of the output registers	Fixed as OW8800
WORD	Size of the output registers	64 words
SCAN	Selection of high-speed scan or low-speed scan	Fixed as HIGH

- For Low-speed Scanning

The start addresses and sizes of the I/O registers dedicated to low-speed scanning are indicated here.

When using the low-speed scan registers, set the I/O start register number and I/O end register number in the module configuration as the range of I/O registers.

(4) SVR Detail Definitions

SVR modules do not automatically generate definitions as a result of self-configuration.

(5) M-EXECUTER Detail Definitions

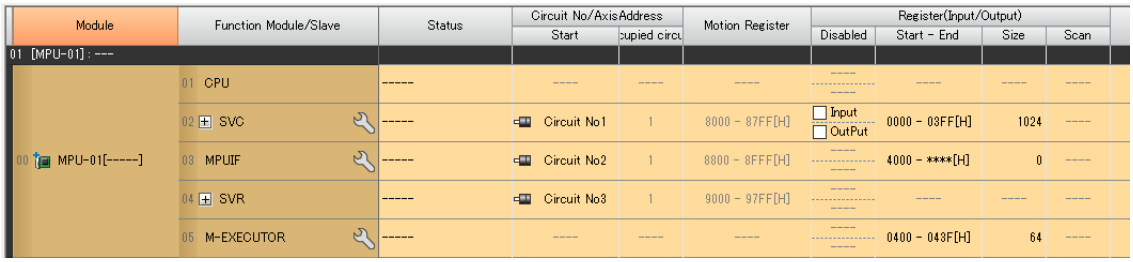
M-EXECUTER modules do not automatically generate definitions as a result of self-configuration.

4.5 Function Modules of MPU-01

The MPU-01 Module comprises the following five function modules.

- CPU: CPU module
- SVC: MECHATROLINK-III servo control function
- MPUIF: Interface with the main CPU
- SVR: Virtual axis function
- M-EXECUTER: Motion program executer

As shown in the figure below, these function modules are allocated as subslots in the module configuration definitions.



- The default value for subslots No. 4 and No. 5 is “UNDEFINED”.
- For details on how to display the Module Configuration Definition Window, refer to *5.2.2 (4) Checking the MPUIF Detail Definitions in the Module Configuration Definitions*.

Each of the function modules is explained in the following pages.

4.5.1 CPU Function Module

(1) CPU Synchronization Function

The MPU-01 Module has a hardware-based function for synchronizing it with the CPU module. Due to this function, the high-speed scan of the main CPU and the scan of the MPU-01 are executed in synchronization.

Explained below are the conditions for synchronization with the main CPU module, along with other information.

- Conditions for Synchronization

The following condition has to be met in order to synchronize the MPU-01 Module with the main CPU.

<Condition>: The main CPU's high-speed scan time must be the same as the high-speed scan time of the MPU-01 Module, or an integral multiple of it.

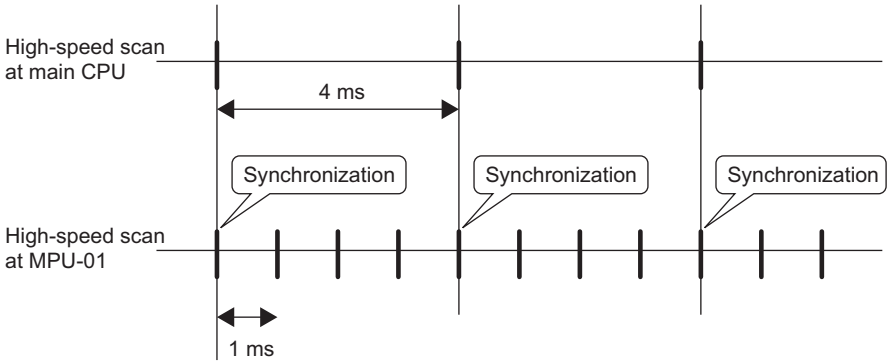
If the condition above is not met, the high-speed scans are executed asynchronously.

Whether the current execution status is synchronous or asynchronous is reported at CPU status (SW00040) in the system registers.

- For details on SW00040, refer to *6.3.1 System Status*.

- Timing chart

When synchronized, the high-speed scans of the main CPU and the MPU-01 Module start at the same time and no discrepancy exists, as shown in the following figure.



- Conditions for Switching to the Asynchronous Condition

When one of the following operations is performed during execution in the synchronous status, operation switches to the asynchronous status, and the power has to be turned OFF and back ON to return to the synchronous status. Perform these operations while the CPU is in the STOP status or while no motion command is being executed.

<At the Main CPU>

Changing the high-speed scan settings

<At the MPU-01>

- Changing the high-speed scan settings
- Saving the SVC transmission definition
- Execution of self-configuration
- Execution of motion setting parameter "OW□□00 Bit C: Network reset"

Be aware that when any of the aforementioned operations is performed at the MPU-01, MECHATROLINK communications stop and the following problems result.

- MECHATROLINK communications are reset.
- Position information is lost as a result of resetting MECHATROLINK communications.
- Zero return completion information is lost as a result of resetting MECHATROLINK communications.
- The soft limit function is not effective as a result of the information for the zero return completion was lost.

(2) Synchronization Among Modules

As shown for the CPU synchronization function, if the conditions for synchronization between the main CPU and an MPU-01 Module are met, then synchronous operation with the main CPU is possible. Accordingly, even when multiple MPU-01 Modules are used, the processing of these modules is synchronized if each of these modules meets the required conditions.

The conditions for synchronization among MPU-01 Modules are explained below.

- Conditions for Synchronization

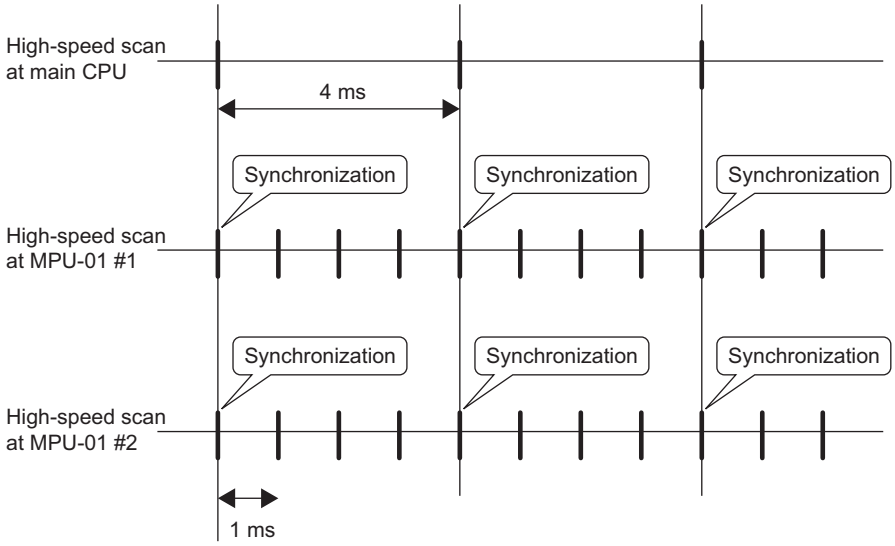
To synchronize operation among multiple MPU-01 Modules, the following conditions must be met.

<Condition 1>: The main CPU's high-speed scan time must be the same as the high-speed scan time of the MPU-01 Modules, or an integral multiple of it.

<Condition 2>: The high-speed scan time settings of each of the MPU-01 Modules are all the same value or integral multiples of one another.

- Timing chart

When synchronized, the high-speed scans of the main CPU and the multiple MPU-01 Modules start at the same time and no discrepancy exists, as shown in the following figure.



(3) Relationship with the Operating Status of the Main CPU

- CPU RUN/CPU STOP

The relationship with CPU RUN/CPU STOP is shown below.

CPU RUN/STOP Setting		CPU RUN/STOP Status	
Main CPU	MPU-01	Main CPU	MPU-01
RUN	RUN	RUN	RUN
STOP	RUN	STOP	STOP*1
RUN	STOP	RUN*2	STOP
STOP	STOP	STOP	STOP

* 1. The MPU-01 Module status is linked to the STOP status of the main CPU.
* 2. The main CPU status is not linked to the STOP status of the MPU-01.

- WDT Error

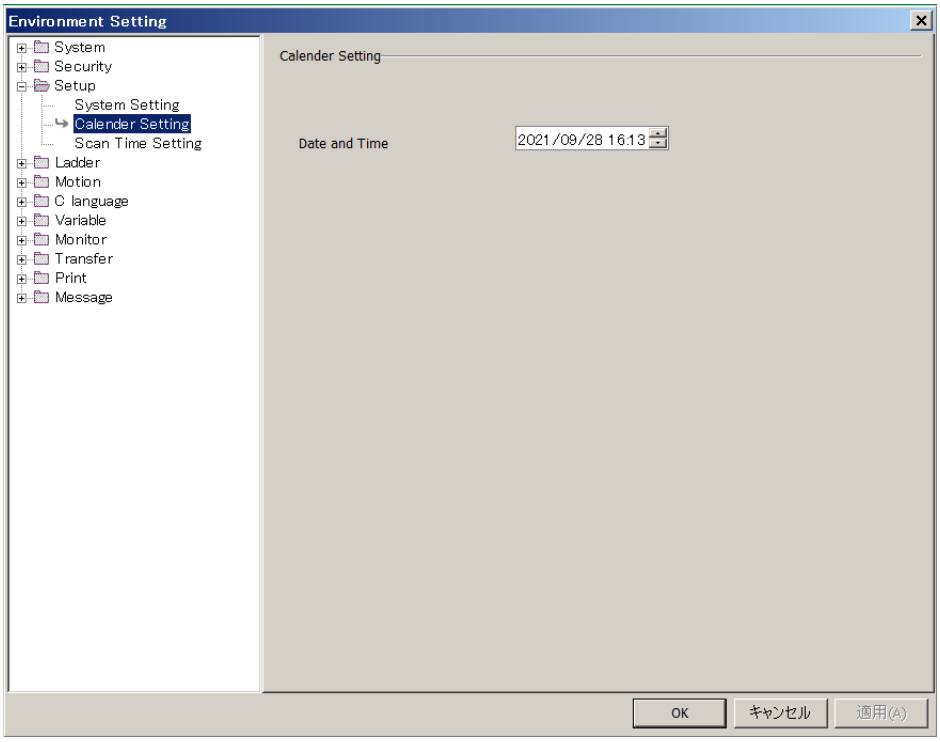
If a WDT Error occurs and the main CPU or the MPU-01 Module crashes, a WDT error will also occur in the other module and its CPU will also crash.

(4) Calendar Settings

When the power is turned ON, the calendar of the MPU-01 Module is set to the same time as the calendar of the main CPU. As a result, the calendar of the MPU-01 Module does not need to be set. If the calendar needs to be reset for any reason, such as a periodic update, use either of the following two methods.

- Using an MPE720

  Select **Calender Setting** in the Environment Setting window, then enter the date and time in the calendar settings.



- Using a Ladder Program

  Using a ladder program in the MPU-01 Module, write the time to the system registers shown below.

Name	Register Number	Remarks
Calendar: Year	SW00015	Year 1999: 0099 (BCD) (Final 2 digits only)
Calendar: Month, day	SW00016	December 31: 1231 (BCD)
Calendar: Hour, minute	SW00017	23rd hour, 59th minute: 2359 (BCD)
Calendar: Seconds	SW00018	59th second: 59 (BCD)
Calendar: Week	SW00019	0 to 6: Sunday, Monday to Saturday

4.5.2 SVC Function Module

For details of the SVC function, the setting methods, the parameters and commands, refer to *Machine Controller MP2000 Series Motion Module SVC-01 User's Manual* (Manual No.: SIEP C880700 41).

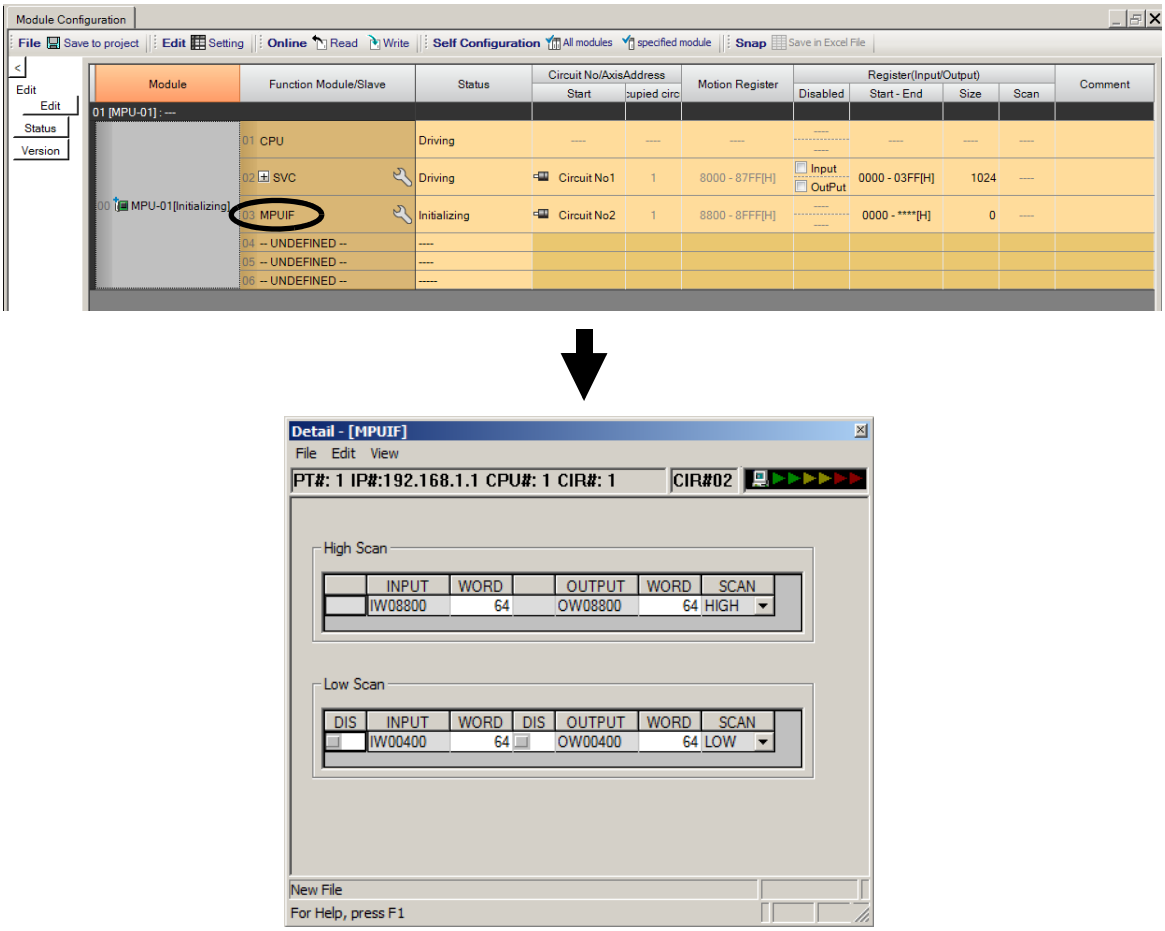
4.5.3 MPUIF Function Module (Interface with the Main CPU)

(1) Overview

(a) Setting the MPUIF Function

The size of the registers used for input/output with the main CPU can be set.

Set the MPUIF function by double-clicking the **MPUIF** cell in the Module Configuration Definition Window, and then making the settings in the **MPUIF** detail definitions window.



<Dedicated to High-speed Scanning>

The MPU-01 Module is allocated from the main CPU as a kind of motion module*.

* Even if the circuit number of the MPUIF is specified in a group definition and axis move commands are executed in the motion program, no motion will take place since the MPUIF has no fixed parameters.

The motion parameter area indicated in the table below (IW8000 and above/OW8000 and above) is assigned to the I/O registers in accordance with the motion module circuit number (module number) selection.

The default circuit number is “2”.

The register size can be set in the range of 16 to 2048 words for both INPUT and OUTPUT, but it has significant influence on the processing time, so care is required when making this setting.

Circuit Number	Settable I/O Registers	Default Setting		Remarks
		I/O Registers	Size	
1	8000 to 87FF (2048W)	8000 to 803F	64W	The register size must be an integral multiple of 16W (32B).
2	8800 to 8FFF (2048W)	8800 to 883F	64W	As above. Default circuit number.
3	9000 to 97FF (2048W)	9000 to 903F	64W	As above.
4	9800 to 9FFF (2048W)	9800 to 983F	64W	As above.
5	A000 to A7FF (2048W)	A000 to A03F	64W	As above.
6	A800 to AFFF (2048W)	A800 to A83F	64W	As above.
7	B000 to B7FF (2048W)	B000 to B03F	64W	As above.
8	B800 to BFFF (2048W)	B800 to B83F	64W	As above.
9	C000 to C7FF (2048W)	C000 to C03F	64W	As above.
10	C800 to CFFF (2048W)	C800 to C83F	64W	As above.
11	D000 to D7FF (2048W)	D000 to D03F	64W	As above.
12	D800 to DFFF (2048W)	D800 to D83F	64W	As above.
13	E000 to E7FF (2048W)	E000 to E03F	64W	As above.
14	E800 to EFFF (2048W)	E800 to E83F	64W	As above.
15	F000 to F7FF (2048W)	F000 to F03F	64W	As above.
16	F800 to FFFF (2048W)	F800 to F83F	64W	As above.

<Dedicated to Low-speed Scanning>

The I/O registers for low-speed scanning are allocated as normal I/O registers.

The register number is the start I/O register number set in the Module Configuration Definition Window.

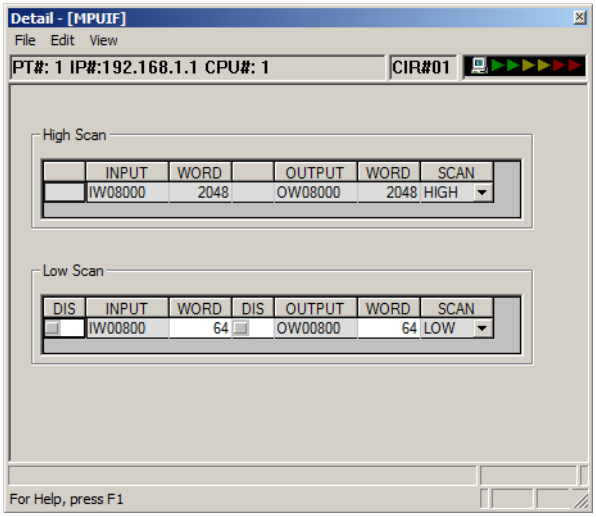
The register size can be set as a multiple of 16 words (32 bytes) in the range of 0 to 1024 words for both INPUT and OUTPUT.

In the **DIS** column, input and output can be disabled by selecting the related check box.

(b) MPUIF at the Main CPU

The main CPU also has an MPUIF, but the register size is fixed at “2048 words”.

The I/O register numbers are assigned in the same way as with the MPU-01 Module.

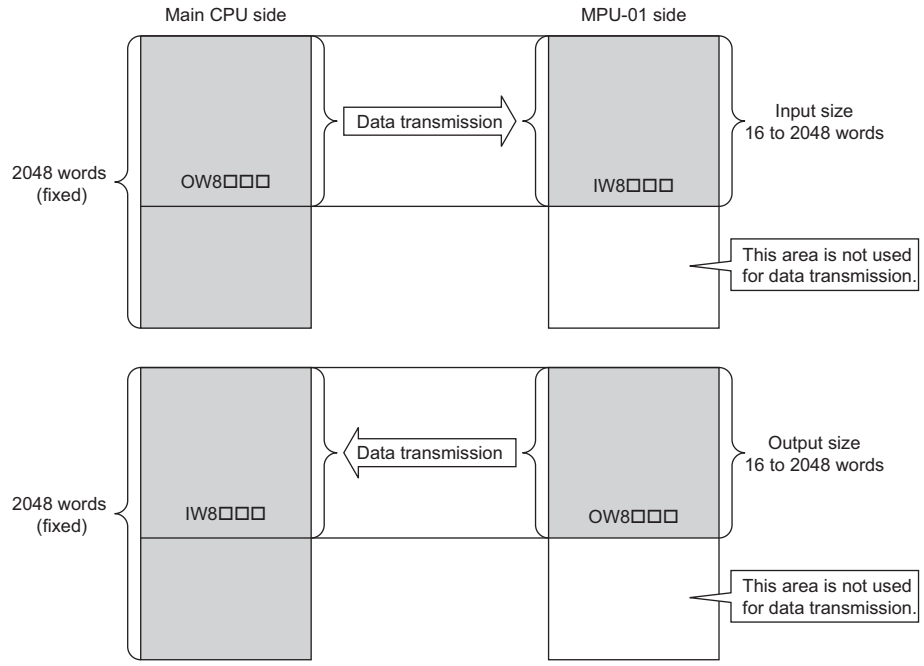


- For the procedure for displaying the Module Configuration Definition Window at the main CPU, refer to *5.2.2 (4) Checking the MPUIF Detail Definitions in the Module Configuration Definitions*.

(2) I/O Service of the MPUIF

(a) For High-speed Scanning

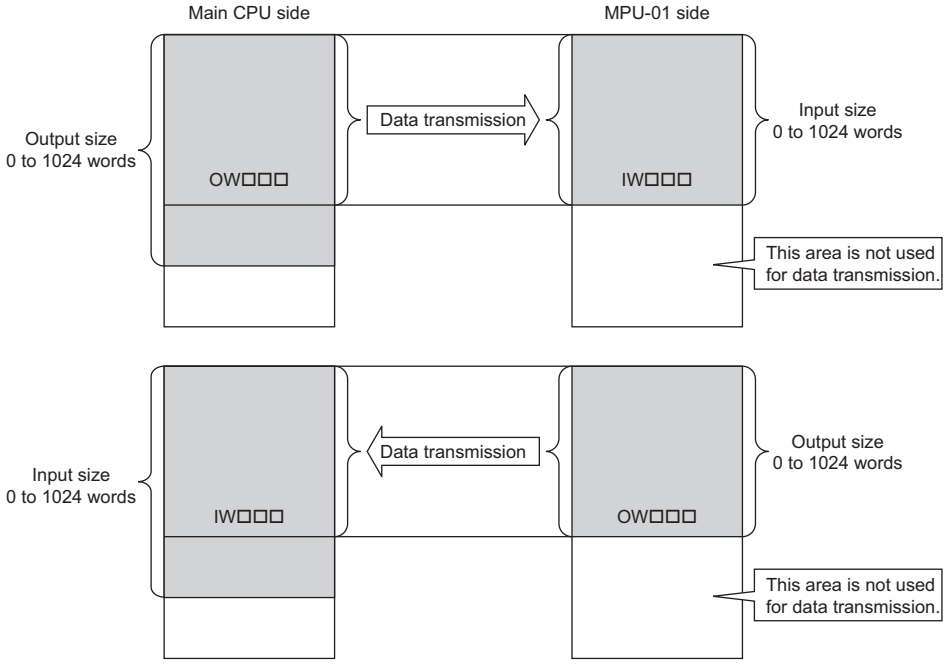
The registers allocated to the high-speed scan cycle are used for data transmission in the high-speed scan cycle of the MPU-01 Module. The data transmission size is the I/O size of the MPU-01 Module.



(b) For Low-speed Scanning

The registers allocated to the low-speed scan cycle are used for data transmission in the low-speed scan cycle of the MPU-01 Module. The data transmission size is the I/O size of the main CPU or the I/O size of the MPU-01 Module, whichever is the lower.

Normally, the same setting is made for the I/O sizes of the main CPU and the MPU-01 Module.

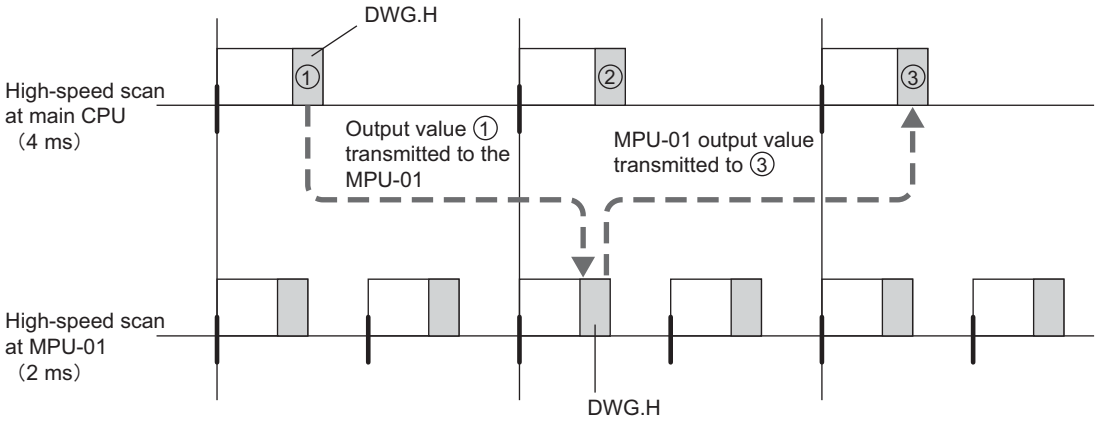


(3) Data Transmission Timing

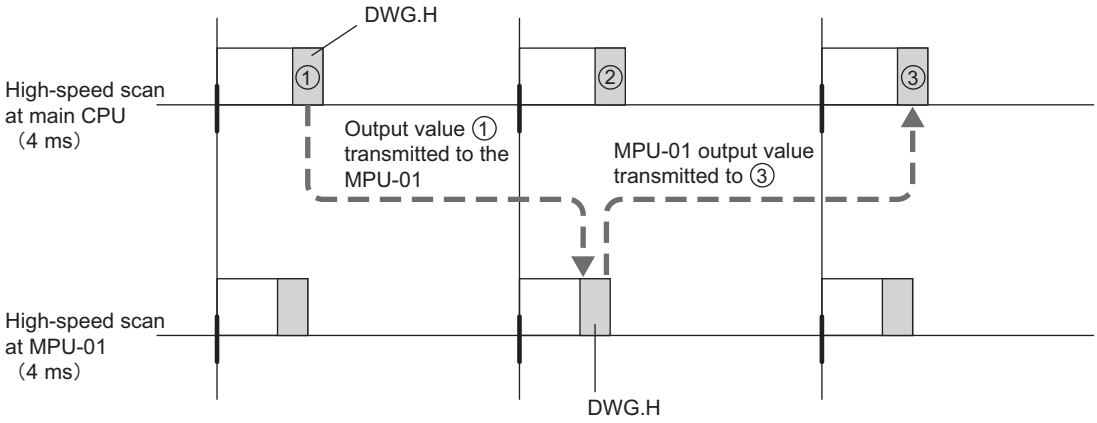
(a) For High-speed Scanning

The data transmission timing for the registers allocated for high-speed scan is shown below.

- When the High-speed Scan Time at the Main CPU is Longer than the High-speed Scan Time at the MPU-01 Module



- When the High-speed Scan Time at the Main CPU is the Same as the High-speed Scan Time at the MPU-01



(b) For Low-speed Scanning

Because the individual scans in data transmission of the registers allocated for low-speed scan are processed asynchronously, the timing in which the data is transmitted is not constant as is the case for high-speed scanning.

However, during low-speed scan data transmission of the main CPU, it does not happen that the low-speed scan of the MPU-01 Module reads the data being transmitted part way through, and during low-speed scan data transmission of the MPU-01 Module, it does not happen that the low-speed scan of the main CPU reads the data being transmitted part way through. Since the two transmissions are controlled in a mutually exclusive manner, the simultaneity of the data is guaranteed.

(4) Guide to Scan Overhead

A guide to the high-speed scan overhead in relation to the I/O size of the MPUIF is explained here.

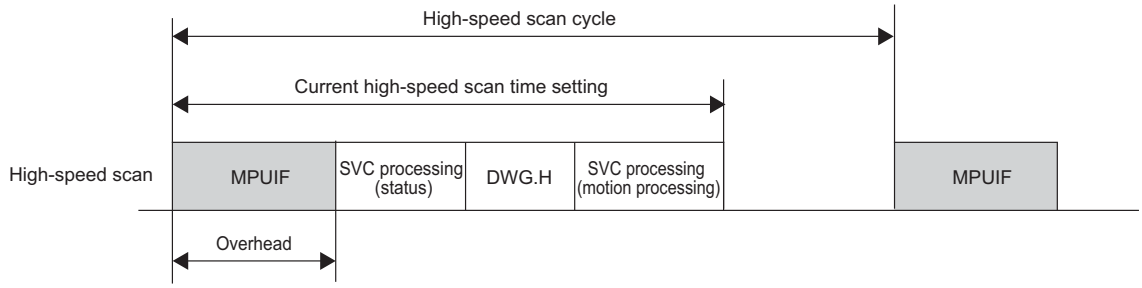
If the scan setting times for the MPU-01 Module and the main CPU are shorter than the overhead time, a Scan Time Over Counter error may occur and the high-speed scan over counter SW00044 may reach its maximum value.

Secure the required scan time in accordance with the I/O size.

- Guide to the High-speed Scan Overhead

I/O Size	512 Words	1024 Words	2048 Words
Overhead	0.1 ms	0.2 ms	0.4 ms

- Outline of High-speed Scan Processing



4.5.4 SVR (Virtual Axis) Function

For details on the SVR function and setting methods, refer to the section “SVR” in *Machine Controller MP2000 Series Motion Module Built-in SVB/SVB-01 User’s Manual* (Manual No.: SIEP C880700 33).

4.5.5 M-EXECUTER (Motion Program Executer) Function

For details on the M-EXECUTER function, refer to the section “M-EXECUTER Module” in *Machine Controller MP2300S Basic Module User’s Manual* (Manual No.: SIEP C880732 00).

5

System Startup and Sample Program

This chapter explains the procedure for starting up the system by using a model system.

5.1 Procedure for Starting up the System

This section explains the procedure for actually starting up a system in which the MPU-01 Module is used, by referring to a sample program.

Note that the procedures for initialization of a SERVOPACK and those relating to mechanical design are not covered.

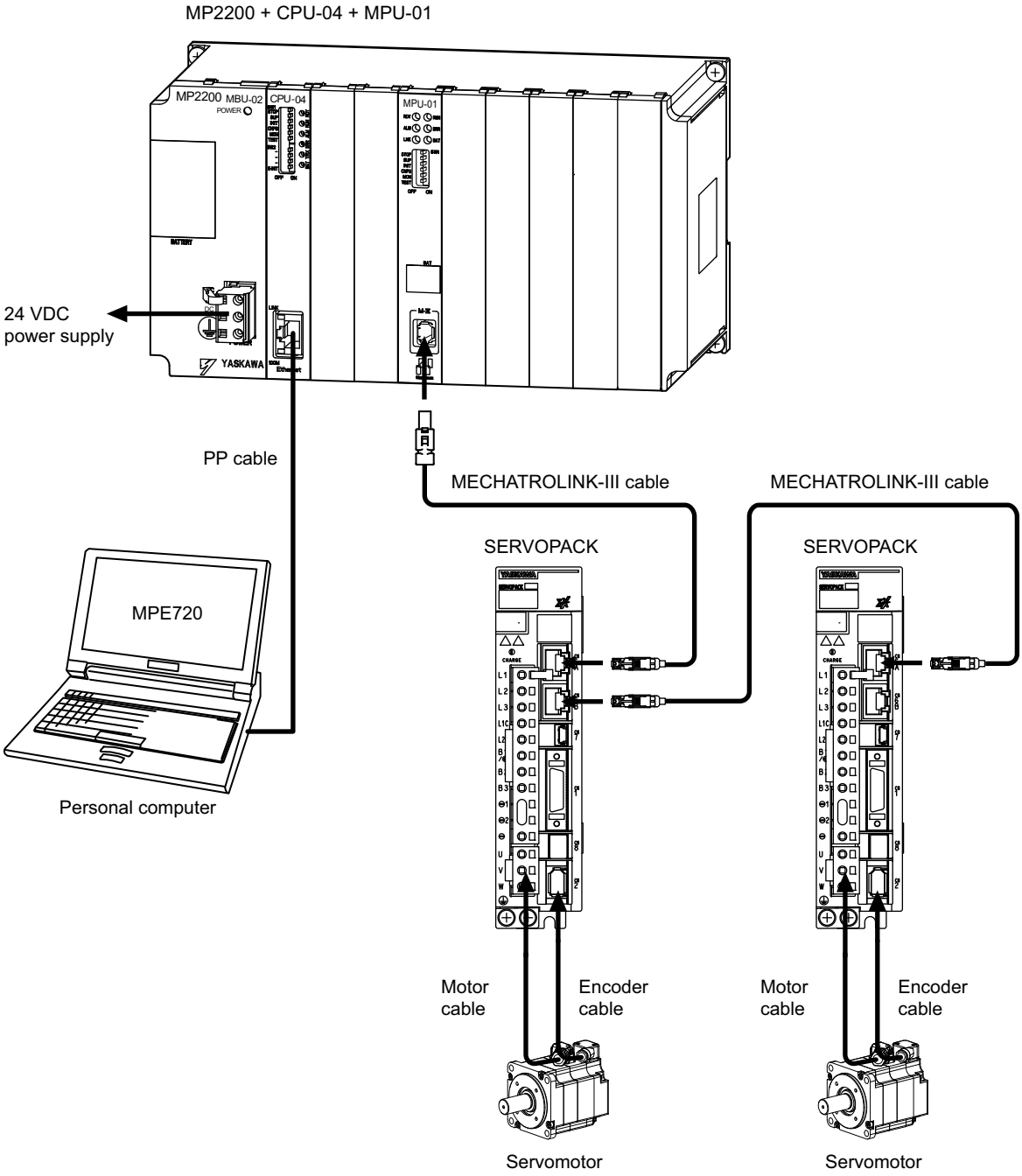
5.1.1 System Startup Flowchart

The procedure for starting up the system is outlined below.

1	Preparation of devices to be used Prepare the devices that are required for system startup.	→	Refer to *5.1.2 System Configuration Model and Necessary Devices*.
⇩			
2	Module mounting Mount the MPU-01 Module in the MP2200.	→	Refer to *2.1.1 Mounting an MPU-01 Module*.
⇩			
3	Connections and wiring Connect the personal computer for programming, and wire up the servomotors and SERVOPACKs.	→	Refer to *5.1.2 System Configuration Model and Necessary Devices*.
⇩			
4	Setting and saving the Communication Platform Make the settings for connecting the personal computer to the CPU-04 and MPU-01 Modules, and save these settings.	→	Refer to *5.1.3 Setting and Saving Communication Platform*.
⇩			
5	Self-configuration Execute self-configuration to check the connected devices.	→	Refer to *5.1.4 Self-configuration*.
⇩			
6	Program creation Start MPE720 Ver.7.□□ and create the program for use at the CPU-04 and MPU-01 Modules.	→	Refer to *5.2 Creating Programs*.
⇩			
7	Operation check Run the program and check the test operation.	→	Refer to *5.3 Checking Program Operation*.

5.1.2 System Configuration Model and Necessary Devices

This section explains system startup by using the configuration model shown below. Prepare each of the devices indicated in (1) to (4) below and connect them as shown in the figure below.



(1) Controller and Related Items

Product Name		Model	Number
MP2200	Base unit (for AC power supply) Or Base unit (for DC power supply)	JEPMC-BU2200 JEPMC-BU2210	1
	CPU-04 module	JAPMC-CP2230-E	1
	MPU-01 Module	JAPMC-CP2700-E	1
MECHATROLINK cable (3 m)		JZSP-CM3RMM0-03-E	1
		JZSP-CM3RRM0-03-E	1

(2) Personal Computer and Related Items

Product Name	Model	Number
MPE720	CPMC-MPE780 (Ver. 7.10 or later)	1
PP cable (for Ethernet connection)	Cross cable available on the market	1
Personal computer body	Product available on the market	1

(3) Servodrive-related Items

Product Name	Model	Number
∑-X SERVOPACK	SGDXS-R70A40A	2
∑-X Servomotor	SGMXJ-01AUA21	2
Motor cable (3 m)	JZSP-CSM01-03-E	2
Encoder cable (3 m)	JZSP-CSP01-03-E	2

- After connecting the SERVOPACK, initialize it by referring to the SERVOPACK manual.

(4) Other Necessary Items

Name	Specification	Number
24 VDC power supply*	Current capacity of 2 A or greater	1

* This is not necessary when the base unit for an AC power supply (JEPMC-BU2200) is used.

5.1.3 Setting and Saving Communication Platform

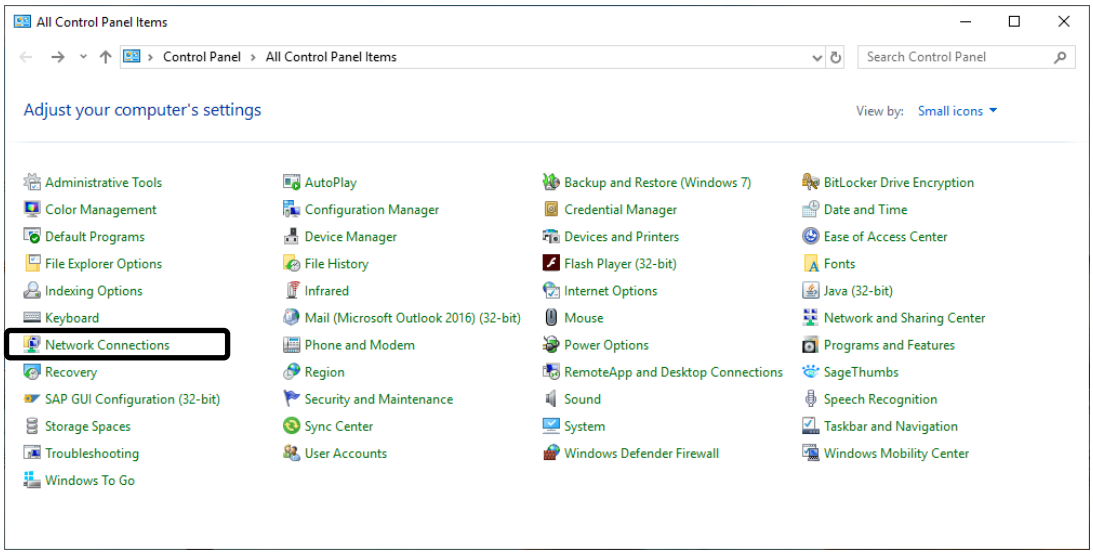
Use the following procedure to make the settings for ETHERNET connections with the Communication Platform software for setting the method of communication between the personal computer (MPE720) and the MP2200.

(1) Setting the IP Address

Prior to making the settings for ETHERNET connection, the IP address of the personal computer must be set in advance. Use the following method to set the IP address.

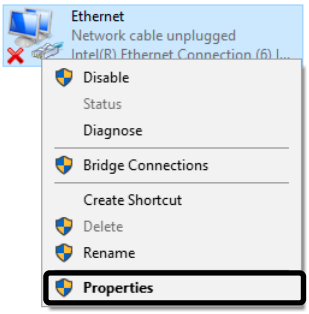
Note: Make the following settings with the LAN cable connected.

1. Open Control Panel from the Windows Start Menu.
2. Click [Network Connections].



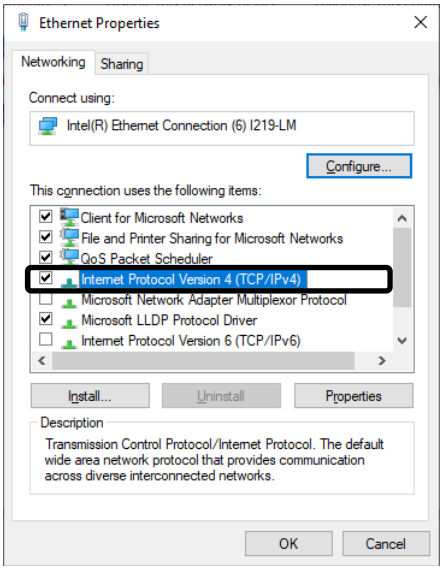
The [Network Connections] window will be displayed.

3. Right-click [Ethernet] and select [Properties].



The [Ethernet Properties] window will be displayed.

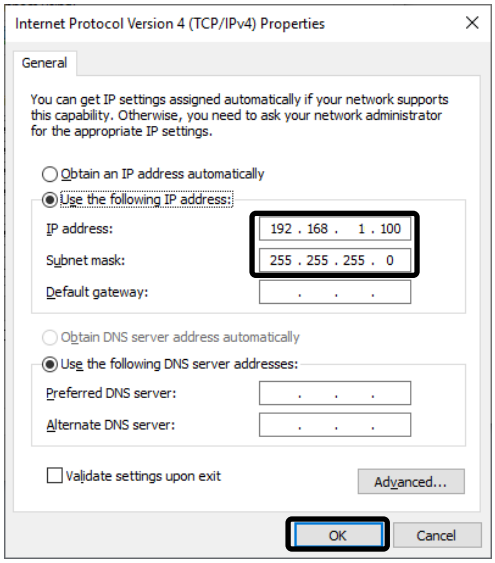
4. Double-click [Internet Protocol Version 4 (TCP/1Pv4)].



The [Internet Protocol Version 4 (TCP/1Pv4) Properties] window will be displayed.

5. In the [Use the following IP address) area, set the following items, and then click the [OK] button.
   - IP address = 192.168.1.□□□
   - Subnet mask = 255.255.255.0

- Do not use the same IP address as the IP address of the controller or any other device.
- It is not necessary to change or specify the default gateway.

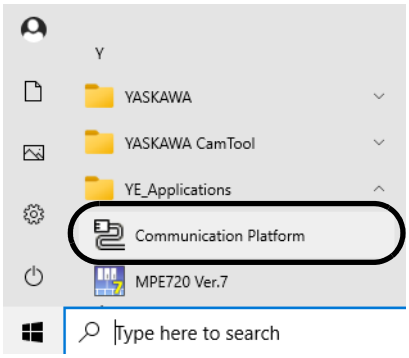


This completes the IP address settings and closes the [Internet Protocol Version 4 (TCP/1Pv4) Properties] window.

(2) Setting and Saving Communication Platform

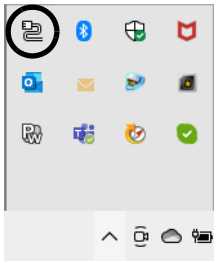
Make the settings for communication to logical ports with the Communication Platform. These settings are not required if the communication settings have already been made.

1. From the Start menu, select [Programs] - [YE_Applications] - [Communication Platform].



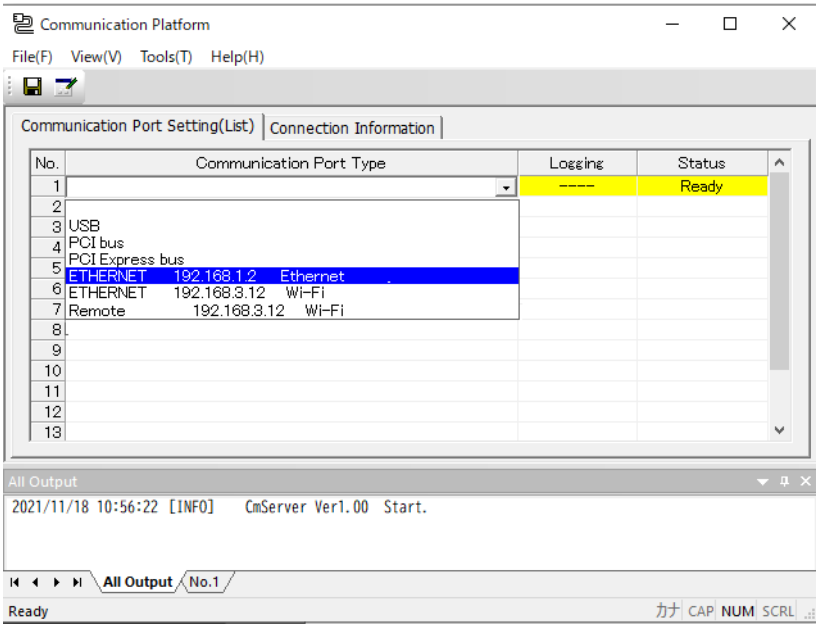
The [Communication Platform] icon appears at the bottom right of the computer screen.

2. Double-click the [Communication Platform] icon.

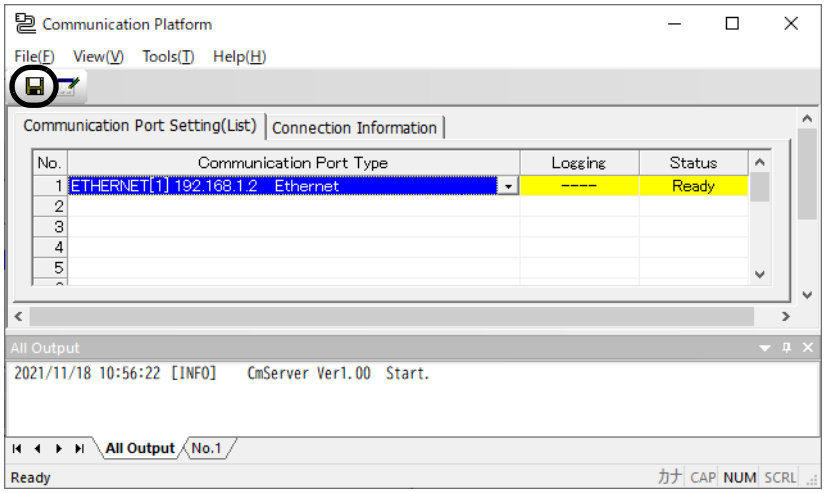


The Communication Platform window appears.

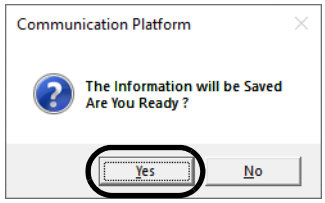
3. Assign [ETHERNET] of the port to which the CPU-04 module is connected to logical port No. 1.



4. Click the [Save] button.



5. When the confirmation message below appears, click the [Yes] button.



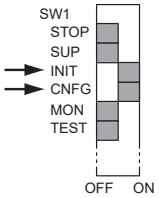
5.1.4 Self-configuration

Execute self-configuration of the CPU-04 and MPU-01 Modules to update the module configuration definition files automatically.

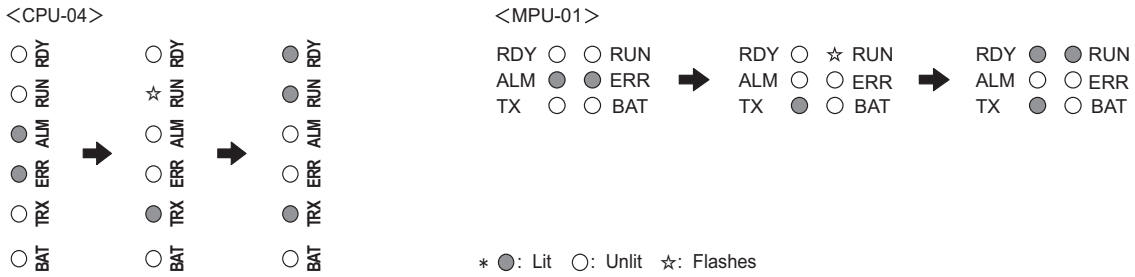
On executing self-configuration of the CPU-04 module, the option modules mounted in the MP2200 are automatically recognized, and the option module information is written to the module configuration definition files. And on executing self-configuration of the MPU-01 Module, the devices connected to the MECHATROLINK connector of the MPU-01 Module are automatically recognized and the MECHATROLINK device information is written to the module configuration definition files.

The procedure for executing self-configuration of the CPU-04 and MPU-01 Modules is explained below.

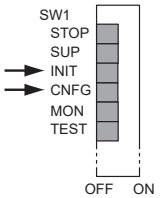
1. Turn the power to the MP2200 OFF.
2. Set the INIT and CNFG switches of DIP switch SW1 on the CPU-04 and MPU-01 Modules to ON.



3. Turn the power to the MP2200 ON and check that the LED indications on the CPU-04 and MPU-01 Modules change as follows.



4. Set the INIT and CNFG switches of DIP switch SW1 on the CPU-04 and MPU-01 Modules to OFF.



This completes the self-configuration of the CPU-04 and MPU-01 Modules, and the option module information is written to the module configuration definition files in the RAM of the CPU-04 module, while the MECHATROLINK device information is written to the module configuration definition files in the RAM of the MPU-01 Module.

- After executing self-configuration, do not turn the power to the MP2200 OFF until the definition data has been saved in the flash memory of the CPU-04/MPU-01 Module. If for some reason the power is turned OFF, execute self-configuration again.
  For details on the method for saving data to flash memory, refer to *5.2.2 (6) Saving the CPU-04 Data in Flash Memory and Transmitting it to the PC* and *5.2.3 (5) Saving the MPU-01 Data in Flash Memory and Transmitting it to the PC*.

■ Turning power OFF and back ON and loss of RAM data

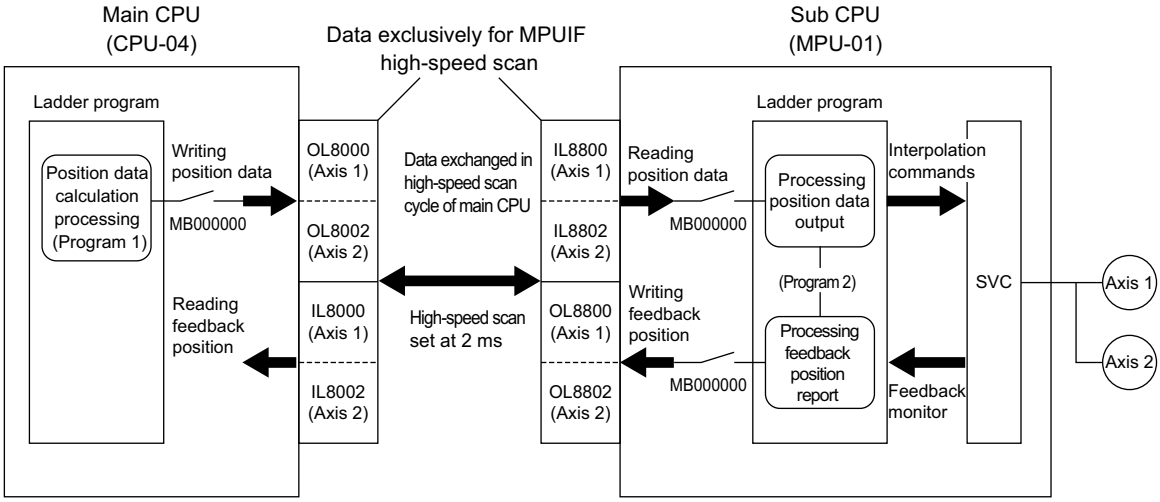
When the power is turned from OFF to ON while the INIT DIP switch of the CPU-04/MPU-01 Module is ON, the RAM data is cleared. When the power is turned from OFF to ON while INIT is OFF, the data in the flash memory is read and the RAM data is overwritten. In either case, the RAM data is lost when the power is turned OFF and back ON.

To protect the RAM data, before turning the power OFF during program creation or editing, always save the data to the CPU-04/MPU-01 Module's flash memory.

5.2 Creating Programs

5.2.1 Outline of Programs

This section explains how to create a program like the sample shown in the following figure.

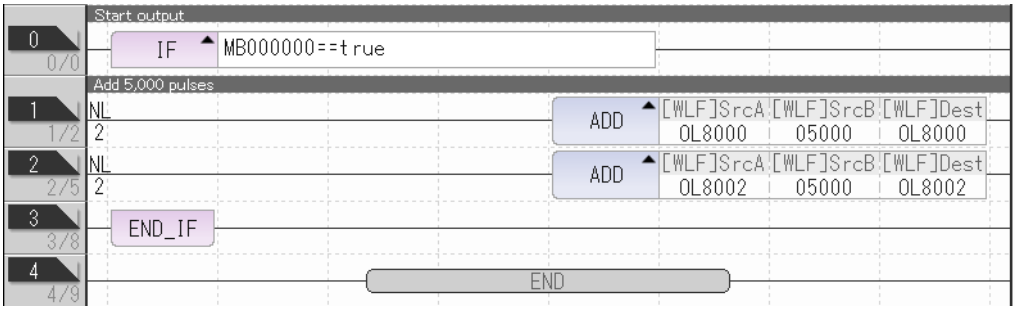


The program to be created outputs 5,000 pulses of position data from the main CPU (CPU-04) in every high-speed scan (2 ms), and controls the two axes connected to the sub CPU (MPU-01) in an interpolation operation.

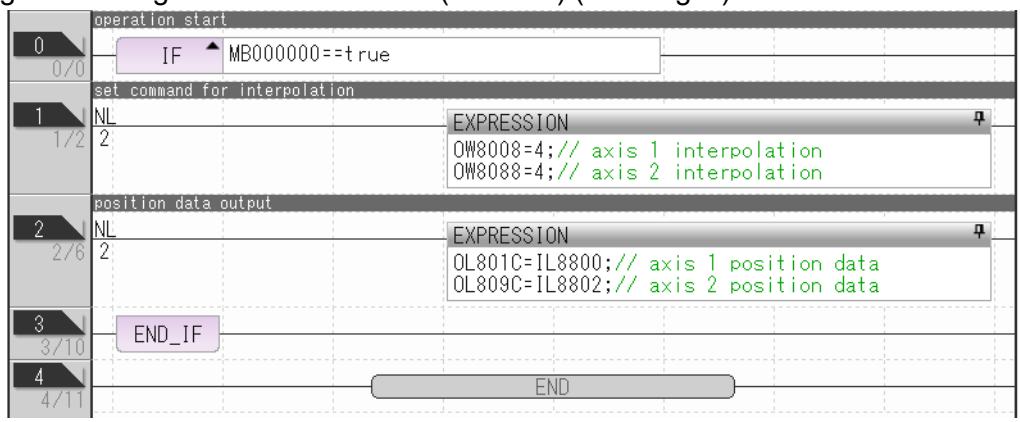
Program 1 and Program 2 are shown here.

In these sample programs, the feedback position that is returned to the main CPU (CPU-04) is not used in control.

- Program 1: Program at the Main CPU (CPU-04) (Drawing H)



- Program 2: Program at the Sub CPU (MPU-01) (Drawing H)



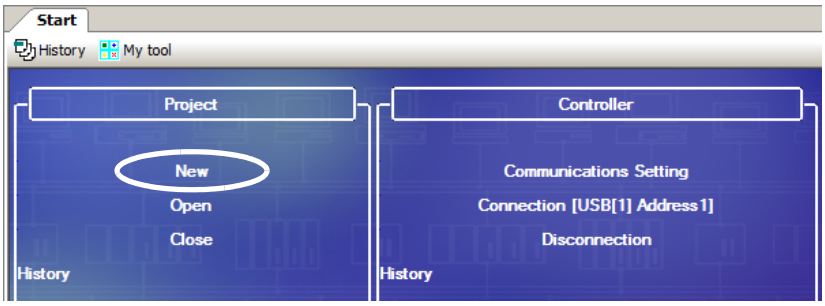
5.2.2 Creating a Project File (CPU-04 Side)

This section explains how to use MPE720 Ver.7 to create a project file as well as how to create and save a program for use with the CPU-04 module.

(1) Creating a New Project File

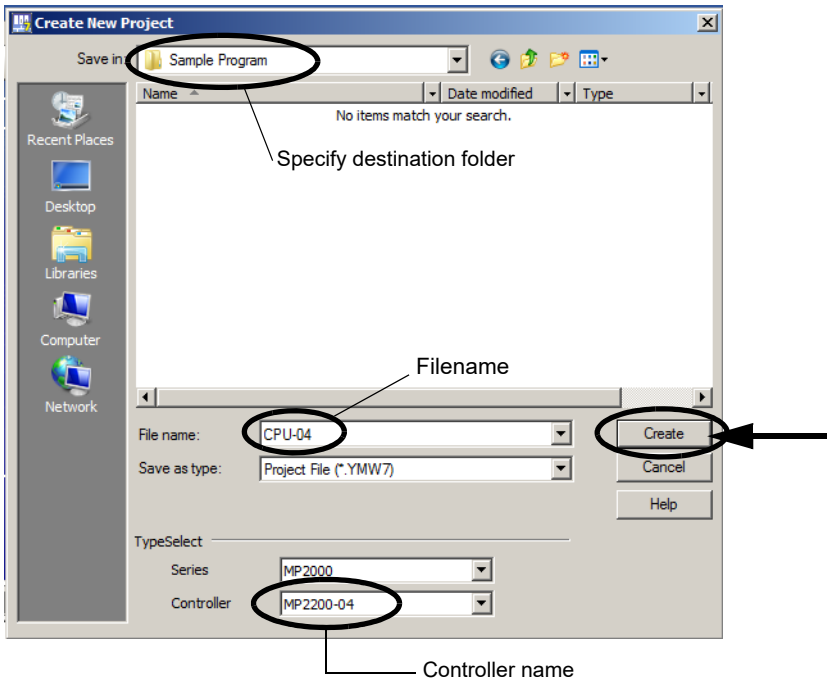
1. Double-click the **MPE720 Ver.7** icon on the personal computer's desktop to start MPE720 Ver.7.

2. Click **New** in the main window.



The **Create New Project** dialog box is displayed.

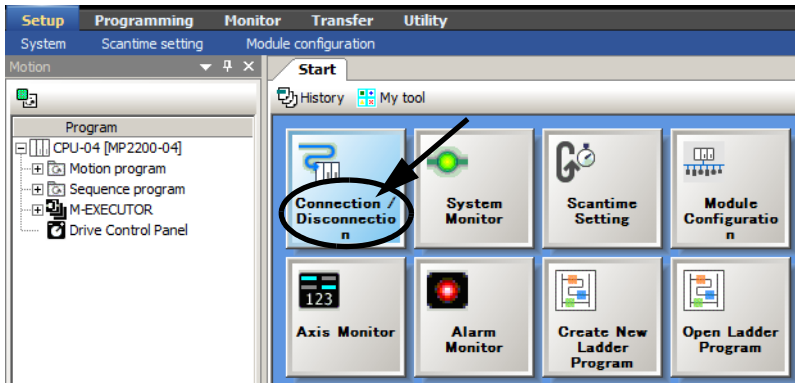
3. Specify the folder in which the project is to be saved, input the filename, select **MP2000** for **Series** and **MP2200-04** for **Controller**, then click the **Create** button.



A new project file is created in the specified folder and the MPE720 Ver.7 window appears again.

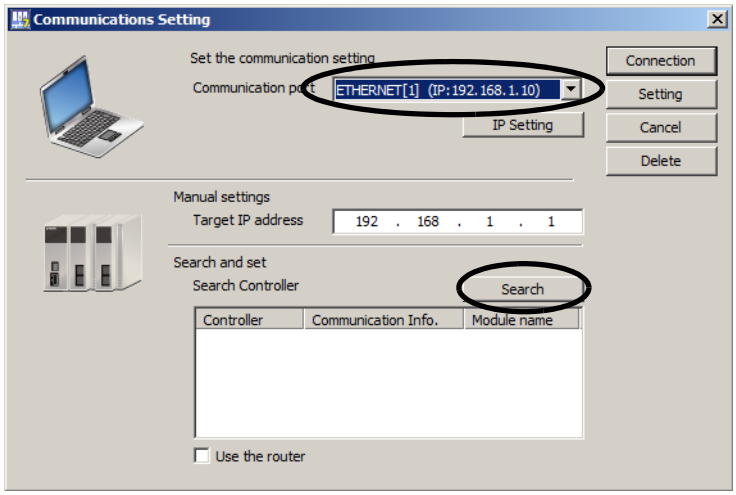
(2) Making the Connection from the Personal Computer to the CPU-04 and Establishing Communication

1. Click **Connection/Disconnection** in the main window.



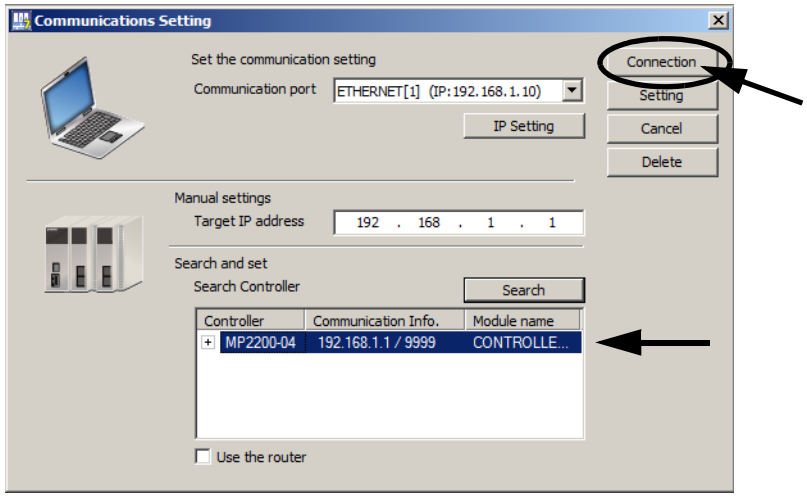
The **Communications Setting** dialog box is displayed.

2. Select **ETHERNET[1]** for **Communication port** and click the **Search** button.

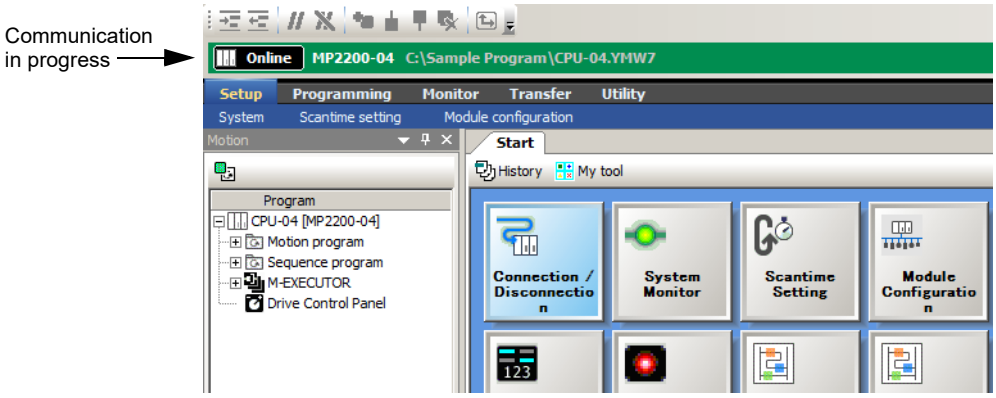


A search is done for controllers in the network, and the results are displayed in the **Search Controller** list.

3. Select **MP2200-04** from the list and click the **Connection** button.

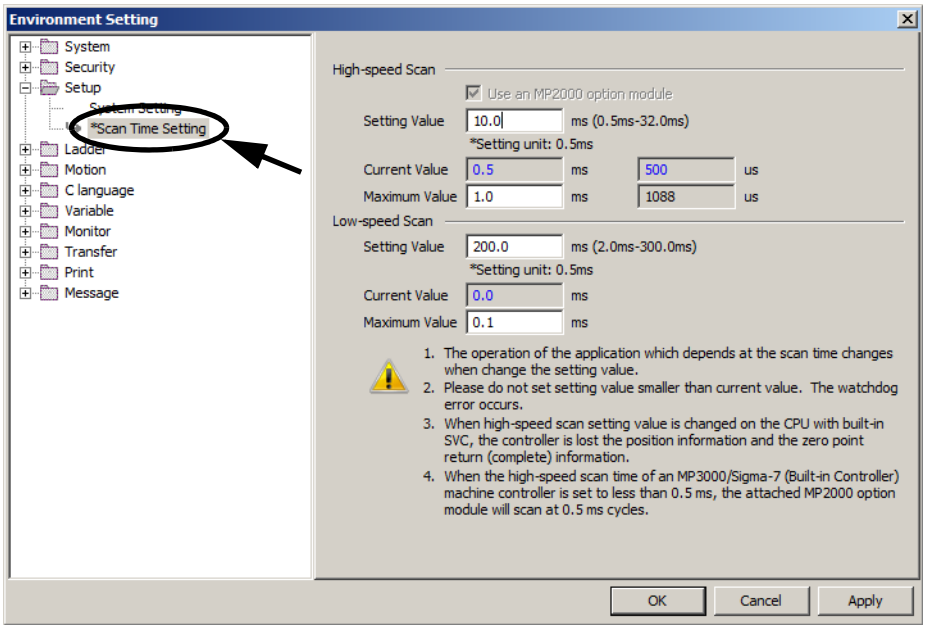


Communication with the CPU-04 module is established and the main window appears again.

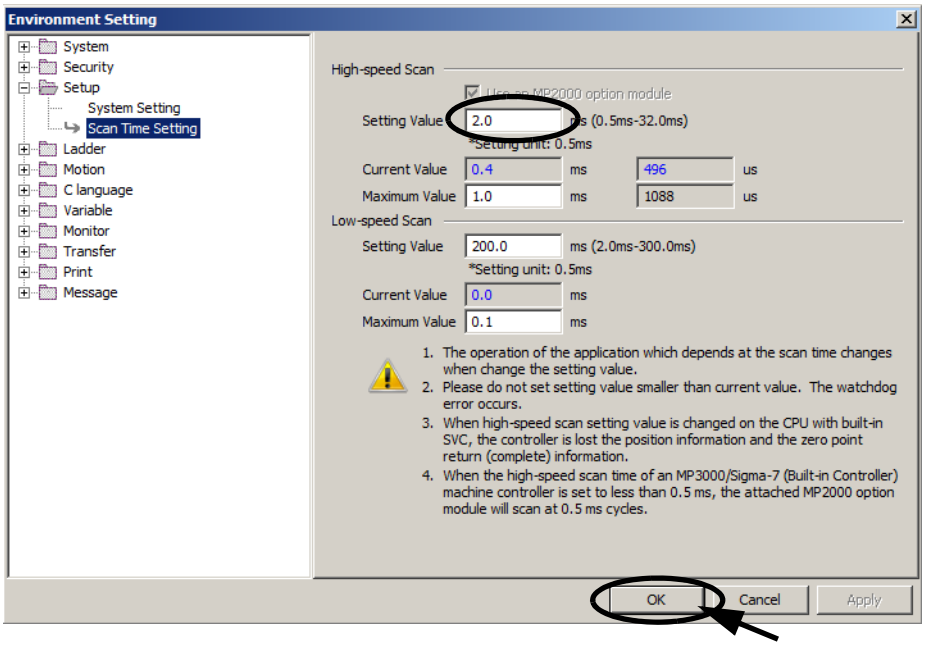


(3) Changing the High-speed Scan Setting

1. Select ***File - Environment Setting*** from the main menu of MPE720 Ver.7.
   The **Environment Setting** dialog box is displayed.
2. Select **Scan Time Setting** in the **Setup** folder.



3. Set the High-speed Scan setting to 2.0 ms and click the **OK** button.

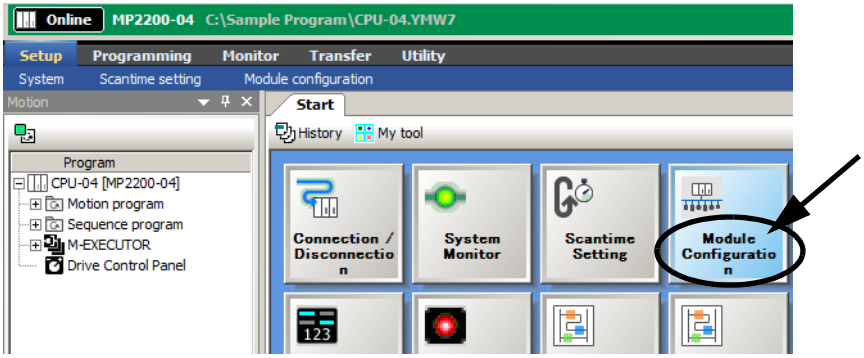


This completes changing of the high-speed scan setting and the main window appears again.

(4) Checking the MPUIF Detail Definitions in the Module Configuration Definitions

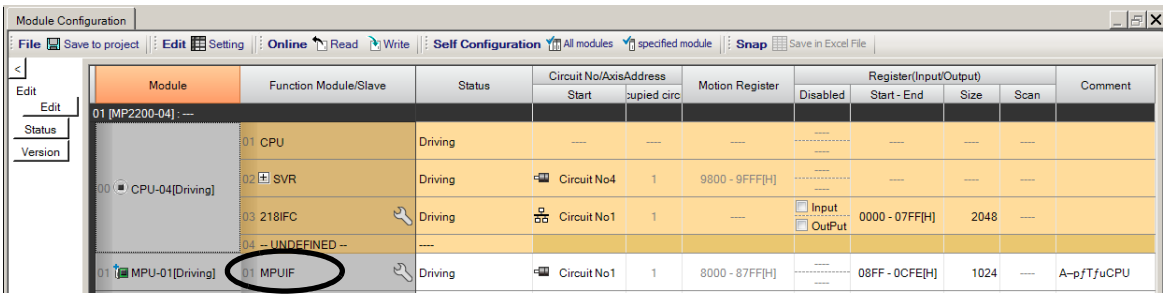
Check the MPUIF detail definitions (start address and I/O size of the registers dedicated to high-speed scanning) in the Module Configuration Definition Window.

1. Click **Module Configuration** in the main window of MPE720 Ver.7.



Module Configuration Definition Window will be displayed.

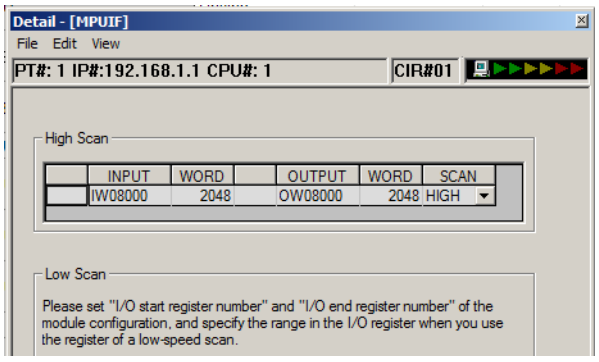
2. Double-click the **MPUIF** cell on the Module Configuration Definition Window.



The **MPUIF** detail definitions window is displayed.

3. Check the start address and I/O size of the **High Scan** registers.

   No data can be input.



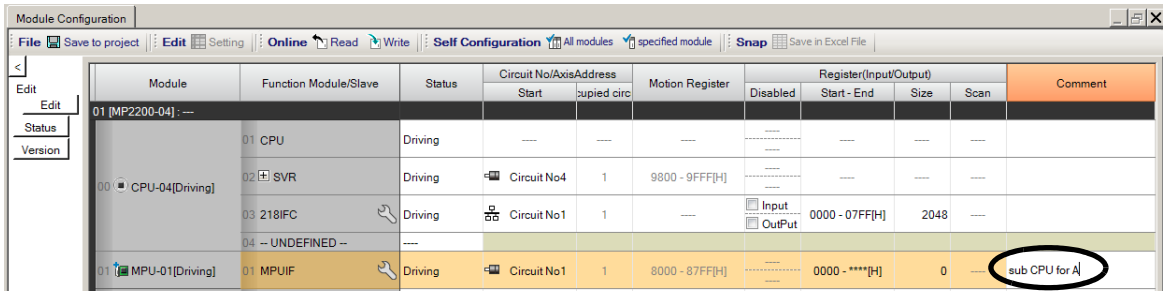
The four words from the start address of the output registers (OUTPUT) checked here are used as the data output to the MPU-01 Module.

■ MPU-01 name setting

If multiple MPU-01 Modules have been installed in the MP2200 base unit, the connection target MPU-01 Module must be specified when connecting to a MPU-01 Module from a personal computer via a CPU-04 module. For this reason, a comment should be set to identify each MPU-01 Module.

Set the comment under the **Comment** column for the MPU-01 on the Module Configuration Definition Window.

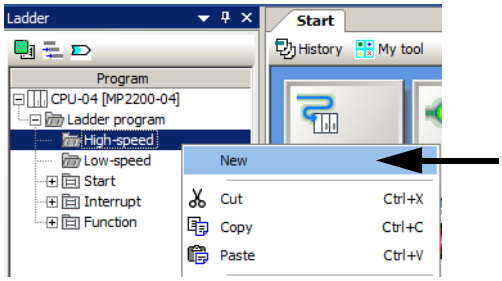
Input comment no longer than 32 one-byte characters.



(5) Creating Ladder Programs

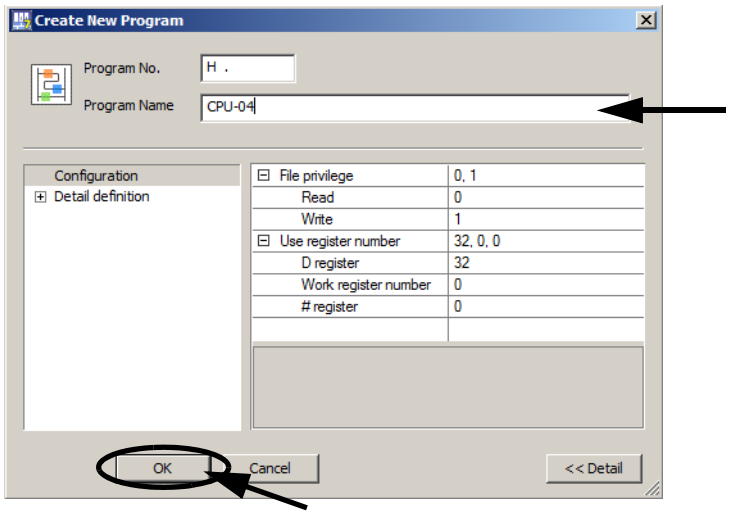
Create the ladder program at the CPU-04 side.

1. Right-click **High-speed** in the MPE720 Ver.7 subwindow, then select **New** from the pop-up menu that is displayed.



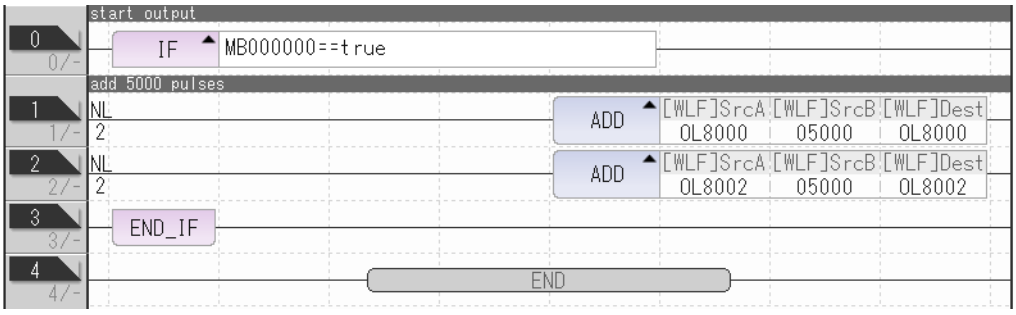
The **Create New Program** dialog box is displayed.

2. Input the **Program Name** and click the **OK** button.



The basic ladder set appears in the main window.

3. Input the ladder program below, then press the **F4** key to compile the program.



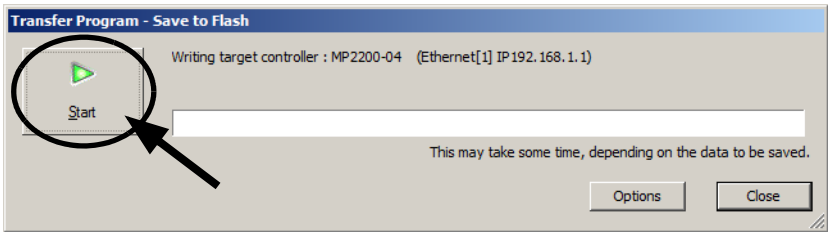
- For details on how to input ladder objects, refer to *System Integrated Engineering Tool MPE720 Version 7 USER'S MANUAL* (Manual No.: SIEP C880761 03).

4. Click ***File - Save Project*** in the main menu of MPE720 Ver.7 to save the program after editing.

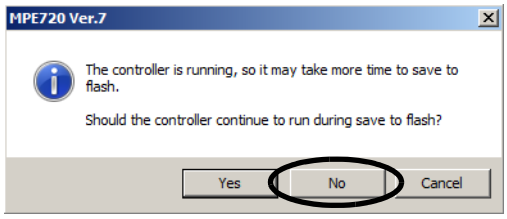
(6) Saving the CPU-04 Data in Flash Memory and Transmitting it to the PC

Save the created program in the flash memory, then transmit it to the personal computer to synchronize the data in the CPU-04 module with that at the personal computer.

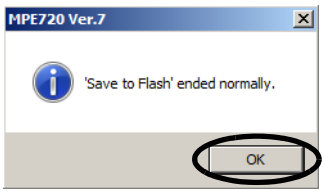
1. In the main window of MPE720 Ver.7, click ***Online - Save to Flash*** in the main menu.
   The **Transfer Program - Save to Flash** dialog box is displayed.
2. Check the information displayed, then click the **Start** button.



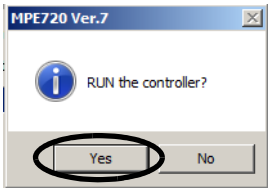
   The CPU STOP confirmation message box is displayed.
3. Click **No** to start saving to flash memory.



   On completion of saving, a confirmation message box is displayed.
4. Click the **OK** button in this box.

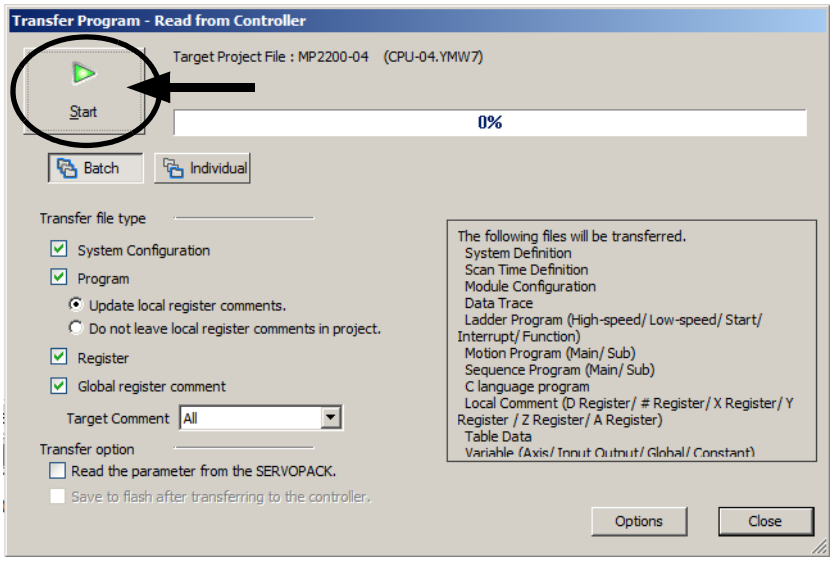


   The CPU RUN confirmation message box is displayed.
5. Click **Yes** in this box.



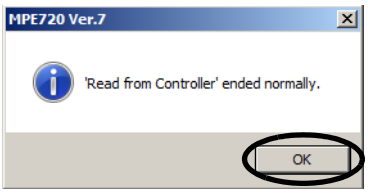
6. In the main window of MPE720 Ver.7, click ***Online - Read from Controller*** in the main menu.
   The **Transfer Program - Read from Controller** dialog box is displayed.

7. Check the information displayed, then click the **Start** button.



The project file in the personal computer is overwritten, and on completion a confirmation message box is displayed.

8. Click the **OK** button to end data transmission from the controller to the personal computer.



9. Click ***File - Save Project*** in the main menu of MPE720 Ver.7 to save the transmitted data.

5.2.3 Creating a Project File (MPU-01 Side)

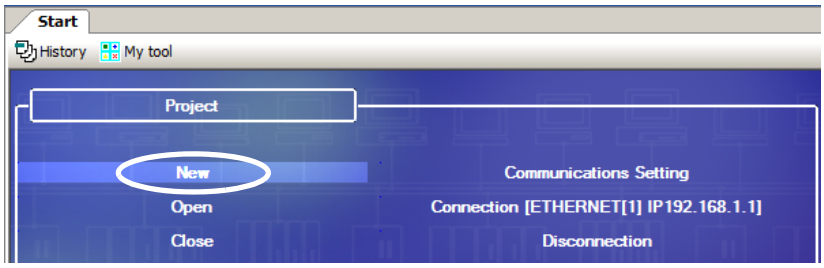
When using an MPU-01 Module, a project file is needed for the MPU-01 in addition to the file for the CPU-04 module.

This section explains how to use MPE720 Ver.7 to create a project file as well as how to create and save a program for use with the MPU-01 Module.

(1) Creating a New Project File

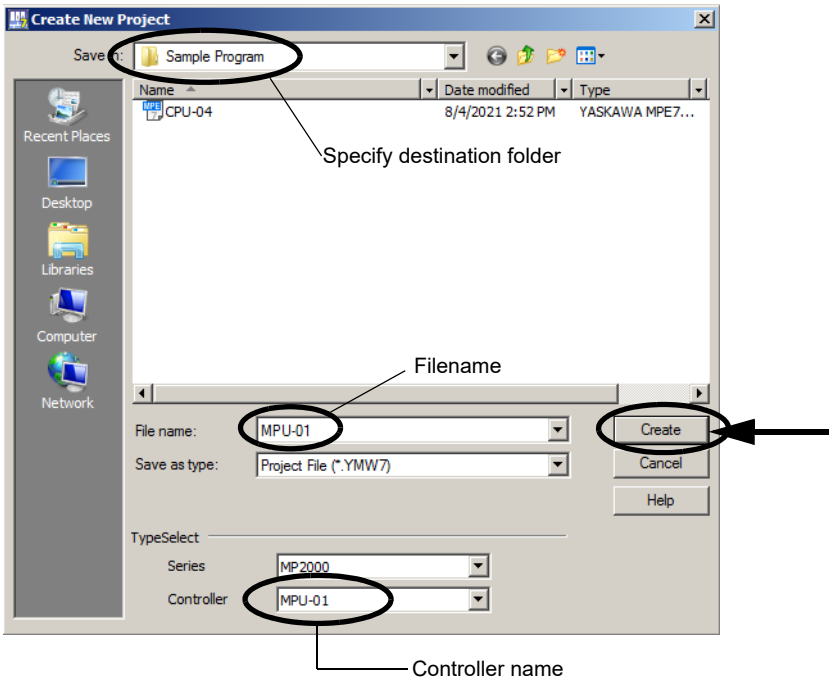
1. Double-click the **MPE720 Ver.7** icon on the personal computer's desktop to start MPE720 Ver.7.

2. Click **New** in the main window.



The **Create New Project** dialog box is displayed.

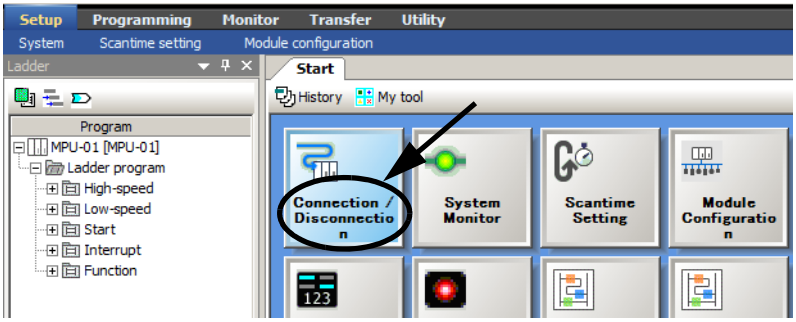
3. Specify the folder in which the project is to be saved, input the filename, select **MP2000** for **Series** and **MPU-01** for **Controller**, then click the **Create** button.



A new project file is created in the specified folder and the MPE720 Ver.7 window appears again.

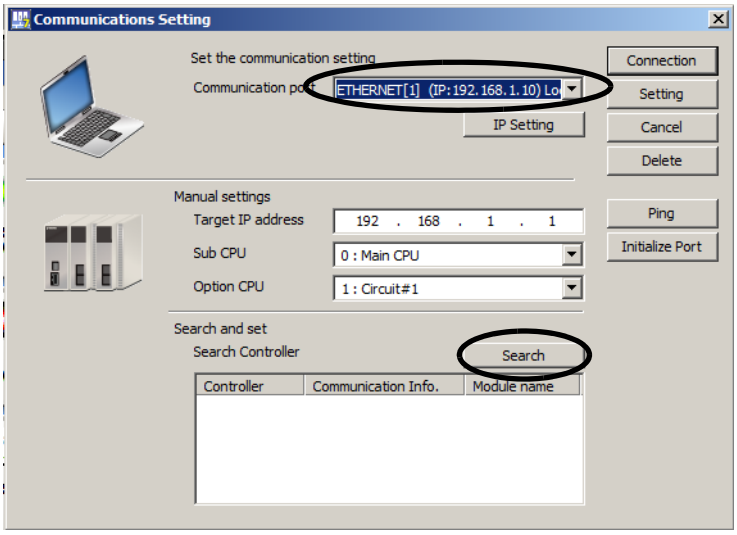
(2) Making the Connection from the Personal Computer to the MPU-01 and Establishing Communication.

1. Click **Connection/Disconnection** in the main window.



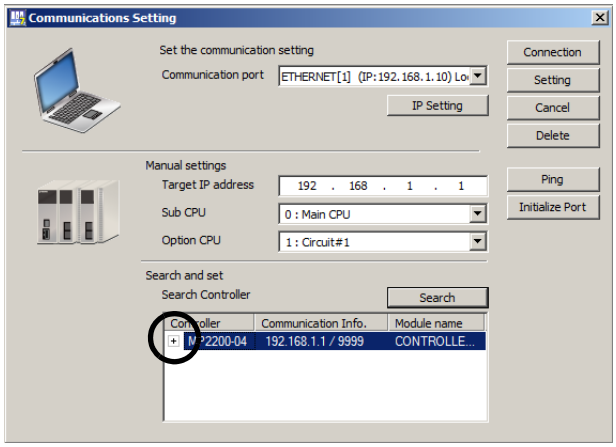
The **Communications Setting** dialog box is displayed.

2. Select **ETHERNET[1]** for **Communication port** and click the **Search** button.

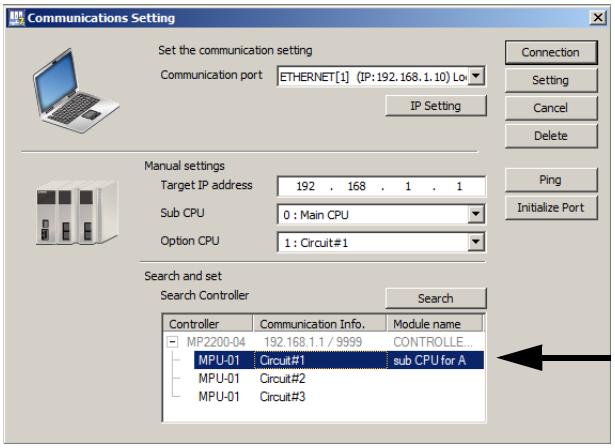


A search is done for all of the controllers in the network, and the results are displayed in the **Search Controller** list.

3. Click the plus symbol (+) associated with the MP2200-04 in the list to change it to a minus symbol (–) and display all of the MPU-01 Modules that are installed in the controller.



4. Select the MPU-01 Module to be connected by clicking it.

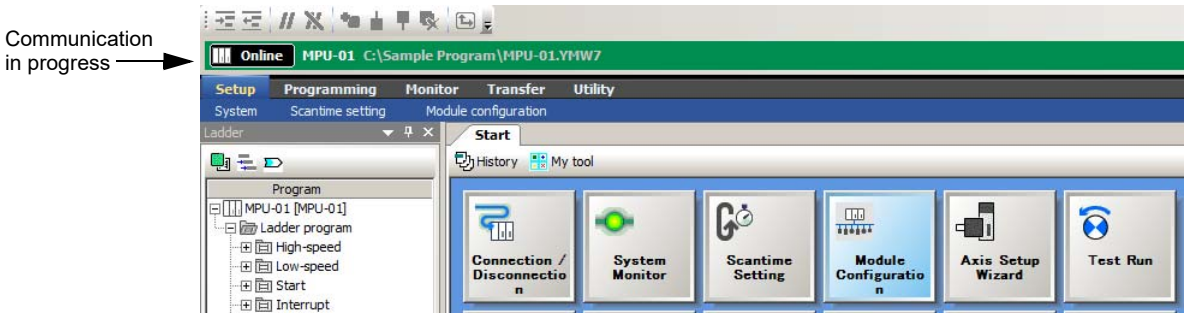


The circuit number of the selected MPU-01 Module is displayed.

- When multiple MPU-01 Modules are installed in the MP2200 base unit, names can be set for the individual modules in order to distinguish them. For details on how to set them, refer to ■ *MPU-01 name setting* in *5.2.2 (4) Checking the MPUIF Detail Definitions in the Module Configuration Definitions*.

5. Check that the circuit number of the MPU-01 Module being connected is displayed and then click the **Connection** button.

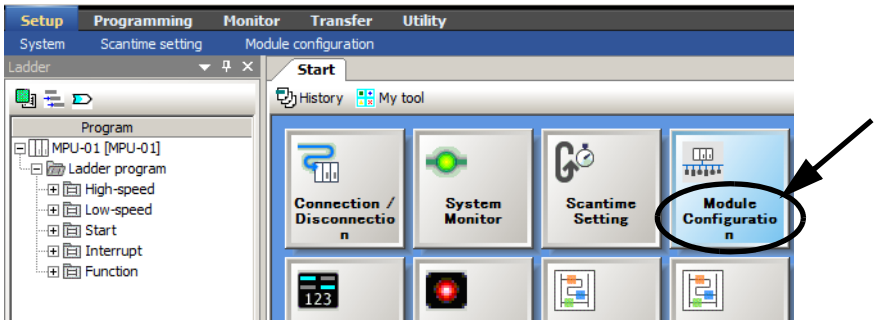
   Communication with the MPU-01 Module is established and the main window appears again.



(3) Checking the MPUIF Detail Definitions in the Module Configuration Definition Window

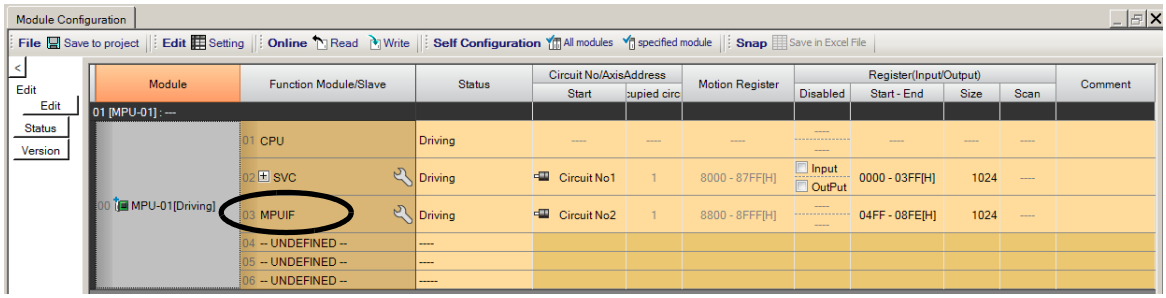
Check the MPUIF detail definitions (start address and I/O size of the registers dedicated to high-speed scanning) in the Module Configuration Definition Window.

1. Click **Module Configuration** in the main window of MPE720 Ver.7.



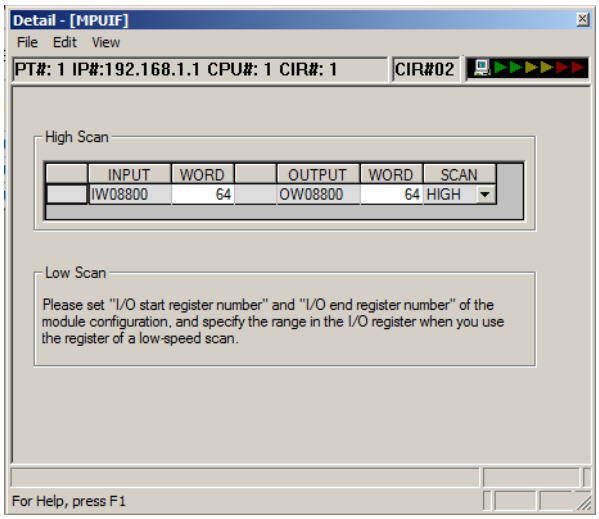
Module Configuration Definition Window is displayed.

2. Double-click the **MPU-IF** cell.



The **MPUIF** detail definitions window is displayed.

3. Check the start address and I/O size of the **High Scan** registers.
   - The I/O size can be changed within the range of 16 to 2048 words.

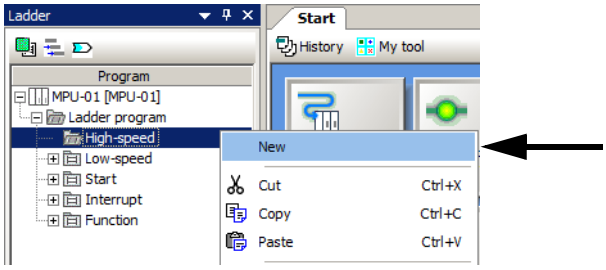


The four words from the start address of the input registers (INPUT) confirmed here are used as the command data from the CPU-04 module. Similarly, the four words from the start address of the output registers (OUTPUT) are used as the feedback position data to the CPU-04 module.

(4) Creating Ladder Programs

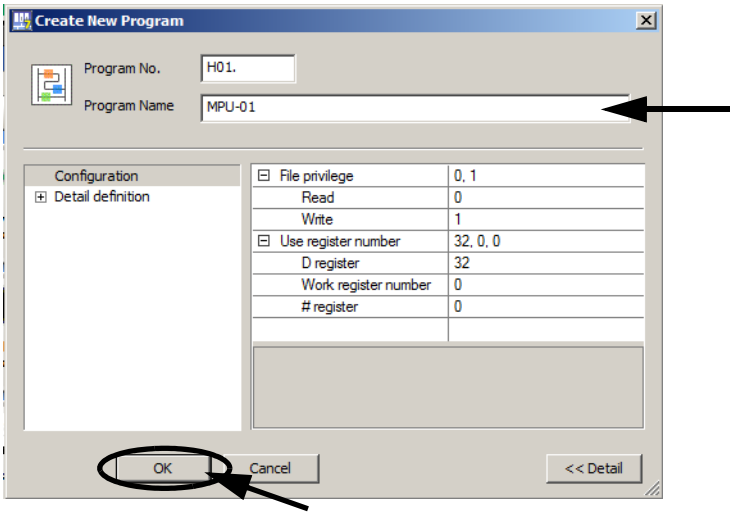
Create the ladder program at the MPU-01 side.

1. Right-click **High-speed** in the MPE720 Ver.7 subwindow, then select **New** from the pop-up menu that is displayed.



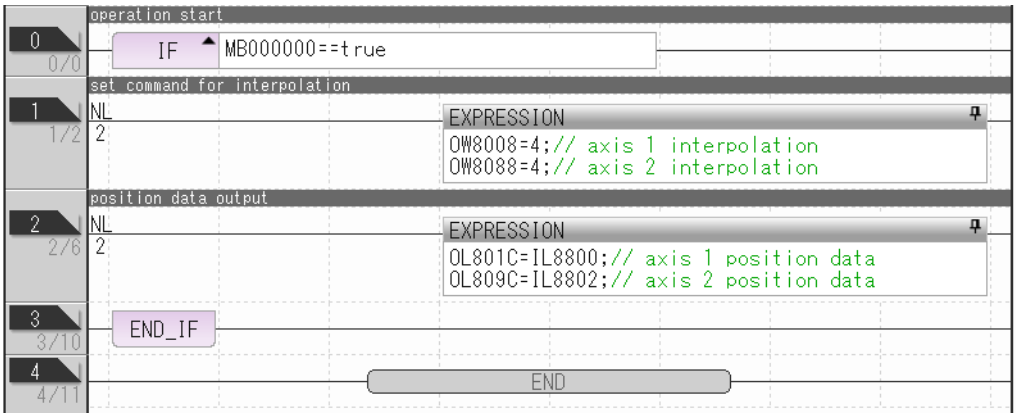
The **Create New Program** dialog box is displayed.

2. Input the **Program Name** and click the **OK** button.



The basic ladder set appears in the main window.

3. Input the ladder program below, then press the **F4** key to compile the program.



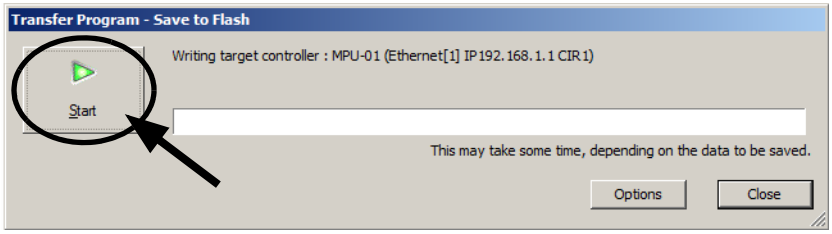
- For details on how to input ladder objects, refer to *System Integrated Engineering Tool MPE720 Version 7 USER'S MANUAL* (Manual No.: SIJP C880761 03).

4. Click ***File - Save Project*** in the main menu of MPE720 Ver.7 to save the program after editing.

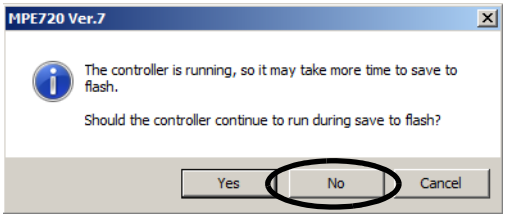
(5) Saving the MPU-01 Data in Flash Memory and Transmitting it to the PC

Save the created program in the flash memory, then transmit it to the personal computer to synchronize the data in the MPU-01 Module with that at the personal computer.

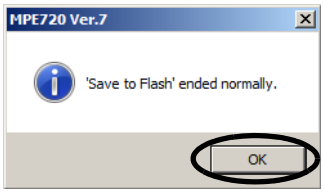
1. In the main window of MPE720 Ver.7, click ***Online - Save to Flash*** in the main menu.
   The **Transfer Program - Save to Flash** dialog box is displayed.
2. Check the information displayed, then click the **Start** button.



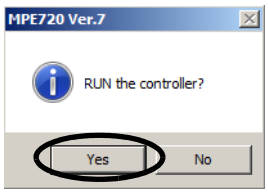
   The CPU STOP confirmation dialog box is displayed.
3. Click **No** to start saving to flash memory.



   On completion of saving, a confirmation message box is displayed.
4. Click the **OK** button in this box.

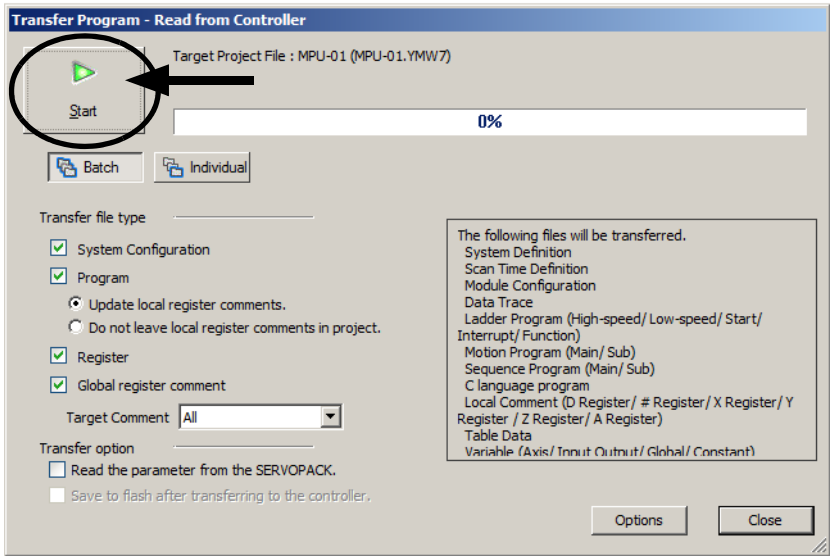


   The CPU RUN confirmation message box is displayed.
5. Click **Yes** in this box.



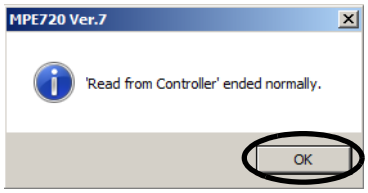
6. In the main window of MPE720 Ver.7, click ***Online - Read from Controller*** in the main menu.
   The **Transfer Program - Read from Controller** dialog box is displayed.

7. Check the information displayed, then click the **Start** button.



The project file in the personal computer is overwritten, and on completion a confirmation message box is displayed.

8. Click the **OK** button to end data transmission from the controller to the personal computer.



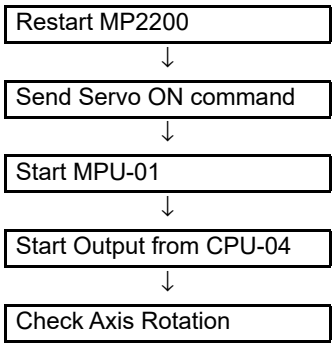
9. Click ***File - Save Project*** in the main menu of MPE720 Ver.7 to save the transmitted data.

5.3 Checking Program Operation

This section explains the procedure for checking the operation of programs.

5.3.1 Outline of Operation Checks

Check operation by the following the procedure.



5.3.2 Details of Operation Checks

The details of each step in an operation check are explained here.

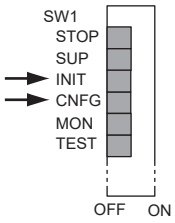
(1) Power OFF → ON

1. Select ***Online - Disconnection*** in the main menu of MPE720 Ver.7 to break the connection with the controller.

   Break the connections for both projects, that of the CPU-04 module and that of the MPU-01 Module.

2. Turn the power to the MP2200 OFF.

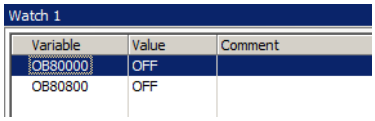
3. Set the INIT and CNFG switches of DIP switch SW1 on the CPU-04 and MPU-01 Modules to OFF.



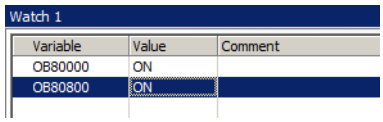
4. Turn the power to the MP2200 back ON.

(2) Servo ON

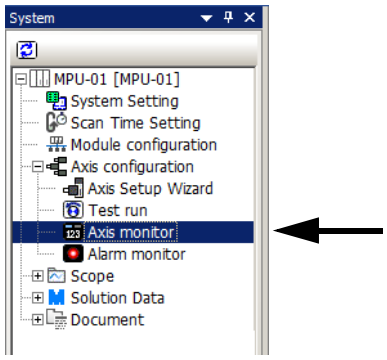
1. In MPE720 Ver.7, select the MPU-01 Module's project, then select ***Online - Connection*** from the main menu to start connection with the MPU-01 Module.
2. In the **Watch 1** subwindow, register the two variables for issuing the servo ON command as shown below.



3. Change the values of these two variables to **ON**.

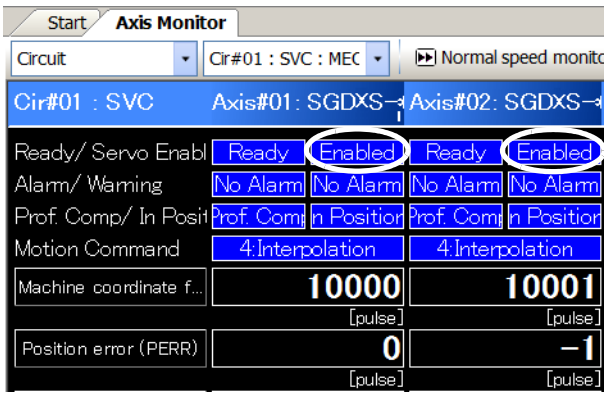


4. Double-click **Axis monitor** in the **System** subwindow.



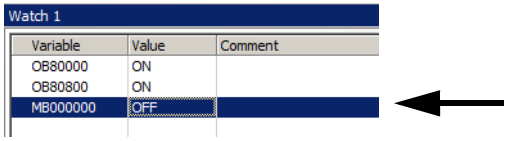
The **Axis Monitor** tab page is displayed in the main window.

5. Check that the **Servo Enabled** state is established for the two axes.

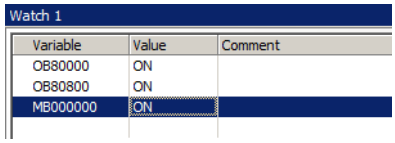


(3) Starting MPU-01

1. In the **Watch 1** subwindow, register the variable (MB000000) for starting the operation of the MPU-01 Module, as shown below.



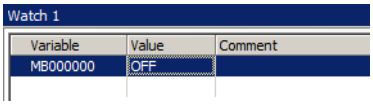
2. Change the value of the registered variable to **ON**.



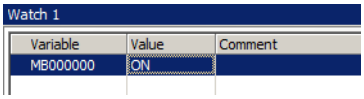
Operation of the MPU-01 Module starts.

(4) Starting Output from CPU-04

1. In MPE720 Ver.7, select the CPU-04 module's project, then select ***Online - Connection*** from the main menu to start connection with the CPU-04 module.
2. In the **Watch 1** subwindow, register the variable (MB000000) for starting output from the CPU-04 module, as shown below.

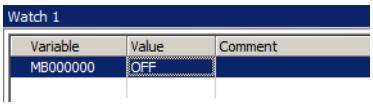


3. After checking safety in the vicinity of moving parts, change the value of MB000000 to **ON**.



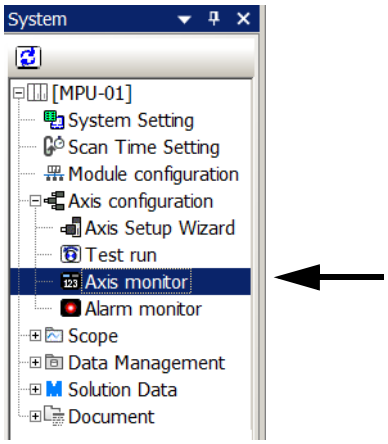
This operation causes the axis to rotate.

4. To stop the axis, change the value of MB000000 to **OFF**.



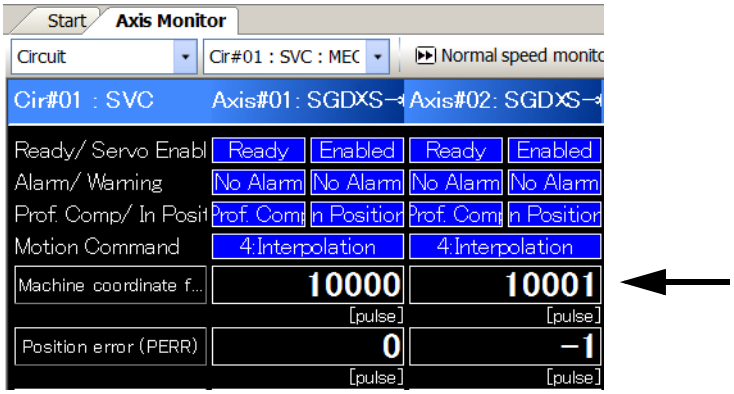
(5) Checking Axis Rotation

1. In MPE720 Ver.7, select the MPU-01 Module's project again, then double-click **Axis monitor** in the **System** subwindow.



The **Axis Monitor** tab page is displayed in the main window.

2. Check that the servo systems for both of the axes are working from the **Machine Coordinate System Feedback Position** of the two axes.



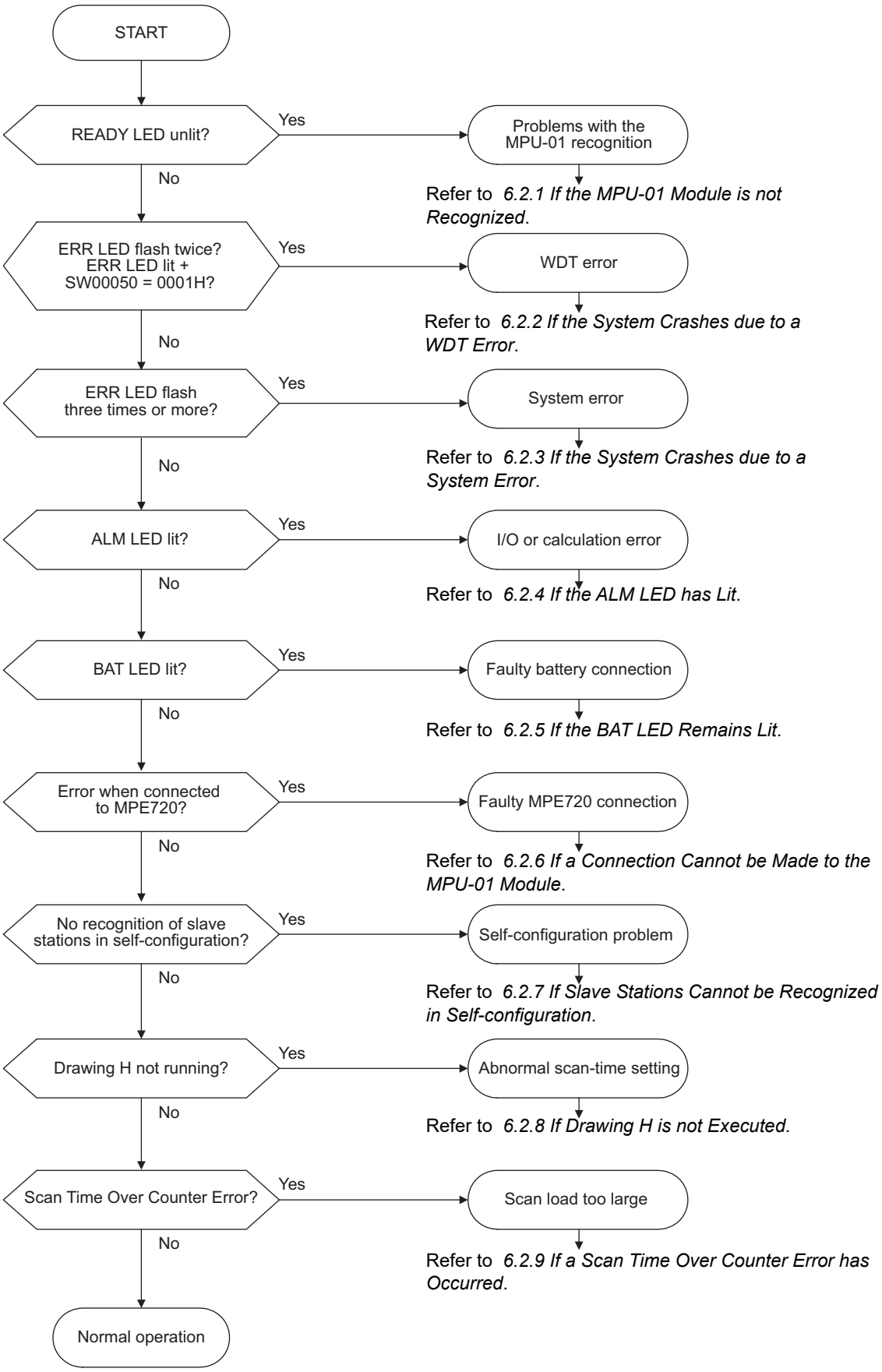
6

Troubleshooting

This chapter explains the basic method for troubleshooting, along with the system register configuration and error statuses.

6.1 Flowchart for Checking MPU-01 Error

If the cause of the problem is thought to be in the MPU-01 Module, search for the method for dealing with it by referring to the flowchart below.

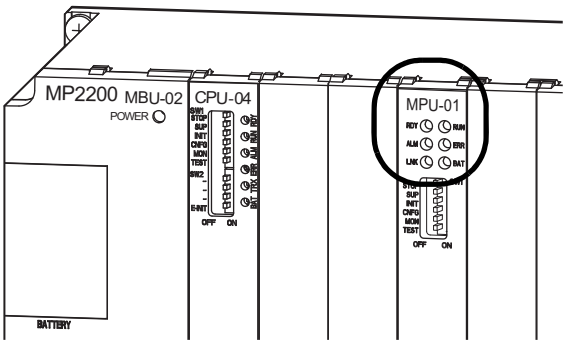


6.2 Dealing with Problems

This section explains how to deal with problems that arise while using an MPU-01 Module.

6.2.1 If the MPU-01 Module is not Recognized

In some cases, even when the power to the Machine Controller is turned ON and the main CPU is started, the MPU-01 Module is not recognized by the main CPU, and the RDY and RUN indicators on the front face of the MPU-01 Module fail to light.



If this happens, check the model of the Machine Controller, and the controller version.

The MPU-01 Module can be used in combination with the following main CPU modules.

- MP2100M
- MP2300S
- MP2310
- MP2200/CPU-03
- MP2200/CPU-04

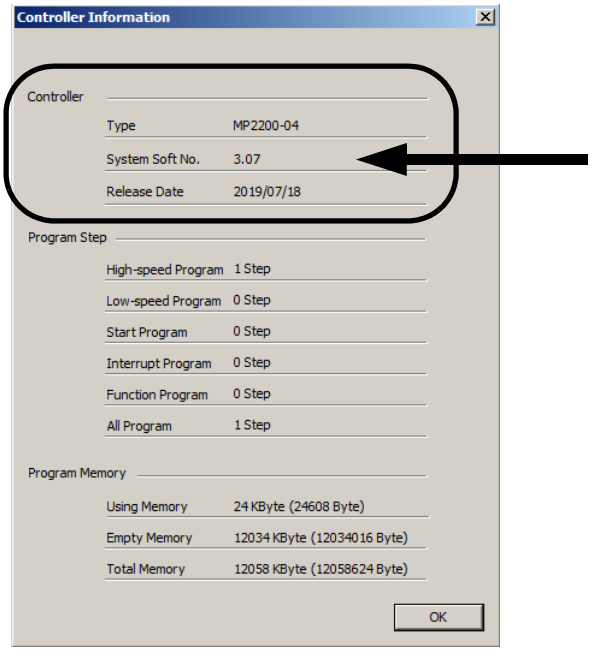
Note that the MPU-01 Module cannot be used with controllers other than those indicated above.

Also note that even with the controllers listed above, MPU-01 Modules cannot be used other than with the following controller versions.

- Controller Ver. 2.73 or later

- Method for checking the controller version

Select ***Online - Controller Information*** from the MPE720 Ver.7 menu, and check the version on the **Controller Information** dialog box that is displayed.



6.2.2 If the System Crashes due to a WDT Error

When a system crashes because a WDT error occurred, the cause might be a WDT error in either of the following two locations.

- A WDT error has occurred at the main CPU.
- A WDT error has occurred at the MPU-01 Module.

The MPU-01 Module and main CPU both constantly check that the other of the two is operating normally.

Accordingly, when one of these modules is stopped due to a WDT error, the other is also stopped by the WDT error.

Due to this specification, when one of these modules becomes uncontrollable as a result of entering an infinite loop in the ladder program, the other module will also execute an emergency stop.

When a system crashes as the result of a WDT error, the module in which the error occurred must be identified.

Try one of the following methods to determine the source of the error.

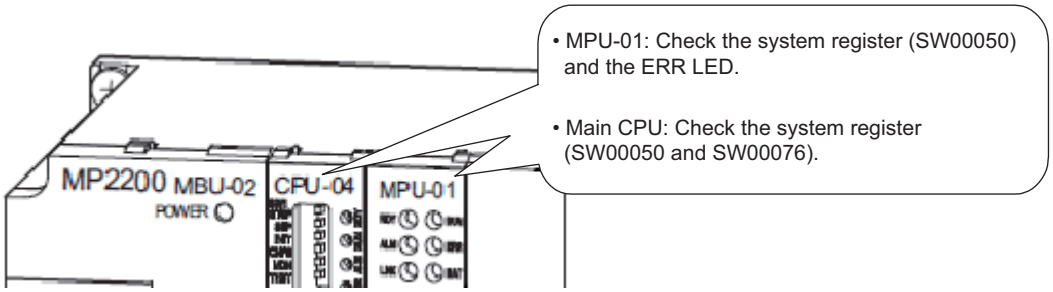
- Check the status of the system registers for the main CPU and the MPU-01.*
- Restart the power of the MPU-01 Module after the ladder program of the MPU-01 has stopped and check for any changes.

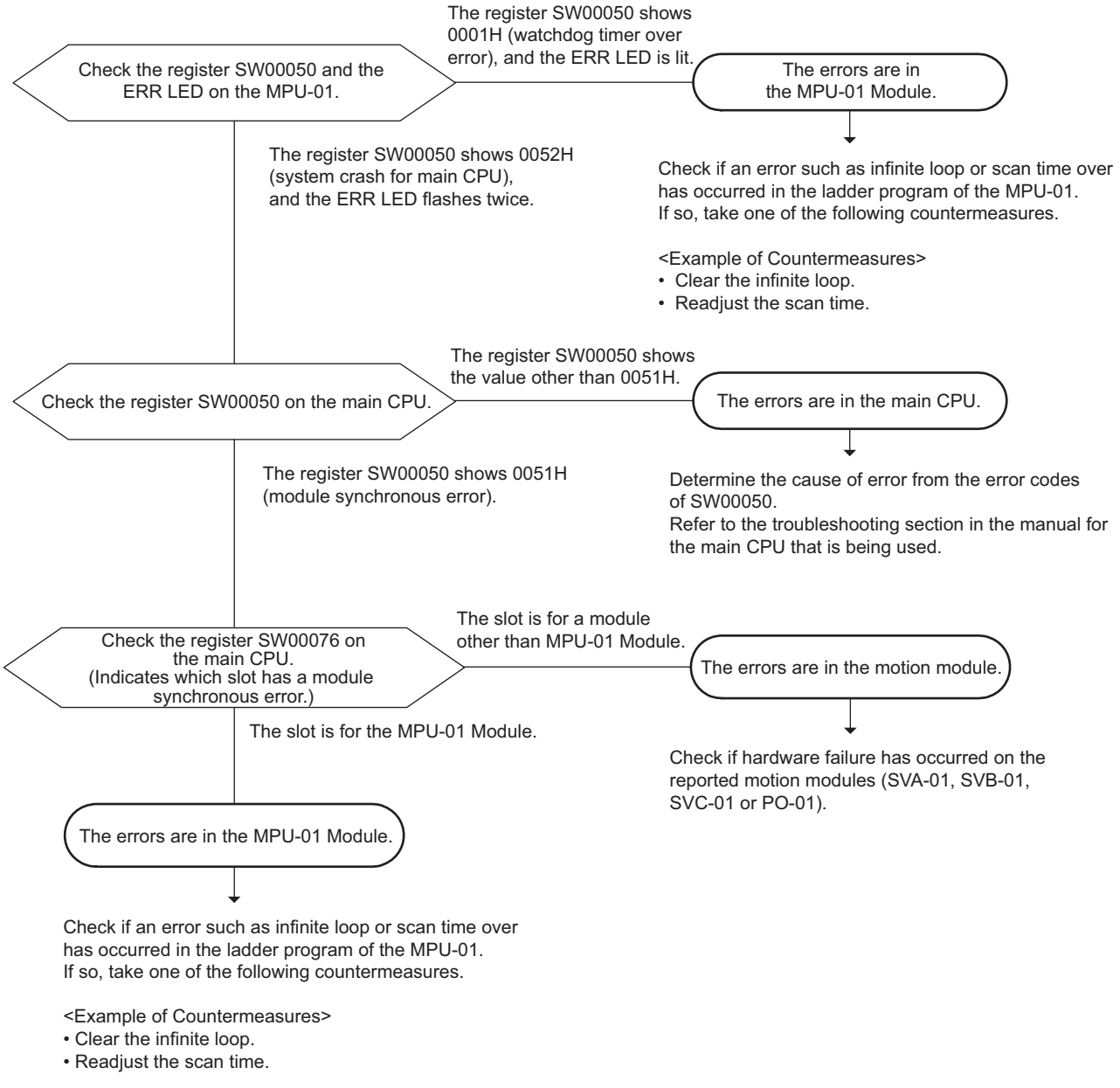
  * The system programs for the main CPU and the MPU-01 Module need to be version 2.75 or later.

More information on these methods can be found on the following pages in this section.

(1) Checking System Register Status for Main CPU and MPU-01

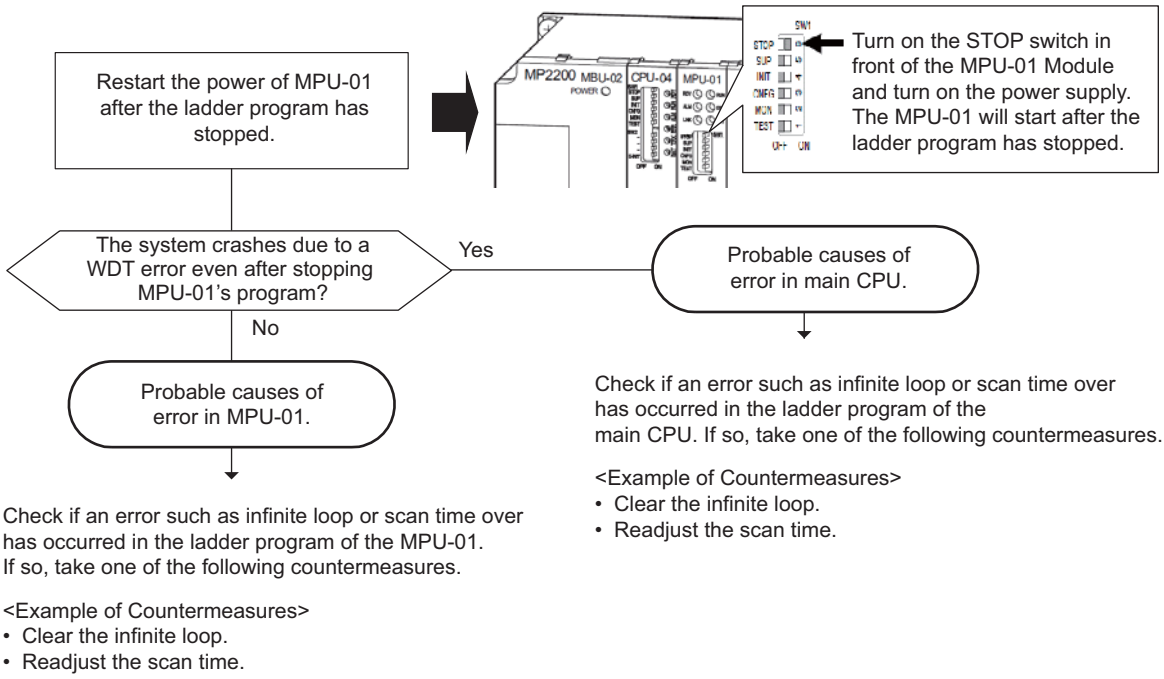
Determine if the system register for the main CPU or the one for the MPU-01 is the cause of a WDT error. If troubleshooting is necessary, use the following flowchart to determine the probable cause of the error.





(2) Restarting the MPU-01 Module and Checking for Changes

If troubleshooting is necessary, use the following flowchart to determine the probable cause of the error.



6.2.3 If the System Crashes due to a System Error

When the system of the MPU-01 Module crashes due to a system error, the cause may be one of the following problems.

- Incorrect operation has been executed in the user program
- Incorrect installation environment
- Hardware failure

When using embedded C-language programming, a system error will cause the system to crash with the incorrect pointer access or incorrect operation using data with a floating point. Refer to the following table for the possible causes of the errors.

ERR LED No. of flashes	Error	Cause	Countermeasure
Three times	Address error (read) exception	Data of 16-bit words or 32-bit long words were read from an incorrect address.*	Check if the incorrect operations on the left have been executed and if so, make corrections.
Four times	Address error (write) exception	Data of 16-bit words or 32-bit long words were written on an incorrect address.*	
Five times	FPU exception	Incorrect operation (nonnumeric operation, division by zero, or overflow) using a floating point was executed.	

* For details, refer to *10 Precautions* in *Machine Controller MP2000 Series Embedded C-language Programming Package Development Guide* (Manual No.: SIEP C880700 25)

If embedded C-language programming or an incorrect operation in C-language was not attempted, a hardware error may be the cause of the system crash.

The causes of the hardware error can be divided into two types: installation environment and the hardware failures.

For troubleshooting errors caused by the installation environment, refer to *D.8 Notes on Connection and Grounding*.

If the installation environment is faultless and the same error still occurs after countermeasures were taken, the hardware may be damaged. Contact your Yaskawa representative or nearest office listed in the back cover for assistance.

6.2.4 If the ALM LED has Lit

When the ALM LED on the front face of the MPU-01 Module has lit, the possible causes are as follows.

Check these causes and find the reason that the alarm occurred.

- An I/O error has occurred.
- A calculation error has occurred in the ladder program.
- The length of the high-speed scan cycle of the MPU-01 Module is not equal to that of the MECHATROLINK-III transmission cycle or an integral multiple of it.

The troubleshooting method for I/O errors and ladder program calculation errors is the same as for MP2000 series machine controllers. Refer to the troubleshooting sections in the manual for each controller.

Make the settings so that the high-speed scan cycle of the MPU-01 Module is the same value as the MECHATROLINK-III transmission cycle or an integral multiple of it. For details on how to set scan cycles, refer to *D.1 (3) Precautions when Setting or Changing the Scan Time*.

6.2.5 If the BAT LED Remains Lit

When the BAT LED on the front face of the MPU-01 Module remains lit, the possible causes are as follows.

Identify the reason why the battery LED is lit, and deal with the error.

- A battery is connected to the BAT connector, but no charge remains.
- No battery is connected to the BAT connector of the MPU-01 Module, and the battery connection setting is set to **Connect**.

If the battery is not charged, replace it with a new one (model: JZSP-BA01). For more information, refer to *2.2.2 Replacing the Lithium Battery*.

As with other CPU modules in the MP2000 series, a battery has to be connected. When a battery is connected, the following data is retained even when the power is turned OFF.

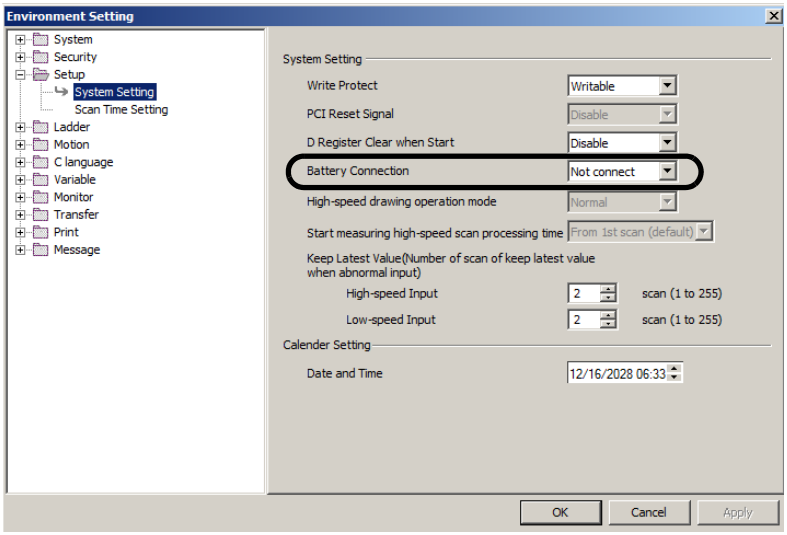
- M registers
- System registers
- Table data (battery backup)
- Trace data

If this data does not have to be retained and no battery is connected, select **Not connect** in **Battery Connection** in the window below.

By setting **Not connect** for battery connection, the BAT indicator can be turned OFF. Note that while this setting is in effect, some data will be lost when the power is turned ON.

- Setting Battery Connection

  Select ***File - Environment Setting*** in the MPE720 Ver.7 menu, and select **Not connect** in **Battery Connection** in the **System Setting** window.



6.2.6 If a Connection Cannot be Made to the MPU-01 Module

When a timeout error occurs on connection between an MPU-01 Module and MPE720, the possible causes are as follows.

Check these causes and find the reason that connection is not possible.

- The LAN cable is not connected correctly.
- The cable used is not a cross cable.
- The Ethernet communication module has not acquired an IP address.
- The specified IP address is not correct.
- The MPU-01 Module is not allocated in the module configuration definitions of the main CPU.
- The circuit number of the MPU-01 Module is wrong.

If a connection to an MPU-01 Module cannot be made, check if the LAN cable is disconnected. Check that the cable connector has been pressed in far enough to click into place. For the LAN cable, use cross cable (category: 5 or 5e) available in the market.

After checking the LAN cable, check that the IP LED of the Ethernet communication module is lit. If this LED is lit, it indicates that the Ethernet communication module has acquired an IP address. If the IP LED is not lit, set the E-INIT switch to ON and turn the power OFF and back ON. This sets the IP address to the default (192.168.1.1), and the IP LED lights.

If the MPU-01 Module is successfully connected, the controller becomes capable of Ethernet communication.

Make the communication settings by referring to *Chapter 5 System Startup and Sample Program*.

6.2.7 If Slave Stations Cannot be Recognized in Self-configuration

When the machine controller has been started in self-configuration mode, the slave stations connected to the MPU-01 Module might not be recognized.

If so, determine which of the following two possibilities is the reason for the cause and correct it.

- The MECHATROLINK-III cable is not connected correctly.
- Self-configuration of the MPU-01 Module is not executed.

If the slave stations connected to the MPU-01 Module cannot be recognized, check if the MECHATROLINK-III cable is disconnected. Check that the cable connector has been pressed in far enough to click into place. For details on the MECHATROLINK-III cables that can be used, refer to *1.3.4 Standard Cables*.

After checking the cable, check whether self-configuration of the MPU-01 Module has been executed.

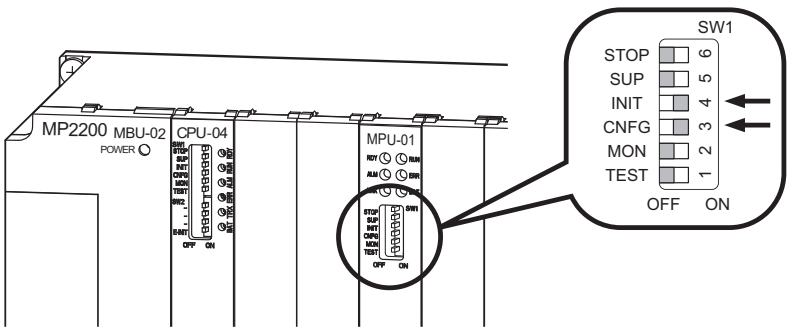
The self-configuration of the MPU-01 Module is independent of the self-configuration of the main CPU.

Self configuration of the MPU-01 Module will not be executed just because self-configuration of the main CPU has been executed.

Self-configuration of the MPU-01 Module can be executed with the DIP switches on the module, or from MPE720.

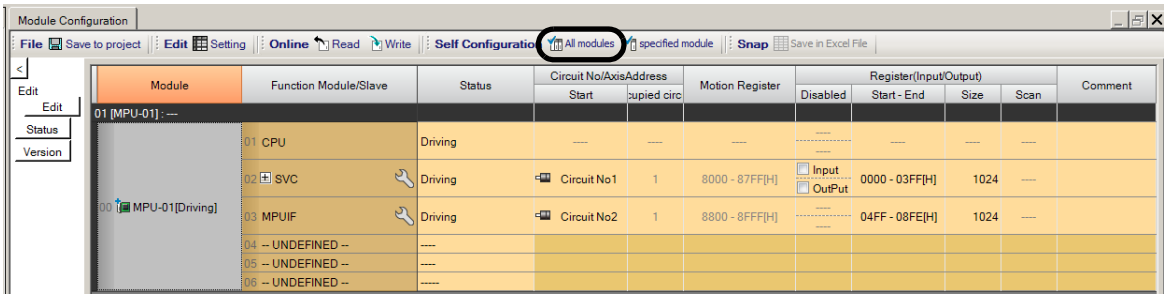
- Executing Self-configuration Using the DIP Switches

  Set the INIT and CNFG switches on the front face of the MPU-01 Module to ON, then turn the power ON.



- Executing Self-configuration from MPE720

Select **All modules** next to Self Configuration on the Module Configuration Definition Window.



6.2.8 If Drawing H is not Executed

When high-speed drawing of the MPU-01 Module is not executed, the possible cause is as follows.

- The length of the high-speed scan cycle of the MPU-01 Module is not equal to that of the MECHATROLINK-III transmission cycle or an integral multiple of it.

Set the high-speed scan cycle of the MPU-01 Module to a value equal to the MECHATROLINK-III transmission cycle or an integral multiple of it. If this condition is not met, high-speed drawing of the MPU-01 Module will not be executed. For details on how to set scan cycles, refer to *D.1 (3) Precautions when Setting or Changing the Scan Time*.

6.2.9 If a Scan Time Over Counter Error has Occurred

When a Scan Time Over Counter error occurs and the H Scan Time Over Counter (SW00044) or L Scan Time Over Counter (SW00046) reaches its maximum value, the possible causes are as follows.

Check these causes, identify the reason that the Scan Time Over Counter error occurred and deal with the error.

- The high-speed scan current value is equal to or greater than the high-speed scan maximum value.
- The low-speed scan current value is equal to or greater than the low-speed scan maximum value.
- The module configuration definitions have been saved in the CPU RUN state.
- Self-configuration has been executed in the CPU RUN state.

The scan set values, scan current values and scan maximum values can be checked with the following system registers.

Name	Register Number	High-speed Scan Set Value
High-speed Scan Set Value	SW00007	High-speed Scan Set Value (µs)
High-speed Scan Current Value	SW00008	High-speed Scan Current Value (µs)
High-speed Scan Maximum Value	SW00009	High-speed Scan Maximum Value (µs)
Low-speed Scan Set Value	SW00010	Low-speed Scan Set Value (ms)
Low-speed Scan Current Value	SW00011	Low-speed Scan Current Value (ms)
Low-speed Scan Maximum Value	SW00012	Low-speed Scan Maximum Value (ms)

As a guide, the scan set value should be set to 1.25 times the scan maximum value or higher. For details on how to set scan cycles, refer to *D.1 (3) Precautions when Setting or Changing the Scan Time*.

If the module configuration definitions have been saved or self-configuration has been executed in the CPU RUN state, on rare occasions a Scan Time Over Counter error may occur. These operations have a significant effect on high-speed scan and low-speed scan processing. Therefore, establish the CPU STOP status before executing them.

6.3 System Register Configuration and Error Status

6.3.1 System Status

System operating status and error status is stored in registers SW00040 to SW00048. Checking of system status details are used to determine whether hardware or software is the cause of an error.

Name	Register No.	Description		
Reserved for system use	SW00030 to SW00039	–		
CPU Status	SW00040	SB000400	READY	0: Failure, 1: Normal
		SB000401	RUN	0: Stopped, 1: Running
		SB000402	ALARM	0: Normal, 1: Alarm
		SB000403	ERROR	0: Normal, 1: Error
		SB000404	Reserved for system use	–
		SB000405	Reserved for system use	–
		SB000406	FLASH	1: Flash operation
		SB000407	WEN	0: Write-disabled, 1: Write-enabled
		SB000408 to SB00040D	Reserved for system use	–
		SB00040E	Operation Stop Request	0: RUN selection, 1: STOP selection
		SB00040F	Run Switch Status at Power ON	0: STOP, 1: RUN
CPU Error Status	SW00041	SB000410	Serious Failure	1: WDGE, undefined command See SW00050 for details.
		SB000411	Reserved for system use	–
		SB000412	Reserved for system use	–
		SB000413	Exception Error	–
		SB000414 to SB000417	Reserved for system use	–
		SB000418	User operation error	1: User operation error
		SB000419	I/O Error	1: I/O error
		SB00041A to SB00041F	Reserved for system use	–
H Scan Over Counter	SW00044	–		
L Scan Over Counter	SW00046	–		
Reserved for system use	SW00047	SB000470 to SB00047F	Reserved for system use	–
Hardware Configura-tion Status	SW00048	SB000480	TEST	DIP switch reports 0: ON, 1: OFF
		SB000481	MON	
		SB000482	CNFG	
		SB000483	INIT	
		SB000484	SUP	
		SB000485	STOP	
		SB000486	–	
		SB000487	Battery Alarm	–
		SB000488 to SB00048F	Reserved for system use	–

(cont'd)

Name	Register No.	Description		
Reserved for system use	SW00049	SW000490 to SW00049F	Reserved for system use	–

6.3.2 System Error Status

The system error status is stored in registers SW00050 to SW00060. The following table shows the details when a system errors occurs.

Name	Register No.	Description	
32-bit Error Code	SW00050	0001H	Watchdog timer over error
		0041H	ROM diagnosis error
		0042H	RAM diagnosis error
		0043H	CPU diagnosis error
		0044H	FPU diagnosis error
		0051H	Module synchronous error*1
		0052H	System crash for main CPU*2
		00E0H	Address read exception error
		0100H	Address write exception error
		0120H	FPU exception error
		0180H	Illegal general command error
		01A0H	Illegal slot command error
		01E0H	User break after command execution
		0800H	General FPU inhibited exception error
		0820H	Slot FPU inhibited exception error
	SW00051	For system error analysis	
32-bit Addresses Generating Error	SW00052	For system error analysis	
	SW00053		
Ladder Program Error Task	SW00054	0000H: System 0001H: DWG.A	0002H: DWG.I 0003H: DWG.H 0005H: DWG.L
Ladder Program Type	SW00055	0000H: System 0001H: DWG.A 0002H: DWG.I	0003H: DWG.H 0005H: DWG.L 0008H: Function 000FH: Motion program
Ladder Program Error Drawing Number	SW00056	Ladder program parent drawing: FFFFH Ladder program function: 8000H Ladder program child drawing: □□00H (H□□: Child drawing number) Ladder program grandchild drawing: □□yyH (Hyy: Grandchild drawing number) Motion program: F0□□H (H□□: Program number)	
Ladder Program Function Calling Drawing Type	SW00057	Type of drawing that calls the ladder program function in which an error occurred.	
		0001H: DWG.A 0002H: DWG.I 0003H: DWG.H 0005H: DWG.L	0008H: Ladder program function 000FH: Motion program 0010H: Reserved by system. 0011H: Reserved by system.
Ladder Program Function Calling Drawing Number	SW00058	Number of drawing that calls the ladder program function in which an error occurred.	
		Parent drawing: FFFFH Function: 0100H	Child drawing: □□00H (H□□: Child drawing number) Grandchild drawing: □□yyH (Hyy: Grandchild drawing number)
Ladder Program Function Calling Drawing Number	SW00059	STEP number of the drawing that calls the ladder program function in which an error occurred. 0 when there is an error in the drawing.	

Name	Register No.	Description
Error Data	SW00060 and SW00061	Reserved for system use
	SW00062 to SW00065	Name of Task Generating Error
	SW00066 and SW00067	Reserved for system use
	SW00068	Year Generated
	SW00069	Month Generated
	SW00070	Day of Week Generated
	SW00071	Day of Month Generated
	SW00072	Hour Generated
	SW00073	Minutes Generated
	SW00074	Seconds Generated
	SW00075	Milliseconds Generated (Not used.)
	SW00076	Number of slot with a module synchronous error *3 xxyyH xx: Rack number (01 to 04) yy: Slot number (01 to 09)
	SW00077 to SW00079	Reserved for system use

* 1. For main CPU only.
Main CPU system program version 2.75 or later: 0051H will be reported.
Main CPU system program version is earlier than 2.75: 0001H (watchdog timer over error) will be reported.
* 2. For MPU-01 Module only.
The MPU-01 system program version 2.75 or later: 0052H will be reported.
The main CPU system program version is earlier than 2.75: 0001H (watchdog timer over error) will be reported.
* 3. For the main CPU only.
The main CPU system program version 2.75 or later: Number of slot with module synchronous error will be reported.
The main CPU system program version is earlier than 2.75: The register will be reserved for system use.

6.3.3 Ladder Program User Operation Error Status

Error information for user operation errors in ladder programs is stored in registers SW00080 to SW00089 (Error Status 1) and SW00110 to SW00189 (Error Status 2).

(1) Ladder Program User Operation Error Status 1

Name	Register No.	Description
DWG.A Error Count Error Code	SW00080	Operation error code: See *6.3.3 (3) Ladder Program User Operation Error Codes 1*. Error code when an index error occurs: See *6.3.3 (4) Ladder Program User Operation Error Codes 2*.
	SW00081	
DWG.I Error Count Error Code	SW00082	
	SW00083	
DWG.H Error Count Error Code	SW00084	
	SW00085	
Reserved for system use	SW00086	
	SW00087	
DWG.L Error Count Error Code	SW00088	
	SW00089	

(2) Ladder Program User Operation Error Status 2

Name	Register No.				Remarks
	DWG.A	DWG.I	DWG.H	DWG.L	
Error Count	SW00110	SW00126	SW00142	SW00174	<Error Drawing Number> Parent drawing: FFFFH Child drawing: □□00H (H□□: Child drawing number) Grandchild drawing: □□yyH (Hyy: Grandchild drawing number) Function: 8000H Motion program: F0□□H (H□□: Program number) <Reference Source Drawing Number> Number of the drawing reference source in which an error occurred. <Reference Source DWG Step Number> Step number of the drawing reference source in which an error occurred. 0 when there is an error in the parent drawing.
Error Code	SW00111	SW00127	SW00143	SW00175	
Error A Register	SW00112	SW00128	SW00144	SW00176	
	SW00113	SW00129	SW00145	SW00177	
Modification A Register	SW00114	SW00130	SW00146	SW00178	
	SW00115	SW00131	SW00147	SW00179	
Error F Register	SW00116	SW00132	SW00148	SW00180	
	SW00117	SW00133	SW00149	SW00181	
Modification F Register	SW00118	SW00134	SW00150	SW00182	
	SW00119	SW00135	SW00151	SW00183	
Address Generating Error	SW00120	SW00136	SW00152	SW00184	
	SW00121	SW00137	SW00153	SW00185	
Error Drawing Number	SW00122	SW00138	SW00154	SW00186	
Reference Source Drawing Number	SW00123	SW00139	SW00155	SW00187	
Reference Source DWG Step Number	SW00124	SW00140	SW00156	SW00188	
Reserved by the system.	SW00125	SW00141	SW00157	SW00189	

(3) Ladder Program User Operation Error Codes 1

	Error Code	Error Contents		System Default Setting*	
Integer Operations	0001H	Integer operation - underflow		–32768	
	0002H	Integer operation - overflow		32767	
	0003H	Integer operation - division error		The A register remains the same.	
	0009H	Double-length integer operation - underflow		–2147483648	
	000AH	Double-length integer operation - overflow		2147483647	
	000BH	Double-length integer operation - division error		The A register remains the same.	
Real Number Operation	0010H	Integer storage - non-numeric error		Store not executed. [00000]	
	0011H	Integer storage - underflow		Store not executed. [–32768]	
	0012H	Integer storage - overflow		Store not executed. [+32767]	
	0021H	Real number storage - underflow		Store not executed. [–1.0E+38]	
	0022H	Real number storage - overflow		Store not executed. [1.0E+38]	
	0023H	Real number operation - division-by-zero error		Operation not executed. [The F register remains the same.]	
	0030H	Real number operation - invalid operation (non-numeric)		Operation not executed.	
	0031H	Real number operation - exponent underflow		0.0	
	0032H	Real number operation - exponent overflow		Maximum value	
	0033H	Real number operation - division error (non-numeric 0/0)		Operation not executed.	
	0034H	Real number storage - exponent underflow		Stores 0.0.	
	0035H	Real number operation - stack error		–	
	0040H to 0059H	Standard System Functions Real number operation errors		Interrupt operation and output = 0.0	
		0040H: SQRT	0041H: SIN	0042H: COS	0043H: TAN
		0044H: ASIN	0045H: ACOS	0046H: ATAN	0047H: EXP
		0048H: LN	0049H: LOG	004AH: DZA	004BH: DZB
		004CH: LIM	004DH: PI	004EH: PD	004FH: PID
		0050H: LAG	0051H: LLAG	0052H: FGN	0053H: IFGN
		0054H: LAU	0055H: SLAU	0056H: REM	0057H: RCHK
		0058H: BSRCH	0059H: SQRT	–	–
		1000H, 2000H, or 3000H is added for an index error.			

* The values in parentheses are the maximum allowable values (setting limits). When this limit is exceeded, an alarm occurs and the value will be changed to the default setting.

(4) Ladder Program User Operation Error Codes 2

	Error Code	Error Contents		System Default	
Integer - Real Number Operations	1000H	Index error within drawing		Execute again when corresponding to i,j = 0. The i and j registers remain the same.	
	2000H	Index error within function		Execute again when corresponding to i,j = 0. The i and j registers remain the same.	
	3000H	Index error within motion program or sequence program		Execute again when corresponding to i,j = 0. The i and j registers remain the same.	
Integer Operation	☐060H to ☐0C9H (☐ = 1,2, 3)	Integer system functions Index error		Operation stopped and output = input.	
		☐06DH: PI	☐06EH: PD	☐06FH: PID	☐070H: LAG
		☐071H: LLAG	☐072H: FGN	☐073H: IFGN	☐074H: LAU
		☐075H: SLAU	☐076H: FGN	☐077H: IFGN	☐08EH: INS
		☐08FH: OUTS	☐090H: ROTL	☐091H: ROTR	☐092H: MOVB
		☐093H: MOVW	☐094H: SETW	☐095H: XCHG	☐096H: LIMIT
		☐097H: LIMIT	☐098H: DZA	☐099H: DZA	☐09AH: DZB
		☐09BH: DZB	☐09CH: PWM	☐09EH: SHFTL	☐09FH: SHFTR
		☐0A0H: BEXTEND	☐0A1H: BPRESS	☐0A2H: SORT	☐0A4H: SORT
		☐0A6H: RCHK	☐0A7H: RCHK	☐0A8H: COPYW	☐0A9H: ASCII
		☐0AAH: BINASC	☐0ABH: ASCBIN	☐0ACH: BSRCH	☐0ADH: BSRCH
		☐0AEH: TIMEADD	☐0AFH: TIMSUB	☐0B1H: SPEND	☐0C0H: TBLBR
		☐0C1H: TBLBW	☐0C2H: TBLSRL	☐0C3H: TBLSRC	☐0C4H: TBLCL
		☐0C5H: TBLMW	☐0C6H: QTBLR	☐0C7H: QTBLRI	☐0C8H: QTBLW
		☐0C9H: QTBLWI	–	–	–

6.3.4 System Service Execution Status

System service execution status is in registers SW00090 to SW00103. The following tables show the details on the execution status of system service.

(1) Data Trace Execution Status

Name	Register No.	Remarks
Reserved for system use	SW00090 to SW00097	–
Existence Of Data Trace Definition	SW00098	Bit 0 to 3 = Group 1 to 4 Definition exists = 1, No definition = 0
Data Trace Execution Status	SW00099	Bit 0 to 3 = Group 1 to 4 Trace stopped = 1, Trace executing = 0

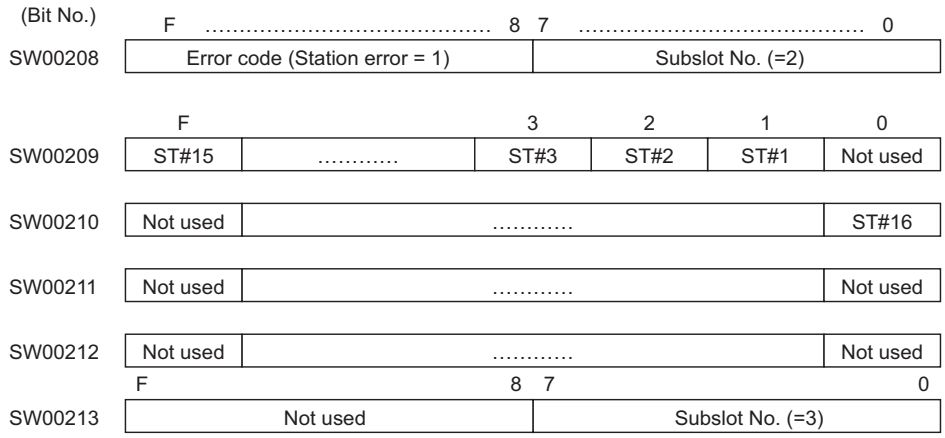
(2) Latest Data Trace Record Numbers

Name	Register No.	Remarks
Data Trace Group 1	SW00100	Latest record number
Data Trace Group 2	SW00101	Latest record number
Data Trace Group 3	SW00102	Latest record number
Data Trace Group 4	SW00103	Latest record number

6.3.5 System I/O Error Status

Name	Register Number	Remarks
I/O Error Count	SW00200	Number of I/O error occurrences
Number of Input Errors	SW00201	Number of input error occurrences
Input Error Address	SW00202	Address of the latest input error (IW□□□□ register number)
Number of Output Errors	SW00203	Number of output error occurrences
Output Error Address	SW00204	Address of the latest output error (OW□□□□ register number)
Reserved for system use	SW00205 to SW00207	Not used
I/O Error Status	SW00208 to SW00212	Slot 0 error status
	SW00213 to SW00463	Reserved for system use

- MPU-01 Module Error Status (Slot 0)



<Error Status Details>

Item	Code	Remarks
Subslot No.	2	1 = SVC (MECHATROLINK-III)
Status	0	Normal
	1	Station error
ST#n	0	Normal communication
	1	Communication error at the station n (n = local station number in slave mode)

6.3.6 Module Information

Name	Register Number	Remarks
CPU Information	SW00800	MPU-01ID (C680H)
	SW00801	CPU Hardware Version (BCD)
	SW00802	CPU Software Version (BCD)
	SW00803	Number of Subslots (0005H)
	SW00804	CPU Function Module ID (C610H)
	SW00805	CPU Function Module Status
	SW00806	SVC Function Module ID (9412H)
	SW00807	SVC Function Module Status
	SW00808	MPUIF Function Module ID (8261H)
	SW00809	MPUIF Function Module Status
	SW00810	SVR Function Module ID (9210H)
	SW00811	SVR Function Module Status
	SW00812	M-EXECUTER Function Module ID (8431H)
	SW00813	M-EXECUTER Function Module Status
	SW00814, SW00815	Reserved for system use

Appendices

A System Registers Lists

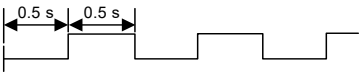
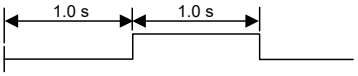
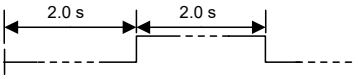
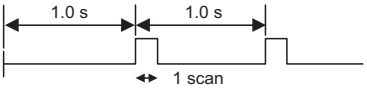
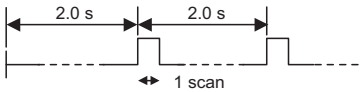
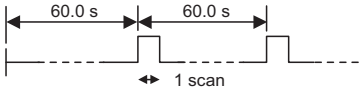
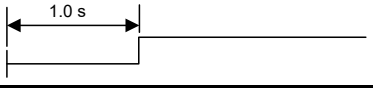
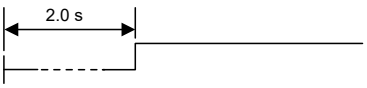
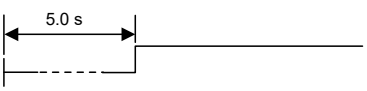
A.1 System Service Registers

(1) Shared by All Drawings

Name	Register No.	Remarks
Reserved for System Use	SB000000	Not used
High-speed Scan	SB000001	ON for only the first scan after high-speed scan is started.
Low-speed Scan	SB000003	ON for only the first scan after low-speed scan is started.
Always ON	SB000004	Always ON (= 1)
Reserved for System Use	SB000005 to SB00000F	Not used

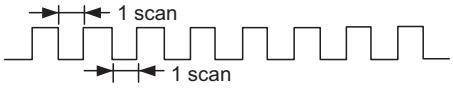
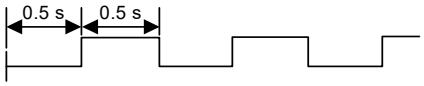
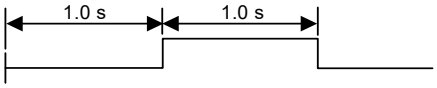
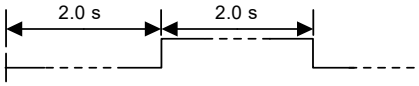
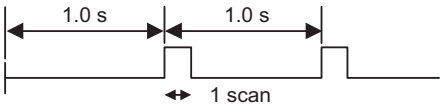
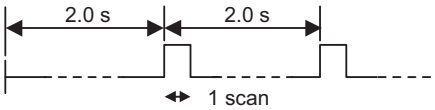
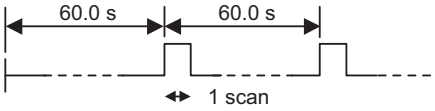
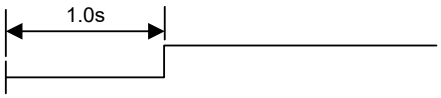
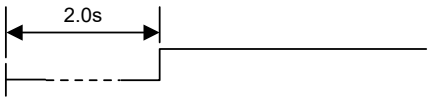
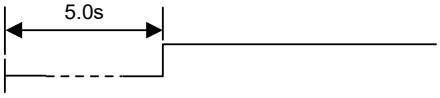
(2) DWG.H Only

Operation starts when high-speed scan starts.

Name	Register No.	Remarks
1-scan Flicker Relay	SB000010	
0.5-s Flicker Relay	SB000011	
1.0-s Flicker Relay	SB000012	
2.0-s Flicker Relay	SB000013	
0.5-s Sampling Relay	SB000014	
1.0-s Sampling Relay	SB000015	
2.0-s Sampling Relay	SB000016	
60.0-s Sampling Relay	SB000017	
1.0 s After Start of Scan Relay	SB000018	
2.0 s After Start of Scan Relay	SB000019	
5.0 s After Start of Scan Relay	SB00001A	

(3) DWG.L Only

Operation starts when low-speed scan starts.

Name	Register No.	Remarks
One-scan Flicker Relay	SB000030	
0.5-s Flicker Relay	SB000031	
1.0-s Flicker Relay	SB000032	
2.0-s Flicker Relay	SB000033	
0.5-s Sampling Relay	SB000034	
1.0-s Sampling Relay	SB000035	
2.0-s Sampling Relay	SB000036	
60.0-s Sampling Relay	SB000037	
1.0 s After Start of Scan Relay	SB000038	
2.0 s After Start of Scan Relay	SB000039	
5.0 s After Start of Scan Relay	SB00003A	

A.2 Scan Execution Status and Calendar

Name	Register No.	Remarks
High-speed Scan Set Value	SW00004	High-speed Scan Set Value (0.1 ms)
High-speed Scan Current Value	SW00005	High-speed Scan Current Value (0.1 ms)
High-speed Scan Maximum Value	SW00006	High-speed Scan Maximum Value (0.1 ms)
Reserved for system use	SW00007 to SW00009	Not used
Low-speed Scan Set Value	SW00010	Low-speed Scan Set Value (0.1 ms)
Low-speed Scan Current Value	SW00011	Low-speed Scan Current Value (0.1 ms)
Low-speed Scan Maximum Value	SW00012	Low-speed Scan Maximum Value (0.1 ms)
Reserved for system use	SW00013	Not used
Executing Scan Current Value	SW00014	Executing Scan Current Value (0.1 ms)
Calendar: Year	SW00015	1999: 0099 (BCD) (Last two digits only)
Calendar: Month Day	SW00016	December 31: 1231 (BCD)
Calendar: Hours Minutes	SW00017	23 hours 59 minutes: 2359 (BCD)
Calendar: Seconds	SW00018	59 s: 59 (BCD)
Calendar: Day of Week	SW00019	0 to 6: Sun., Mon. to Sat.

A.3 Program Software Numbers and Remaining Program Memory Capacity

Name	Register No.	Remarks
System Program Software Number	SW00020	S□□□□ (□□□□ is stored as BCD)
System Number	SW00021 to SW00025	Not used
Remaining Program Memory Capacity	SL00026	Unit: Bytes
Total Memory Capacity	SL00028	Unit: Bytes

B SVC Motion Parameter Lists

B.1 Fixed Parameter List

The following table provides a list of SVC motion fixed parameters.

- For details on individual fixed parameters, refer to the reference column and read the listed section of *Machine Controller MP2000 Series Motion Module SVC-01 User's Manual* (Manual No.: SIEP C880700 41).

No.	Name	Contents	Reference
0	Selection of Operation Modes	0: Normal Operation Mode	4.4.1 (1)
		1: Axis unused	
		2: Simulation mode	
		3: Servo Driver Transmission Reference Mode	
		4 and 5: Reserved for system use	
1	Function Selection Flag 1	Bit 0: Axis Selection (0: Finite length axis/1: Infinite length axis) Note: Set to 0 for linear type.	4.4.1 (2)
		Bit 1: Soft Limit (Positive Direction) Enable/Disable (0: Disabled/1: Enabled)	
		Bit 2: Soft Limit (Negative Direction) Enable/Disable (0: Disabled/1: Enabled)	
		Bit 3: Overtravel Positive Direction Enable/Disable (0: Disabled/1: Enabled)	
		Bit 4: Overtravel Negative Direction Enable/Disable (0: Disabled/1: Enabled)	
		Bits 5 to 7: Reserved for system use	
		Bit 8: Interpolation Segment Distribution Processing	
		Bit 9: Simple ABS Rotary Pos. Mode (Simple absolute infinite axis position control) (0: Disabled/1: Enabled) Note: Set to 0 for linear type.	
		Bit A: User Constants Self-writing Function (0: Enabled/1: Disabled)	
		Bit B: User Select User Constants Self-writing Function (0: Enabled/1: Disabled)	
		Bits C to F: Reserved for system use	
2	Function Selection Flag 2	Bit 0: Communication Abnormality Detection Mask	4.4.1 (3)
		Bit 1: WDT Abnormality Detection Mask	
		Bits 2 to F: Reserved for system use	
3	–	Reserved for system use	–
4	Reference Unit Selection	0: pulse 3: inch 1: mm 4: μm 2: deg Note: For linear type, 0 (pulse), 1 (mm), and 4 (μm) can be used. If 2 (deg.) or 3 (inch) is selected, the selected unit will be converted to mm.	4.4.1 (4)
5	Number of Digits below Decimal Point	1 = 1 digit	
6	Travel Distance per Machine Rotation (rotary motor)	1 = 1 reference unit	4.4.1 (4)
	Linear Scale Pitch (linear motor)	1 = 1 reference unit	
8	Servo Motor Gear Ratio	1 = 1 rev • Invalid for linear type	
9	Machine Gear Ratio	1 = 1 rev • Invalid for linear type	

No.	Name	Contents	Reference
10	Infinite Length Axis Reset Position (POSMAX)	1 = 1 reference unit Note: Invalid for linear type	4.4.1 (5)
12	Positive Software Limit Value	1 = 1 reference unit	4.4.1 (6)
14	Negative Software Limit Value	1 = 1 reference unit	
16 to 29	–	Reserved for system use	–
30	Encoder Selection	0: Incremental encoder 1: Absolute encoder 2: Absolute encoder (Incremental encoder is used.) 3: Reserved for system use Note: When using a linear encoder, the setting is ignored, and the encoder is treated as an incremental encoder.	4.4.1 (7)
31 to 33	–	Reserved for system use	–
34	Rated Motor Speed (rotary motor)	1 = 1 min^{-1}	4.4.1 (8)
	Rated Speed (linear motor)	1 = 0.1 m/s	
36	Number of Pulses per Motor Rotation (rotary motor)	1 = 1 pulse/rev Set the value after multiplication.	
	Number of Pulses per Linear Scale Pitch (linear motor)	1 = 1 pulse/scale pitch	
38	Maximum Number of Absolute Encoder Turns Rotation	1 = 1 rev Note: 1. Set to 0 when a direct drive motor is being used. 2. Invalid for linear type	
40 to 41	–	Reserved for system use	–
42	Feedback Speed Movement Averaging Time Constant	1 = 1 ms	4.4.1 (8)
43	–	Reserved for system use	–
44	User Select Servo Driver User constant Number	Specifies the SERVOPACK parameter numbers that are to be reflected automatically.	4.4.1 (8)
45	User Select Servo Driver User constant Size	Specifies the data size of the SERVOPACK parameters above. 1 = 1 W	4.4.1 (8)

B.2 Setting Parameter List

The following table provides a list of SVC motion setting parameters.

- For details on individual setting parameters, refer to the reference column and read the listed section of *Machine Controller MP2000 Series Motion Module SVC-01 User's Manual* (Manual No.: SIEP C880700 41).

Register No.	Name	Contents	Reference
OW□□00	RUN Command Setting	Bit 0: Servo ON (0: OFF/1: ON)	4.4.2 (1)
		Bit 1: Machine Lock (0: Normal Operation/1: Machine Lock)	
		Bits 2 to 3: Reserved for system use	
		Bit 4: Latch Detection Demand (0: OFF/1: ON)	
		Bit 5: Reserved for system use	
		Bit 6: POSMAX Turn Number Presetting Demand (0: OFF/1:ON) Note: Set to 0 for linear type	
		Bit 7: Request ABS Rotary Pos. Load (Absolute system infinite length position information load request) (0: OFF/1:ON) Note: Set to 0 for linear type	
		Bit 8: Forward Outside Limiting Torque Input (Forward external torque/thrust input) (0: OFF/1: ON)	
		Bit 9: Reverse Outside Limiting Torque Input (Reverse external torque/thrust input) (0: OFF/1: ON)	
		Bit A: Reserved for system use	
		Bit B: Integration Reset (0: OFF/1: ON)	
		Bit C: Network Reset (0: OFF/1: ON)	
		Bit D: Latch Completion Status Clear Request (0: OFF/1: ON)	
		Bit E: Communication Reset (0: OFF/1: ON)	
		Bit F: Alarm Clear (0: OFF/1: ON)	
OW□□01	Mode Setting 1	Bit 0: Excessive Deviation Error Level Setting (0: Alarm/1: Warning)	4.4.2 (2)
		Bits 1 to 2: Reserved for system use	
		Bit 3: Speed Loop P/PI Switch	
		Bit 4: Gain Switch	
		Bit 5: Gain Switch 2	
		Bits 6 to F: Reserved for system use	
OW□□02	Mode Setting 2	Bits 0 to 7: Reserved for system use	4.4.2 (3)
		Bits 8 to F: Stop Mode Selection 0: Decelerate to a stop according to the linear deceleration time constant 1: Stop immediately 2: Decelerate to a stop according to the deceleration stop	

Register No.	Name	Contents	Reference
OW□□03	Function Setting 1	Bits 0 to 3: Speed Unit Selection 0: Reference unit/s 1: 10^n reference unit/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)	4.4.2 (4)
		Bits 4 to 7: Acceleration/Deceleration Degree Unit Selection 0: Reference unit/s^2 1: ms	
		Bits 8 to B: Filter Type Selection 0: None 1: Exponential acceleration/deceleration filter 2: Moving average filter	
		Bits C to F: Torque Unit Selection 0: Percentage of rated toque (1 = 0.01%) 1: Percentage of rated toque (1 = 0.0001%)	
OW□□04	Function Setting 2	Bits 0 to 3: Latch Detection Signal Selection	4.4.2 (5)
		0: –	
		1: –	
		2: Phase-C pulse input signal	
		3: /EXT1	
		4: /EXT2	
		5: /EXT3	
		Bits 4 to 7: External Positioning Signal Setting	
		0: –	
		1: –	
		2: Phase-C pulse input signal	
		3: /EXT1	
		4: /EXT2	
		5: /EXT3	
		Bits 8 to F: Reserved for system use	
OW□□05	Function Setting 3	Bit 1: Phase Reference Creation Calculation Disable (0: Enabled/1: Disabled)	4.4.2 (6)
		Bits 2 to A: Reserved for system use	
		Bit B: Zero Point Return Input Signal (0: OFF/1: ON)	
		Bits C to F: Reserved for system use	
OW□□06	M-III Vendor Specific Servo Command Output	Used as the vendor-specific I/O output area.	4.4.2 (7)
OW□□07	–	Reserved for system use	–

Register No.	Name	Contents	Reference
OW□□08	Motion Command	0: NOP (No Command) 1: POSING (Position Mode) (Positioning) 2: EX_POSING (Latch Target Positioning) (External positioning) 3: ZRET (Zero Point Return) 4: INTERPOLATE (Interpolation) 5: ENDOF_INTERPOLATE (Last Interpolation Segment) (Reserved for system use) 6: LATCH (Interpolation Mode with Latch Input) 7: FEED (Jog Mode) 8: STEP (Relative Position Mode) (Step mode) 9: ZSET (Set Zero Point) 10: ACC (Change Acceleration Time) 11: DCC (Change Deceleration Time) 12: SCC (Change Filter Time Constant) 13: CHG_FILTER (Change Filter Type) 14: KVS (Change Speed Loop Gain) 15: KPS (Change Position Loop Gain) 16: KFS (Change Feed-forward) 17: PRM_RD (Read User Constant) (Read SERVOPACK parameter) 18: PRM_WR (Write User Constant) (Write SERVOPACK parameter) 19: ALM_MON (Alarm Monitor) 20: ALM_HIST (Alarm History Monitor) 21: ALMHIST_CLR (Clear Alarm History) 22: Reserved for system use 23: VELO (Speed Reference) 24: TRQ (Torque Reference) 25: PHASE (Phase Reference) 26: KIS (Change Position Loop Integration Time Constant) 27: PPRM_WR (Stored Parameter Write) 28 to 33: Reserved for system use 34: EX_FEED (Jog Mode with the external positioning function) 35: MEM_RD 36: MEM_WR 37: PMEM_RD 38: PMEM_WR	4.4.2 (8)
OW□□09	Motion Command Control Flag	Bit 0: Holds a Command (0: OFF/1: ON)	4.4.2 (9)
		Bit 1: Interrupt a Command (0: OFF/1: ON)	
		Bit 2: Moving Direction (JOG/STEP) (0: Forward rotation/1: Reverse rotation)	
		Bit 3: Zero Point Return Direction Selection (0: Reverse rotation/1: Forward rotation)	
		Bit 4: Latch Zone Effective Selection (0: Disabled/1: Enabled)	
		Bit 5: Position Reference Type (0: Incremental Value Add Method/1: Absolute Value Set Method)	
		Bit 6: Phase Compensation Type (0: Incremental Value Add Method/1: Absolute Value Set Method)	
		Bit 7: Reserved for system use	
		Bit 8: Access Target Servo Driver User Constant (0: Vendor-specific parameters/1: Common parameters)	
		Bits 9 to F: Reserved for system use	

Register No.	Name	Contents	Reference
OW□□0A	Motion Subcommand	0: NOP (No command) 1: PRM_RD (Read User constant) (Read SERVOPACK parameter) 2: PRM_WR (Write User constant) (Write SERVOPACK parameter) 3: INF_RD (Read Device Information) 4: SMON (Status Monitor) 5: FIXPRM_RD (Read Fixed Parameters) 6: FIXPRM_CHG (Write Fixed Parameters)	4.4.2 (10)
OW□□0B	–	Reserved for system use	–
OL□□0C	Torque/Thrust Reference Setting	Unit is according to OW□□03, bits 12 to 15 (Torque Unit Setting).	4.4.2 (11)
OW□□0E	Speed Limit Setting at the Torque/Thrust Reference	1 = 0.01% (percentage of rated speed)	
OW□□0F	–	Reserved for system use	
OL□□10	Speed Reference Setting	Unit is according to OW□□03, bits 0 to 3 (Speed Unit Selection).	4.4.2 (12)
OW□□12 to OW□□13	–	Reserved for system use	–
OL□□14	Torque/Thrust Limit Setting	Unit is according to OW□□03, bits C to F (Torque Unit).	4.4.2 (13)
OL□□16	Secondly Speed Compensation	Unit is according to OW□□03, bits 0 to 3 (Speed Unit Selection).	4.4.2 (14)
OW□□18	Override	1 = 0.01%	4.4.2 (15)
OW□□19 to OW□□1B	–	Reserved for system use	–
OL□□1C	Position Reference Setting	1 = 1 reference unit	4.4.2 (16)
OL□□1E	Width of Positioning Completion	1 = 1 reference unit	4.4.2 (17)
OL□□20	NEAR Signal Output Width	1 = 1 reference unit	4.4.2 (18)
OL□□22	Error Count Alarm Detection	1 = 1 reference unit	4.4.2 (19)
OL□□24	–	Reserved for system use	–
OW□□26	Positioning Completion Check Time	1 = 1 ms	4.4.2 (20)
OW□□27	–	Reserved for system use	
OL□□28	Phase Correction Setting	1 = 1 reference unit	4.4.2 (21)
OL□□2A	Latch Zone Lower Limit Setting	1 = 1 reference unit	4.4.2 (22)
OL□□2C	Latch Zone Upper Limit Setting	1 = 1 reference unit	

Register No.	Name	Contents	Reference
OW□□2E	Position Loop Gain	1 = 0.1/s	4.4.2 (23)
OW□□2F	Speed Loop Gain	1 = 1 Hz	
OW□□30	Speed Feed Forward	1 = 0.01% (percentage of distribution segment)	
OW□□31	Speed Compensation	1 = 0.01% (percentage of rated speed)	
OW□□32	Position Loop Integration Time Constant	1 = 1 ms	
OW□□33	–	Reserved for system use	
OW□□34	Speed Loop Integration Time Constant	1 = 0.01 ms	
OW□□35	–	Reserved for system use	–
OL□□36	Straight Line Acceleration/ Acceleration Time Constant	Unit is according to OW□□03, bits 4 to 7 (Acceleration/Deceleration Degree Unit Selection).	4.4.2 (24)
OL□□38	Straight Line Deceleration/ Deceleration Time Constant	The units depend on the setting of OW□□03, bits 4 to 7 (Acceleration/Deceleration Degree Unit Selection).	
OW□□3A	Filter Time Constant	1 = 0.1 ms	4.4.2 (25)
OW□□3C	Zero Point Return Method	0: DEC1 + C (DEC1 and C-phase) 1: ZERO (Zero signal) 2: DEC1 + ZERO (DEC1 and ZERO Signal) 3: C (C-phase) 4 to 10: Reserved for system use 11: C Pulse Only 12: P-OT & C-phase 13: P-OT Only 14: HOME LS & C-phase 15: HOME LS Only 16: N-OT & C-phase 17: N-OT Only 18: INPUT & C-phase 19: INPUT Only	4.4.2 (26)
OW□□3D	Width of Starting Point Position Output	1 = 1 reference unit	
OL□□3E	Approach Speed	Unit is according to OW□□03, bits 0 to 3 (Speed Unit Selection).	
OL□□40	Creep Rate	Unit is according to OW□□03, bits 0 to 3 (Speed Unit Selection).	
OL□□42	Zero Point Return Travel Distance	1 = 1 reference unit	
OL□□44	Step Travel Distance	1 = 1 reference unit	4.4.2 (27)
OL□□46	External Positioning Final Travel Distance	1 = 1 reference unit	4.4.2 (28)
OL□□48	Zero Point Position in Machine Coordinate Offset	1 = 1 reference unit	4.4.2 (29)
OL□□4A	Work Coordinate System Offset	1 = 1 reference unit	
OL□□4C	Number of POSMAX Turns Presetting Data	1 = 1 turn • Invalid for liner type	

Register No.	Name	Contents	Reference
OW□□4E	Servo User Monitor Setting	Bits 0 to 3: Monitor 1 (Cannot be set.) Bits 4 to 7: Monitor 2 (Cannot be set.) Bits 8 to B: Monitor 3 (Cannot be set.) Bits C to F: Monitor 4	4.4.2 (30)
OW□□4F	Servo Driver Alarm Monitor No.	Sets the number of the alarm to monitor.	4.4.2 (31)
OW□□50	Servo Driver User Constant No. (SERVOPACK parameter No. for motion command)	Set the number of the SERVOPACK parameter.	
OW□□51	Servo Driver User Constant Size	Sets the number of words in the SERVOPACK parameter.	
OL□□52	Servo Driver User Constant Set Point (SERVOPACK parameter setting value for motion command)	Sets the setting for the SERVOPACK parameter.	
OW□□54	Servo Driver for Assistance User Constant No. (SERVOPACK parameter No. for motion subcommand)	Sets the number of the SERVOPACK parameter number.	
OW□□55	Servo Driver for Assistance User Constant Size (SERVOPACK parameter size for motion subcommand)	Sets the number of words in the SERVOPACK parameter.	
OL□□56	Servo Driver for Assistance User Constant Set Point (SERVOPACK parameter setting value for motion subcommand)	Sets the setting for the SERVOPACK parameter.	
OW□□58	Address Setting	Sets the target addresses for motion commands MEM_RD, MEM_WR, PMEM_RD, and PMEM_WR.	
OW□□59 to OW□□5A	–	Reserved for system use	
OW□□5B	Device Information Selection Code	00H: Invalid data 01H: Vendor ID 02H: Device Code 03H: Device Version 04H: MDI Version 05H: Serial No.	
OW□□5C	Fixed Parameter Number	Sets the number of the fixed parameter to read with the FIX-PRM_RD motion subcommand.	4.4.2 (32)
OW□□5D	–	Reserved for system use	–

Register No.	Name	Contents	Reference
OL□□5E	Encoder Position When Power is OFF (Lower 2 words)	1 = 1 pulse Note: For linear type, do not set this register.	4.4.2 (33)
OL□□60	Encoder Position When Power is OFF (Upper 2 words)	1 = 1 pulse Note: For linear type, do not set this register.	
OL□□62	Pulse Position When Power is OFF (Lower 2 words)	1 = 1 pulse Note: For linear type, do not set this register.	
OL□□64	Pulse Position When Power is OFF (Upper 2 words)	1 = 1 pulse Note: For linear type, do not set this register.	
OL□□66 to OL□□6E	–	Reserved for system use	–
OW□□70	User Select Servo Driver User Constant Setting Value (SERVOPACK parameter setting value for user-selected servo driver)	Enter the value to be set for the SERVOPACK parameter set for fixed parameter No. 44 here.	4.4.2 (34)
OW□□68 to OW□□7F	Command Buffer for Servo Driver Transmission Reference Mode	This area is used for command data when MECHATROLINK servo commands are specified directly.	4.4.2 (35)

B.3 Monitoring Parameter List

The following table provides a list of SVC motion monitoring parameters.

- For details on individual monitoring parameters, refer to the reference column and read the listed section of *Machine Controller MP2000 Series Motion Module SVC-01 User's Manual* (Manual No.: SIEP C880700 41).

Register No.	Name	Contents	Reference
IW□□00	RUN Status	Bit 0 Motion Controller Operation Ready	4.4.3 (1)
		Bit 1: Running (At Servo ON)	
		Bit 2: System BUSY	
		Bit 3: Servo Ready	
		Bit 4: Latch Mode	
		Bits 5 to F: Reserved for system use	
IW□□01	Parameter Number When Range Over is Generated	Setting parameters: 0 or higher Fixed Parameters: 1000 or higher	4.4.3 (2)
IL□□02	Warning	Bit 0: Excessive Deviation	4.4.3 (3)
		Bit 1: Set Parameter Error (Setting parameter error)	
		Bit 2: Fixed Parameter Error	
		Bit 3: Servo Driver Error	
		Bit 4: Motion Command Set Error	
		Bit 5: Reserved for system use	
		Bit 6: Positive Direction Overtravel	
		Bit 7: Negative Direction Overtravel	
		Bit 8: Servo ON Incomplete	
		Bit 9: Servo Driver Communication Warning	
		Bit A: Servo Driver Stop Signal Input	
		Bits B to 1F: Reserved for system use	

Register No.	Name	Contents	Reference
IL□□04	Alarm	Bit 0: Servo Driver Error	4.4.3 (4)
		Bit 1: Positive Direction Overtravel	
		Bit 2: Negative Direction Overtravel	
		Bit 3: Positive Direction Software Limit	
		Bit 4: Negative Direction Software Limit	
		Bit 5: Servo OFF	
		Bit 6: Positioning Time Over	
		Bit 7: Excessive Positioning Moving Amount	
		Bit 8: Excessive Speed	
		Bit 9: Excessive Deviation	
		Bit A: Filter Type Change Error	
		Bit B: Filter Time Constant Change Error	
		Bit C: Reserved for system use	
		Bit D: Zero Point Unsetting Note: Invalid for linear type.	
		Bit E: Reserved for system use	
		Bit F: Reserved for system use	
		Bit 10: Servo Driver Synchronization Communications Error	
		Bit 11: Servo Driver Communication Error	
		Bit 12: Servo Driver Command Timeout Error	
		Bit 13: Excessive ABS Encoder Rotations Note: Invalid for linear type	
		Bits 14 and 15: Reserved for system use	
		Bit 16: Scanning Set Error	
		Bits 17 to 1B: Reserved for system use	
		Bit 1C: Cyclic Communication Initialization Incomplete	
		Bit 1D: Detected Servo Driver Type Error	
		Bit 1E: Motor type set error	
		Bit 1F: Connected Encoder Type Error	
IL□□06	–	Reserved for system use	–
IW□□08	Motion Command Response Code	Same as OW□□08 (Motion Command).	4.4.3 (5)
IW□□09	Motion Command Status	Bit 0: Command Execution Flag (BUSY)	4.4.3 (6)
		Bit 1: Command Hold Completed (HOLDL)	
		Bit 2: Reserved for system use	
		Bit 3: Command Error Completed Status (FAIL) (Command Encoder Type Error)	
		Bits 4 to 6: Reserved for system use	
		Bit 7: Reset Absolute Encoder Completed	
		Bit 8: Command Execution Completed (COMPLETE)	
		Bits 9 to F: Reserved for system use	
IW□□0A	Subcommand Response Code	Same as OW□□0A (Motion Subcommand).	4.4.3 (7)
IW□□0B	Subcommand Status	Bit 0: Command Executing Flag	4.4.3 (9)
		Bits 1 to 2: Reserved for system use	
		Bit 3: Command Error Completed Status (Command Error Occurrence)	
		Bits 4 to 7: Reserved for system use	
		Bit 8: Command Execution Completed	
		Bits 9 to F: Reserved for system use	

Register No.	Name	Contents	Reference
IW□□0C	Position Management Status	Bit 0: Discharging Completed (DEN)	4.4.3 (9)
		Bit 1: Positioning Completed (POSCOMP)	
		Bit 2: Latch Complete (LCOMP)	
		Bit 3: NEAR Position (NEAR)	
		Bit 4: Zero Point Position (ZERO)	
		Bit 5: Zero Point Return (Setting) Completed (ZRNC)	
		Bit 6: During Machine Lock (MLKL)	
		Bit 7: Absolute Position read-out Completed	
		Bit 8: ABS Rotary Pos. LOAD Complete (ABS System Infinite Length Position Control Information Load Completed) (ABSLDE) Note: Invalid for linear type	
		Bit 9: POSMAX Turn Preset Complete (TPRSE) Note: Invalid for linear type	
		Bits A to F: Reserved for system use	
IW□□0D	–	Reserved for system use	–
IL□□0E	Target Position in Machine Coordinate System (TPOS)	1 = 1 reference unit	4.4.3 (10)
IL□□10	Calculated Position in Machine Coordinate System (CPOS)	1 = 1 reference unit	
IL□□12	Machine Coordinate System Reference Position (MPOS)	1 = 1 reference unit	
IL□□14	CPOS for 32 bit	1 = 1 reference unit	
IL□□16	Machine Coordinate System Feedback Position (APOS)	1 = 1 reference unit	
IL□□18	Machine Coordinate System Latch Position (LPOS)	1 = 1 reference unit	
IL□□1A	Position Error (PERR)	1 = 1 reference unit	
IL□□1E	Number of POSMAX Turns	1 = 1 turn • Invalid for linear type	
IL□□20	Speed Reference Output Monitor	pulse/s	4.4.3 (11)
IL□□22 to IL□□27	–	Reserved for system use	–
IL□□28	M-III Servo Command Input Signal Monitor	Stores the signal information entered in MECHATROLINK-III.	4.4.3 (11)
IL□□2A	M-III Servo Command Status	Stores the servo command information entered in MECHATROLINK-III.	
IW□□2C	M-III Command Status	Bit 0: Device Alarm Occurrence (D_ALM) Bit 1: Device Warning Occurrence (D_WAR) Bit 2: Command Ready (CMDRDY) Bit 3: Alarm Clear Execution Completed (ALM_CLR_CMP) Bits 4 and 5: Reserved for system use Bits 6 and 7: Echo-back of Command ID (RCMD_ID) Bits 8 to F: Reserved for system use	4.4.3 (12)
IW□□2D	Servo Driver Alarm Code	Stores the alarm codes from the servo driver.	
IW□□2E	–	Reserved for system use	–

Register No.	Name	Contents	Reference
IW□□2F	Servo Driver User Monitor Information	Bits 0 to 3: Monitor 1 (Cannot be set.) Bits 4 to 7: Monitor 2 Bits 8 to B: Monitor 3 (Cannot be set.) Bits C to F: Monitor 4	4.4.3 (13)
IL□□30	Servo Driver User Monitor 2	Stores the result of the selected monitor.	
IL□□32	Servo Driver User Monitor 3	Reserved for system use	
IL□□34	Servo Driver User Monitor 4	Stores the result of the selected monitor.	
IW□□36	Servo Driver User Constant No. (SERVOPACK parameter No. for MECHATROLINK command area)	Stores the number of the parameter being processed.	
IW□□37	Supplementary Servo Driver User Constant No. (SERVOPACK parameter No. for MECHATROLINK subcommand area)	Stores the number of the parameter being processed.	
IL□□38	Servo Driver User Constant Reading Data (SERVOPACK parameter reading area for MECHATROLINK command area)	Stores the data of the parameter being read.	
IL□□3A	Supplementary Servo Driver User Constant Reading Data (SERVOPACK parameter reading area for MECHATROLINK subcommand area)	Stores the data of the parameter being read.	
IW□□3C to IW□□3E	–	Reserved for system use	–
IW□□3F	Motor Type	Stores the type of motor actually connected. 0: Rotation type motor 1: Linear motor	4.4.3 (14)
IL□□40	Feedback Speed	Unit is according to OW□□03, bits 0 to 3 (Speed Unit Selection).	
IL□□42	Feedback Torque/ Thrust	Unit is according to OW□□03, bits 12 to 15 (Torque Unit Selection).	
IW□□44 to IW□□55	–	Reserved for system use	–
IL□□56	Fixed Parameter Monitor	Stores the data of the fixed parameter when FIXPRM_RD has been specified in the Motion Subcommand.	4.4.3 (15)
IW□□58 to IW□□5A	–	Reserved for system use	–
IW□□5B	Device Information Monitor Code	00H: Invalid data 01H: Vendor ID 02H: Device Code 03H: Device Version 04H: MDI Version 05H: Serial No.	4.4.3 (15)

Register No.	Name	Contents	Reference
IL□□5C	–	Reserved for system use	–
IL□□5E	Encoder Position When the Power is OFF (Lower 2 words)	1 = 1 pulse	4.4.3 (16)
IL□□60	Encoder Position When the Power is OFF (Upper 2 words)	1 = 1 pulse	
IL□□62	Pulse Position When the Power is OFF (Lower 2 Words)	1 = 1 pulse	
IL□□64	Pulse Position When the Power is OFF (Upper 2 Words)	1 = 1 pulse	
IW□□66 to IW□□6F	–	Reserved for system use	–
IW□□70 to IW□□7F	Device Information Monitor Data	Stores the information read with the subcommand INF_RD.	4.4.3 (17)

C Checking MPU-01 Module Operating Status from Main CPU Module

To check the operating status of the MPU-01 Module from the main CPU module, refer to the following system registers.

Refer to these system registers to check the status of MPU-01 battery alarm and the system status when alarm occurs. For details on the MPU-01 Module's status (SW00040) and error status (SW00041), refer to *6.3.1 System Status*.

Name	Register Number	Remarks
MPU-01 #1 Status	SW01411	Status (SW00040) of MPU-01 Module circuit 1
MPU-01 #1 Error Status	SW01412	Error status (SW00041) of MPU-01 Module circuit 1
MPU-01 #2 Status	SW01413	Status (SW00040) of MPU-01 Module circuit 2
MPU-01 #2 Error Status	SW01414	Error status (SW00041) of MPU-01 Module circuit 2
...	...	...
MPU-01 #16 Status	SW01441	Status (SW00040) of MPU-01 Module circuit 16
MPU-01 #16 Error Status	SW01442	Error status (SW00041) of MPU-01 Module circuit 16

D Precautions when Using MPU-01 Module

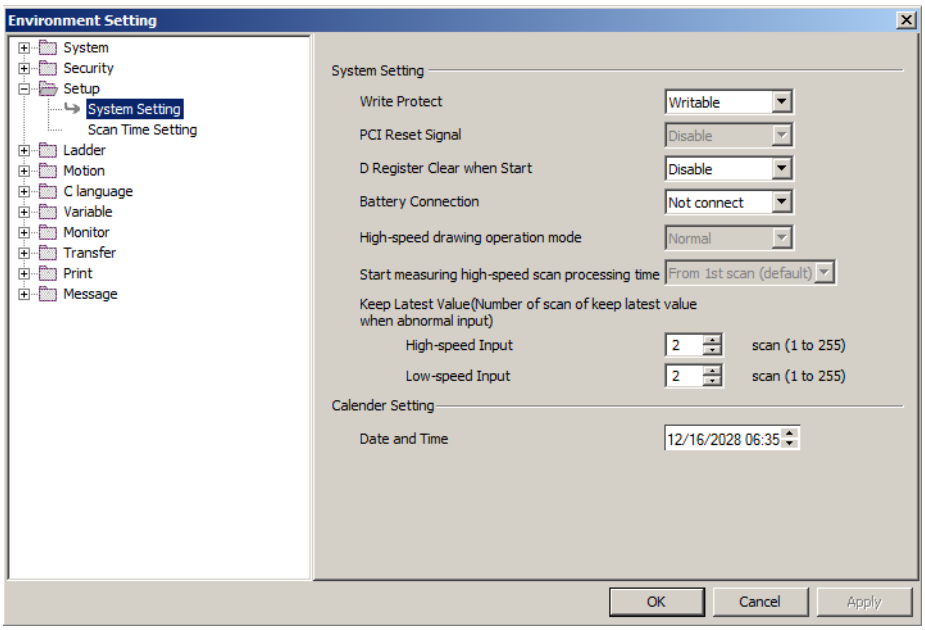
D.1 General Precautions

(1) Precautions when Setting or Changing User Definition Files

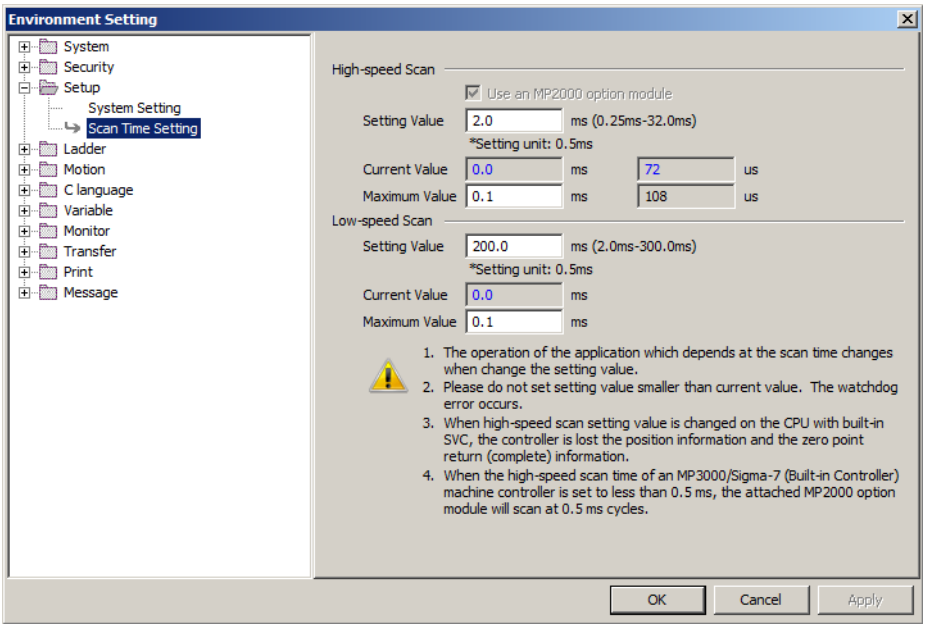
User definition files (system settings, scan time settings, and module configuration definitions) must be saved to flash memory.

When setting or changing these definition files by the MPE720, be sure to save the results to flash memory. If data is not saved to flash memory, the settings and changes will be lost when the power supply to the MPU-01 is turned OFF and ON.

System Setting (Select ***File*** - ***Environment Setting*** - ***Setup*** - ***System Setting*** from the menu bar.)



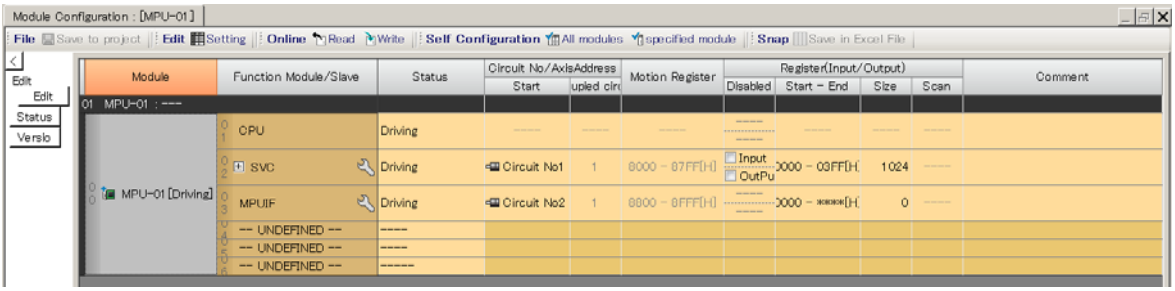
Scan Time Setting (Select ***File - Environment Setting - Setup - Scan Time Setting*** from the menu bar.)



(2) Precautions when Setting or Changing Module Configuration Definitions

Observe the following precautions when setting or changing module configuration definitions.

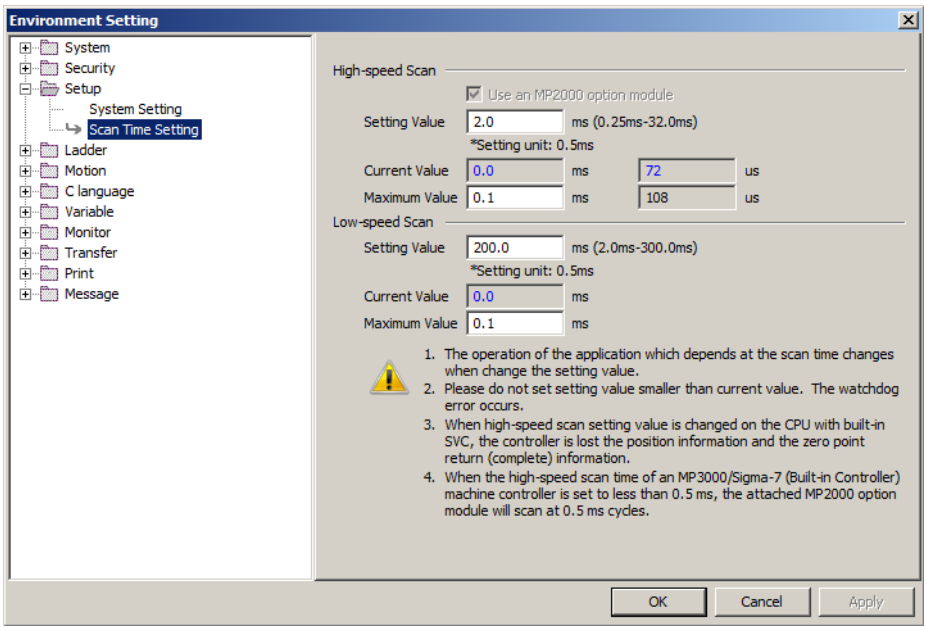
- Always make sure to check that the mounted module is the one that is defined.
- Be sure to save any new settings or changes to flash memory.
- After the settings or changes have been completed, turn the power supply to the MPU-01 OFF and ON.



(3) Precautions when Setting or Changing the Scan Time

Scan time can be set or changed in the following window.

Scan Time Setting (Select ***File - Environment Setting - Setup - Scan Time Setting*** from the menu bar.)



Observe the following precautions when setting or changing the scan time.

- Set the set values of the scan time for both the high-speed (H) and low-speed (L) scans to at least the maximum time required to execute the scans. Use the following formula to calculate the scan time.

  (set value − maximum time to execute scan) ≥ (0.2 × set values of the scan time)

  The set value of the scan time should be at least 1.25 times greater than the maximum time required for the scan.

  - If the scan time is set too close to the maximum execution time for the scan, the refresh time for the MPE720 will be very slow and communication timeouts may occur. If the maximum execution time exceeds the scan time set value, a watchdog timer timeout error will occur and the MPU-01 system will stop.
- Do not change the scan time set value while the Servo is ON. Never change the setting while the axis is moving (while the motor is running). Otherwise an error may occur during motor operation (e.g., high-speed rotation).
- When the scan time is set or changed, be sure to save the data to flash memory.

D.2 Limitations when Setting a High-speed Scan of 0.25 ms

Note that the following functional limitations apply when the high-speed scan setting is set to 0.25 ms.

- Motion programs cannot be used.
- The following ladder commands cannot be used.

  Motion program call command (MSEE)

  PI control command (PI)

  PD control command (PD)

  PID control command (PID)

  First-order lag command (LAG)

  Phase lead lag command (LLAG)

  Linear accelerator/deccelerator 1 command (LAU)

  Linear accelerator/deccelerator 2 command (SLAU)

  Pulse width modulation command (PWM)

  ON delay timer command: Measuring unit = 0.01 seconds

  OFF delay timer command: Measuring unit = 0.01 seconds

  Note: Because no error occurs even if the commands above are input, take care not to use them.

D.3 Effect of High-speed Scan Setting Changes on Position Management Information

The following processing is carried out if the high-speed scan setting is changed.

- MECHATROLINK communication is reset.
- Position information is lost as a result of resetting MECHATROLINK communication.
- Zero return completion information is lost as a result of resetting MECHATROLINK communication.
- The soft limit function is ineffective as a result of the zero return completion information being lost.

D.4 Constraints on High-speed Scans

The MPU-01 high-speed scan (communication cycle) is executed in synchronization with the MECHATROLINK-III transmission cycle. Accordingly, the high-speed scan (communication cycle) has to be set as an integral multiple of the MECHATROLINK-III transmission cycle. Because of this, the following constraint applies to high-speed scans.

<Constraint>: The length of the high-speed scan cycle of the MPU-01 Module is equal to that of the MECHATROLINK-III transmission cycle or an integral multiple of it.

Note: This applies when the MECHATROLINK-III transmission is defined in the motion parameters window.

If this constraint is not satisfied, high-speed scan processing stops and an alarm occurs. The details of this alarm are reported in the CPU error status (SW00041) in the system registers. For details on SW00041, refer to *6.3.1 System Status*.

D.5 Restrictions on Use of MPU-01 Module in an Environment Synchronized with Slave CPUs

The slave CPU synchronization function serves to synchronize the high-speed scan cycles of two MP2000 series controllers connected via MECHATROLINK-II.

Note that when this function is used, an MPU-01 Module cannot be used in an option slot of the MP2000 series controller at the MECHATROLINK slave side.

D.6 Restrictions on Use of SERVOPACK

SERVOPACKs have the following constraints.

If the following constraint is not satisfied, the warning A.94B "Data Setting Warning 2 (Out of Range)" occurs.

Set the high-speed scan cycle or MECHATROLINK transmission cycle so as to satisfy this constraint.

<Constraint>: The MPU-01 high-speed scan is no greater than 32 times the MECHATROLINK transmission cycle of the built-in SVC.

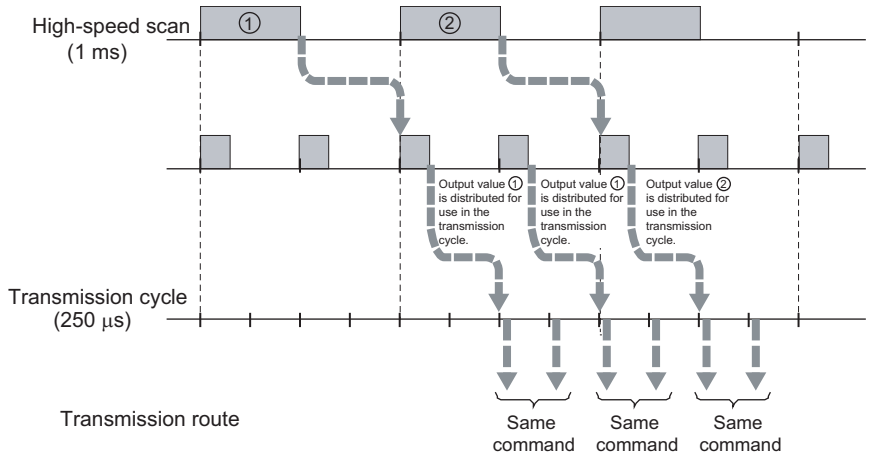
Example: When the MECHATROLINK transmission cycle is 125 μs, the high-speed scan cycle can be set up to 4 ms (125 μs × 32).

D.7 Difference in Distribution Timing Relative to SVC-01 Module

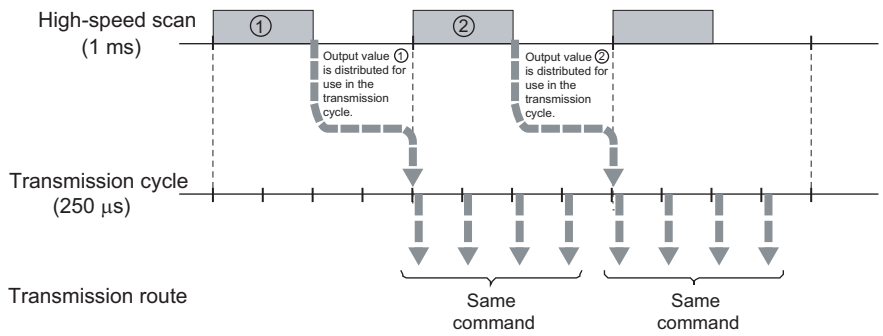
Note that a difference exists between the SVC-01 Module and the built-in SVC in the MPU-01 Module in terms of the timing of data distribution in the transmission route, as shown in the following diagram.

- Interpolation commands

<SVC-01 Module>

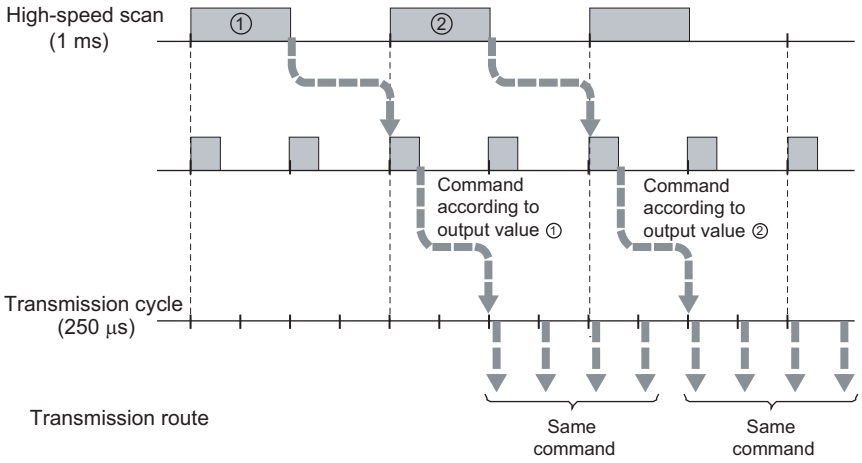


<MPU-01 Module>

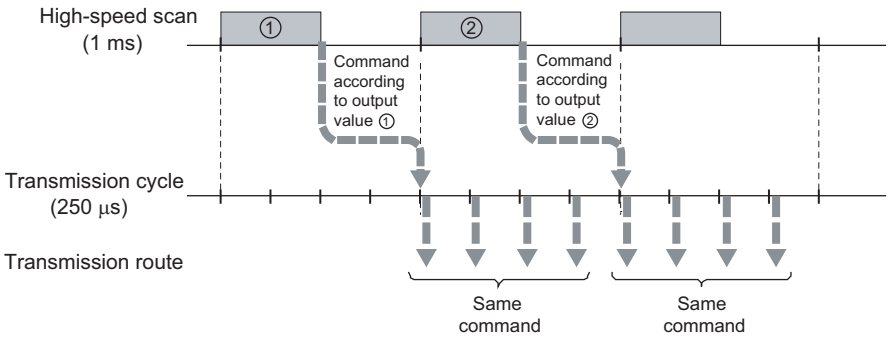


- Commands other than interpolation commands

<SVC-01 Module>



<MPU-01 Module>

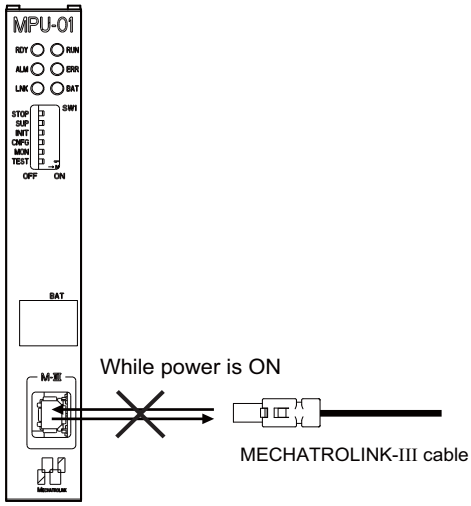


D.8 Notes on Connection and Grounding

(1) Connecting and Disconnecting MECHATROLINK-III Cables

⚠ CAUTION

- Do not connect or disconnect a MECHATROLINK-III cable while power is being supplied.
  There is a risk of electric shock or malfunction of the MPU-01 Module. It is very dangerous and must not be attempted.

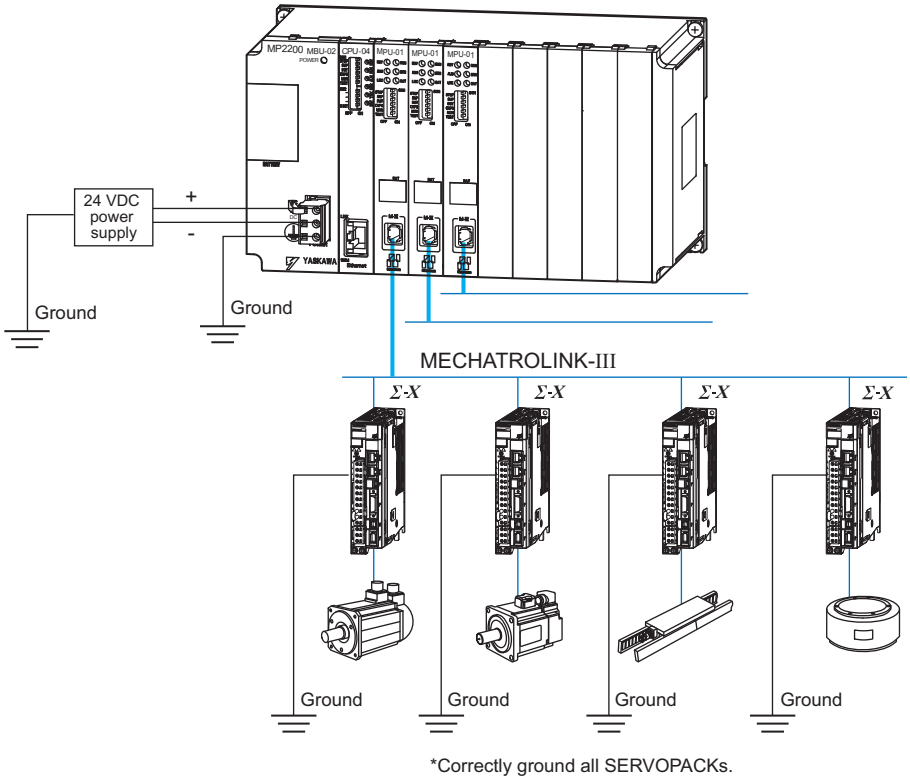


(2) Grounding

Ground the unit correctly and reliably.

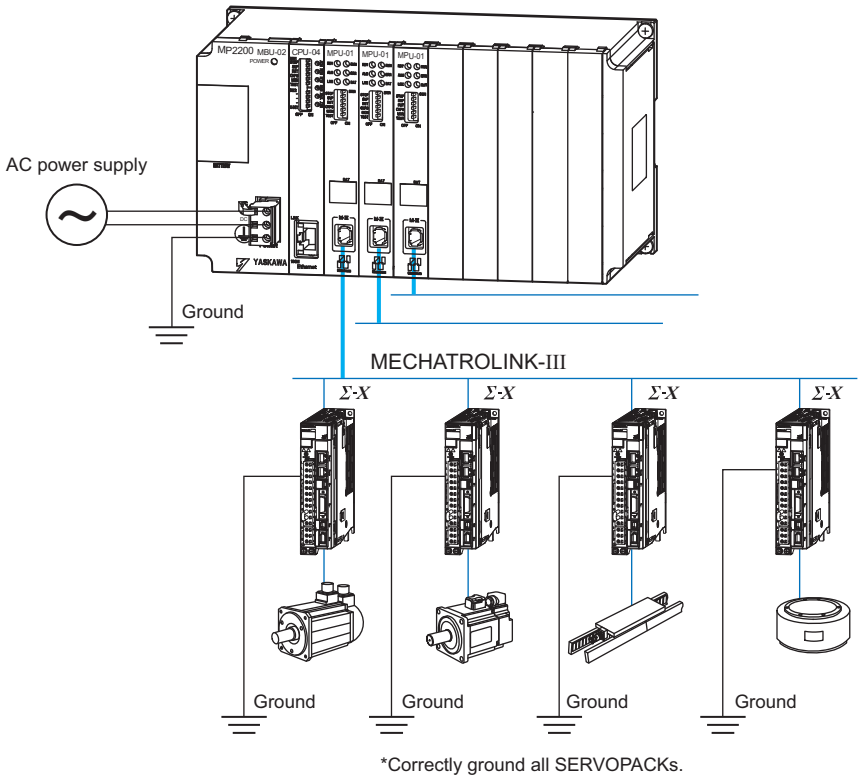
If the grounding is not done correctly, there is a risk of fire damage to devices and of electric shock or injury.

<With a 24 VDC Power Supply>



*Correctly ground all SERVOPACKs.

<With an AC Power Supply>



*Correctly ground all SERVOPACKs.

D.9 Restrictions when Mounting an MPU-01 Module on an MP2200 Base Unit

The following restrictions apply when mounting an MPU-01 Module on an MP2200 base unit of MBU-02 (9 slots and 24 VDC power supply).

Note: No restrictions apply for the MBU-01 (9 slots and 100 VAC power supply) and the MBU-03 (4 slots and 24 VDC power supply).

(1) Restrictions for MP2200 base unit of MBU-02

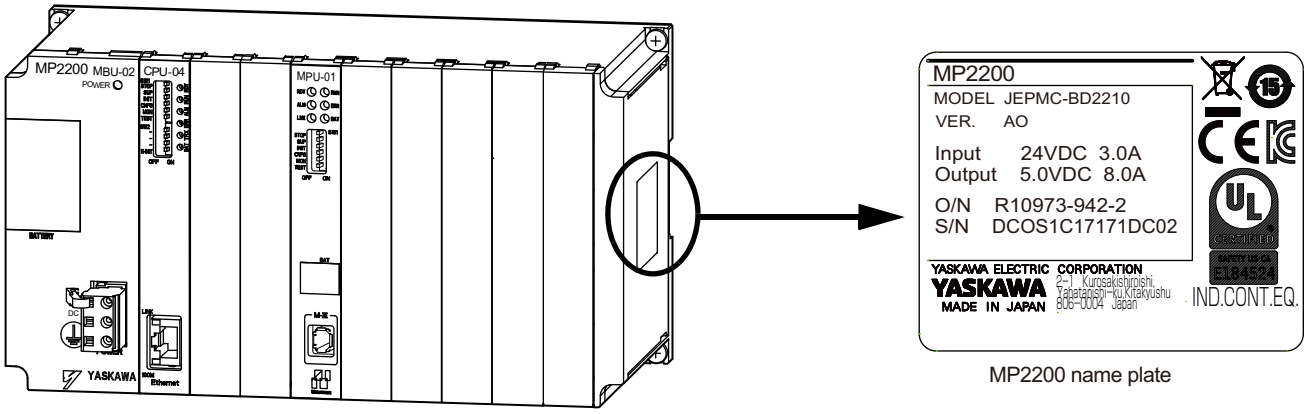
For JEPMC-BU2210

Unit Version	Mounting Method	
	On main CPU base unit	On base unit for expansion rack
REV.A0 or earlier	Available	Not available
REV.A1 or later		Available

For JEPMC-BU2210-E

Unit Version	Mounting Method	
	On main CPU base unit	On base unit for expansion rack
REV.A00	Available	Not available
REV.A01		Not available
REV.A2 or later		Available

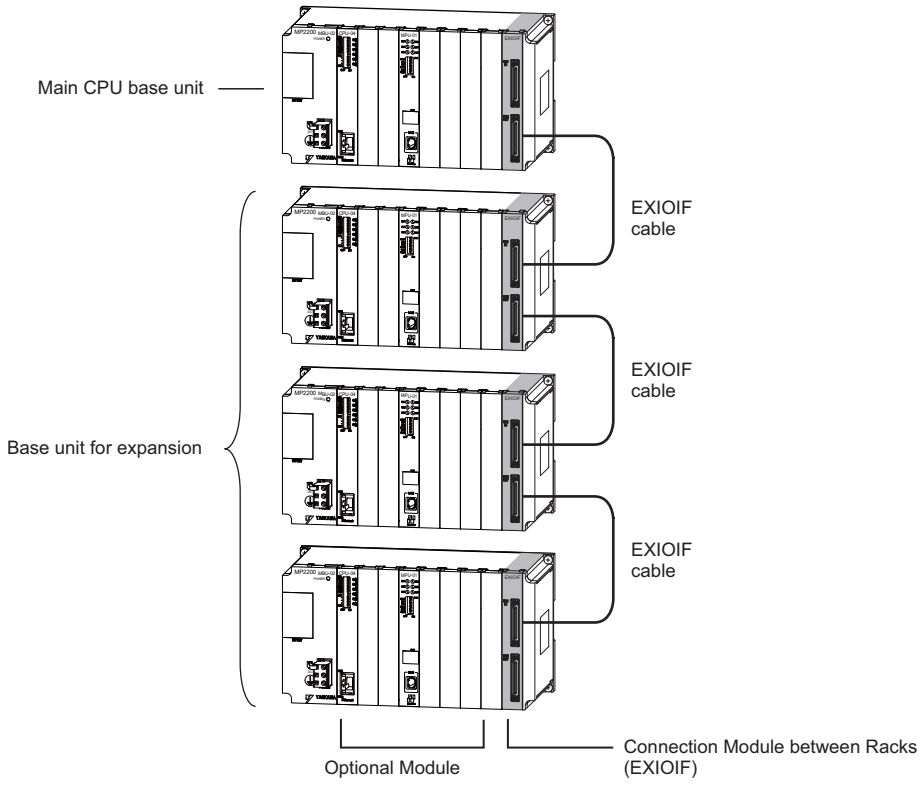
Check the nameplate of MP2200 base unit for the unit version number.



MP2200 name plate

The following figure shows a system using expansion racks on base units.

<Example of Expansion for MP2200>



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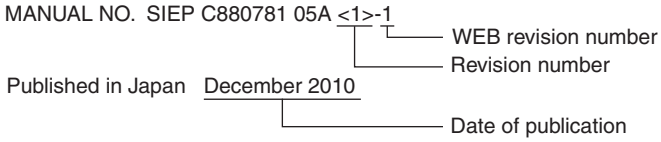
Revision History

The revision dates and numbers of the revised manuals are given on the bottom of the back cover.



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December 2021	<4>	0	All chapters	Revision: MPE720 windows changed to Ver.7 Revision: SERVOPACK descriptions changed to Σ-X
			Back cover	Revision: Address
April 2018	<3>	0	3.2.2	Revision: Noise resistance
January 2018	<2>	0	3.1	Revision: Applicable Machine Controllers for MPU-01 Module
			3.2.2	Revision: Pollution Level, Noise Resistance
			Back cover	Revision: Address
May 2015	<1>	5	Front cover, Back cover	Revision: Format
			1.3.1	Revision: Compatible SERVOPACKs
			1.3.2, 1.3.3	Addition: Compatible Inverters and Modules
			2.2.2	Revision: Illustration of the lithium battery
November 2014		4	1.3.3, 2.2	Revision: Battery kit model number
			Back cover	Revision: Address
January 2013		3	3.3	Addition: Note for using the MPE720
			Back cover	Revision: Address
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			4.4.3 (2) [a]	Revision: Description of options and precautions on settings in Number of connection Addition: Range of number of connectable stations setting Addition: Description of SigmaWin+
			Back cover	Revision: Address, format
July 2010		0	All chapters	Slightly revised
			1.1.2 (1),1.4, Appendix D.8	Revision: Examples of system configurations
			1.2.3	Revision: Indicator details and countermeasures for errors
			3.1	Addition: Note for the restrictions when mounting an MPU-01 Module on an MP2200 base unit
			6.1	Revision: Flowchart for checking MPU-01 error
			6.2.2 (1), (2)	Revision and Addition: Description of how to determine the source of a WDT error
			6.2.3	Addition: Section about when system crashes due to a system error
			6.2.4, 6.2.5 6.2.6, 6.2.7, 6.2.8, 6.2.9, 6.3.5, 6.3.6	Revision: Section numbers
			6.3.1	Revision: Table showing system status
			6.3.2	Revision: Table showing hardware configuration status
			6.3.3	Addition: Section about ladder program user operation error status
			Appendix D.9	Addition: Section about the restrictions when mounting an MPU-01 Module on an MP2200 base unit
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Machine Controller MP2000 Series

MPU-01 Multiple-CPU Module
USER'S MANUAL

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Specifications are subject to change without notice for ongoing product modifications and improvements.

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