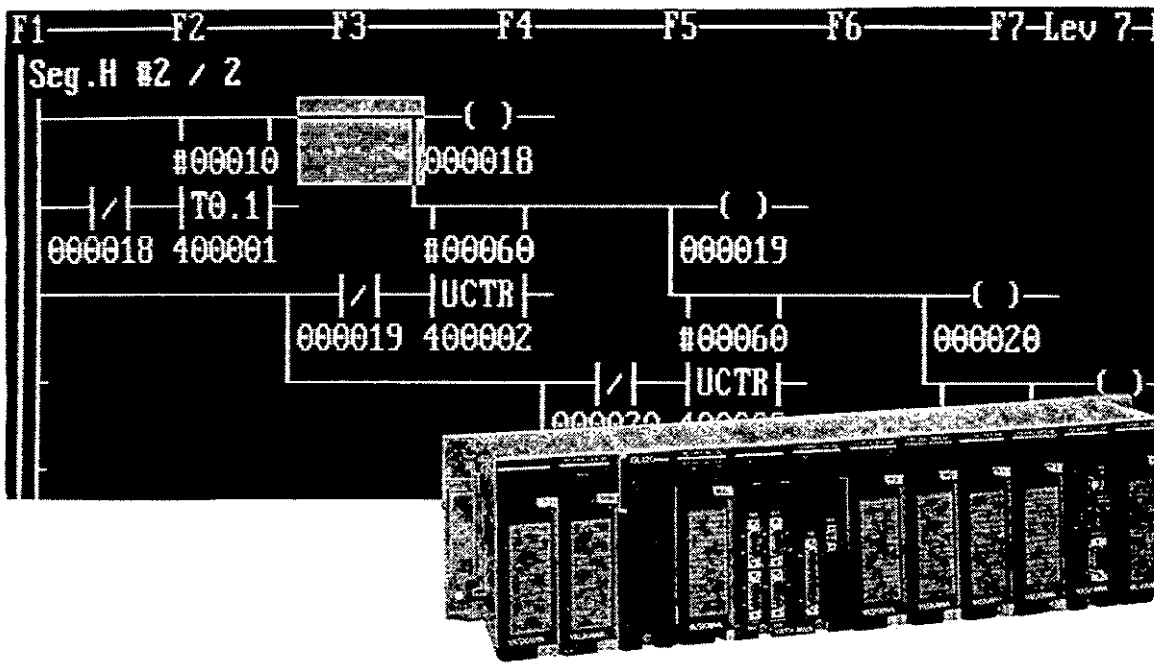
MEMOCON GL120, GL130

MOTION MODULE MC20

HARDWARE USER'S MANUAL



YASKAWA

MANUAL NO. SIEZ-C825-20.51C

Manual Contents

This manual describes specifications and applications for the MC20 Module as applicable to the MEMOCON GL120 and GL130 Programmable Controllers.

This manual also explains new step-2 functions and version B08 functions. Systems that support step-2 functions and version B08 functions are listed in *1.1 Overview of Manual*.

Please read this manual carefully and be sure you understand the information provided before attempting to install or use a MC20 Module.

Visual Aids

The following aids are used to indicate certain types of information for easier reference.

	Indicates additional information on version B08 functions.
	Indicates additional information on step-2 functions.
	Indicates references for additional information.
IMPORTANT	Indicates important information that should be memorized.
◀EXAMPLE▶	Indicates application examples.
	Indicates supplemental information.
◗SUMMARY	Indicates a summary of the important points of explanations.
Note	Indicates inputs, operations, and other information required for correct operation but that will not cause damage to the device.
	Indicates definitions of terms used in the manual.

NOTICE

The following conventions are used to indicate precautions in this manual. Failure to heed precautions provided in this manual can result in injury to people or damage to the products.

⚠**WARNING** Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.

⚠**Caution** Indicates precautions that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

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Introduction and Precautions

1

This chapter introduces the MC20 Module and provides precautions for the use of this manual and the product. **You must read this chapter before attempting to read the rest of the manual or using the product.**

1.1 Overview of Manual

- This manual describes the functional specifications of the MC20 Modules used for the MEMOCON GL120 and GL130 Programmable Controllers. Read this manual carefully in order to use the MC20 Modules properly. Also, keep this manual in a safe place so that it can be used whenever necessary.

- This manual also provides information on version B08 functions. Systems that support version B08 functions are listed below. Information related to version B08 functions is referred to by notes in the text or is indicated by the following icon.

Ver. B08

Ver. B08

- **Systems Supporting Version B08 Functions**
  The following Modules used with MEMOCON GL120 and GL130 Programmable Controllers and with the version numbers listed in the table support version B08 functions.

Module	Name	Model	Version Numbers Enabling Version B08 Functions	Location of Version Number
CPU Module (8 kW)	CPU10	DDSCR-120CPU14200	□□A01 and later	Nameplate (note 1)
CPU Module (16 kW)	CPU20	DDSCR-120CPU34100	□□B05 and later	Nameplate (note 1)
CPU Module (16 kW)	CPU21	DDSCR-120CPU34110	□□A02 and later	Nameplate (note 1)
CPU Module (32 kW)	CPU30	DDSCR-120CPU54100	□□B05 and later	Nameplate (note 1)
CPU Module (40 kW)	CPU35	DDSCR-130CPU54110	□□A01 and later	Nameplate (note 1)
Four-axis Motion Module	MC20	JAMSC-120MMB10400	□□B08 and later	Nameplate (note 1)
MEMOSOFT		FMSGL-AT3 (MEMOSOFT for DOS)	1.40□ and later (note 2)	Displayed at the center bottom of the MEMOSOFT Startup Screen.
		FMSGL-PP3 (MEMOSOFT for P120 Programming Panel)		
		FMSGL-PP3E (MEMOSOFT for P120 Programming Panel)		

Note (1) The nameplates are on the right side of the Modules.

(2) Override functions cannot be set using version 1.40 of the MEMOSOFT. Use the PRM instruction from the ladder program to set override functions.

- This manual also provides information on the new step-2 functions. Systems that support step-2 functions are listed below. Information related to step-2 functions is referred to by

notes in the text or is indicated by the following icon.

- **Systems Supporting Step-2 Functions**

The following Modules used with MEMOCON GL120 and GL130 Programmable Controllers and with the version numbers listed in the table support step-2 functions.

Module	Name	Model	Version Numbers Enabling Step-2 Functions	Location of Version Number
CPU Module (8 kW)	CPU10	DDSCR-120CPU14200	□□A01 and later	Nameplate (Note 1)
CPU Module (16 kW)	CPU20	DDSCR-120CPU34100	□□A08 and later	Nameplate (Note 1)
CPU Module (16 kW)	CPU21	DDSCR-120CPU34110	□□A02 and later	Nameplate (Note 1)
CPU Module (32 kW)	CPU30	DDSCR-130CPU54100	□□A07 and later	Nameplate (Note 1)
CPU Module (40 kW)	CPU35	DDSCR-130CPU54110	□□A01 and later	Nameplate (note 1)
Four-axis Motion Module	MC20	JAMSC-120MMB10400	□□B01 and later	Nameplate (Note 1)
MEMOSOFT		FMSGL-AT3 (MEMOSOFT for DOS)	1.30□ and later	Displayed at the center bottom of the MEMOSOFT Startup Screen.
		FMSGL-PP3 (MEMOSOFT for P120 Programming Panel)		

Note The nameplates are on the right side of the Modules.

• Refer to the following manuals for related Peripheral Devices and Modules.

Manual Name	Manual Number	Content
MEMOCON GL120, GL130 Motion Module MC20 Software User's Manual	SIEZ-C825-20.52	Describes motion instructions for the GL120 and GL130.
MEMOCON GL120, GL130 MEMOSOFT for P120 Programming Panel User's Manual	SIEZ-C825-60.7	Describes the functions, specifications, and operating methods of the P120 Programming Panel with the MEMOSOFT built in.
MEMOCON GL120, GL130 MEMOSOFT for DOS User's Manual	SIEZ-C825-60.10	Describes the functions and operating procedures of the DOS version of MEMOSOFT.
MEMOCON GL120, GL130 Hardware User's Manual	SIEZ-C825-20.1	Describes system configuration devices and their functions, specifications, application methods, etc., for the GL120 and GL130.
MEMOCON GL120, GL130 Software User's Manual Vol.1	SIEZ-C825-20.11	Describes the operating principles, I/O allocation, operation instructions, processing time, etc., of the GL120 and GL130.
MEMOCON GL120, GL130 Software User's Manual Vol.2	SIEZ-C825-20.12	Describes extended arithmetic function instructions (for instance, floating point operation instructions) for the GL120 and GL130.
MEMOCON GL120, GL130 Teach Pendant TB120 User's Manual	SIEZ-C825-60.3	Describes the operating methods of the Teach Pendant for on-site operation of MC20 Modules.

Manual Name	Manual Number	Content
AC Servo Drive M, F, G, S and D Series User's Manual: Technical Sheets (Incremental Encoders)	TSE-S800-11.1	Describes the functions, specifications, and handling methods for CACR-SR□□BE Servopacks with Incremental Encoders.
AC Servo Drive M, F, G, S and D Series User's Manual: Technical Sheets (Absolute Encoders)	TSE-S800-11.2	Describes the functions, specifications, and handling methods for CACR-SR□□BY Servopacks with Absolute Encoders.
Σ Series SGM□/SGDA User's Manual	TSE-S800-15	Describes the functions, specifications, and handling methods for SGDA-□□□S Servopacks with Incremental or Absolute Encoders.
Σ Series SGM□/SGDB User's Manual	TSE-S800-16	Describes the functions, specifications, and handling methods for SGDB-□□ Servopacks with Incremental or Absolute Encoders.
Σ Series SGM□/DR2 User's Manual	TSE-S800-17	Describes the functions, specifications, and handling methods for DR2-□□ Servopacks.
Σ- II Series SGM□H/SGDM User's Manual Design and Maintenance	SIE-S800-31.2	Describes the functions, specifications, and handling methods for SGDM-□□ Servopacks with Incremental or Absolute Encoders.
Σ- II Series SGM□H/SGDH User's Manual Design and Maintenance	SIE-S800-32.2	Describes the functions, specifications, and handling methods for SGDH-□□ Servopacks with Incremental or Absolute Encoders.

- Refer to *MEMOCON GL120, GL130 Motion Module MC20 Software User's Manual* for details on programming the MC20 Module.

1.2 Precautions

This section outlines general precautions that apply to using this manual and the product. You must read this section first before reading the remainder of the manual.

1.2.1 Installation Precautions

Abide by the following precautions when installing MEMOCON systems.

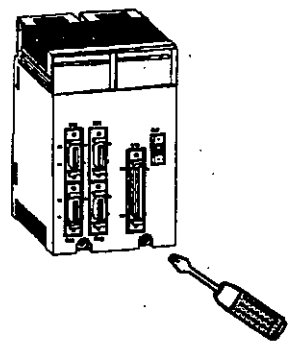
⚠ **Caution** The installation environment must meet the environmental conditions given in the product catalog and manuals. Using the MEMOCON in environments subject to high temperatures, high humidity, excessive dust, corrosive gases, vibration, or shock can lead to electrical shock, fire, or faulty operation. Do not use the MEMOCON in the following locations.

- Locations subject to direct sunlight or ambient temperatures not between 0 and 60 °C.
- Locations subject to relative humidity in excess of 95%, rapid changes in humidity, or condensation.
- Locations subject to corrosive or flammable gas.
- Locations that would subject the MEMOCON to direct vibration or shock.
- Locations subject to contact with water, oil, chemicals, etc.

⚠ **Caution** Install the MEMOCON as described in this product manual. Improper installation can cause product failure, malfunctions, or Modules or other components to fall off.

Mounting Screws

- Make sure that all mounting screws for the connectors and modules mounted to the MC20 Module must be tightened securely, otherwise the MC20 Module may malfunction.



⚠ **Caution** Do not allow wire clippings or other foreign matter to enter the MEMOCON. Foreign matter can cause fires, product failure, or malfunctions.

1.2.2 Wiring Precautions

⚠ **Caution** Wiring must be performed by qualified personnel

Mistakes in wiring can cause fires, product failure, or malfunctions.

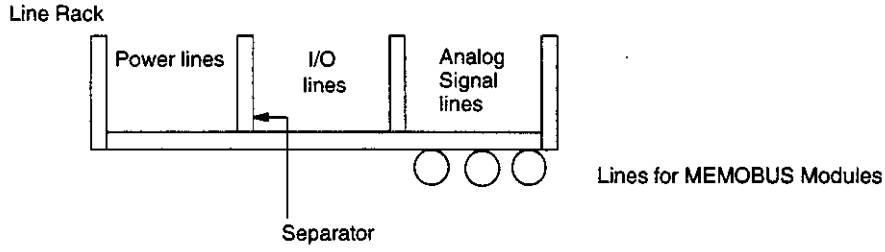
- Insert the interface cables properly.

Insert the connectors of the various interface cables that are to be connected to MEMOCON into the communication ports and attach them properly. Improper insertion of interface cables may cause operational errors in the MEMOCON.

- Separate wiring properly.

I/O lines connecting external devices to the MC20 Modules must be selected based on the following considerations: mechanical strength, resistance to noise, wiring distance, signal voltage, etc.

I/O lines must be separated from power lines both within and outside of the control panel to minimize the affects of noise. Faulty operation can result if I/O lines are not sufficiently separated from power lines.

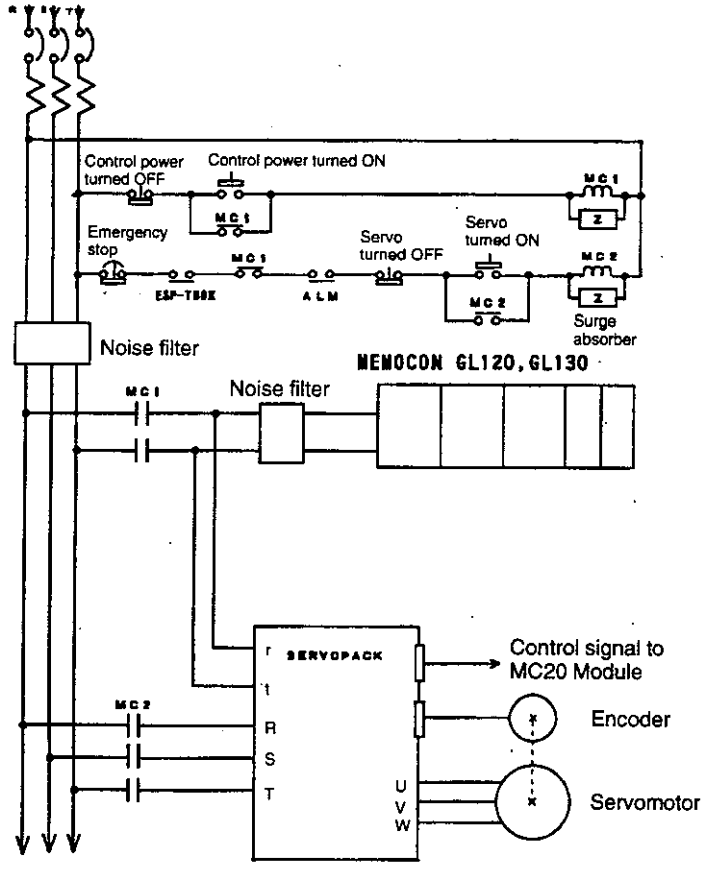


1.2.3 Applications Precautions

⚠WARNING An external emergency stop circuit and interlock circuit must be connected to the MEMOCON. Do not build these circuits into the MEMOCON, otherwise the MEMOCON may malfunction and the machines connected to the MEMOCON may be damaged or accidents may result.

1) External Emergency Stop Circuit

Do not write a ladder logic program with MEMOCON for the emergency stop circuit of your system. As shown in the following diagram, design an external emergency stop circuit consisting of mechanical relays with normally closed contacts so that the main power supplied to the servo will be turned OFF when the emergency stop circuit works, otherwise the system may be damaged or accidents resulting in injury or death may be caused if there is any input circuit malfunction or cable disconnection.

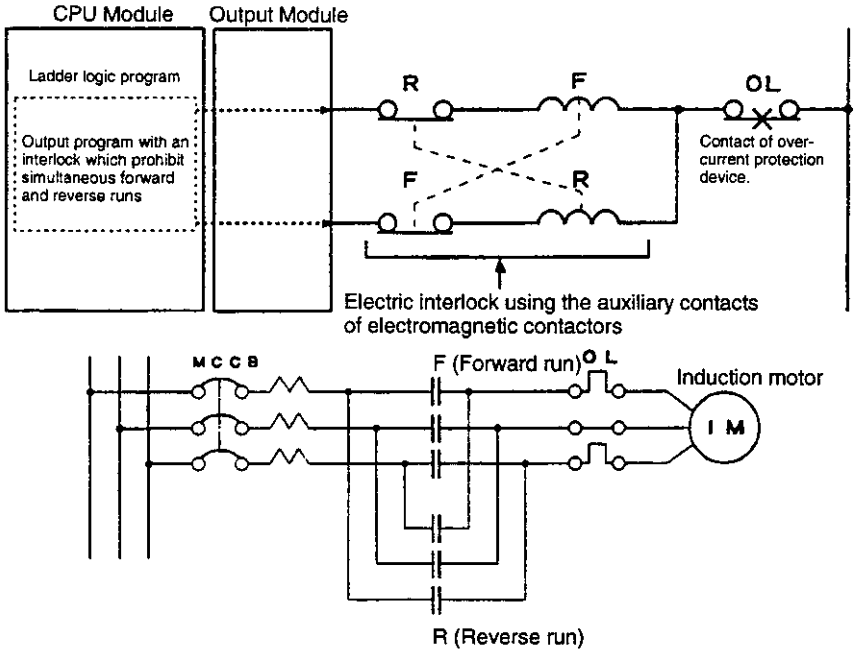


2) External Interlocks for the GL120, GL130

Externally connect an interlock to the GL120, GL130 if there is any chance that GL120, GL130 failure could result in bodily harm or equipment damage.

Always use an external interlock system as shown in the following example when reciprocal operations (e.g., forward and reverse directions) are being performed with a motor.

An interlock is generally programmed in the GL120, GL130 to ensure that forward and reverse signals are not simultaneously output. An external interlock circuit must also be provided using the auxiliary contacts of electromagnetic contactors.



⚠Caution An operation such as a program change during operation must be carried out with care. Operational errors may damage the machine or cause accidents.

1.2.4 Maintenance

⚠Caution Mount the MC20 Module to the MEMOCON or dismount the MC20 Module from the MEMOCON after turning OFF the power supplied to the MEMOCON and MC20 Module, otherwise the MC20 Module may malfunction.

⚠Caution Connect I/O and signal cables to the MC20 Module or disconnect the cables from the MC20 Module after turning OFF the power supplied to the MC20 Module, otherwise the MC20 Module may malfunction.

⚠Caution Do not attempt to disassemble or modify the MEMOCON in any way. Doing so can cause fires, product failure, or malfunctions.

1.2.5 Safety Precautions

- MEMOCON was not designed or manufactured for use in devices or systems directly related to human life. Users who intend to use the product described in this manual for special purposes such as devices or systems relating to transportation, medical, space aviation, atomic power control, or underwater use must contact Yaskawa Electric Corporation beforehand.

- This product has been manufactured under strict quality control guidelines. However, if this product is to be installed in any location in which a failure of MEMOCON involves a life and death situation or in a facility where failure may cause a serious accident, safety devices MUST be installed to minimize the likelihood of any accident.

- Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable.

- The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual. A new version of the manual will be re-released under a revised manual number when any changes are made.

- Contact your Yaskawa representative or a Yaskawa office listed on the back of this manual to order a new manual whenever this manual is damaged or lost. Please provide the manual number listed on the front cover of this manual when ordering.

- Contact your Yaskawa representative or a Yaskawa office listed on the back of this manual to order new nameplates whenever a nameplate becomes worn or damaged.

- Yaskawa cannot make any guarantee for products which have been modified. Yaskawa assumes no responsibility for any injury or damage caused by a modified product.

1.3 Using this Manual

- **Meaning of Basic Terms**

  In this manual, the following terms indicate the meanings as described below, unless otherwise specified.

  - **PLC = Programmable (Logic) Controller**
  - **PP = Programming Panel**
  - **MC = Motion Module**
  - **GL120, GL130 = MEMOCON GL120 and MEMOCON GL130 Programmable Controllers**

- **Description of Technical Terms**

  The shaded technical terms in this manual are briefly explained in the **Glossary** provided at the bottom of the page. An example is shown below.

Glossary

The following types of terms are described.

- Specific sequence control terms required for explanation of functions.
- Terms that are specific to programmable controllers and electronic devices.

MC20 Module

2

This chapter describes the general features of the MC20 Module and systems with one or two MC20 Modules for a variety of applications.

2.1 General Features

The general features of the MC20 Module are described below.

2.1.1 Appearance

The MC20 Module is a motion module occupying two slots of the MEMOCON GL120 or GL130, which are Yaskawa's medium- and high-capacity Programmable Controllers. Refer to *Figure 2.1* for the appearance of the MC20 Module.

Product: Four-axis Motion Module
Model no.: JAMSC-120MMB10400

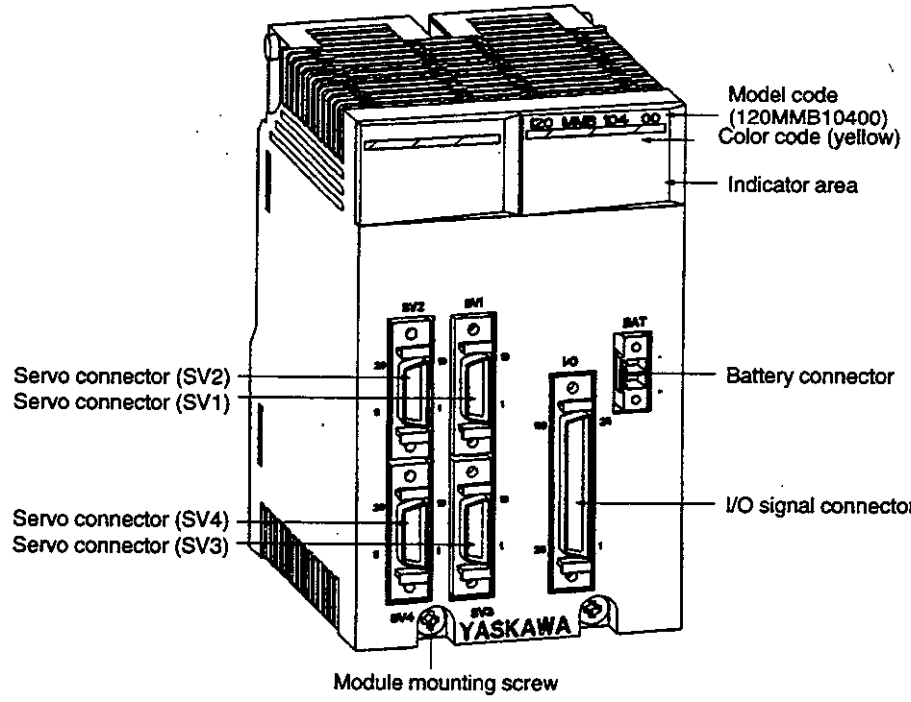
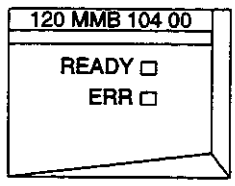


Figure 2.1 MC20 Module

Indicator area



Indicator	Color	Status	Meaning
READY	Green	Lit	MC20 Module is being serviced by CPU Module
		Not lit	Allocation has not been performed for MC20 Module by CPU Module.
ERR	Red	Lit	An error has occurred in the MC20 Module.

2.1.2 Features

1) A single MC20 Module can control a maximum of four servomotors, i.e., a maximum of four axes. With a powerful motion control function, the MC20 Module performs a variety of machine control operations.

2) The features of the machine control operations preformed by the MC20 Module are described below.

   a) The MC20 Module has a memory that can store **motion programs** and **ladder logic programs** independently for **motion control**.

   b) A ladder logic program can be used to monitor the data of a motion program while the MC20 Module is executing the motion program. Furthermore, I/O signals can be exchanged between the ladder logic and motion programs, which makes it possible for the MC20 Module to perform motion control linked up with **sequential control**.

   c) The MC20 Module performs point-to-point positioning control. Furthermore, the MC20 Module incorporates linear, circular, and helical interpolation functions, thus performing locus control.

   d) A single system can include a maximum of two MC20 Modules, to control two machines simultaneously and independently.

   e) A ladder logic program can be used to control an independent axis regardless of the designated motion program of the MC20 Module, i.e., while an axis is controlled by a motion program, the MC20 Module can start operating an independent axis, which makes it possible to shorten the cycle time required by the MC20 Module.

TERMS

Motion program

The motion program is stored in the MC20 Module for motion control. The MC20 reads the motion program and outputs commands for servomotor control. Refer to the *MEMOCON GL120, GL130 Motion Module MC20 Software User's Manual* (Manual No. : SIEZ-C825-20.52) for details.

Ladder logic program

The ladder logic program, in which ladder diagrams are used, is stored in the CPU Module for sequential control. Refer to the following manuals for details.

- *MEMOCON GL120, GL130 Software User's Manual Vol.1*
  (Manual No. : SIEZ-C825-20.11)
- *MEMOCON GL120, GL130 Software User's Manual Vol.2 Part1 to 3*
  (Manual No. : SIEZ-C825-20.12)

Motion control

Motion control is a type of machine control performed by changing the position and locus of a moving object with one or more servomotor.

Sequential control

Sequential control is a type of machine control performed by turning I/O signals to the machine ON and OFF under certain conditions.

2.2 Motion Control

Typical application examples of the MC20 Module are described below and illustrates what can be done with the MC20 Module.

2.2.1 Servomotor Control

1) The MC20 Module performs **position control** and speed control in combination with a servo drive consisting of a Servo Amp and servomotor. The MC20 Module is responsible for position control and the servo drive is responsible for **speed control.**
The MC20 Module supplies analog voltage signals as speed references to the Servo Amp. Yaskawa's speed-controlling Servo Amp can be connected to the MC20 Module.

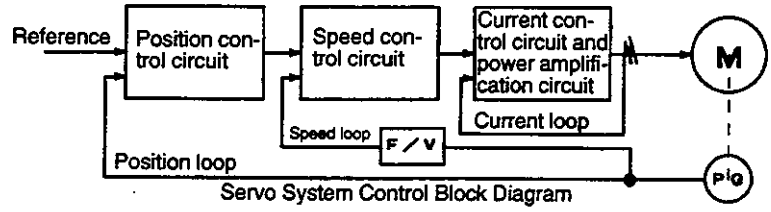
TERMS

Position control

Position control is a type of control performed by using a servo control system and position detector. The servo control system gives position data as commands to the position detector, whose output signals are used as feedback signals. The type of position data is usually a pulse train.

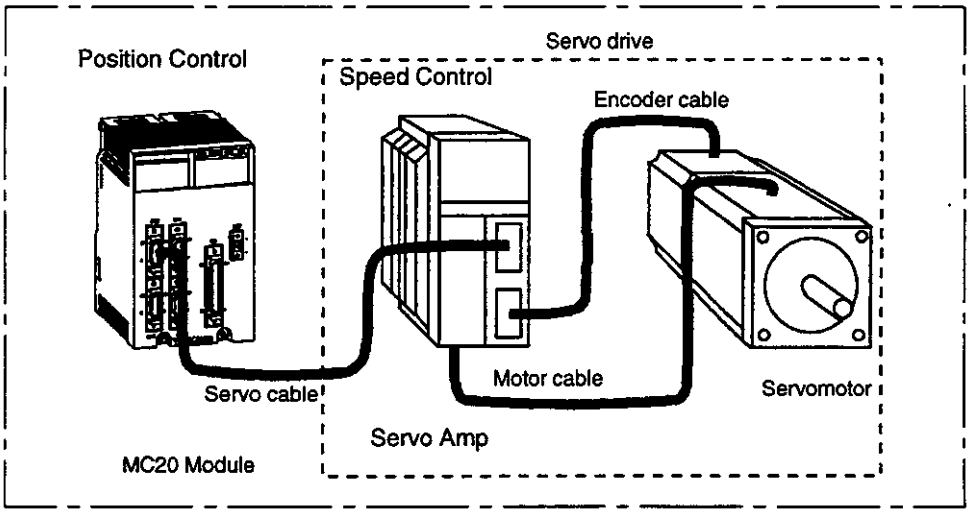
Speed control

Speed control is a type of control performed by using a servo control system and speed detector. The servo control system gives speed data as reference to the speed detector, whose output signals are used as feedback signals. The type of speed data is usually an analog voltage signal.



Servo System Control Block Diagram

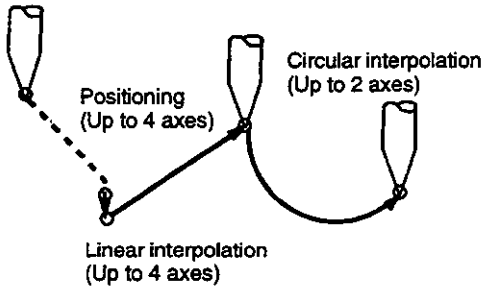
2) A single MC20 Module can control a maximum of four servomotors, i.e., a maximum of four axes.



2.2.2 Single MC20 Module

The following examples illustrate the main types of motion that can be programmed with a single MC20 Module.

- Basic motions, such as rapid traverse positioning, linear interpolation, and circular interpolation, can be easily programmed.



- Helical interpolation can be programmed to combine linear and circular interpolation (Fig. A).

- Helical interpolation can also be used by applying the linear interpolation portion to the rotary axis to trace an arc using **normal line control** (Fig. B).

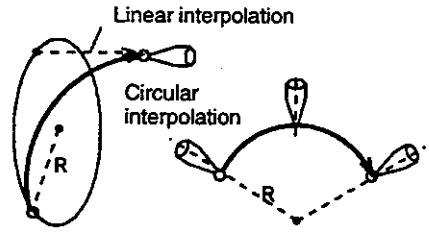
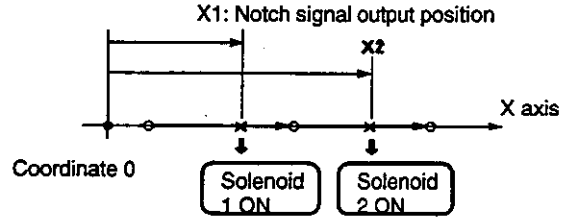


Fig. A Helical Interpolation **Fig. B Normal Line Control**

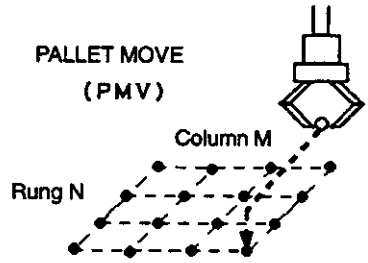
- The M code is output when the specified position (i.e., the notch signal output position) is passed during axis movement by a block command. This M code can be used, for example, to turn ON a particular solenoid.

Using PASS NOTCH SIGNAL OUTPUT (PNT)



- Positioning can be carried out with a rapid traverse speed to a particular grid point position on the pallet. The pallet number and grid point data are set in memory in advance.

- Palletizing and depalletizing operations can be easily programmed.



TERMS

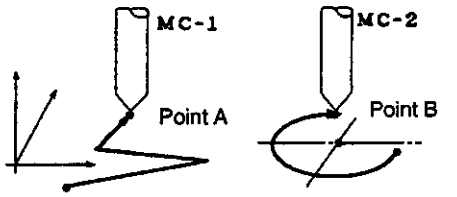
Normal line control

The control of an object such as a paint gun or the tip of a welding torch in the normal line direction with respect to the forward direction is called "normal line control."

2.2.3 Two MC20 Modules

The following examples illustrate the comparatively complicated motions that can be programmed with two MC20 Modules.

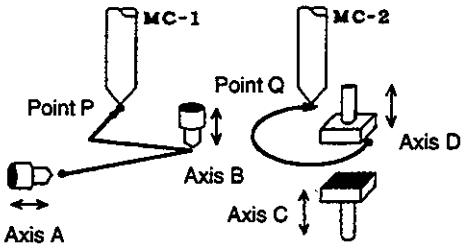
- Two MC20 Modules are used.
- Independent locus control by separate programs is possible for points A and B.



Linear interpolation (Up to 4 axes)

Circular interpolation (Up to 2 axes)

- Movement to points P and Q is simultaneously controlled from the MC20 Module along two axes.
- Axes A to D are controlled independently from the CPU Module.
- A total of eight axes are controlled all together.

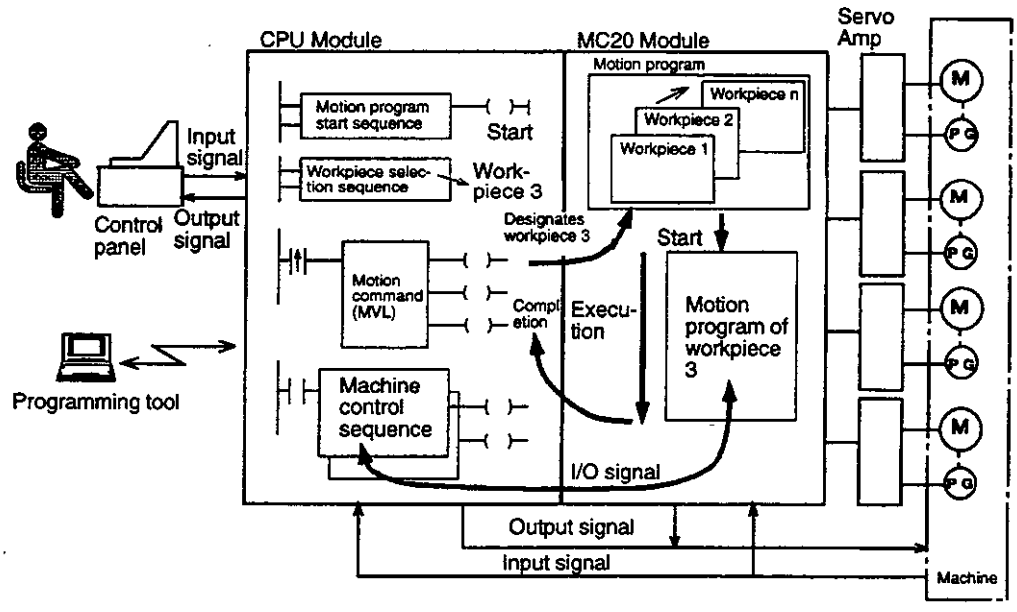


2.3 CPU Module

The relationship between the MC20 Module and CPU Module is described below.

2.3.1 Relationship between MC20 Module and CPU Module

1) The MC20 Module does not function alone. By executing motion commands for ladder logic programs with the CPU Module, the CPU Module sends the commands to the MC20 Module for a variety of control operations. Refer to the following for the CPU Module and MC20 Module in program operation.



2) The MC20 Module is connected to the CPU Module through a bus to exchange the following data.

a) **MC Coil and MC Relay (I/O Variable)**
MC coil and MC relay data is a type of I/O signal that can be written to and read from ladder logic programs and motion programs. MC coil and MC relay data is treated as a variable in motion programs.

b) **MC Link Register (Link I/O Variable)**
MC link register (link I/O variable) data is a type of register data that can be directly written from ladder logic programs or motion programs. This data is treated as a variable in motion programs. The allocation of the data is fixed according to configuration.

c) **M Code Relay**
M code relay data is a type of signal that the MC20 Module outputs to CPU Module when the SET EXTERNAL OUTPUT (SET) command is executed in the designated motion program of the MC20 Module.

d) **MC Control Coil**
MC control coil data is a type of coil data for the CPU Module to control the MC20 Module. MC control coil data is turned ON and OFF with the designated ladder logic program of the CPU Module to control the MC20 Module. MC control coil data consists of signals, such as override and M code completion signals, whose allocation is fixed.

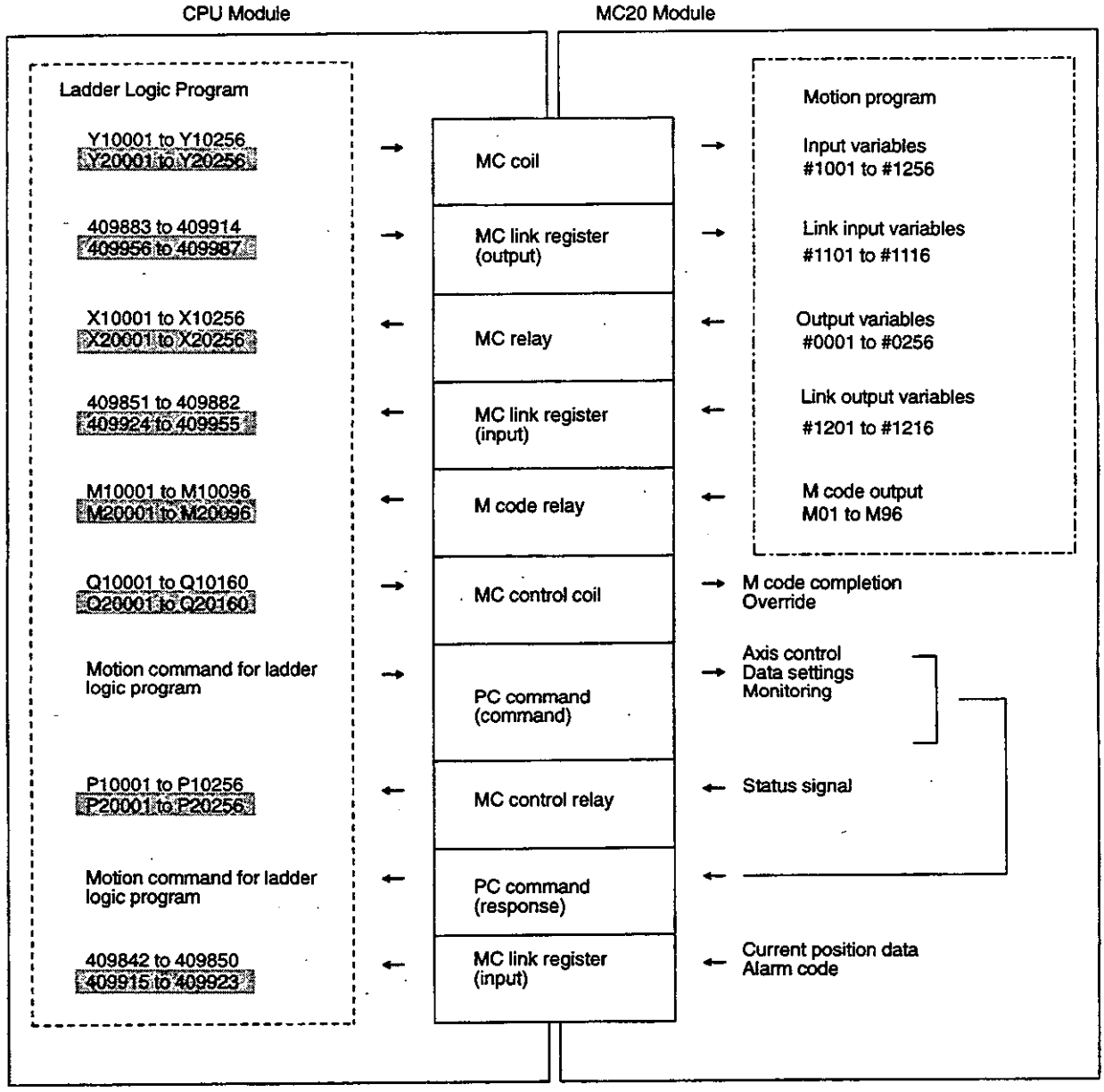
e) **MC Control Relay**
MC control relay data is a type of data that relays the signal status of the MC20 to the CPU Module. A ladder logic program can be used to monitor the operating status of the MC20 Module. MC control relay data is a signal whose allocation is fixed.

f) **PLC Command (Command and Response)**
When a motion command is executed in the ladder logic program of the CPU Module, the CPU Module sends a command to the MC20 Module to control the MC20 Module. After the MC20 Module is under control, the MC20 Module sends a response to the CPU Module. The type of command sent by the CPU Module varies with the motion command.

g) **MC Link Register (Current Position and Alarm)**
MC link register (current position and alarm) data is a type of data containing the current position data and status data of each servo-controlled axis. The allocation of this data is fixed according to configuration. The data can be used in ladder logic programs.

Note The output data sent from the MC20 Module to the CPU Module is refreshed every 8 ms. If the scan time of the designated ladder logic program of the CPU Module is more than 8 ms, the CPU may read the wrong output data.
To prevent this, write a ladder logic program so that the output data can be transferred to the internal coil first. Then use the internal coil in the succeeding part of the ladder logic program. The register must be treated similarly.

3) Concept of Data Exchanges



Note (1) The plain reference numbers of the ladder logic program are for the MC20 Module 1 and the gray-shaded reference numbers of the ladder logic program are for the MC20 Module 2.

(2) The numbers for the MC link registers are default values.

2.3.2 Operation Mode

1) Four Operation Modes

a) The MC20 Module operates in the following four modes.

(1) Edit mode (EDIT)

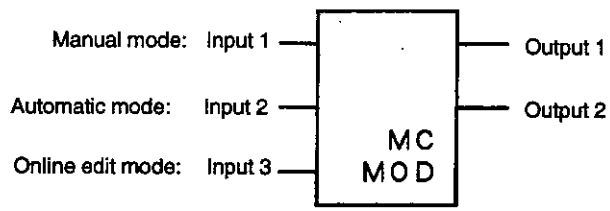
(2) Manual mode (MANUAL)

(3) Automatic mode (AUTO)

(4) Online edit mode (ONLINE-EDIT)

b) To select any of the above operation modes, change the input status of MODE SET (MOD), which is a motion command for ladder logic programs, in the ladder logic program.

Mode set command



c) Operation modes and input signals can be combined as shown in the following table.

	Input 1	Input 2	Input 3
Edit Mode	OFF	OFF	OFF
Manual Mode	ON	OFF	OFF
Automatic Mode	OFF	ON	OFF
Online Edit Mode	OFF	OFF	ON

To reset the mode of the MC20 Module, be sure to turn OFF the previous input, otherwise the mode will not change.

d) The MC20 Module in any mode can control axes A, B, C, and D. The movability of axes X, Y, Z, and S, depends on the mode.

e) If there is a mode change of the MC20 Module while it is controlling an axis, the MC20 Module will decelerate the axis to a stop (except axes A to D).

2) Edit Mode (EDIT)

a) Select this mode so that the MC20 Module can be loaded with the following data from a **programming device** loaded with the MEMOSOFT.

(1) Motion program

(2) Parameter

(3) Point table

b) Before selecting this mode, turn OFF inputs 1 to 3 of MODE SET (MOD), which is a motion command for ladder logic programs.

c) An alarm signal will turn ON if you try to load a motion program to the MC20 Module when it is not in edit mode. Make sure that the MC20 Module is in edit mode before loading the motion program.

d) Parameters and point table data can be loaded to the MC20 Module in any mode. It is, however, recommendable to load them in edit mode for safety's sake.

e) Any parameter loaded to the MC20 Module will not be enabled unless the MC20 Module is turned OFF and ON or MODULE RESET (MRS), which is a motion command for ladder logic programs, is executed.

f) The MC20 Module in edit mode cannot control axis X, Y, Z, or S. An alarm signal will turn ON if the MC20 Module is made to control any of them with a motion command for ladder logic programs.
The MC20 Module in any mode can control axes A, B, C, and D.

3) Manual Mode (MANUAL)

a) Select this mode to enable the MC20 Module to perform the following manual operations.

(1) JOG (JOG)

(2) STEP (STP)

(3) HOME RETURN (ZRN)

Programming Device

A programming device is a personal computer or Yaskawa's dedicated programming panel DISCT-P120□ which are both loaded with motion programs and ladder logic programs for the MEMOCON GL120 or GL130. Use Yaskawa's MEMOSOFT programming software to write the motion programs and ladder logic programs.

b) Before selecting this mode, turn ON only input 1 of MODE SET (MOD), which is a motion command for ladder logic programs.
The MC20 Module in manual mode performs the following operations manually for axes X, Y, Z, and S.

c) **JOG (JOG)**
While input 1 of JOG, which is a motion command for ladder logic programs, is ON, the axis designated with the MC20 Module will move at the speed designated within the parameters of the MC20 Module. Input 2 of JOG can be used to designate the travelling direction of the axis.

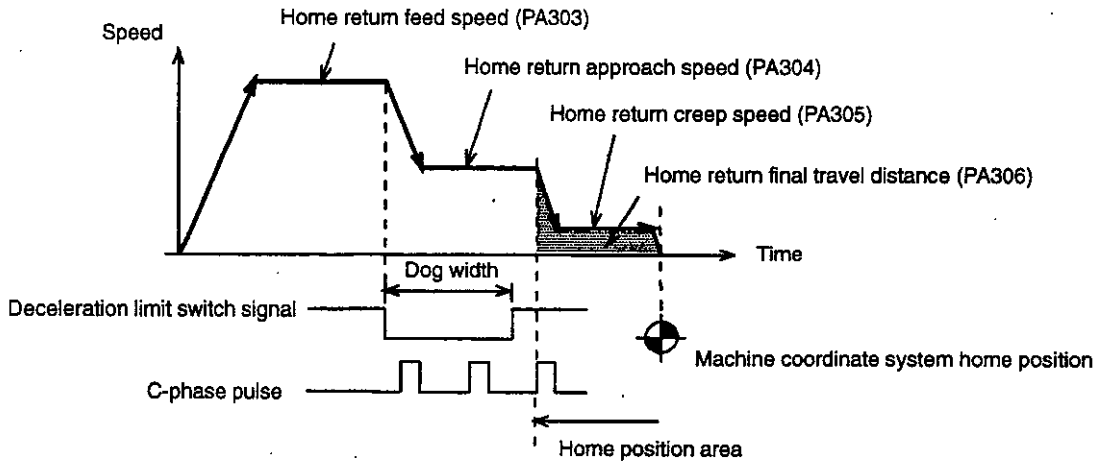
d) **STEP (STP)**
When input 1 of STEP (STP), which is a motion command for ladder logic programs, turns ON, the axis designated with the MC20 Module will move for the distance designated with the MC20 Module and then stop. Input 2 of STEP (STP) command can be used to designate the travelling direction of the axis.

e) **HOME RETURN (ZRN)**

(1) **MC20 Module in Incremental Position Detecting System**

When input 1 of HOME RETURN (ZRN), which is a motion command for ladder logic programs, turns ON, the axis designated with the MC20 Module will move and return home. The position at which the axis stops will be set as the zero point of the machine coordinate system.

Example of home return operation



(2) **MC20 Module in Absolute Position Detecting System**

When input 1 of HOME RETURN (ZRN), which is a motion command for ladder logic programs, turns ON, the axis designated with the MC20 Module will be in POSITIONING (MOV) operation and return home as the zero point of the machine coordinate system.

4) Automatic Mode (AUTO)

a) Select this mode so that the MC20 Module will allow the following automatic operations.

(1) PROGRAM RUN (MVL)

(2) SINGLE BLOCK MODE (SMD)

(3) MACHINE LOCK MODE (MLK)

b) Before selecting this mode, turn ON only input 2 of MODE SET (MOD), which is a motion command for ladder logic programs.
The MC20 Module in automatic mode allows the following operations.

c) **PROGRAM RUN (MVL)**
When input 1 of PROGRAM RUN (MVL), which is a motion command for ladder logic programs, is ON, the program operation of the MC20 Module will use the motion program from the block number, both which are designated with the MVL data setting register of the MC20 Module.

d) **SINGLE BLOCK MODE (SMD)**
The MC20 Module in single-block operation mode executes a motion program block by block.
When input 1 of SINGLE BLOCK MODE (SMD), which is a motion command for ladder logic programs, turns ON while the MC20 Module in program operation is executing a block, the MC20 Module will stop operating after executing the block.
Then, whenever input 1 of SINGLE BLOCK MODE (SMD) is ON, the MC20 Module will execute a single block and stop operating.
To enable the MC20 Module to operate continuously, turn OFF input 1 of SINGLE BLOCK MODE (SMD) and turn ON input 1 of PROGRAM RUN (MVL).

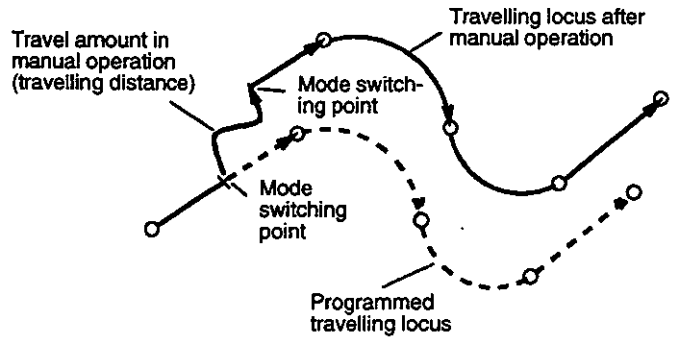
e) **MACHINE LOCK MODE (MLK)**
The MC20 Module in program or manual operation can be in this mode so that the current position display of the MC20 Module will change according to the designated program without any axis travelling.
To change the current position display, turn ON input 1 of MACHINE LOCK MODE (MLK), which is a motion command for ladder logic programs, and then turn ON input 1 of PROGRAM RUN (MVL), in which case there will be no axis movement and the current display will change according to the designated program which runs continuously.
This mode is effective for checking programs after creating or editing the programs.

This mode is also effective for the JOG or STEP operation of the MC20 Module in manual mode.

f) **Change into Manual Operation**

The MC20 Module in automatic mode of program operation can be interrupted so that the MC20 Module will operate in manual mode.
In this case, after the MC20 Module is in program operation again, the remaining axis travel amount is executed with a parallel travelling locus according to the travel amount obtained with the MC20 Module in manual operation.
In other words, if the MC20 Module goes into manual mode with MODE SET (MOD) while it is in program operation, the travelling axis controlled with the MC20 Module will decelerate its speed stop travelling. Then, if input 1 of PROGRAM RUN (MVL) is ON after the MC20 Module is in JOG or STEP operation, the remaining program operation of the MC20 Module will start, in which case, the MC20 Module will continue axis control with the travel amount obtained with the MC20 Module in manual operation shifted, regardless of the designation of the ABS or INC mode.

If PROGRAM END (END) in the designated motion program of the MC20 Module or MACHINE RESET (RST), which is a motion command for ladder logic programs, is executed, the travelling distance obtained with the MC20 Module in manual operation will be ignored.



There is no simple method to cancel the above travelling distance to return to the programmed travelling locus. If you need to cancel the above travelling distance, remember the coordinates where the MC20 Module starts operating manually. Then cancel the above travelling distance with the MC20 Module in manual operation again after the MC20 Module finishes operating manually.

5) Online Edit Mode (ONLINE-EDIT)

a) Select this mode so that the MC20 Module will allow the following operations.

(1) Writing or editing a motion program with a programming device loaded with the MEMOSOFT while teaching positions.

(2) Operating the Teach Pendant in teach mode.

b) Turn ON only input 3 of MODE SET (MOD), which is a motion command for ladder logic programs, so that the MC20 Module will be in online edit mode.
The MC20 Module in online edit mode allows the following operations.

c) **MC20 Module in Online Edit Mode**
Allows the following operations of programming devices.

(1) The execution of a single line of a program.

(2) The editing of a motion program by teaching the travelling positions obtained with the MC20 Module in JOG operation. These positions are taught as designated positions.

The above operations are effective for the debugging of motion programs.

For details, refer to the following manuals.

Chapter 13 of the *MEMOCON GL120, GL130 MEMOSOFT for DOS User's Manual (SIEZ-C825-60.10)*

Chapter 13 of the *MEMOCON GL120, GL130 MEMOSOFT for P120 Programming Panel User's Manual (SIEZ-C825-60.7)*

After a program is written in the above operation, it is possible to run a single block of the program to check the operation of the block. It is, however, impossible to run more than one block in sequence.

d) **Teach Mode Operation of the Teach Pendant**
The Teach Pendant is connected to the MEMOBUS communications port of the ME-MOCON GL120 or GL130.
Press the Teach Mode Key of the Teach Pendant so that the Teach LED will be lit and the Teach Pendant will be in teach mode.

The Teach Pendant in this mode allows the following operations.

- Program editing
- Point table editing
- Manual operation: Jogging operation
  Stepping operation
  Home return operation
- Block run: Single block run
  Multi block run
- Internal data display and changing

Refer to the *MEMOCON GL120, GL130 Teach Pendant TB120 User's Manual (SIEZ-C825-60.3)* for details.

2.4 Peripheral Equipment

The features of programming devices and the Teach Pendant used in a system are described below.

2.4.1 Features of Programming Devices

1) A programming device is a personal computer or Yaskawa's dedicated programming panel DISCT-P120□ which are both loaded with motion programs and ladder logic programs for the MEMOCON GL120 or GL130. Use Yaskawa's MEMOSOFT programming software to write the motion programs and ladder logic programs.

2) Connect a programming device to the CPU Module or the MEMOBUS port of the Communications Module through a dedicated cable so that the programming device can communicate with the MC20 Module.

3) A programming device allows the following operations.

a) **Data Creation and Editing**

(1) **Program Editing**
Motion programs can be written or edited offline and stored in the memory of the programming device, in which case the programming device need not be connected to the MEMOCON GL120 or GL130.

(2) **Online Program Editing**
The motion programs in the memory of the MC20 Module can be edited on the line and the current values of the axes to be controlled can be written to the programs.

(3) **Program Transfer**
Motion programs can be exchanged between the memory of the programming device and that of the MC20 Module.

b) **Information and Status Monitoring**

The following information and status of the MC20 Module can be monitored through the programming device.

(1) The motion program being executed and the current positions and following errors of the axes being controlled.

(2) The status of I/O signals directly to or from the MC20 Module.

(3) The status information items of the MC20 Module, such as mode, travelling, and alarm number status information items.

4) A programming device also allows the editing, transfer, and status monitoring of the parameter and point table data needed for the operation of the MC20 Module in the methods similar to those described above.

5) As described above, the online creation and editing of motion program data, parameter data, and point table data are performed with programming devices for machinery manufacturers' systems incorporating MC20 Modules.

For details, refer to the following manuals.

Chapters 12 to *18* of the *MEMOCON GL120, GL130 MEMOSOFT for DOS User's Manual (SIEZ-C825-60.10)*

Chapters 12 to *18* of the *MEMOCON GL120, GL130 MEMOSOFT for P120 Programming Panel User's Manual (SIEZ-C825-60.7)*

2.4.2 Teach Pendant

1) Connect the Teach Pendant to the CPU Module or the MEMOBUS port of the Communications Module through a dedicated cable before supplying power to the system. The Teach Pendant will be connected to MEMOCON GL120 or GL130, which will ensure easy operation of the system.

2) The Teach Pendant allows the following operations on the MC20 Module.

a) **Online Program Editing**
The motion programs of the MC20 Module can be edited online when the Teach Pendant is in teach mode. In this mode, the current positions of the axes being controlled can be written to the programs. Motion programs are edited in this mode on-site.

b) **Data Change**
The parameter data, register data used in ladder logic programs, and I/O ON and OFF status of the MC20 Module can be monitored or forced set.

c) **Particular Operations**
The following operations are possible for axes travelling to any teaching position or program checking.

(1) Manual operation (JOG, STEP, and HOME RETURN)

(2) Single block run and Multi block run

The above (a) and (c) are possible when the MC20 Module is in online edit mode and the Teach Pendant is in teach mode.

3) As described above, the online editing of motion programs or the system startup and changes are performed with the Teach Pendant.

   Refer to the *MEMOCON GL120, GL130 Teach Pendant TB120 User's Manual (SIEZ-C825-60.3)* for details.

2.5 Specifications of MC20 Module

The main specifications and functions of the MC20 Module are described below.

2.5.1 General Specifications

Refer to the following table for the general specifications of the MC20 Module.

Table 2.1 General Specifications of MC20 Module

Item		Specification
Environmental Conditions	Ambient Operating Temperature	0° to 60°C
	Ambient Storage Temperature	–25° to 85°C (battery excluded)
	Ambient Operating Humidity	30% to 95% RH (with no condensation)
	Storage Humidity	5% to 95% RH (with no condensation)
	Dust	With no conductive dust
	Pollution Level	Pollution level 1 (conforming to JIS B 3501)
	Corrosive Gas	With no corrosive gas
	Altitude of Use	2,000 m max. above sea level
Mechanical Operating Conditions	Shock Resistance	Conforming to JIS B 3502: Single amplitude of 0.075 mm at 10 to 57 Hz and a constant acceleration of 9.8 m/s^2 (1 G) at 57 to 150 Hz for 10 sweep times each in the X, Y, and Z directions at the rate of 1 octave per min
	Shock Resistance	Conforming to JIS B 3502: Peak acceleration value of 147 m/s^2 (15G) for 11 ms twice each in the ±X, ±Y, and ±Z directions
Electrical Operating Conditions	Noise Immunity	Conforming to JIS B 3502: 1,500 V (p-p) in normal and common modes with a pulse width of 100 ns/1 µs and a rise time of 1 ns (tested with impulse noise simulator)
Installation Requirements	Ground	Ground to 100 Ω or less
	Structure	• Building block • Wall mounting or DIN-track mounting
	Cooling Method	Natural air ventilation
	Mass	510 g
	Dimensions (mm)	81 x 130 x 105.2 (WxHxD) (see note)

Note When a connector is connected to the MC20 Module, the maximum height of the connector from the panel will be approximately 41 mm.

2.5.2 Hardware Specifications

The hardware specifications for the MC20 Module are given in the following table.

Table 2.2 MC20 Module Hardware Specifications

Item	Specification
Abbreviation	MC20
Model Number	JAMSC-120MMB10400
Internal Current Consumption	1,650 mA
Hot Swapping	Not possible
CPUs	1) Main CPU NG80386SX-16 (32-bit, 16-MHz) 2) Servo CPU μPD70236GD-16 (16-bit, 16-MHz)
Memory	1) Memory 1 ROM: 512 Kbytes RAM: 256 Kbytes (with battery backup) 2) Memory 2 ROM: 128 Kbytes RAM: 64 Kbytes (with battery backup)
Servo Interface Signals	The following signals can be input/output from/to up to four servo amps via the servo connectors (SV1 to SV4) on the front panel of the Module. 1) Input Signals a) Feedback Input 5-V differential line receiver. A/B phases. Maximum frequency: 1 Mpps (1X). Line breakage detection. b) Servo Alarm Input 24 VDC, 5 mA, photocoupler isolation 2) Output Signals a) Speed Reference Output Analog speed reference output. 0 to ±10 VDC. b) Battery Output Connect to battery input on absolute Servopack. c) SEN Signal Output Connect to SEN input on absolute Servopack. 5 VDC, 5mA d) Servo ON Output 24 VDC, 15 mA, photocoupler isolation, open-collector output (sinking output) e) Servo Reset Output:Same as above. f) PCON Signal Output * : Same as above

*: New step-2 functions.

Item	Specification
External I/O Signals	The following signals can be input/output from/to external devices via the I/O signal connector on the front panel of the Module. 1) Input Signals a) Number of Signals: 17 b) Signal Names Positive overtravel (axes 1 to 4) Negative overtravel (axes 1 to 4) Zero signal (axes 1 to 4) Deceleration signal (axes 1 to 4) Skip input c) Input Circuit Specifications 24 VDC, 5 mA, photocoupler isolation, sinking/sourcing inputs 2) Output Signals a) Number of Signals: 4 b) Signal Names Brake outputs (axes 1 to 4) c) Output Signal Specifications 24 VDC, 50 mA, photocoupler isolation, open-collector outputs (sinking outputs)
Battery Backup	1) Memory Backup Circuits a) Parameter, the motion program, and point table data is maintained by memory backup circuits during power interruptions. b) Backup Power Supplies (1) Lithium Battery in CPU Module Battery life: 5 years (at 25 °C) Memory backup time without power supply: 1 year (at 25 °C) (2) Large-Capacity Capacitor in 4-axis Motion Module Maximum backup time of 3 days on full charge. 2) Absolute Encoder Backup Circuits a) Rotation data for absolute encoder application is backed up during power interruptions by the absolute encoder backup circuits. b) Backup Power Supplies (1) Battery Module (Model: JRMSP-120XCP96000) Rotation data for up to 8 absolute encoders can be backed up with one Battery Module. The memory backup time without power supply when 8 absolute encoders are connected is 1 year, but this time will be shortened if the encoders are operated when power is not being supplied. (2) Large-Capacity Capacitor in Absolute Encoder Maximum backup time of 3 days on full charge. c) A battery voltage drop detection circuit is built into the Battery Module and an alarm output for voltage drop can be read with a Digital Input Module.
External Power Supply	The following external power supply is required as power for the external I/O signals: 24 VDC, 2 A

2.5.3 Functions

Refer to the following table for the functions of the MC20 Module.

Table 2.3 Functions of MC20 Module

Function	Specification
1) No. of Controlled Axes	4 axes • 4 axes simultaneously: Positioning and linear interpolation • 3 axes simultaneously: Helical interpolation • 2 axes simultaneously: Circular interpolation
2) Independent Axis Operation	Possible with a sequence command from the CPU Module
3) Coordinate Setting Unit	Linear axis: 0.001 mm min. Rotary axis: 0.001 degree min.
4) Maximum Command Value	±99999999. Rotary positioning and linear axis positioning are possible with no length limit.
5) Rapid Traverse Speed and Interpolation Feed Speed	240 m per min max.
6) Automatic Acceleration and Deceleration	Interpolation: Single-step linear acceleration and deceleration; double-step linear acceleration and deceleration; asymmetric acceleration and deceleration; exponential acceleration and deceleration; moving average acceleration and deceleration; S-curve acceleration and deceleration Positioning, Stepping operation, Jogging operation, Independent axis operation: Single-step linear acceleration and deceleration; double-step linear acceleration and deceleration; asymmetric acceleration and deceleration; exponential acceleration and deceleration; moving average acceleration and deceleration; S-curve acceleration and deceleration Home return: Single-step linear acceleration and deceleration
7) Override	Using MC Control Coils Positioning: 0% to 100% (16 steps) Jogging: 0% to 100% (16 steps) Interpolation: 0% to 200% (16 steps) Using MC Link Registers Positioning: 0.0% to 3276.7% (0.1% increments) Jogging: 0.0% to 3276.7% (0.1% increments) Interpolation: 0.0% to 3276.7% (0.1% increments)
8) Manual Jogging	4 axes simultaneously
9) Manual Stepping	4 axes simultaneously
10) Positioning Control	Possible to set to a value between 0 and 10,000 command resolutions (Note) "0" setting prevents "In-position check".
11) Stored Stroke Limit	Upper- and lower-limits for each axis independently
12) Current Value Change	Possible
13) Backlash Compensation	0 to 32,767 pulses

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Function	Specification
14) Operation Mode	Any of the following modes can be selected with a sequence command from the CPU Module. a) **Edit mode:** Used to load programs from the programming device to the MC20 Module. b) **Automatic mode:** Used to enable the MC20 Module to operate automatically using any one of the programs registered with the MC20 Module. c) **Manual mode:** Used to enable the MC20 Module to perform JOG, STEP, or HOME RETURN. d) **Online edit mode:** Used to write programs by teaching the MC20 Module the current value block by block from the programming device.
15) Programming Method	Interpreter method in dedicated motion language
16) Motion Command	POSITIONING (MOV), LINEAR INTERPOLATION (MVS), CIRCULAR INTERPOLATION (MCW, MCC), HELICAL INTERPOLATION (MCW, MCC), HOME RETURN (ZRN), ABSOLUTE PROGRAMMING MODE (ABS), INCREMENTAL PROGRAMMING MODE (INC), CURRENT POSITION SET (POS), MOVE ON MACHINE COORDINATES (MVM), DWELL TIME (TIM), PROGRAM STOP (STP), PROGRAM END (END), IN-POSITION CHECK (PFN), SECOND IN-POSITION RANGE SETTING (INP), SET EXTERNAL OUTPUT (SET), PASS NOTCH SIGNAL OUTPUT (PNT), IGNORE SINGLE-BLOCK SIGNAL (SNG), I/O WAIT (IOW), SUB-PROGRAM CALL (GSB), RETURN (RET), PCON SIGNAL OUTPUT (PCN)*, VOLTAGE OUTPUT (VCC)*, EXTERNAL POSITIONING (EXM)*, RATIO OPERATION (PGS)*, RATIO OPERATION CANCEL (PGR)*, TRAILING SYNCHRONOUS OPERATION (TSS)*, TRAILING SYNCHRONOUS OPERATION CANCEL (TSR)*, ARITHMETIC COMMANDS (=, +, −, *, /), BRANCH CONTROL COMMANDS (IF...GOTO...), REPEAT CONTROL COMMANDS (WHILE...DO...), and VARIABLES (#nnn, #nnnn, Hn)
17) Positioning Command Using Point Table	MOV #E... ; Enables the MC20 Module to decide the position designated by #E in the space made with the four-axis (X, Y, Z, and S) data stored by the MC20 Module. A maximum of 500 points can be stored.
18) Palletizing Command	PMV P...C... ; Enables the MC20 Module to decide the position on the grid number designated by C on pallet P. Max. pallet no.: 199 Max. grid no.: 999 x 999
19) SKIP	SKP X...Y...Z...S...F... ; When an external SKIP signal is ON while the above is enabling the MC20 Module to execute axis travelling, the MC20 Module will stop the axis travelling, cancel the remaining travel amount of the current block, and go to the next block.
20) Program Registration	Programs with program numbers between 01 and 99 and sequence numbers between N001 and N999 can be registered and stored.

*: New step-2 commands.

Function	Specification
21) Program Execution	a) A program number and block number can be designated from the CPU Module to enable the MC20 Module in automatic mode to execute the program from the designated block. b) A single block can be designated from the CPU Module to enable the MC20 Module in automatic mode to execute the block. c) A program can be designated from the programming device to enable the MC20 Module in online edit mode to execute the program.
22) Program Execution Method	While the MC20 Module is executing servomotor control command such as positioning or interpolation in a block, the commands not involving servomotor control in the next block will be executed simultaneously.
23) Machine Lock Function	The MC20 Module can check the motion programs of the MC20 Module without executing axis control.
24) I/O Variable	The MC20 Module makes it possible to monitor the MC coil status of the CPU Module from the motion programs stored in the MC20 Module or output the MC coil status to the MC relay.
25) Link I/O Variable	Data can be exchanged between the MC link registers of the ladder logic programs of the CPU Module and the variables of the motion programs of the MC20 Module.
26) Home Return	All axes return home simultaneously. It is possible to designate axes to return home with a program. Axes return home with a command from the CPU Module or a motion program.
27) Monitor	The following status can be monitored from the programming device. a) Current positions, I/O status with the CPU Module, and program step being executed b) Position errors and alarm contents
28) Utility Commands	A variety of commands can be executed with sequence commands of the CPU Module, such as mode selection, servo ON and OFF, program run, programmed independent axis operation, home return, jogging operation, single block operation, resetting alarms, machine reset, resetting Modules, stepping operation, machine lock operation, status of emergency stop and data monitor, parameter change commands, setting present value, setting H variables, setting point tables, and setting home (zero point).

System Configuration

3

This section describes systems with MC20 Modules and the configurations of the systems.

3.1 Basic System Configuration

A system with the MC20 Module and the configuration of the system are described below.

3.1.1 Basic Modules

1) Modules and Products Required by the System

Table 3.1 Basic Modules and Products

No.	Product Name	Model No.	Feature
1	Power Supply Module	PS□	Supplies power to each Module.
2	CPU Module	CPU□	Used for the sequential control of the system with a ladder logic program.
3	Motion Control Module	MC□	Used for the motion control of the system.
4	Mounting Base	MB□	A base to which a variety of Modules is mounted.
5	Motion Control Module I/O Cable	W04□	Connects external devices to the MC20 Module.
6	Servo Cable	W05□	Connects the Servo Amp to the MC20 Module.
7	Software Package	MEMOSOFT	Used for writing motion programs.
8	DC Power Supply		24-VDC power supply for external I/O signals.
9	Servo Amp		Speed control type.
10	Servomotor		Select the most suitable one from a variety of Servomotors.
11	Motor Cable		Power cable for the Servomotor.
12	Encoder Cable		Connects the Encoder of the Servomotor to the Servo Amp.

Note (1) Yaskawa has not released any DC power supply for external I/O signals.

(2) Select the Servo Amp and Servomotor from Yaskawa's AC Servo products.

2) MEMOCON GL120 and GL130.Basic Modules

Table 3.2 Basic Modules and their Features

Product Name	Name	Model No.	Model	Feature	Re-marks
Power Supply Module	AC Input Power Supply Module (7A)	PS10	JRMSP-120CPS11300	1) Supplies DC to a variety of Modules. 2) One Power Supply Module is required for each Mounting Base. 3) PS10 : 7A at 100/200 VAC (switchable) 4) PS05 : 3A at 100/200 VAC (switchable)	
	AC Input Power Supply Module (3A)	PS05	JRMSP-120CPS11100		
	DC Input Power Supply Module (7A)	PS11	JRMSP-120CPS21300	1) Supplies DC to a variety of Modules. 2) One Power Supply Module is required for each Mounting Base. 3) PS11 : 7A at 24 VDC 4) PS06 : 3A at 24 VDC	
	DC Input Power Supply Module (3A)	PS06	JRMSP-120CPS21100		

Product Name	Name	Model No.	Model	Feature	Re-marks
CPU Module	CPU Module (8 kW)	CPU10	DDSCR-120CPU14200	1) Stores user programs, reads the programs according to the information obtained from input signals to the CPU Module, and outputs the results of what the CPU Module reads. 2) CPU10: Program memory capacity: 8K words No. of digital I/O points: 1,024 max. No. of register I/O points: 512 max. Scan time: Approximately 1 ms for 1K words 3) CPU20: Program memory capacity: 16K words No. of digital I/O points: 1,024 max. No. of register I/O points: 512 max. Scan time: Approximately 1 ms for 1K words 4) CPU21: Program memory capacity: 16K words No. of digital I/O points: 1,024 max. No. of register I/O points: 512 max. Scan time: Approximately 1 ms for 1K words 5) CPU30: Program memory capacity: 32K words No. of digital I/O points: 4,096 max. No. of register I/O points: 512 max. Scan time: Approximately 0.6 ms for 1K words 6) CPU35: Program memory capacity: 32K words No. of digital I/O points: 4,096 max. No. of register I/O points: 512 max. Scan time: Approximately 0.6 ms for 1K words 7) MEMOBUS ports CPU10: No. of MEMOBUS ports 1: 1 (slave, RS-232C) No. of MEMOBUS ports 2: 1 (master/slave, RS-232C) CPU20, CPU21, CPU30, CPU35: No. of MEMOBUS ports :1 (slave, RS-232C) 8) MEMOBUS PLUS ports CPU10: No. of MEMOBUS PLUS ports: 0 CPU20, CPU21, CPU30, CPU35: No.of MEMOBUS PLUS ports: 1	
	CPU Module (16 kW)	CPU20	DDSCR-120CPU34100		
	CPU Module (16 kW)	CPU21	DDSCR-120CPU34110		
	CPU Module (32 kW)	CPU30	DDSCR-130CPU54100		
	CPU Module (40 kW)	CPU35	DDSCR-130CPU54110		

Product Name	Name	Model No.	Model	Feature	Re-marks
Motion Control Module	4-axis Motion Control Module	MC20	JAMSC-120MMB10400	1) Used for 4-axis control. 2) Analog speed reference method 3) 4 axes simultaneously: Positioning and linear interpolation 3 axes simultaneously: Helical interpolation 2 axes simultaneously: Circular interpolation 4) Possible to control all axes independently.	
Mounting Base	6-slot Mounting Base	MB06	JRMSI-120XBP00600	1) A base to which a variety of Modules is mounted. 2) No. of slots MB06: 06 slots MB08: 08 slots MB10: 10 slots MB12: 12 slots MB16: 16 slots 3) Up to 4 Mounting Bases can be used at each station of a local or remote channel.	
	8-slot Mounting Base	MB08	JRMSI-120XBP00800		
	10-slot Mounting Base	MB10	JRMSI-120XBP01000		
	12-slot Mounting Base	MB12	JRMSI-120XBP01200		
	16-slot Mounting Base	MB16	JRMSI-120XBP01600		

Product Name	Name	Model No.	Model	Feature	Re-marks
Motion Control Module I/O Cable	W0400 Cable	W0400-01	JZMSZ-120W0400-01	1) Connects external devices, such as limit switches, to the MC20 Module. 2) Only one end of the cable has a connector for the MC20 Module. Connect a suitable connector to the other end of the cable for the external device used. 3) Cable length W0400-01: 1.0 m W0400-03: 3.0 m W0400-05: 5.0 m	
		W0400-03	JZMSZ-120W0400-03		
		W0400-05	JZMSZ-120W0400-05		
	W0401 Cable	W0401-01	JZMSZ-120W0401-01	1) Connects external devices, such as limit switches, to the MC20 Module. 2) Both ends of the cable have a connector. One of the connectors is for the MC20 Module and the other is for the external device. 3) Cable length W0401-01: 1.0 m W0401-03: 3.0 m W0401-05: 5.0 m	
		W0401-03	JZMSZ-120W0401-03		
		W0401-05	JZMSZ-120W0401-05		
Servo Cable	W0500 Cable	W0500-05	JZMSZ-120W0500-05	1) Connects the speed control Servopack for analog speed references to the Motion Control Module. 2) Only one end of the cable has a connector for the Motion Control Module. Connect a suitable connector to the other end of the cable for the Servopack. 3) Cable length W0500-05: 0.5 m W0500-10: 1.0 m W0500-30: 3.0 m	
		W0500-10	JZMSZ-120W0500-10		
		W0500-30	JZMSZ-120W0500-30		
	W0501 Cable	W0501-05	JZMSZ-120W0501-05	1) Connects the SR-series Servopack for incremental encoders to the Motion Control Module. 2) Both ends of the cable have a connector. One of the connectors is for the Motion Control Module and the other is for the Servopack. 3) Cable length W0501-05: 0.5 m W0501-10: 1.0 m W0501-30: 3.0 m	
		W0501-10	JZMSZ-120W0501-10		
		W0501-30	JZMSZ-120W0501-30		

Product Name	Name	Model No.	Model	Feature	Remarks
Servo Cable	W0502 Cable	W0502-05	JZMSZ-120W0502-05	1) Connects the SR-series Servopack for absolute encoders to the Motion Control Module. 2) Both ends of the cable have a connector. One of the connectors is for the Motion Control Module and the other is for the Servopack. 3) Cable length W0502-05: 0.5 m W0502-10: 1.0 m W0502-30: 3.0 m	
		W0502-10	JZMSZ-120W0502-10		
		W0502-30	JZMSZ-120W0502-30		
	W0503 Cable	W0503-05	JZMSZ-120W0503-05	1) Connects the Σ-series SGDA Servopack for incremental and absolute encoders to the Motion Control Module. 2) Both ends of the cable have a connector. One of the connectors is for the Motion Control Module and the other is for the Servopack. 3) Cable length W0503-05: 0.5 m W0503-10: 1.0 m W0503-30: 3.0 m	
		W0503-10	JZMSZ-120W0503-10		
		W0503-30	JZMSZ-120W0503-30		
	W0504 Cable	W0504-05	JZMSZ-120W0504-05	1) Connects the Σ-series SGDB or Σ-II series SGDM/SGDH Servopacks for incremental and absolute encoders to the Motion Control Module. 2) Both ends of the cable have a connector. One of the connectors is for the Motion Control Module and the other is for the Servopack. 3) Cable length W0504-05: 0.5 m W0504-10: 1.0 m W0504-30: 3.0 m	
		W0504-10	JZMSZ-120W0504-10		
		W0504-30	JZMSZ-120W0504-30		
	W0505 Cable	W0505-05	JZMSZ-120W0505-05	1) Connects the Σ-series DR2 Servopack for incremental and absolute encoders to the Motion Control Module. 2) Both ends of the cable have a connector. One of the connectors is for the Motion Control Module and the other is for the Servopack. 3) Cable length W0505-05: 0.5 m W0505-10: 1.0 m W0505-30: 3.0 m	
		W0505-10	JZMSZ-120W0505-10		
		W0505-30	JZMSZ-120W0505-30		

Product Name	Name	Model No.	Model	Feature	Remarks
Software Package	MEMOSOFT		FMSGL-AT3	1) Used for online and offline programming for the MEMOCON GL120 or GL130 with the DOS personal computer. 2) Applicable models: MEMOCON GL120, GL130 3) Language: English 4) Medium: 3.5-inch floppy disk	
			FMSGL-PP3E	1) Used for online and offline programming for the MEMOCON GL120 or 130 with the P120 Programming Panel. 2) Applicable models: MEMOCON GL120, GL130 3) Language: English 4) Medium: 3.5-inch floppy disk	
	P120 MEMOCON SC Online Programmer		FMSC-PP3	1) Used for online programming for the MEMOCON-SC with the P120 Programming Panel. 2) Applicable models: MEMOCON-SC R84HM, GL120 MEMOCON-SC U84-series MEMOCON-SC GL40-series MEMOCON-SC GL60-series MEMOCON-SC GL70H 3) Language: Japanese and English	
	P120 MEMOCON GL120, GL130 Online Programmer		FMGLON-PP3	1) Used for online programming for the MEMOCON GL120 or 130 with the P120 Programming Panel. 2) Applicable models: MEMOCON GL120, GL130 3) Language: Japanese and English 4) Medium: 3.5-inch floppy disk	

Note (1) Select optimum Modules for the system.

(2) Each Module requires a Motion Module I/O cable.

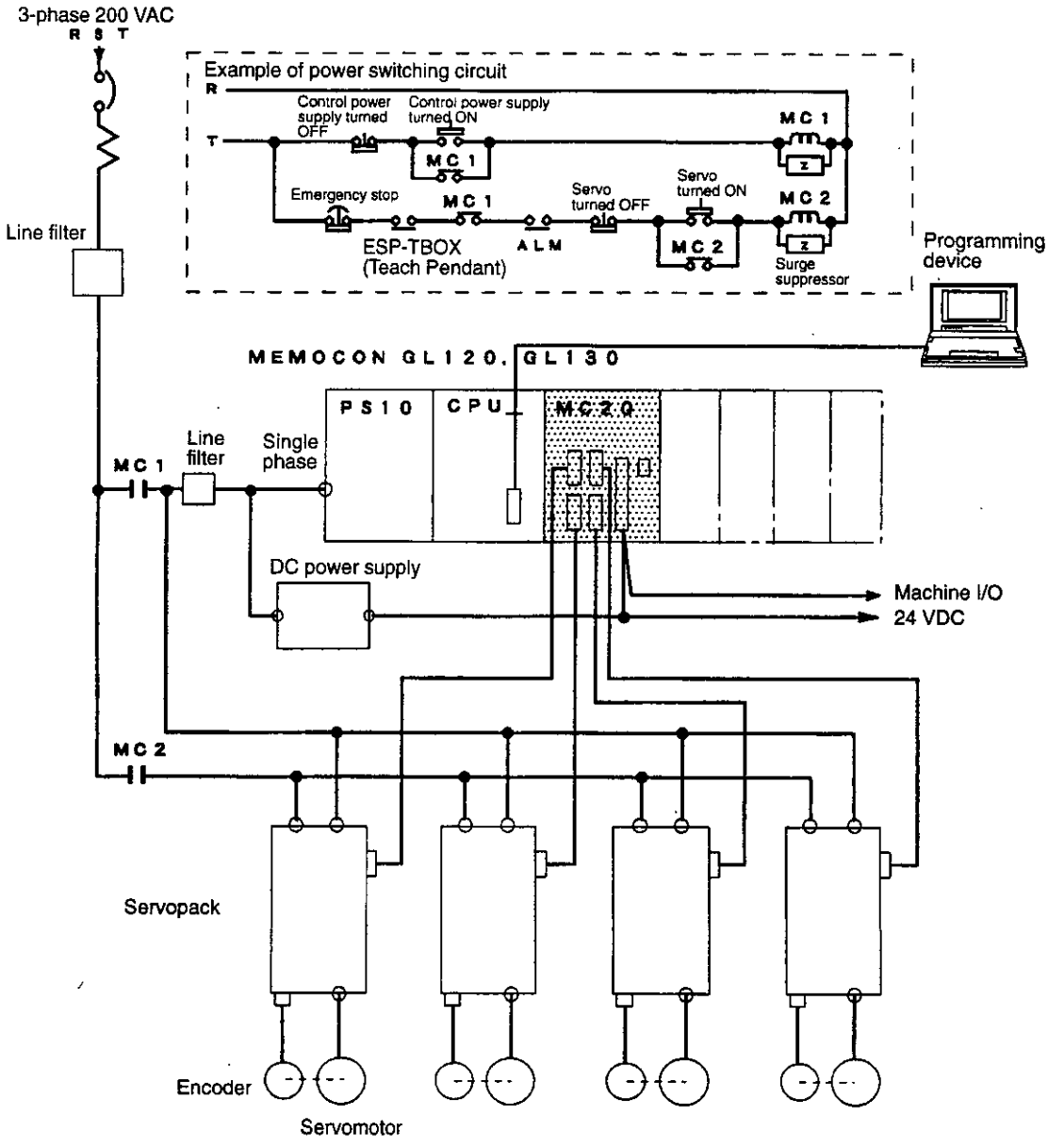
(3) The type of Servo Cable varies with the Servopack to be connected. Each Module requires a maximum of four Servo Cables.

(4) Use a suitable software package for the device.

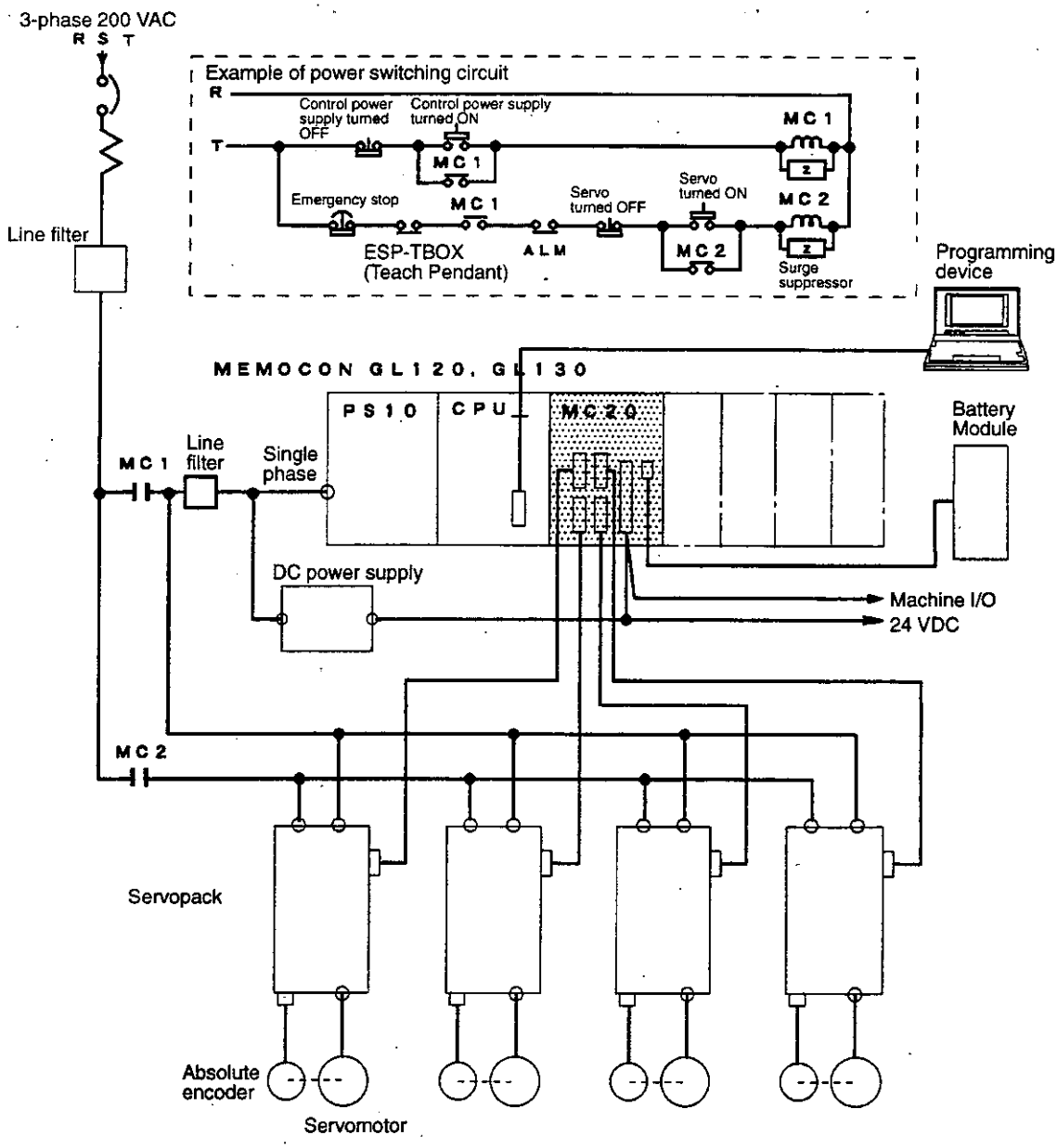
(5) No software package is required if one for ladder logic programming is available.

3.1.2 Basic System Configuration

1) Configuration of a System Using a Servomotor with an Incremental Encoder



2) Configuration of a System Using a Servomotor with an Absolute Encoder



Note Refer to the following before you design systems using MC20 Modules.

1) The MC20 Module can be mounted only to the Mounting Base to which the CPU Module is mounted.

2) A maximum of two MC20 Modules can be mounted to the Mounting Base.

3) The MC20 Module occupies two slots of the Mounting Base. For I/O allocation with the programming device, the MC20 Module must be mounted to the two slots farthest to the right.

4) A system using an absolute value detecting function needs a battery to back up the data of the absolute encoder. Use Yaskawa's Battery Module.

5) Yaskawa supplies a variety of standard cables. Be sure to select proper cables.

6) Yaskawa supplies cables which connect the Servopack to servomotors. Refer to the data sheet of the servo drive used in order to select a correct cable.

3.2 Peripheral Devices

A system with the MC20 Module and MEMOCON GL120 or GL130 and peripheral devices is described below.

3.2.1 Peripheral Devices for MEMOCON GL120 and GL130

Table 3.3 Peripheral Equipment for Systems Using MC20 Modules

Type	Product Name	Abbreviated Product Name	Model	Feature	Remarks
Human Interface	Teach Pendant	TB120E	DISCT-TB120E	Same as the TB120 except the following item. • Language: English	
	Programming Panel	P120M	DISCT-P120M	1) Used as dedicated programming panel. 2) Applicable models: MEMOCON GL120, GL130 MEMOCON-SC R84, R84H, R84HM, GL20 MEMOCON-SC U84-series MEMOCON-SC GL40-series MEMOCON-SC GL60-series MEMOCON-SC GL70H 3) Display panel: Monochrome STN LCD, 640 x 480 dots, 9 inches 4) No. of communications port: 1 (MEMOBUS Master, RS-232C) for PLC, 1 (Centronics) for printer, 1 (VGA) for CRT, and 1 (PS/2) for mouse 5) No. of auxiliary data storage devices: One 3.5-inch floppy disk drive and one 256-megabyte hard disk drive	
		P120MN	DISCT-P120MN	Same as the P120M except for the following item. • Additional MEMOBUS PLUS port for PLC	
		P120C	DISCT-P120C	Same as the P120M except for the following item. • Display panel: Color TFT LCD, 640 x 480 dots, 9 inches	
		P120CN	DISCT-P120CN	Same as the P120M except for the following item. • Display panel: Color TFT LCD, 640 x 480 dots, 9 inches • Additional MEMOBUS PLUS port for PLC	
		P120D	DISCT-P120D	Same as the P120M except for the following item. • Display panel: Color DSTN LCD, 640 x 480 dots, 9 inches	

Type	Product Name	Abbreviated Product Name	Model	Feature	Remarks
Human Interface	Programming Panel	P120DN	DISCT-P120DN	Same as the P120M except for the following item. • Display panel: Color DSTN LCD, 640 x 480 dots, 9 inches • Additional MEMOBUS PLUS port for PLC	
	Teach pendant	TB120	DISCT-TB120E	1) Used to teach 4-axis Motion Control Module (MC20). 2) Language : English 3) Display : Backlit LCD panel, 16 characters × 4 lines 4) Communications port PC connection : 1 port (MEMOBUS master, RS-232C)	
Other Module	Battery Module	BATTERY	JRMSP-120XCP96000	Used to back up the data of the absolute encoder of the servomotor controlled by the Motion Module and Servopack.	
Teach Pendant Cable	W0600 Cable	W0600-02	JZMSZ-120W0600-02	1) Connects the TB120E Teach Pendant to the CPU Module or the RS-232C MEMOBUS port of the MEMOBUS Module. 2) Used in combination with the W0601 or W0602 Cable. 3) Cable length W0600-02: 2.0 m W0600-04: 4.0 m W0600-08: 8.0 m	
		W0600-04	JZMSZ-120W0600-04		
		W0600-08	JZMSZ-120W0600-08		
	W0601 Cable	W0601-02	JZMSZ-120W0601-02	1) Connects the TB120E Teach Pendant to the CPU Module or the RS-232 MEMOBUS port of the MEMOBUS Module. 2) Used in combination with the W0600 Cable. 3) Provided with a panel-mounting plate. 4) Cable length W0601-02: 2.0 m W0601-04: 4.0 m	
		W0601-04	JZMSZ-120W0601-04		
	W0602 Cable	W0602-02	JZMSZ-120W0602-02	1) Connects the TB120E Teach Pendant to the CPU Module or the RS-232 MEMOBUS port of the MEMOBUS Module. 2) Used in combination with the W0600 Cable. 3) No panel-mounting plate is provided. 4) Cable length W0602-02: 2.0 m W0602-04: 4.0 m	
		W0602-04	JZMSZ-120W0602-04		

3.2.1 Peripheral Devices for MEMOCON GL120 and GL130 cont.

Type	Product Name	Abbre-viated Product Name	Model	Feature	Re-marks
MEMO-BUS Cable	W0202 Cable	W0202-03	JZMSZ-120W0202-03	1) Connects the DOS personal computer to the CPU Module or the RS-232C MEMOBUS port of the MEMOBUS Module. 2) The end of the cable connecting to the DOS personal computer has a 25-pin male D-sub connector. 3) Cable length W0202-03: 2.5 m W0202-15: 15.0 m	
		W0202-15	JZMSZ-120W0202-15		
	W0203 Cable	W0203-03	JZMSZ-120W0203-03	1) Connects the P120 Programming Panel to the CPU Module or the RS-232C MEMOBUS port of the MEMOBUS Module. 2) Cable length W0203-03: 2.5 m W0203-15: 15.0 m	
		W0203-15	JZMSZ-120W0203-15		
	W0204 Cable	W0204-05	JZMSZ-120W0204-05	1) Connects the ACGC4200 FA Monitor to the CPU Module or the RS-232C MEMOBUS port of the MEMOBUS Module. 2) Cable length W0204-05: 5.0 m W0204-10: 10.0 m W0204-15: 15.0 m	
		W0204-10	JZMSZ-120W0204-10		
		W0204-15	JZMSZ-120W0204-15		

Note Select optimum Modules for the system.

Basic Connections

4

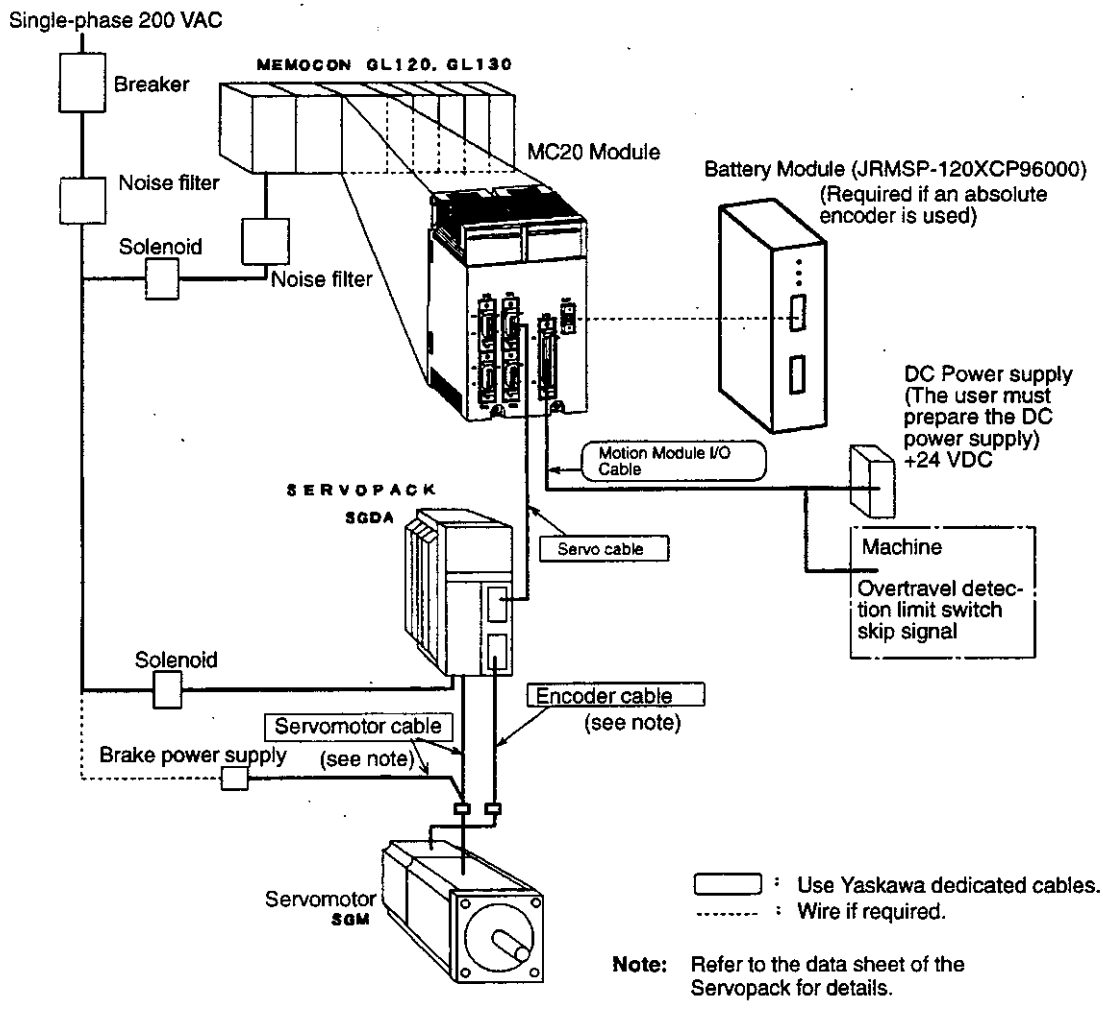
This chapter describes how to connect the MC20 Module to the servo drive and other driving devices.

4.1 Basic Connections and Standard Cables

The methods of connecting the MC20 Module to peripheral equipment and Yaskawa standard cables are described below. Be sure to be familiar with the connecting methods before using the MC20 Module and peripheral equipment.

4.1.1 System Configuration

1) System Configuration with the MC20 Module



Note: Refer to the data sheet of the Servopack for details.

2) In the above system Yaskawa Σ-series AC servo is used as a servo drive. The MC20 Module connects to the following series of Yaskawa Servo Drives as well.

- M, F, and G Series: Standard servo
- D, S, R, and P Series: Special servo
- VS-866 Series: Large-capacity servo

3) The Servo Amp with a **speed control** function and responding to **analog speed references** must be used. The following Yaskawa Servopack models can be used.

AC Servo Series	Model
Σ Series	SGD□-□□□
Σ Series	DR□-□□□□
Σ-II Series	SGDM-□□□
Σ-II Series	SGDH-□□□
M, F, G, D, S, R, and P Series	CACR-SR□□□□
VS-866	CIMR-SVJ-□A□

Speed control

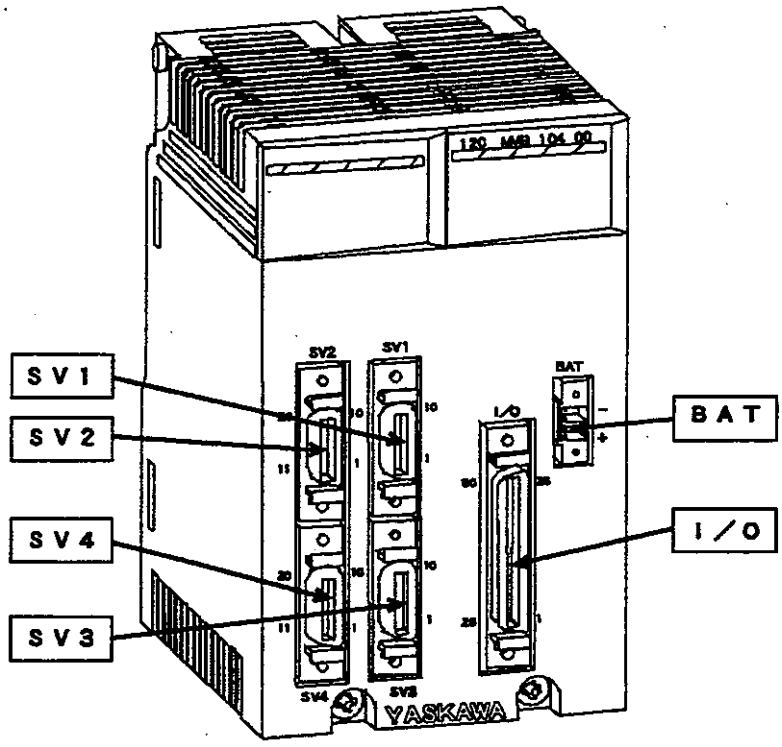
Yaskawa AC Servo-series models are available for speed, torque, or position control. Yaskawa AC Servo-series models controlling speed are called speed control Servo Amps.

Analog speed reference

In this manual the analog speed reference using voltage is called analog speed reference and the numeric speed reference is called digital speed reference.

4.1.2 Connector

1) Connectors on the Front Panel of the MC20 Module



2) Connector Specifications

Name	Connector	No. of Pins	Connector Model		Manufacturer
			Module Side	Cable Side	
Servo Connector	SV1	20	10220-L8A9-VE	10120-3000VE 10320-52A0-008	3M
	SV2	20	10220-L8A9-VE	10120-3000VE 10320-52A0-008	3M
	SV3	20	10220-L8A9-VE	10120-3000VE 10320-52A0-008	3M
	SV4	20	10220-L8A9-VE	10120-3000VE 10320-52A0-008	3M
I/O Connector	I/O	50	10250-52A2JL	10150-3000VE 10350-52A0-008	3M
Battery Connector	BAT	2	MC1.5/2-GF-3.81AU	MC1.5/2-STF-3.81 AU Already attached to the MC20 Module.	Phoenix

Note (1) The connectors for the cable side with the model number suffix "VE" are soldering connector models and those with the model number suffix "008" are connector frames.

(2) Yaskawa sells dedicated standard cables for Yaskawa Servo Amps.

4.1.3 Connector Pin Arrangement and I/O Example

1) Connector Pin Arrangements of Servo Connectors SV1 to SV4

a) **Servo Connector SV1**
Connector: 10220-L8A9-VE

Pin No.	Signal	Name	Pin No.	Signal	Name
1	PAI1	A-phase signal input (first axis)	11	SEN1	SEN signal output (first axis)
2	*PAI1	A-phase signal input (first axis)	12	OSEN1	SEN GND (first axis)
3	PBI1	B-phase signal input (first axis)	13	SVON1	Servo ON output (fist axis)
4	*PBI1	B-phase signal input (first axis)	14	PCON1*	PCON signal output (first axis)
5	PCI1	C-phase signal input (first axis)	15	ALMRST1	Servo reset output (first axis)
6	*PCI1	C-phase signal input (first axis)	16	ALM1	Servo alarm input (first axis)
7	VREF1	Speed reference output (first axis)	17	ALM01	Servo alarm GND (first axis)
8	SG1	Speed reference GND (first axis)	18	---	Not used
9	BAT1	Battery output (first axis)	19	+24V1	+24-V output (first axis)
10	BAT01	Battery GND (first axis)	20	---	Not used

*: PCON1 is a new step-2 function.

b) **Servo Connector SV2**
Connector: 10220-L8A9-VE

Pin No.	Signal	Name	Pin No.	Signal	Name
1	PAI2	A-phase signal input (second axis)	11	SEN2	SEN signal output (second axis)
2	*PAI2	A-phase signal input (second axis)	12	OSEN2	SEN GND (second axis)
3	PBI2	B-phase signal input (second axis)	13	SVON2	Servo ON output (second axis)
4	*PBI2	B-phase signal input (second axis)	14	PCON2*	PCON signal output (second axis)
5	PCI2	C-phase signal input (second axis)	15	ALMRST2	Servo reset output (second axis)
6	*PCI2	C-phase signal input (second axis)	16	ALM2	Servo alarm input (second axis)
7	VREF2	Speed reference output (second axis)	17	ALM02	Servo alarm GND (second axis)
8	SG2	Speed reference GND (second axis)	18	---	Not used

Pin No.	Signal	Name	Pin No.	Signal	Name
9	BAT2	Battery output (second axis)	19	+24V2	+24-V output (second axis)
10	BAT02	Battery GND (second axis)	20	---	Not used

*: PCON2 is a new step-2 function.

⚠ **Caution** Do not use any reserved or unused pins for relay signals.

c) **Servo Connector SV3**
Connector: 10220-L8A9-VE

Pin No.	Signal	Name	Pin No.	Signal	Name
1	PAI3	A-phase signal input (third axis)	11	SEN3	SEN signal output (third axis)
2	*PAI3	A-phase signal input (third axis)	12	OSEN3	SEN GND (third axis)
3	PBI3	B-phase signal input (third axis)	13	SVON3	Servo ON output (third axis)
4	*PBI3	B-phase signal input (third axis)	14	PCON3*	PCON signal output (third axis)
5	PCI3	C-phase signal input (third axis)	15	ALMRST3	Servo reset output (third axis)
6	*PCI3	C-phase signal input (third axis)	16	ALM3	Servo alarm input (third axis)
7	VREF3	Speed reference output (third axis)	17	ALM03	Servo alarm GND (third axis)
8	SG3	Speed reference GND (third axis)	18	---	Not used
9	BAT3	Battery output (third axis)	19	+24V3	+24-V output (third axis)
10	BAT03	Battery GND (third axis)	20	---	Not used

*: PCON3 is a new step-2 function.

d) **Servo Connector SV4**
Connector: 10220-L8A9-VE

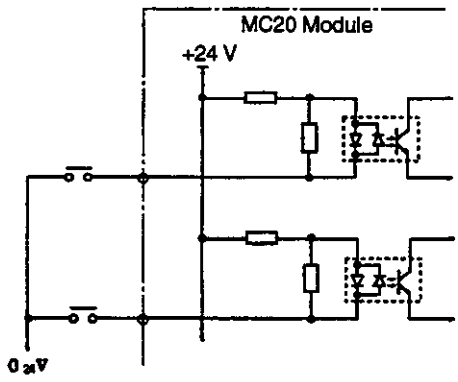
Pin No.	Signal	Name	Pin No.	Signal	Name
1	PAI4	A-phase signal input (fourth axis)	11	SEN4	SEN signal output (fourth axis)
2	*PAI4	A-phase signal input (fourth axis)	12	OSEN4	SEN GND (fourth axis)
3	PBI4	B-phase signal input (fourth axis)	13	SVON4	Servo ON output (fourth axis)
4	*PBI4	B-phase signal input (fourth axis)	14	PCON4*	PCON signal output (fourth axis)
5	PCI4	C-phase signal input (fourth axis)	15	ALMRST4	Servo reset output (fourth axis)
6	*PCI4	C-phase signal input (fourth axis)	16	ALM4	Servo alarm input (fourth axis)
7	VREF4	Speed reference output (fourth axis)	17	ALM04	Servo alarm GND (fourth axis)
8	SG4	Speed reference GND (fourth axis)	18	---	Not used
9	BAT4	Battery output (fourth axis)	19	+24V4	+24-V output (fourth axis)
10	BAT04	Battery GND (fourth axis)	20	---	Not used

*: PCON4 is a new step-2 function.

⚠ Caution Do not use any reserved or unused pins for relay signals.

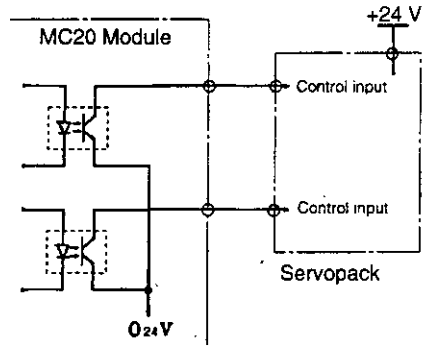
Refer to the following for connecting examples of the above I/O signals.

- **Input Circuit**



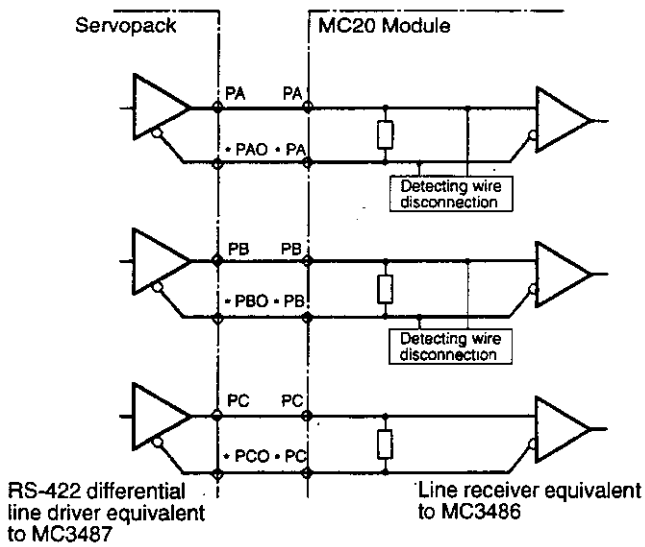
- OFF current must be 0.5 mA max. or input voltage must be 3.4 V max.
- The above is an example with sourcing input current.

- **Output Circuit**

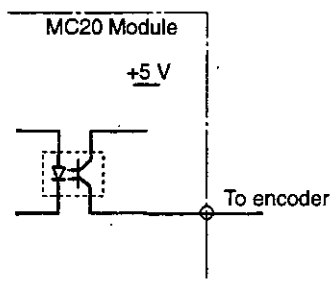


- Maximum Voltage: 30 V
- Maximum Current: 50 mA
- Leakage Current: 1 mA max.
- The above is an example with sinking output current.

- **Feedback Interface**



- **SEN Signal**



- Maximum Voltage: 5 V
- Maximum Current: 5 mA

2) **Connector Pin Arrangement of the I/O Signal Connector**
To connect the I/O signal connector to peripheral equipment other than Servo Amps.

I/O Signal Connector: I/O
Connector: 10250-52A2JL

Table 4.1 Pin Numbers and Signal Names

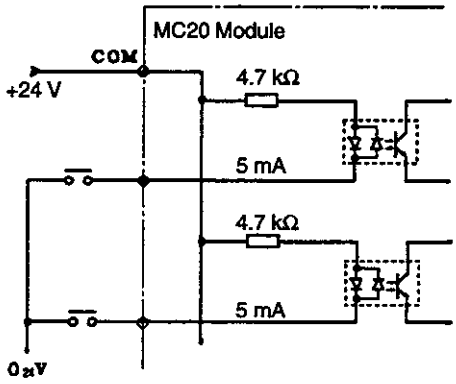
Pin No.	Signal	Name	Pin No.	Signal	Name
1	OTF1	Forward overtravel (first axis)	26	OTF3	Forward overtravel (third axis)
2	OTR1	Reverse overtravel (first axis)	27	OTR3	Reverse overtravel (third axis)
3	ZERO1	Zero signal (first axis)	28	ZERO3	Zero signal (third axis)
4	DEC1	Deceleration signal (first axis)	29	DEC3	Deceleration signal (third axis)
5	EXP1*	External input signal (first axis)	30	EXP3*	External input signal (third axis)
6	---	Reserved (Do not use.)	31	SPI3	Reserved
7	BRK1	Brake output (first axis)	32	BRK3	Brake output (third axis)
8	SPO1	Reserved	33	SPO3	Reserved
9	OTF2	Forward overtravel (second axis)	34	OTF4	Forward overtravel (fourth axis)
10	OTR2	Reverse overtravel (second axis)	35	OTR4	Reverse overtravel (fourth axis)
11	ZERO2	Zero signal (second axis)	36	ZERO4	Zero signal (fourth axis)
12	DEC2	Deceleration signal (second axis)	37	DEC4	Deceleration signal (fourth axis)
13	EXP2*	External input signal (second axis)	38	EXP4*	External input signal (fourth axis)
14	SPI2	Reserved	39	SPI4	Reserved
15	BRK2	Brake output (second axis)	40	BRK4	Brake output (fourth axis)
16	SPO2	Reserved	41	SPO4	Reserved
17	SKIP	Skip input	42	CSPO1	Reserved
18	CSPI1	Reserved	43	CSPO2	Reserved
19	CSPI2	Reserved	44	024IN	0_{24}-VDC input (external power supply)
20	CSPI3	Reserved	45	024IN	0_{24}-VDC input (external power supply)
21	COM	Common input signal	46	024IN	0_{24}-VDC input (external power supply)
22	COM	Common input signal	47	024IN	0_{24}-VDC input (external power supply)
23	COM	Common input signal	48	+24IN	+24-VDC input (external power supply)
24	COM	Common input signal	49	+24IN	+24-VDC input (external power supply)
25	COM	Common input signal	50	+24IN	+24-VDC input (external power supply)

*: EXP1 to EXP4 are new step-2 functions.

⚠ **Caution** Do not use any reserved or unused pins for relay signals.

Refer to the following for connecting examples of the above I/O signals.

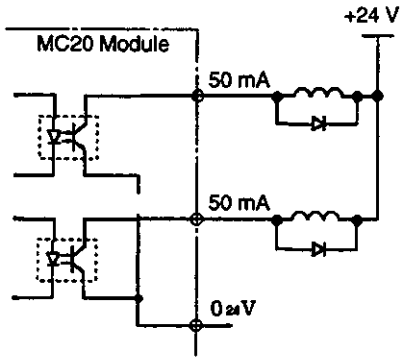
- **Input Circuit**
  For Sinking/Sourcing Input



- OFF current must be 0.5 mA max. or input voltage must be 3.4 V max.

- The above is an example with sourcing input signals.

- **Output Circuit**
  For Sinking Output



- Maximum Voltage: 30 V

- Maximum Current: 50 mA

- Leakage Current: 1 mA max.

4.1.4 Connector Signals

1) Signals and Functions of Servo Connectors SV1 to SV4

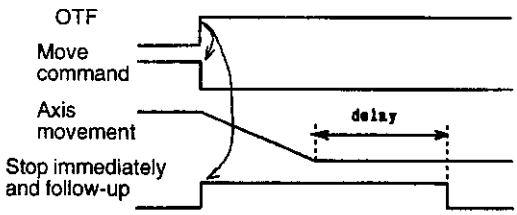
Signal	Function
+24V□	Power supply output for servo I/O signals • Connect to the power supply input of the I/O signals on the servo side.
VREF□	Speed reference output • Analog speed reference output • Analog voltages are output via the VOLTAGE OUTPUT (VCC) command (see note 2).
SG□	0 V of the control power supply and speed reference output
SVON□	Servo ON reference output • The output transistor will be ON when the servo is ON. • Open collector output
ALM□	Servo alarm signal input • A normally closed contact that will open when there is an alarm input.
ALM0□	Servo alarm ground
PA, $\overline{PA}$, PB, $\overline{PB}$, PC, $\overline{PC}$	Feedback signal input (differential line receiver input) • Connect the PG signal output of the servo. • These inputs can be set for use as general-purpose counter inputs (b4 of PA506 = 1) when a voltage output axis is set to use the VOLTAGE OUTPUT (VCC) command (see note 2).
BAT□, BAT0□	Battery power supply • Connect to the battery input of the Servopack for absolute encoders. • BAT□: + BAT0□: –
SEN□, 0SEN□	SEN signal output • Connect to the SEN input of the Servopack for absolute encoders. • 0SEN□: SEN□ signal ground
ALMRST□	Alarm reset signal output • Connect to alarm reset input of Servopack. • This signal will be reset when an alarm occurs in the Servopack.
PCON□	PCON Signal Output • This signal is used to turn ON/OFF the P-CON input to a Yaskawa Servopack when using the PCON SIGNAL OUTPUT command.

STEP 2

Note (1) Replace □ with axis number 1, 2, 3, or 4 for actual connections.

(2) These are new step-2 functions.

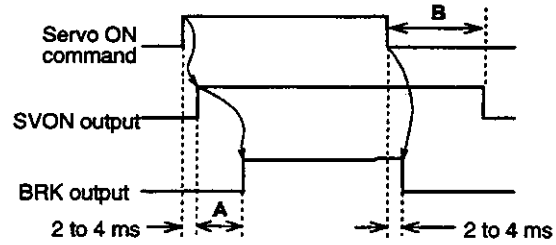
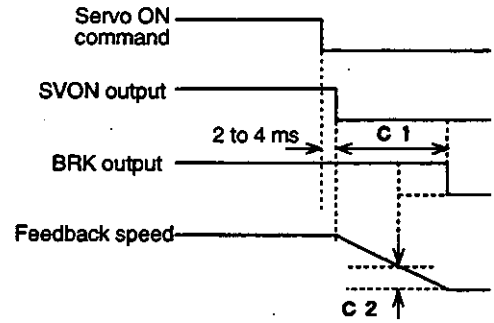
2) Input Signals and Functions of I/O Signal Connectors

Signal	Meaning
+24IN, 0_{24}IN	Power supply input for I/O signals (external power supply) • Power supply input for control signals for the Servo Amp. Although the signal lines of the MC20 Module with the same name are connected internally, connect the power to all the signal lines to reduce the current of each of the signal lines.
COM	Input signal common line • +24 v or 0_{24} V • All lines are connected internally.
OTF1 to OTF4	Forward overtravel input • A normally closed contact that will open when there is overtravel. • When the contact is open while an axis is moving, the axis will stop immediately and the alarm signal of the MC20 Module will be turned ON. The alarm signal can be reset the MODULE RESET or MACHINE RESET. While the contact is open, axis movement in the original direction is prohibited.  The delay time is always 0.5 s. • These signals can be enabled or disabled with the parameter PA601-b0.
OTR1 to OTR4	Reverse overtravel input • A normally closed contact that will open when there is overtravel. • The operation and the signal timing of reverse overtravel input is the same as those of forward overtravel input.
DEC1 to DEC4	Home return deceleration dog input • Used for dog deceleration and C-phase pulse home return. • The polarity of the signals can be reversed with the parameter PA310.
ZERO1 to ZERO4	Home return and home position signal input • Input signal for home return with the proximity switch. • Be sure not to use the signals when a home return method with a C-phase pulse is used. • The home return method can be selected with the parameter PA301. • The polarity of the signals can be reversed with the parameter PA308.

Signal	Meaning
SKIP	Skip input signal • A normally closed contact that will open when there is skip input.
EXP1 to 4	External Input Signals (See note.) • Connected to the following motion commands input signals. a) External positioning signal for the EXTERNAL POSITIONING (EXM) command b) Mark sensor input signal for the TRAILING SYNCHRONOUS OPERATION (TSS) command • The ZERO signals cannot be used to return to home when the EXTERNAL POSITIONING (EXM) or the TRAILING SYNCHRONOUS OPERATION (TSS) command is being executed.

Note These are new step-2 functions.

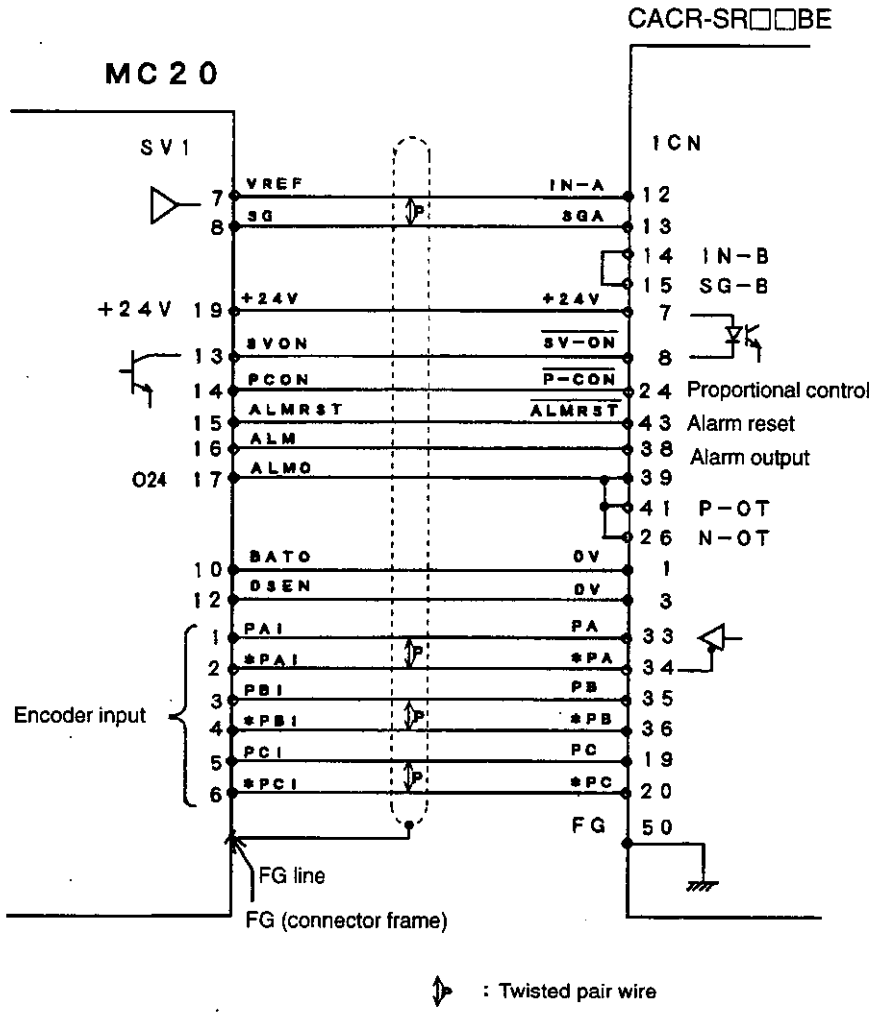
3) Output Signals and Functions of I/O Signal Connectors

Signal	Meaning
BRK1 to BRK4	Brake control output • When the brake is released, the output transistor will be turned ON. • Open collector output 1) The following timing chart shows the status of a controlled axis not in operation.  A: Brake release output ON timer (always 8 ms) B: Servo OFF timer (set with the parameter PA602) 2) When the controlled axis is moving, BRK□ will be turned OFF if either the C1 or C2 condition is satisfied.  C1: Brake release output OFF timer (always 200 ms) C2: The feedback speed is the same as that set with the parameter PA603 or less.

4.1.5 Typical Connection Examples of Connectors

1) Refer to the following to connect servo connectors SV1 to SV4 to the following Servo Amp. For details, refer to the *AC Servo Drive M, F, G, S and D Series User's Manual: Technical Sheets (Incremental Encoders) (TSE-S800-11.1).*

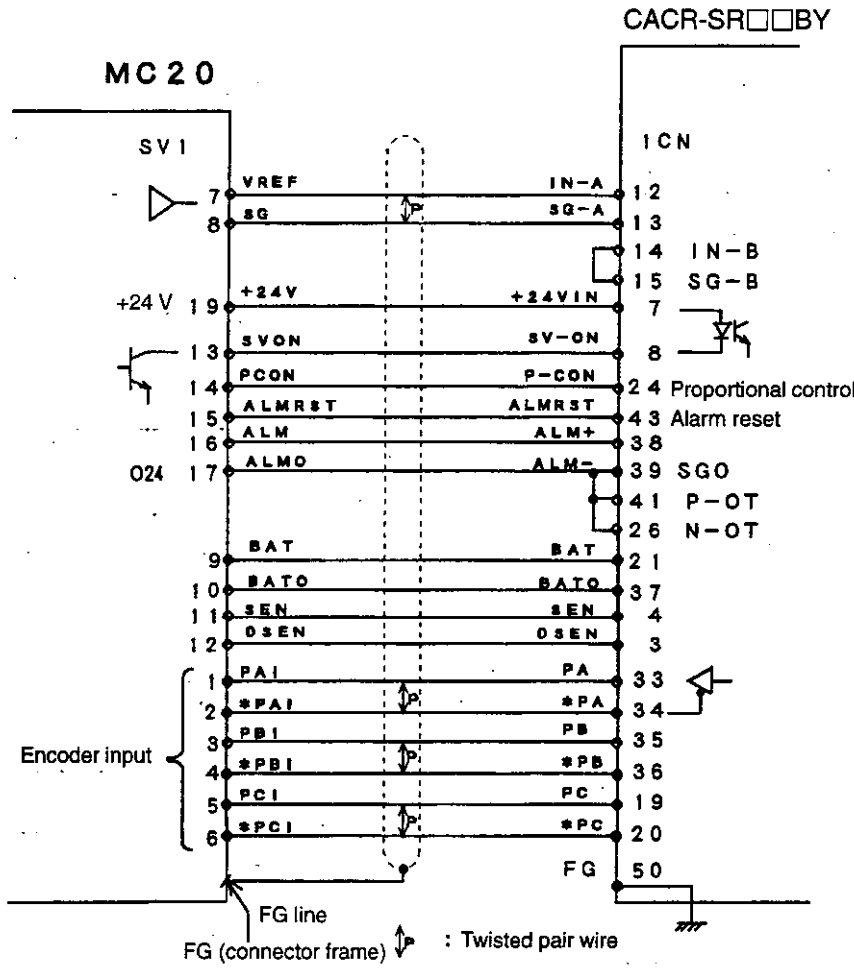
• Servopack: CACR-SR□□BE with Incremental Encoder



Recommended Wire: 0.08 mm^2 (AWG28)

2) Refer to the following to connect servo connectors SV1 to SV4 to the following Servo Amp. For details, refer to the *AC Servo Drive M, F, G, S and D Series User's Manual: Technical Sheets (Absolute Encoders) (TSE-S800-11.2).*

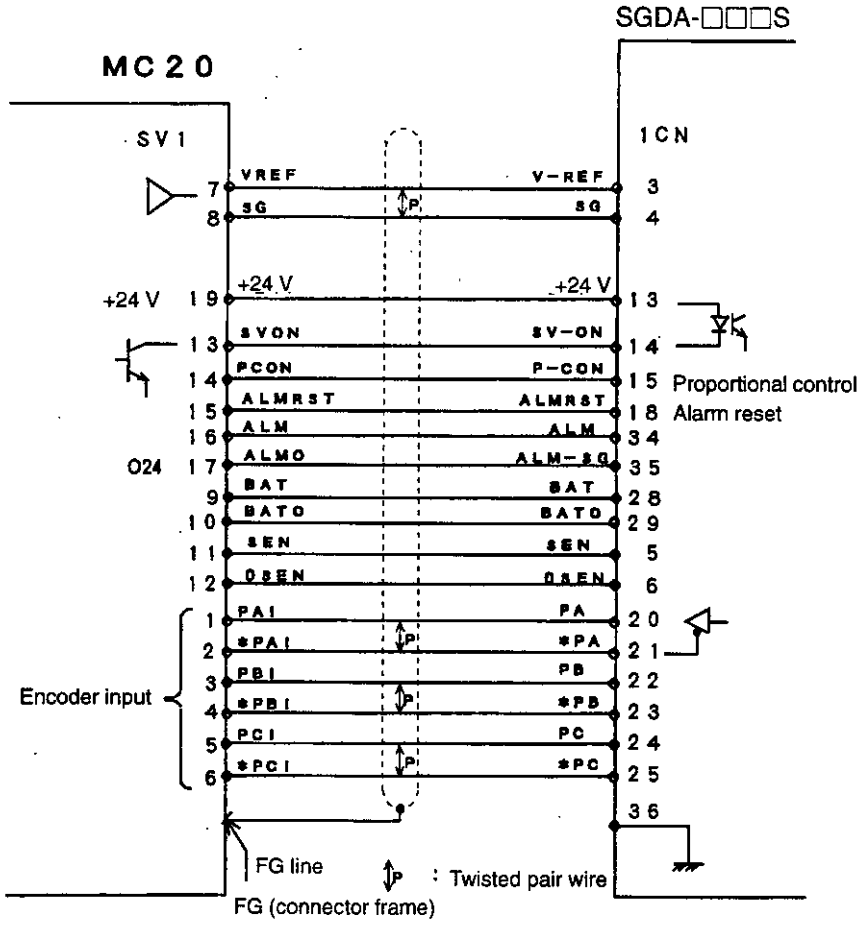
• Servopack: CACR-SR□□BY with Absolute Encoder



Recommended Wire: 0.08 mm^2 (AWG28)

3) Refer to the following to connect servo connectors SV1 to SV4 to the following Servo Amp. For details, refer to the *Σ Series SGM□/SGDA User's Manual (TSE-S800-15).*

• Servopack: SGDA-□□□S with Incremental and Absolute Encoders

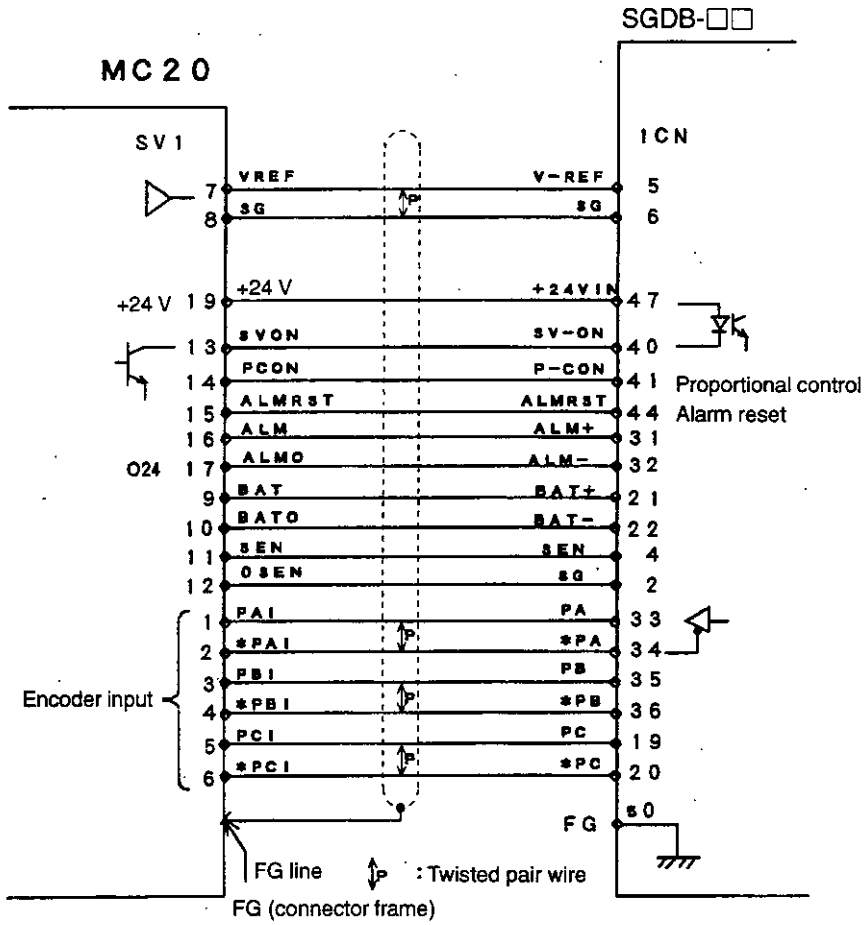


Recommended Wire: 0.08 mm^2 (AWG28)

Note Set both bits 2 and 3 of the user constant Cn-01 of the Servopack to 1 and disable the P-OT and N-OT inputs.

4) Refer to the following to connect servo connectors SV1 to SV4 to the following Servo Amp. For details, refer to the following manuals:
Σ Series SGM□/SGDB User's Manual (TSE-S800-16)
Σ- II Series SGM□H/SGDM User's Manual Design and Maintenance (SIE-S800-31.2)
Σ- II Series SGM□H/SGDH User's Manual Design and Maintenance (SIE-S800-32.2)

- **Servopack: SGDB-□□, SGDM-□□ or SGDH-□□, with Incremental and Absolute Encoders**



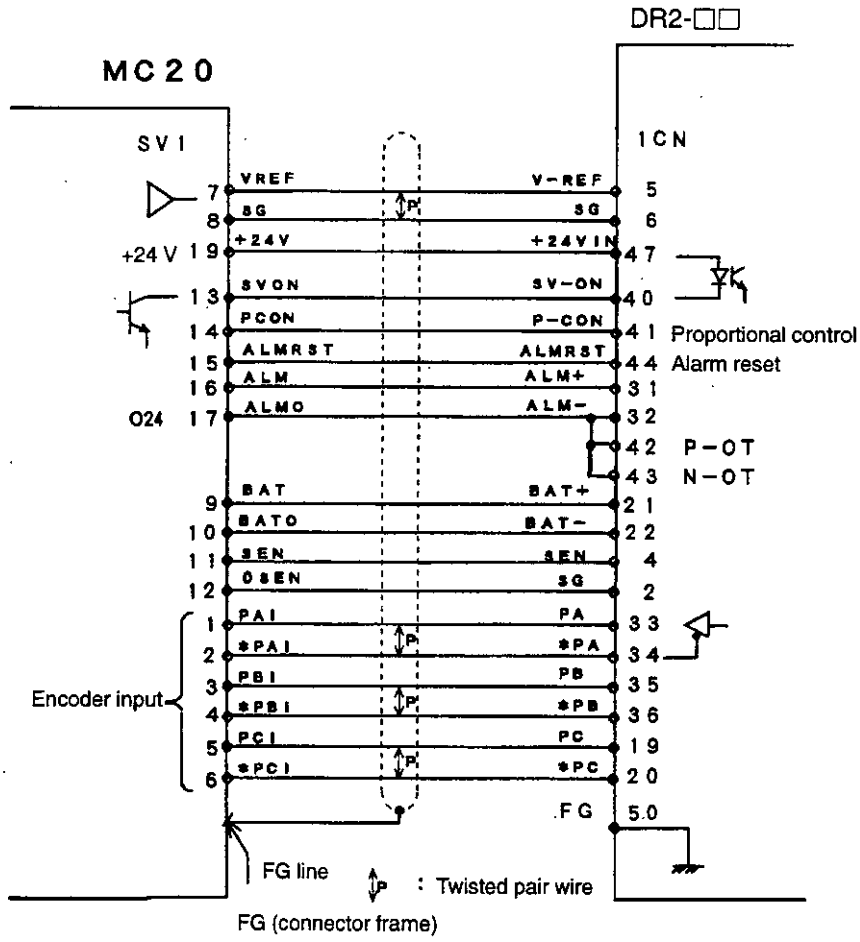
Recommended Wire: 0.08 mm^2 (AWG28)

Note (1) Set bits 2 and 3 of the user constant Cn-01 in the Servopack to 1 to disable the P-OT and N-OT inputs when using SGDB-□□ Servopack.

(2) Set the third digit of user constant Pn50A and the zero digit of user constant Pn50B to 8 to disable the P-OT and N-OT inputs when using SGDM-□□ or SGDH-□□ Servopack.

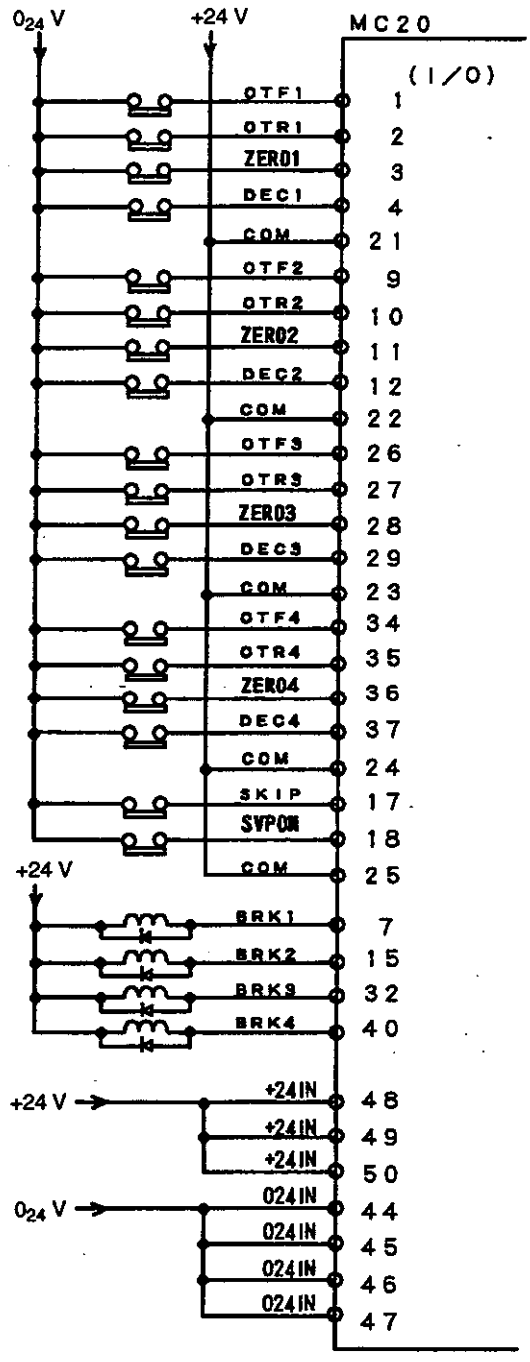
5) Refer to the following to connect servo connectors SV1 to SV4 to the following Servo Amp. For details, refer to the *Σ Series SGM□/DR2 User's Manual (TSE-S800-17).*

• Servopack: DR2-□□ with Incremental and Absolute Encoders



Recommended Wire: 0.08 mm^2 (AWG28)

6) Refer to the following to connect the I/O signal connector to peripheral equipment other than Servo Amps.



Recommended Wire: 0.08 mm^2 (AWG28)

The above is an example with sinking input signals.

7) Refer to the following to connect the battery connector (BAT) to the Battery Module if a servomotor incorporating an absolute encoder is used with the Battery Module. The Battery Module is required to back up the data of the absolute encoder.

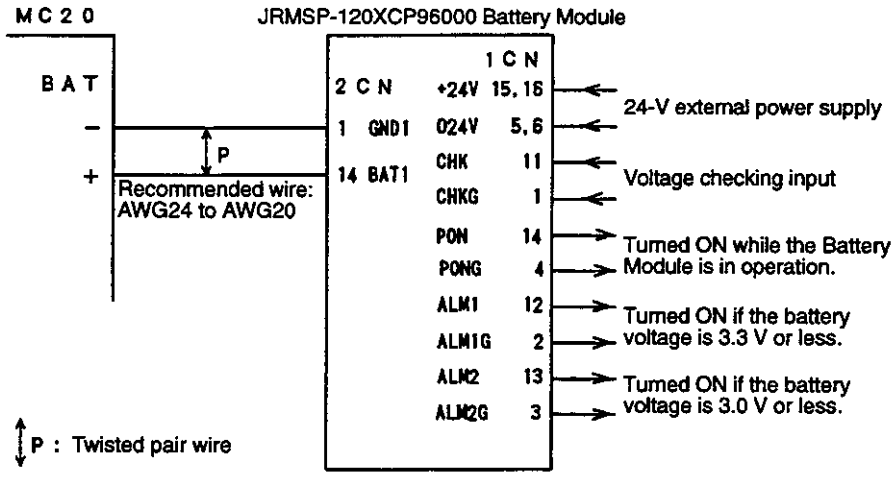


Table 4.2 Connectors for Battery Module

Connector	Use	Connector Model		Manufacturer
		Battery Module Side	Cable Side	
1CN	+24-V External power supply External I/O signals	MR-16RMA	MR-16F MR-16L	Honda Tsushin Kogyo Ltd.
2CN	Battery voltage output	MR-20RFA4	MR-20M MR-20L	Honda Tsushin Kogyo Ltd.

Note (1) The connectors for the cable side with the model number suffix "16F" or "20M" are soldering connector models and those with the model number suffix "16L" or "20L" are connector frames.

(2) The connectors on the cable side are provided with the Battery Module.

Specifications of the Battery Module Built-in Battery

- Model: Toshiba ER6VC3 with connector for the Yaskawa Battery Module.
- Voltage: 3.6 V
- Current Capacity: 2,000 mAh

(3) The Battery Module can back up the 8-axis data of an absolute encoder.

Note Connect the 1CN connector of the Battery Module to the system and arrange an appropriate sequence so that an alarm will be turned ON when the battery voltage drops excessively.

4.1.6 Standard Cables

1) Yaskawa supplies the following standard cables. The cables shown in a) are used to connect the MC20 Module to the peripheral equipment such as overtravel limit switches, and cables in b) are used to connect MC20 to the Servopack.

a) Motion Module I/O Cable

	Model	Length	Specification
1	JZMSZ-120W0400-01 JZMSZ-120W0400-03 JZMSZ-120W0400-05	1.0 m 3.0 m 5.0 m	I/O cable One of the ends of the cable has no connector. AWG size of the conductor: AWG28 ($0.08mm^2$)
2	JZMSZ-120W0402-01 JZMSZ-120W0402-03 JZMSZ-120W0402-05	1.0 m 3.0 m 5.0 m	I/O cable One of the ends of the cable has no connector. AWG size of the conductor: AWG24 ($0.20mm^2$)
3	JZMSZ-120W0401-01 JZMSZ-120W0401-03 JZMSZ-120W0401-05	1.0 m 3.0 m 5.0 m	For terminal block (with MR50F connector) Suitable terminal block: OMRON XW2B-50Y5

b) Servo Cable

	Model	Length	Specification
4	JZMSZ-120W0500-05 JZMSZ-120W0500-10 JZMSZ-120W0500-30	0.5 m 1.0 m 3.0 m	Servopack Cable One of the ends of the Cable has no connector.
5	JZMSZ-120W0501-05 JZMSZ-120W0501-10 JZMSZ-120W0501-30	0.5 m 1.0 m 3.0 m	Servopack Cable For CACR-SR□□BE For incremental encoders
6	JZMSZ-120W0502-05 JZMSZ-120W0502-10 JZMSZ-120W0502-30	0.5 m 1.0 m 3.0 m	Servopack Cable For CACR-SR□□BY For absolute encoders
7	JZMSZ-120W0503-05 JZMSZ-120W0503-10 JZMSZ-120W0503-30	0.5 m 1.0 m 3.0 m	Servopack Cable SGDA-□□□S
8	JZMSZ-120W0504-05 JZMSZ-120W0504-10 JZMSZ-120W0504-30	0.5 m 1.0 m 3.0 m	Servopack Cable For SGDB-□□, SGDM-□□ or SGDH-□□
9	JZMSZ-120W0505-05 JZMSZ-120W0505-10 JZMSZ-120W0505-30	0.5 m 1.0 m 3.0 m	Servopack Cable For DR2-□□

The size of the conductor is different between W0400 and W0402 cables.

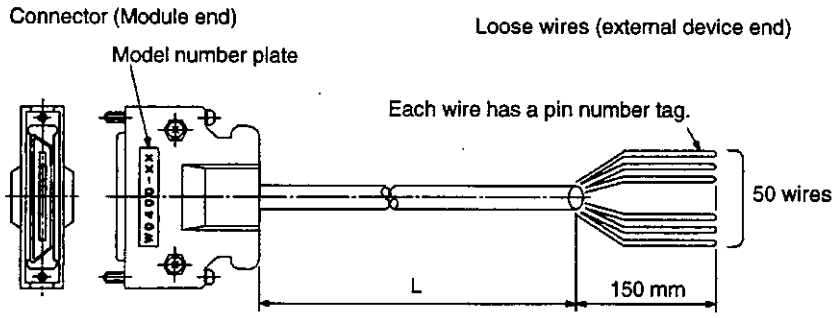
2) Motion Module I/O Cable

a) W0400 Cables

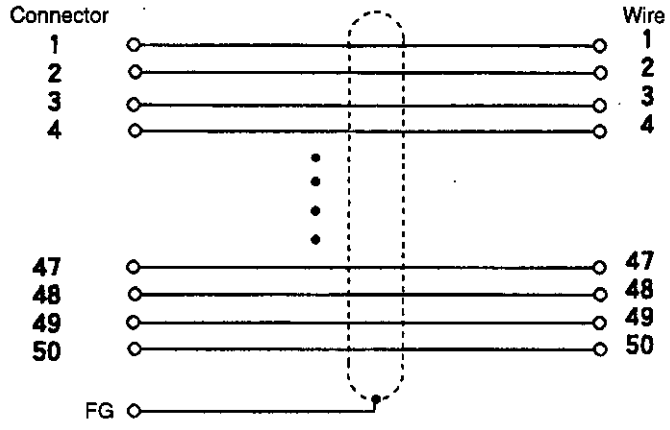
• Specifications

Item	W0400 Cable		
Model Name	W0400-01	W0400-03	W0400-05
Model	JZMSZ-120W0400-01	JZMSZ-120W0400-03	JZMSZ-120W0400-05
Length (L)	1.0 m	3.0 m	5.0 m
Cable Specifications	Shielded cable, 50P, corresponding to UL20276, 0.08 mm^2 (AWG28)		
Connector Specifications	10150-6000EL + 10350-52A0-008 (3M)		

• Configuration



• Connections



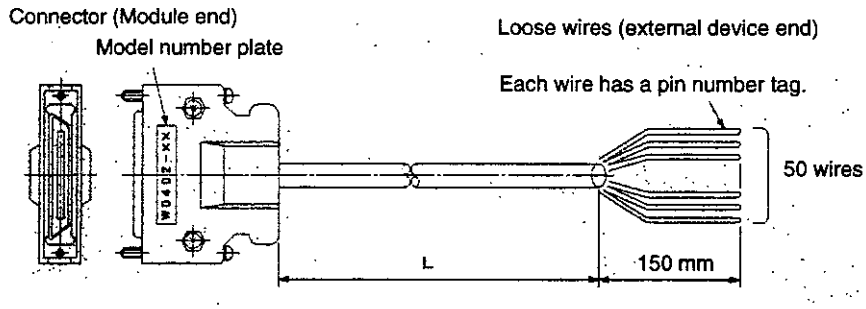
Wire: 0.08 mm^2 (AWG28)

b) W0402 Cables

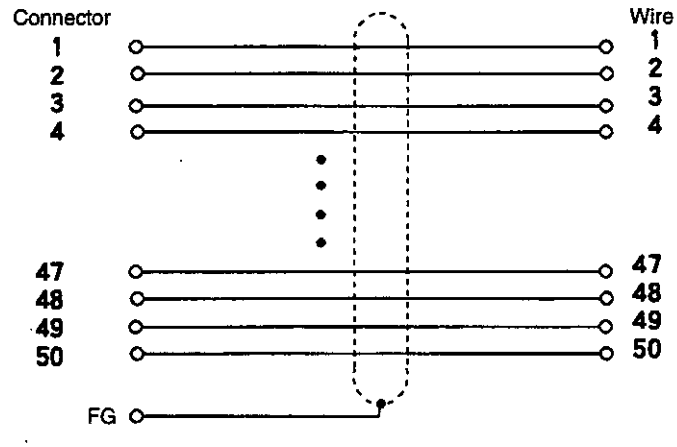
• Specifications

Item	W0402 Cable		
Model Name	W0402-01	W0402-03	W0402-05
Model	JZMSZ-120W0402-01	JZMSZ-120W0402-03	JZMSZ-120W0402-05
Length (L)	1.0 m	3.0 m	5.0 m
Cable Specifications	Shielded cable, 50P, corresponding to UL20276, 0.20 mm^2 (AWG24)		
Connector Specifications	10150-6000EL + 10350-52A0-008 (3M)		

• Configuration



• Connections



Wire: 0.20 mm^2 (AWG24)

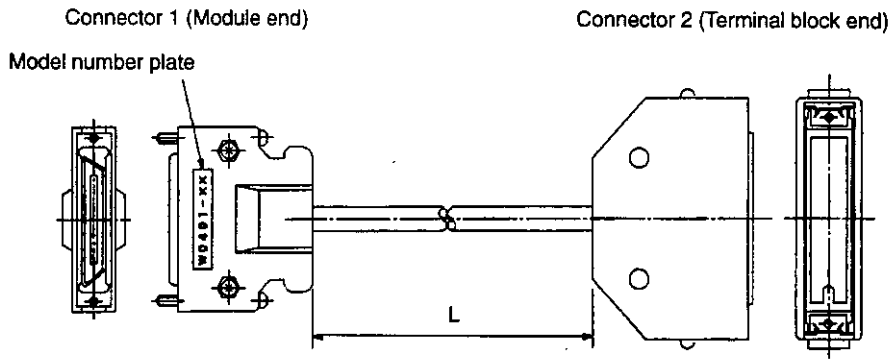
INFO The size of the conductor is different between W0400 and W0402 cables.

c) W0401 Cables

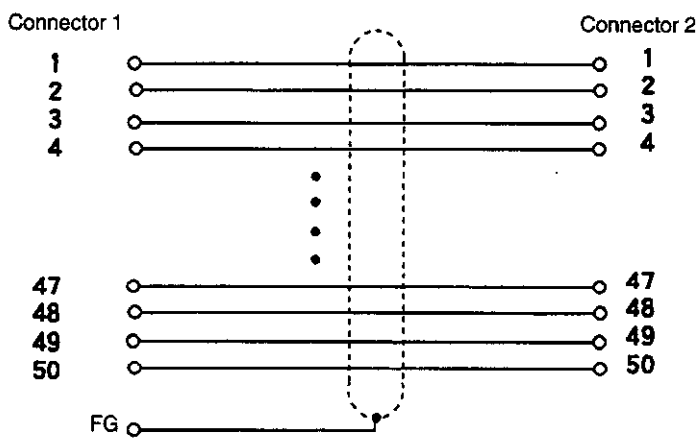
• Specifications

Item	W0401 Cable		
Model Name	W0401-01	W0401-03	W0401-05
Model	JZMSZ-120W0401-01	JZMSZ-120W0401-03	JZMSZ-120W0401-05
Length (L)	1.0 m	3.0 m	5.0 m
Cable Specifications	Shielded cable, 50P, corresponding to UL20276, 0.08 mm^2 (AWG28)		
Connector Specifications	Connector 1 : 10150-6000EL + 10350-52A0-008 (3M) Connector 2 : MR-50F + MR-50L (Honda Tsushin Kogyo Ltd.)		

• Configuration



• Connections



Wire: 0.08 mm^2 (AWG28)

• The following terminal block can be connected to connector 2.

Terminal Block

OMRON's XW2B-50Y5

Refer to the following for the terminal numbers of the terminal board and the signal names of the terminals.

Table 4.3 Terminal Numbers and Signal Names

Terminal No.	Signal	Signal Name	Terminal No.	Signal	Signal Name
1	OTF1	Forward overtravel (first axis)	26	OTF3	Forward overtravel (third axis)
2	OTR1	Reverse overtravel (first axis)	27	OTR3	Reverse overtravel (third axis)
3	ZERO1	Zero signal (first axis)	28	ZERO3	Zero signal (third axis)
4	DEC1	Deceleration signal (first axis)	29	DEC3	Deceleration signal (third axis)
5	EXP1	Reserved	30	EXP3	Reserved
6	---	Reserved (Do not use.)	31	SPI3	Reserved
7	BRK1	Brake output (first axis)	32	BRK3	Brake output (third axis)
8	SPO1	Reserved	33	SPO3	Reserved
9	OTF2	Forward overtravel (second axis)	34	OTF4	Forward overtravel (fourth axis)
10	OTR2	Reverse overtravel (second axis)	35	OTR4	Reverse overtravel (fourth axis)
11	ZERO2	Zero signal (second axis)	36	ZERO4	Zero signal (fourth axis)
12	DEC2	Deceleration signal (second axis)	37	DEC4	Deceleration signal (fourth axis)
13	EXP2	Reserved	38	EXP4	Reserved
14	SPI2	Reserved	39	SPI4	Reserved
15	BRK2	Brake output (second axis)	40	BRK4	Brake output (fourth axis)
16	SPO2	Reserved	41	SPO4	Reserved
17	SKIP	Skip input	42	CSPO1	Reserved
18	CSPI1	Reserved	43	CSPO2	Reserved
19	CSPI2	Reserved	44	024IN	0_{24}-VDC input (external power supply)
20	CSPI3	Reserved	45	024IN	0_{24}-VDC input (external power supply)
21	COM	Common input signal	46	024IN	0_{24}-VDC input (external power supply)
22	COM	Common input signal	47	024IN	0_{24}-VDC input (external power supply)
23	COM	Common input signal	48	+24IN	+24-VDC input (external power supply)
24	COM	Common input signal	49	+24IN	+24-VDC input (external power supply)
25	COM	Common input signal	50	+24IN	+24-VDC input (external power supply)

Caution Do not use any reserved or unused pins for relay signals.

Note Refer to *4.1.4 Connector Signals* for details.

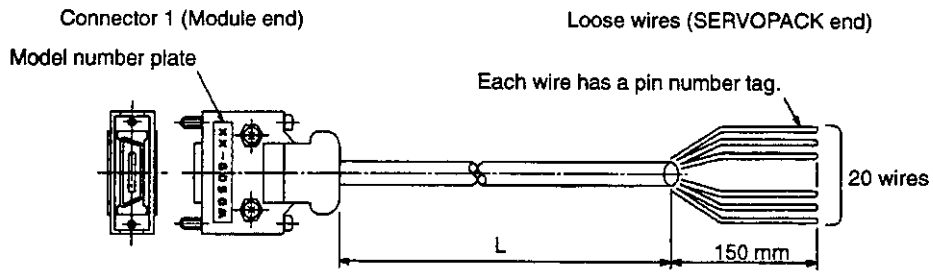
3) Servo Cables

a) W0500 Cables: Servo Cable with Connector on One End

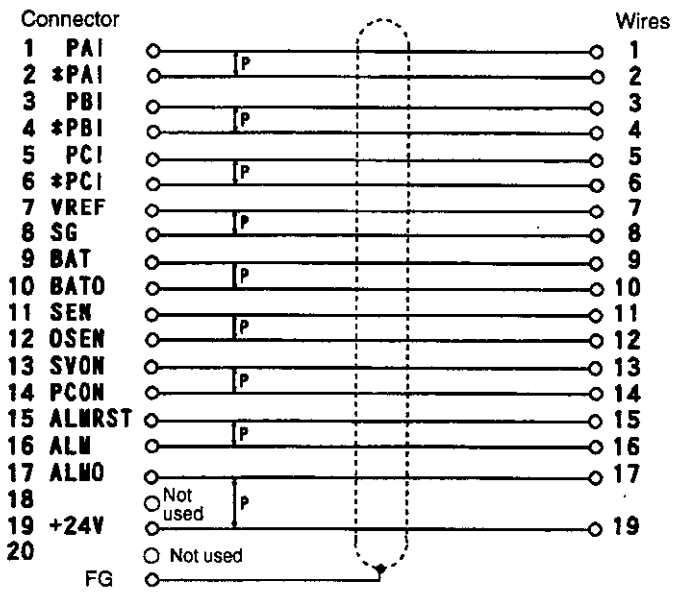
• Specifications

Item	W0500 Cable		
Model Name	W0500-05	W0500-10	W0500-30
Model	JZMSZ-120W0500-05	JZMSZ-120W0500-10	JZMSZ-120W0500-30
Length (L)	0.5 m	1.0 m	3.0 m
Cable Specifications	Shielded twisted-pair cable, 10P, corresponding to UL20276, 0.08 mm^2 (AWG28)		
Connector Specifications	10120-6000EL + 10320-52A0-008 (3M)		

• Configuration



• Connections



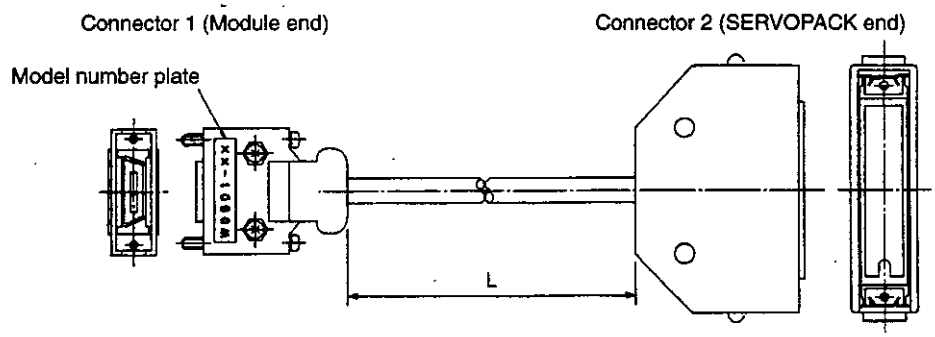
Wire: 0.08 mm^2 (AWG28)

b) W0501 Cables: CACR-SR□□BE Servo Cable for Incremental Encoders

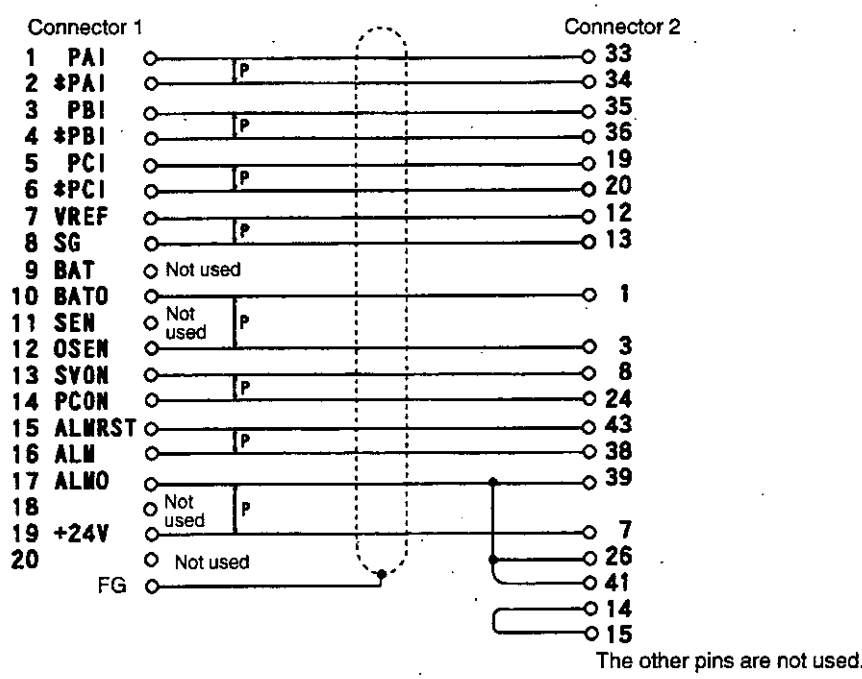
• Specifications

Item	W0501 Cable		
Model Name	W0501-05	W0501-10	W0501-30
Model	JZMSZ-120W0501-05	JZMSZ-120W0501-10	JZMSZ-120W0501-30
Length (L)	0.5 m	1.0 m	3.0 m
Cable Specifications	Shielded twisted-pair cable, 10P, corresponding to UL20276, 0.08 mm^2 (AWG28)		
Connector Specifications	Connector 1 : 10120-6000EL + 10320-52A0-008 (3M) Connector 2 : MR-50F + MR-50L (Honda Tsushin Kogyo Ltd.)		

• Configuration



• Connections



The other pins are not used.

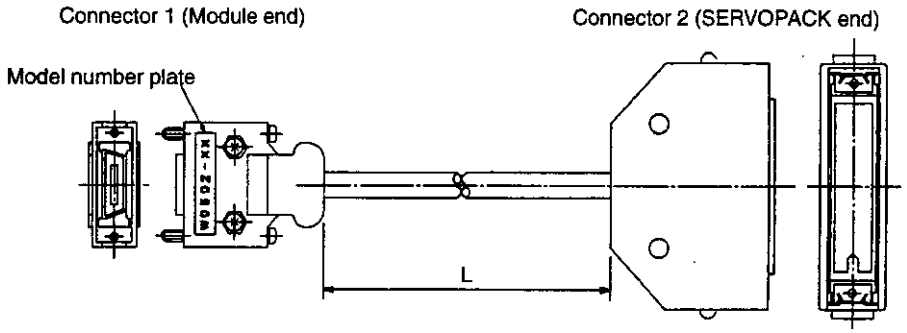
Wire: 0.08 mm^2 (AWG28)

c) W0502 Cables : CACR-SR□□BY Servo Cable for Absolute Encoders

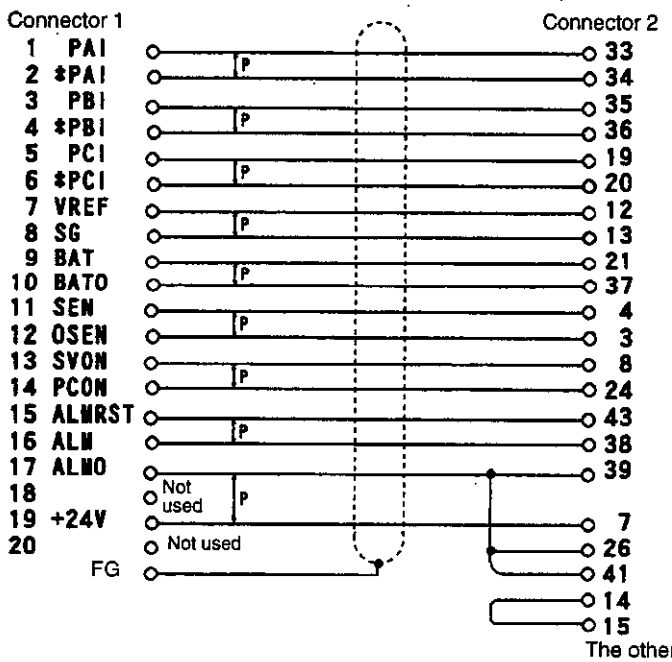
• **Specifications**

Item	W0502 Cable		
Model Name	W0502-05	W0502-10	W0502-30
Model	JZMSZ-120W0502-05	JZMSZ-120W0502-10	JZMSZ-120W0502-30
Length (L)	0.5 m	1.0 m	3.0 m
Cable Specifications	Shielded twisted-pair cable, 10P, corresponding to UL20276, 0.08 mm^2 (AWG28)		
Connector Specifications	Connector 1 : 10120-6000EL + 10320-52A0-008 (3M) Connector 2 : MR-50F + MR-50L (Honda Tsushin Kogyo Ltd.)		

• **Configuration**



• **Connections**



The other pins are not used.

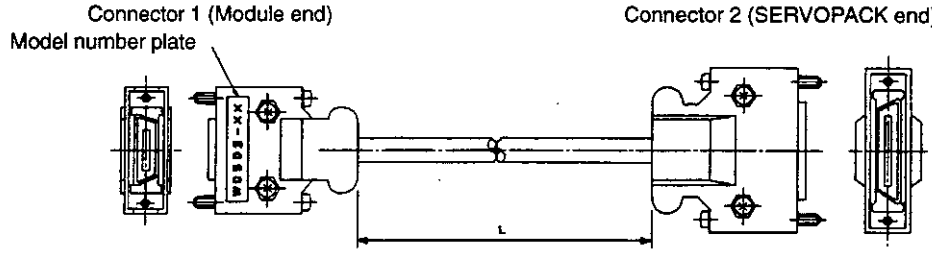
Wire: 0.08 mm^2 (AWG28)

d) W0503 Cables : SGDA-□□□S Servo Cable for Incremental Encoders

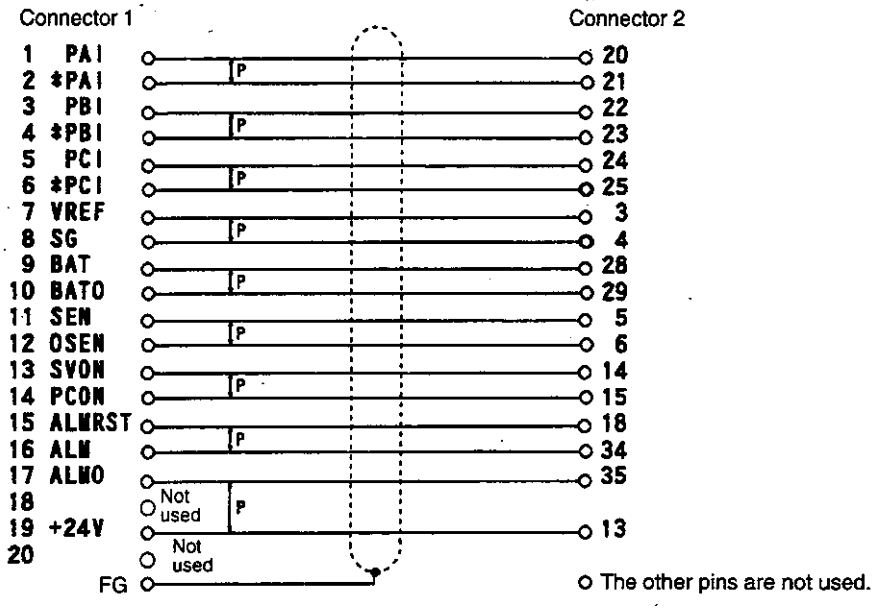
• Specifications

Item	W0503 Cable		
Model Name	W0503-05	W0503-10	W0503-30
Model	JZMSZ-120W0503-05	JZMSZ-120W0503-10	JZMSZ-120W0503-30
Length (L)	0.5 m	1.0 m	3.0 m
Cable Specifications	Shielded twisted-pair cable, 10P, corresponding to UL20276, 0.08 mm^2 (AWG28)		
Connector Specifications	Connector 1 : 10120-6000EL + 10320-52A0-008 (3M) Connector 2 : 10136-6000EL + 10336-52A0-008 (3M)		

• Configuration



• Connections



Wire: 0.08 mm^2 (AWG28)

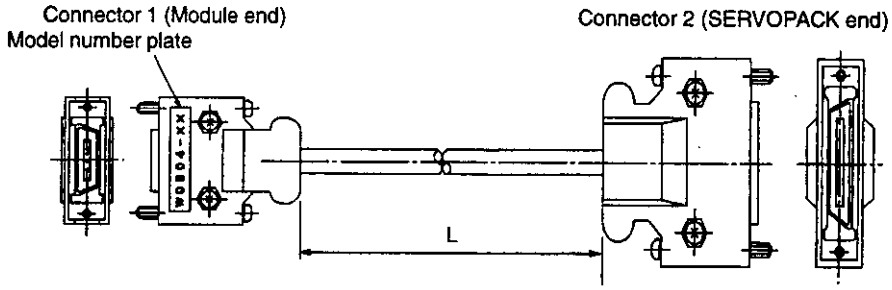
Note Set both bits 2 and 3 of the user constant Cn-01 of the Servopack to 1 and disable the P-OT and N-OT inputs.

e) W0504 Cables : SGDB-□□, SGDM-□□or SGDH-□□ Servo Cable for Incremental Encoders

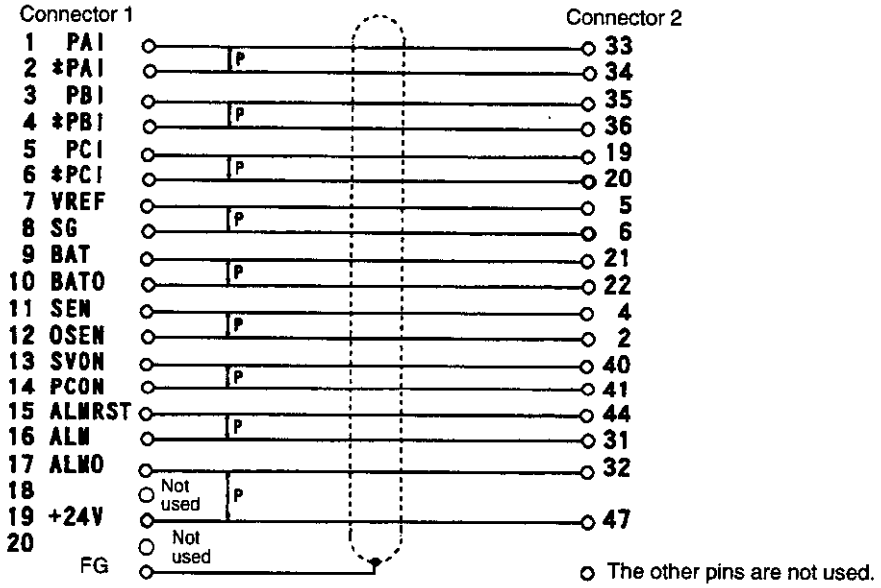
• **Specifications**

Item	W0504 Cable		
Model Name	W0504-05	W0504-10	W0504-30
Model	JZMSZ-120W0504-05	JZMSZ-120W0504-10	JZMSZ-120W0504-30
Length (L)	0.5 m	1.0 m	3.0 m
Cable Specifications	Shielded twisted-pair cable, 10P, corresponding to UL20276, 0.08 mm^2 (AWG28)		
Connector Specifications	Connector 1 : 10120-6000EL + 10320-52A0-008 (3M) Connector 2 : 10150-6000EL + 10350-52A0-008 (3M)		

• **Configuration**



• **Connections**



Wire: 0.08 mm^2 (AWG28)

Note (1) Set bits 2 and 3 of the user constant Cn-01 in the Servopack to 1 to disable the P-OT and N-OT inputs when using SGDB-□□ Servopack.

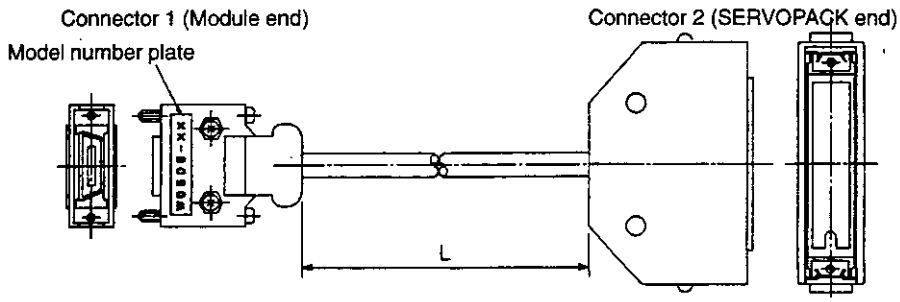
(2) Set the third digit of user constant Pn50A and the zero digit of user constant Pn50B to 8 to disable the P-OT and N-OT inputs when using SGDM-□□ or SGDH-□□ Servopack.

f) W0505 Cables : DR2-□□ Servo Cable for Incremental Encoders

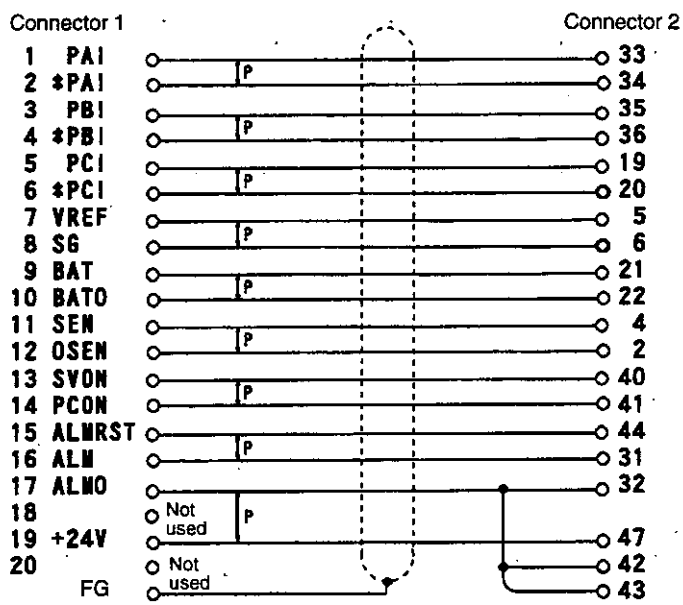
• Specifications

Item	W0505 Cable		
Model Name	W0505-05	W0505-10	W0505-30
Model	JZMSZ-120W0.505-05	JZMSZ-120W0505-10	JZMSZ-120W0505-30
Length (L)	0.5 m	1.0 m	3.0 m
Cable Specifications	Shielded twisted-pair cable, 10P, corresponding to UL20276, 0.08 mm^2 (AWG28)		
Connector Specifications	Connector 1 : 10120-6000EL + 10320-52A0-008 (3M) Connector 2 : MR-50M + MR-50L (Honda Tsushin Kogyo Ltd.)		

• Configuration



• Connections



○ The other pins are not used.

Wire: 0.08 mm^2 (AWG28)

Parameter Setting

5

This chapter describes all parameters that are necessary to operate the MC20 Module. Be sure to familiarize yourself with this chapter before operating the MC20 Module.

5.1 Parameters

All parameters that are necessary to operate the MC20 are briefly explained below.

5.1.1 Types of Parameters

1) **Summary**
A particular constant that is necessary to operate the MC20 Module is called a parameter. Set the parameters of the MC20 Module to optimum values according to the machine or servo drive operated with the MC20 Module.
Use **MEMOSOFT** to set or edit parameters.

2) Refer to *page 5-6* or *Appendix B* for a list of all parameters. Parameters are classified into the following two types.

Parameter	Parameter No.	Difference
1) Common parameters	P0000 to P0017	A common parameter is set for controlled axes.
2) Axis parameters	PA101 to PA603	A particular parameter is set for an individual controlled axis.

The letter "A" of an axis parameter should be replaced with an axis number 1, 2, 3, or 4. For example, P4101 means a parameter set for the fourth axis.
Axis parameters are classified by purpose into the following types.

- Parameter for positioning
- Parameter for speed and acceleration/deceleration
- Parameter for home return
- Parameter for absolute position detecting
- Parameter for machine system and peripheral equipment
- Parameter for external I/O

MEMOSOFT

The MEMOSOFT is software used to program Yaskawa Programmable Controllers. The MEMOSOFT makes it possible to write and edit ladder programs and motion programs and set and monitor a variety of data.

3) Each parameter is classified by either one of the following letter.

Letter	Meaning
A	Parameters that are necessary for the MC20 Module in standard operation.
B	Parameters that are necessary for the MC 20 Module in particular operation.
C	Parameters that usually need not be changed.
D	Parameters that must not be changed.

4) **Parameters can be written or edited in the following methods.**

Tools	Methods	Remarks
Programming Device	1) Select the Mode from the Main Menu and then select Offline. a) Select the Motion from the Main Menu and then select Parameter to write or edit parameters. b) Select the Tools from the Main Menu and then select loader and transfer sets of parameters to the MC20 Module. (See note 1.)	• MC20 Module must be in edit mode. • All parameters will be on hold if the MC20 Module is turned OFF.
	2) Select the Mode from the Main Menu and then select the Online. a) Select the Motion from the Main Menu and then select Parameter to write or edit parameters.	
CPU Module	3) Change parameters with PARAMETER SETTING (PRM), which is a **motion command for ladder logic programs.** (See note 2.)	• The previous data of the parameter will be on hold if the MC20 Module is turned OFF.

Note (1) To write a new set of parameters, before selecting Mode from the Main Menu, select Tools from the Main Menu, Files, and then New Programs to make a new parameter file.

(2) All parameters cannot be edited with the CPU Module. Refer to *5.1.3 List of Parameters* for details.

Programming Device

Programming Devices are personal computers loaded with Yaskawa programming software called MEMOSOFT. DOS/V personal computers can be used as Programming Devices.

Motion commands for ladder logic programs

The motion commands used in the ladder logic programs of the CPU Module are called motion commands for ladder logic programs. Motion commands for ladder logic programs are a set of commands used to control the MC20 Module with the CPU Module.

5) **Validation of Parameters**

a) All parameters rewritten with a Programming Device or the Teach Pendant will not be valid. Refer to the following.

(1) If MACHINE RESET (RST) is executed in a ladder program, the final set values of the parameters remarked "reset" will be valid.

(2) The final set values of the rewritten parameters will be valid if MODULE RESET (MRS) or the MC20 Module is turned OFF and ON.

b) If a parameter is rewritten with PARAMETER SETTING (PRM), which is a motion command for ladder logic program, execute MACHINE RESET (RST) to valid the parameter.

c) Refer to *5.1.2 Rewritten Parameters* for details.

Note (1) Some parameters are related to one another. For example, if PA508 for a positive stored stroke limit and PA509 for a negative stored stroke limit are set, PA510-b0 must be set to 1 so that the stored stroke limits can be used. Refer to *5.1.3 List of Parameters* for details.

(2) Whenever a set of parameters is loaded or the value of a parameter is changed, sum check data will be stored automatically.
When the MC20 Module is turned ON, the MC20 Module will use its **sum check** function and execute sum checking for the parameters of the MC20 Module. An alarm for alarm code 079 (parameter destruction) will be ON if the sum check data does not coincide with the data of the parameters.

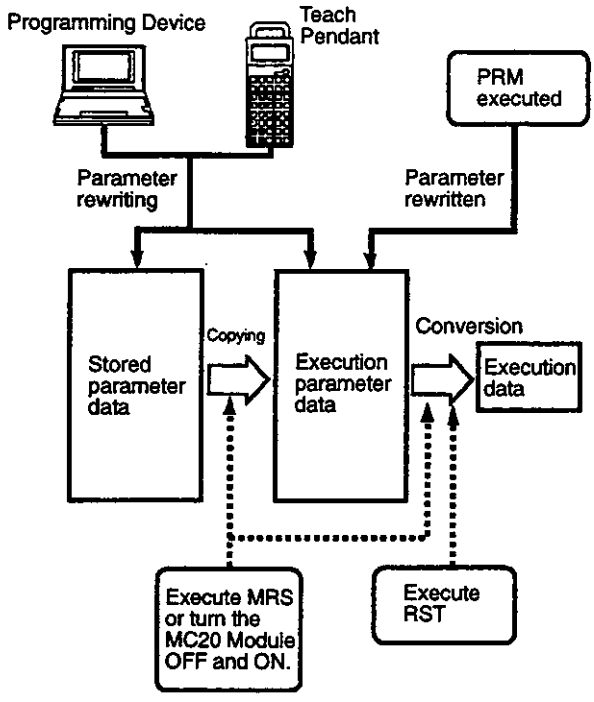
5.1.2 Rewritten Parameters

1) All parameters rewritten with the Programming Device or Teach Pendant will not be valid unless they are handled properly.

Sum check function

The sum check function is used to check the data of the parameters of the MC20 Module automatically. With this function, the MC20 Module stores the total data value of the parameters and when the MC20 Module is turned ON again, the MC20 Module will calculate the total data value of the parameters and compare it with the stored total data value. This function makes it possible for the MC20 Module to easily check if the data values of the parameters are correct.

2) The following illustrates how parameters are rewritten with the Programming Device, the Teach Pendant, or PARAMETER SETTING (PRM).



- PRM: **PARAMETER SETTING**
- MRS: **MODULE RESET**
- RST: **MACHINE RESET**

3) The Programming Device and Teach Pendant rewrites both the stored and execution parameter data.
Then, if MODULE RESET (MRS) is executed or the MC20 Module is turned OFF and ON, the contents of the stored parameter data are copied as the execution parameter data. The execution data is created according to the contents of the execution parameter data, when the rewritten parameters become valid. If MACHINE RESET (RST) is executed after the parameters are rewritten, the rewritten parameters will be also valid.

4) If PARAMETER SETTING (PRM) is executed, only the execution parameter data will be rewritten.
Then, if MACHINE RESET (RST) is executed, the execution data will be created according to the contents of the execution parameter data, when the rewritten parameters will be valid.

PARAMETER SETTING (PRM), MODULE RESET (MRS), and MACHINE RESET (RST)

These commands are motion commands for ladder logic programs, which are used to control the MC20 Module with the CPU Module. For details, refer to *2.3* and *2.4* of the *Motion Module MC20 Software User's Manual*.

Note If MODULE RESET (MRS) is executed or the MC20 Module is turned OFF and ON after PARAMETER SETTING (PRM) is executed, the rewritten parameters will be invalid and the previous parameters will be valid.

5.1.3 List of Parameters

1) MC20 Module Common Parameters

No.	Name	Setting Range	Units	Related Parameters	Read/Write (See note 1)		Effective Timing (See note 2)	Default Value	Type
					Ladder	Teach Pendant			
P0000	Not used	---	---	---	---	---	---	---	---
P0001	Axis-1 name specification	Axis X: b0 = 1 Axis Y: b1 = 1 Axis Z: b2 = 1 Axis S: b3 = 1 Axis A: b4 = 1 Axis B: b5 = 1 Axis C: b6 = 1 Axis D: b7 = 1	Set axis X, Y, Z, S, A, B, C, or D in the Programming Device set. Set "–" if the axis is not used.		× (No)	×	Power-up	X	C
P0002	Axis-2 name specification				×	×	Power-up	Y	C
P0003	Axis-3 name specification				×	×	Power-up	Z	C
P0004	Axis-4 name specification				×	×	Power-up	S	C
P0005	Decimal point position	1 to 3			×	×	Reset	3	B
P0006	Max. interpolation feed speed setting	1 to 240,000	mm/min (deg/min)		○ (Yes)	○	Reset	24,000	A
P0007	Time constant of linear A/D for interpolation (1) (See note 3)	1 to 10,000	ms		○	○	Reset	100	A
P0008	Time constant of linear A/D for interpolation (2) (See note 3)	1 to 10,000	ms		○	○	Reset	100	B
P0009	Linear A/D constant switch speed for interpolation	0 to 240,000	mm/min (deg/min)		○	○	Reset	24,000	B
P0010	Deceleration constant of the asymmetric A/D for interpolation	1 to 10,000	ms		○	○	Reset	100	B
P0011	Time constant of the exponential A/D for interpolation	2 to 1,000	ms		○	○	Reset	100	B
P0012	Bias speed of the exponential A/D for interpolation	0 to 240,000	mm/min (deg/min)		○	○	Reset	0	B
P0013	Time constant of moving average A/D for interpolation	2 to 1,000	ms		○	○	Reset	100	B
P0014	A/D setting for interpolation	0: None 1: Single-step linear A/D 2: Double-step linear A/D 3: Asymmetric A/D			○	○	Reset	1	B

No.	Name	Setting Range	Units	Related Parameters	Read/Write (See note 1)		Effective Timing (See note 2)	Default Value	Type
					Ladder	Teach Pendant			
P0015	Filter selection for interpolation	0: None 1: Exponential A/D 2: Exponential A/D with bias 3: Moving average A/D 4: S-curve A/D			○	○	Reset	0	B
P0016	Override enabled/ disabled bn = 0: Disabled bn = 1: Enabled	Overrides using MC Control Coils: 16 steps		202	○	○	Reset	0	B
		b0: Axis 1 b1: Axis 2 b2: Axis 3 b3: Axis 4	For independent axis and manual operation						
		b8: Rapid traverse b9: Interpolation feed	For program run						
	Ver. B08	Overrides using MC Link Registers: 0.1% increments							
		b11: Axis 1 b12: Axis 2 b13: Axis 3 b14: Axis 4	For independent axis and manual operation						
		b15: Rapid traverse b16: Interpolation feed	For program run						
P0017	Function selections 4 bn = 0: Disabled bn = 1: Enabled	b0: Manual operation simultaneous outputs b1: Axis alarm disable b2: Servo OFF disable			×	×	Power-up	0	B

Note (1) "○ (Yes)" in the "Read/Write" column indicates the parameter can be changed from the ladder logic program (Ladder or Teach Pendant).

(2) Effective Timing:

Item	Meaning
Power-up	The parameters rewritten with the Programming Device or Teach Pendant are valid when the MC20 Module is turned OFF and ON or MODULE RESET (MRS) is executed.
Reset	The parameters rewritten with the Programming Device or Teach Pendant are valid in the following cases. • When MACHINE RESET (RST) is executed. • When MODULE RESET (MRS) is executed. • When the MC20 is turned OFF and ON.

(3) "A/D" stands for acceleration/deceleration.

2) Axis Parameter Groups

Table 5.1 Axis Parameters (Positioning)

A = Axis no. (1 to 4)

No.	Name	Setting Range	Units	Related Parameters	Read/Write		Effective Timing	Default Value	Type
					Ladder	Teach Pendant			
PA101	Position loop gain (Kp)	0 to 200	s–1		○ (Yes)	○	Reset	30	A
PA102	Feed-forward gain	0 to 200	%		○	○	Reset	0	A
PA103	Positioning completion range	0 to 10,000	Command resolution	104	○	○	Reset	10	A
PA104	Positioning completion check time	0 to 100,000	ms	103	○	○	Reset	100,000	A
PA105	Following error margin	0 to 200	%	101	○	○	Reset	200	A

Table 5.2 Axis Parameters (Speed and Acceleration/Deceleration)

A = Axis no. (1 to 4)

No.	Name	Setting Range	Units	Related Parameters	Read/Write		Effective Timing	Default Value	Type
					Ladder	Teach Pendant			
PA201	Maximum feed speed	1 to 240,000	mm/min (deg/min)		○ (Yes)	○	Reset	24,000	A
PA202	Rapid traverse speed	1 to 240,000	mm/min (deg/min)	201, 204, 205, 206	○	○	Reset	24,000	A
PA203	Not used							0	
PA204	Linear A/D constant (1)	1 to 10,000	ms	201	○	○	Reset	100	A
PA205	Linear A/D constant (2)	1 to 10,000	ms	201, 202, 204, 206	○	○	Reset	100	B
PA206	Linear A/D constant switching speed	0 to 240,000	mm/min (deg/min)	201, 202, 204, 205	○	○	Reset	24,000	B
PA207	Deceleration constant for asymmetric A/D	1 to 10,000	ms	201, 213 to 216	○	○	Reset	100	B
PA208	Not used							0	
PA209	Time constant for exponential A/D	2 to 1,000	ms	210, 217	○	○	Reset	100	B
PA210	Bias speed for exponential A/D	0 to 240,000	mm/min (deg/min)	209, 217	○	○	Reset	0	B
PA211	Time constant for moving average A/D	2 to 1,000	ms	217	○	○	Reset	100	B
PA212	Not used								
PA213	A/D type for positioning (MOV/STEP)	0: None 1: Single-step linear A/D 2: Double-step linear A/D 3: Asymmetric A/D		204 to 207	○	○	Reset	1	B
PA214	A/D type for JOG operation (JOG)				○	○	Reset	1	B
PA215	A/D type for independent axis operation (MVA to MVD)				○	○	Reset	1	B
PA216	A/D type for HOME RETURN (ZRN)	Always single-step linear A/D			---	---	---	---	---
PA217	Filter selection (common filter for PA213 to PA216)	0: None 1: Exponential A/D 2: Exponential A/D with bias 3: Moving average A/D 4: S-curve A/D		209, 210, 211	○	○	Reset	0	B

Note "A/D" stands for acceleration/deceleration.

Table 5.3 Axis Parameters (Home Return)

A = Axis no. (1 to 4)

No.	Name	Setting Range	Units	Related Parameters	Read/Write		Effective Timing	Default Value	Type
					Ladder	Teach Pendant			
PA301	Home return mode	0 : DEC+C 1: ZERO 2: DEC+ZERO 3: C		302 to 308	× (No)	×	Power-up	0	B
PA302	Home return direction	0: Positive 1: Negative			×	×	Power-up	0	B
PA303	Home position returning feed speed	1 to 240,000	mm/min (deg/min)		○ (Yes)	○	Reset	10,000	B
PA304	Home position returning approach speed	1 to 240,000	mm/min (deg/min)		○	○	Reset	1,000	B
PA305	Home position returning creep speed	1 to 240,000	mm/min (deg/min)		○	○	Reset	500	B
PA306	Home position returning final travelling distance	0 to 99,999,999	Command resolution		○	○	Reset	0	B
PA307	Home position output width	0 to 32,767	Pulse		○	○	Reset	100	B
PA308	Home position pulse polarity selection	0, 1	0: Positive transition 1: Negative transition		×	×	Power-up	0	C
PA309	Not used	---	---	---	---	---	---	---	---
PA310	Deceleration limit switch inversion	0: Disabled 1: Enabled			×	×	Power-up	0	C

Table 5.4 Axis Parameters (Absolute Detecting System)

A = Axis no. (1 to 4)

No.	Name	Setting Range	Units	Related Parameters	Read/Write		Effective Timing	Default Value	Type
					Ladder	Teach Pendant			
PA401	Absolute encoder allowable error	0 to 1,000,000	Pulse	402	× (No)	×	Power-up	40,960	A
PA402	Absolute detecting system selection	• Meaning: Encoder / Detecting System 0: Incremental / Incremental 2: Absolute / Incremental 3: Absolute / Absolute • Setting method: Bit b0 = System: 0: Incremental 1: Absolute b1 = Encoder: 0: Incremental 1: Absolute		401, 403, 404	×	×	Power-up	0	C
PA403	Reference offset 1 at home position setting (Home position shift distance)	0 to +99,999,999	Command resolution	404, 402	×	×	Power-up	0	B
PA404	Reference offset 2 at home position setting (home position shift adjustment)	0 to ±99,999,999	Command resolution	403, 402	×	×	Power-up	0	B
PA405	Servopack type	1 : Σ-Ⅱtype (SGDM-□□ or SGDH-□□) 2 : Other types			×	×	Power-up	0	C

Table 5.5 Axis Parameters (Machine System and Peripheral Equipment)

A = Axis no. (1 to 4)

No.	Name	Setting Range	Units	Related Parameters	Read/Write		Effective Timing	Default Value	Type
					Ladder	Teach Pendant			
PA501	Number of encoder pulses	1 to 32,768	Pulse	502	× (No)	×	Power-up	2,048	C
PA502	Encoder pulse signal selection	1: AB phase x 1 2: AB phase x 2 4: AB phase x 4		501	×	×	Power-up	4	B
PA503	One machine rotation/command resolution	1 to 1,500,000	Command resolution		×	×	Power-up	10,000	A
PA504	Gear ratio (motor rev.)	1 to 10,000,000	Revolution		×	×	Power-up	1	A
PA505	Gear ratio (load rev.)	1 to 10,000,000	Revolution		×	×	Power-up	1	A
PA506	Mode setting:				×	×	Power-up		
	b0: Motor revolution direction	0: Forward, 1: Reverse		---				0	B
	b1: Finite/Infinite length	0: Finite length, 1: Infinite length		510-b0				0	B
	b2: Linear/Rotary axis	0: Linear axis, 1: Rotary axis		---				0	C
PA507	Backlash compensation	0 to 32,767	Pulse	510-b1	○ (Yes)	○	Reset	0	B
PA508	Stored stroke limit (+)	–99,999,999 to +99,999,999	Command resolution	510-b0	○	○	Reset	+99,999,999	B
PA509	Stored stroke limit (–)	–99,999,999 to +99,999,999	Command resolution	510-b0	○	○	Reset	–99,999,999	B
PA510	Function selections 2:				×	×	Power-up		
	b0: Stored stroke limit usage	0: Disabled 1: Enabled		508, 509				0	B
	b1: Backlash offset usage	0: Disabled 1: Enabled		507				0	B
PA511	Servomotor rated revolution	100 to 4,500	r/min		×	×	Reset	3,000	B
PA512	Speed command D/A output	1 to 10	V		×	×	Reset	6	B
PA513	Servomotor maximum revolution	0 to 10,000	r/min		×	×	Reset	4,000	B
PA514	Constant of automatic 0 tune	1,000 to 9,999	ms					1,000	D

Table 5.6 Axis Parameters (Servo External I/O)

A = Axis no. (1 to 4)

No.	Name	Setting Range	Units	Related Parameters	Read/Write		Effective Timing	Default Value	Type
					Ladder	Teach Pendant			
PA601	Function selections 3: b0: Overtravel input signal (OT) b1: Brake control output signal (BRK)	0: Disabled 1: Enabled 0: Disabled 1: Enabled		602, 603	× (No)	×	Power-up	1 0	B B
PA602	Brake time (Tb) (= servo OFF)	8 to 1,000	ms	601-b2 603	○ (Yes)	○	Reset	8	B
PA603	Brake ON motor speed	1 to 10,000	r/min	601-b2 602	○	○	Reset	1	B

5.2 Common Parameter Setting

The setting methods of common parameters for axis control are explained below. Be sure to be familiar with these methods before operating the MC20 Module.

5.2.1 Axis Numbers and Axis Designation Characters

1) As shown in the following table, common parameters P0001 to P0004 can be used to specify an axis name. X, Y, Z, S, A, B, C, D, or – can be specified as an axis name for each of these common parameters provided that the axis names of these common parameters are different from one another.

Table 5.7 Axis Numbers and Axis Designation Characters

Axis Number	Alphanumeric Axes Designation characters
P0001	Any of X, Y, Z, S, A, B, C, D, or –.
P0002	Any of X, Y, Z, S, A, B, C, D, or –.
P0003	Any of X, Y, Z, S, A, B, C, D, or –.
P0004	Any of X, Y, Z, S, A, B, C, D, or –.
Classification	• X, Y, Z, and S: Basic axes that can be controlled from the motion program. • A, B, C, and D: Independent axes (See note)

Note Independent axes can be designated from the ladder logic program only.

Note (1) The same axis designation character cannot be set for more than one parameter.

(2) Set "–" (minus sign) for the axis number of any unused axes.

2) **Basic and Independent Axes**

a) Any or all of an MC20 Module's four axes can be designated as basic axes. The basic axes are called axis X, axis Y, axis Z, and axis S, and can be operated from the motion program.

b) Any or all of an MC20 Module's four axes can be designated as independent axes. The independent axes are called axis A, axis B, axis C, and axis D, and can be operated from the CPU Module. They cannot be operated from the motion program.

c) Independent axis settings can only be made by means of parameter settings (P0001 to P0004). It is not possible to change from independent axes to basic axes, or vice versa, from the CPU Module during operation.

5.2.2 Parameter for Designating Decimal Point Position

1) The number of digits to the right of the decimal point for coordinate words is set by parameter P0005, as shown in the following table.

Table 5.8 Parameter Designating Decimal Point Position

Parameter Setting	Meaning	Programming Resolution for Linear and Rotary Axes
P0005 = 1	The first digit to the right of the decimal point for coordinate words is set.	0.1 mm, °
P0005 = 2	The second digit to the right of the decimal point for coordinate words is set.	0.01 mm, °
P0005 = 3	The third digit to the right of the decimal point for coordinate words is set.	0.001 mm, °

In this manual the programming resolution is also called command resolution.

2) Coordinate words are sets of the following coordinate characters succeeded by numeric values.

Coordinate characters: X, Y, Z, S, I, J, K, L, R, U, V, W, T, XF, YF, ZF, and SF.

Note (1) Decimal point positions can be designated so that the movable resolution of the machine system controlled by the MC20 Module will be the ones shown in the following table.

Movable Resolution of Linear and Rotary Axes
0.1 mm, °
0.01 mm, °
0.001 mm, °

(2) In principle, the resolution used as the programming resolution of a linear or rotary axis must be the same as the resolution used as the movable resolution of the linear or rotary axis. Use parameters PA501 to PA505 for movable resolution settings.

Refer to *5.3.5 Parameters for Machine System and Peripheral Devices* for the meanings and setting methods of these parameters.

5.2.3 Parameters for Designating Acceleration and Deceleration Settings for Interpolation

1) The MC20 Module allows the following automatic acceleration and deceleration settings for interpolations.

		Acceleration/Deceleration setting for interpolation (P0014)			
		0: None	**1: Single-step linear type**	**2: Double-step linear type**	**3: Asymmetric linear type**
Filter Selection for Interpolation (P0015)	0: None	---	1) Single-step linear acceleration/deceleration • Constant acceleration/deceleration	2) Double-step acceleration/deceleration • Constant acceleration/deceleration	3) Asymmetric linear acceleration/deceleration • Constant acceleration/deceleration
	1: Exponent	4) Exponential acceleration/deceleration • Constant acceleration/deceleration time	---	---	---
	2: Exponent with bias	5) Exponential acceleration/deceleration with bias • Constant acceleration/deceleration time	---	---	---
	3: Moving average	6) Single-step linear acceleration/deceleration • Constant acceleration/deceleration time	7) S-curve acceleration/deceleration • Constant acceleration/deceleration	---	8) Asymmetric S-curve acceleration/deceleration • Constant acceleration/deceleration
	4: S-curve	9) S-curve acceleration/deceleration • Constant acceleration/deceleration time	---	---	---

Nine types of automatic acceleration/deceleration can be set.

Note (1) Constant acceleration/deceleration means the acceleration/deceleration time changes if the F command speed changes. Constant acceleration/deceleration time means the acceleration/deceleration time does not change if the F command speed changes.

(2) Any combination other than the above nine types is not possible.

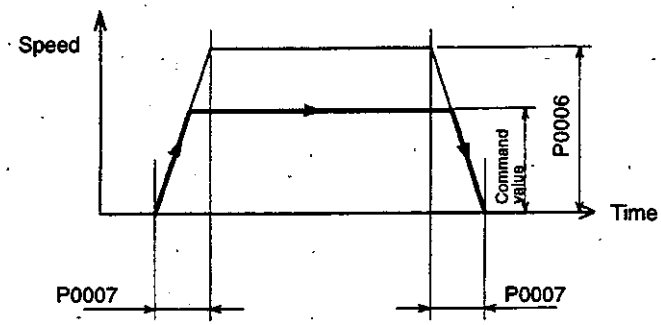
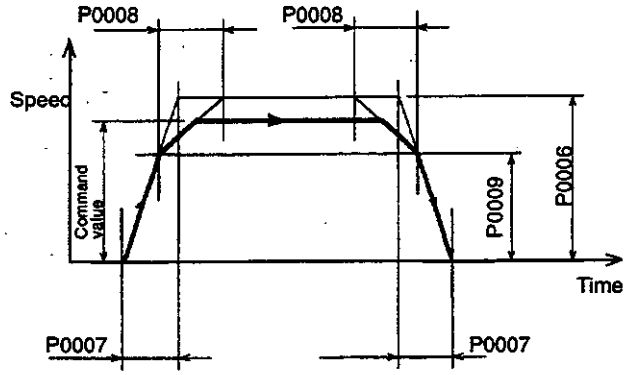
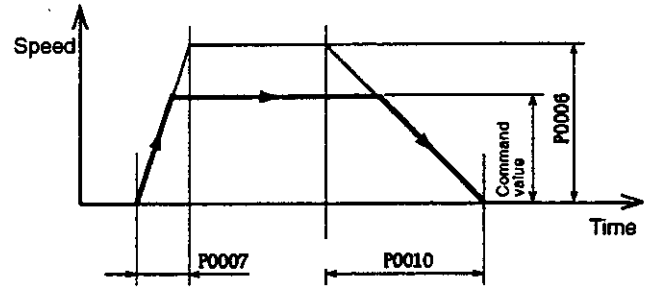
2) To set any of the above automatic acceleration/deceleration types, the following parameters must be set.

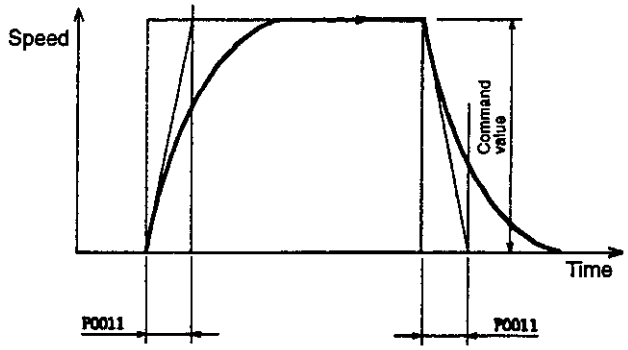
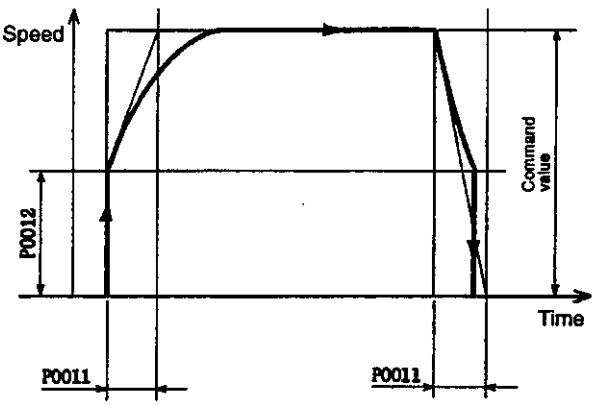
Parameter Number	Name	Setting Range	Units
P0006	Max. interpolation feed speed setting	1 to 240,000	mm/min (deg/min)
P0007	Time constant of linear acceleration/deceleration for interpolation (1)	1 to 10,000	ms
P0008	Time constant of linear acceleration/deceleration for interpolation (2)	1 to 10,000	ms
P0009	Linear acceleration/deceleration constant switch speed for interpolation	0 to 240,000	mm/min (deg/min)
P0010	Deceleration constant of the asymmetric acceleration/deceleration for interpolation	1 to 10,000	ms
P0011	Bias speed of the exponential acceleration/deceleration for interpolation	2 to 1,000	ms
P0012	Bias speed of the exponential acceleration/deceleration for interpolation	0 to 240,000	mm/min (deg/min)
P0013	Time constant of moving average acceleration/deceleration for interpolation	2 to 1,000	ms
P0014	Acceleration/deceleration for interpolation (MVS, MCW, etc.)	0: None 1: Single-step linear acceleration/deceleration 2: Double-step linear acceleration/deceleration 3: Asymmetric linear acceleration/deceleration	
P0015	Filter selection for interpolation (MVS, MCW, etc.)	0: None 1: Exponential acceleration/deceleration 2: Exponential acceleration/deceleration with bias 3: Moving average acceleration/deceleration 4: S-curve acceleration/deceleration	

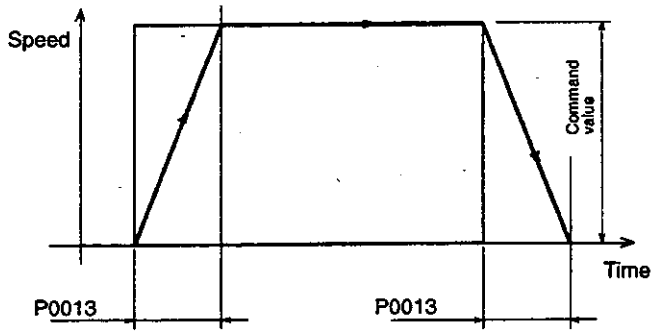
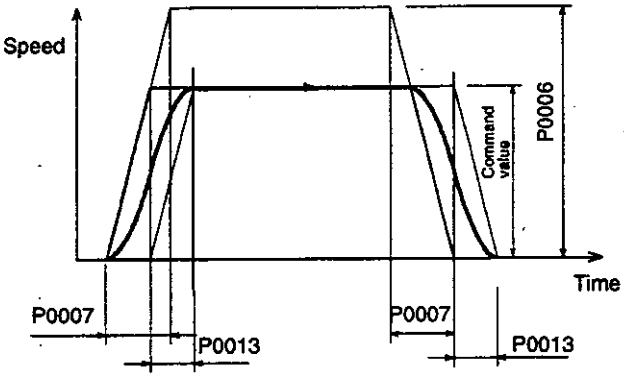
3) Determine the type of automatic acceleration/deceleration to be used for interpolation. Then, set the value corresponding to the type with parameters P0014 and P0015.

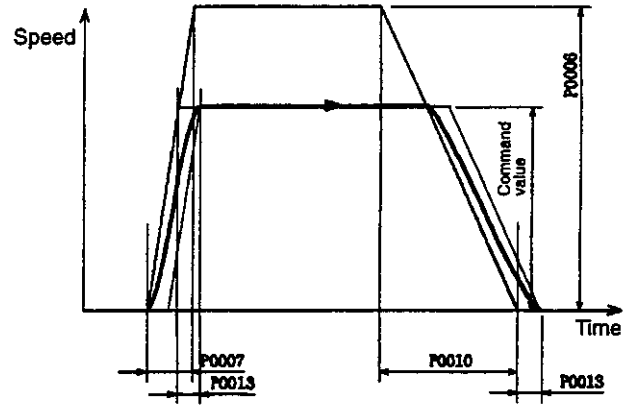
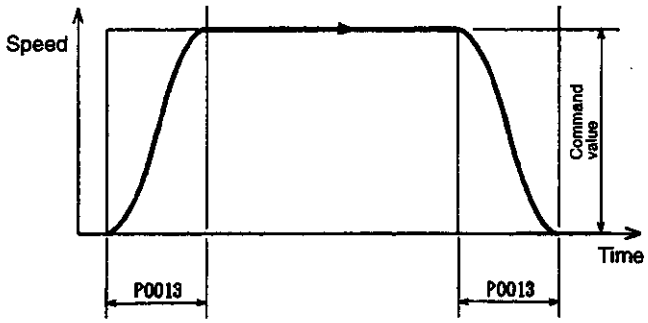
4) Next, set parameters necessary for the type. Refer to the following for all types of automatic acceleration/deceleration and the parameters required for setting them.

Table 5.9 Automatic Acceleration/Deceleration Parameters for Interpolation

Parameter Number	Name	Meaning	Default Value
P0014	= 1	1) Single-step linear acceleration/deceleration with constant acceleration/deceleration	1
P0015	= 0		0
P0006	Max. interpolation feed speed setting		24,000
P0007	Time constant of linear acceleration/deceleration for interpolation (1)		100
			
		Command value: Interpolation feed speed (= F command)	
P0014	= 2	2) Double-step linear acceleration/deceleration with constant acceleration/deceleration	1
P0015	= 0		0
P0006	Max. interpolation feed speed setting		24,000
P0007	Time constant of linear acceleration/deceleration for interpolation (1)		100
P0008	Time constant of linear acceleration/deceleration for interpolation (2)		100
P0009	Linear acceleration/deceleration constant switch speed for interpolation		24,000
		Command value: Interpolation feed speed (= F command)	
P0014	= 3	3) Asymmetric linear acceleration/deceleration with constant acceleration/deceleration	1
P0015	= 0		0
P0006	Max. interpolation feed speed setting		24,000
P0007	Time constant of linear acceleration/deceleration for interpolation (1)		100
P0010	Deceleration constant of the asymmetric acceleration/deceleration for interpolation		100
		Command value: Interpolation feed speed (= F command)	

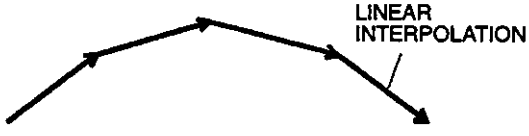
Parameter Number	Name	Meaning	Default Value
P0014	= 0	4) Exponential acceleration/deceleration with constant acceleration/deceleration	1
P0015	= 1		0
P0011	Time constant of the exponential acceleration/deceleration for interpolation		100
		Command value: Interpolation feed speed (= F command)	
P0006	Max. interpolation feed speed setting	← Set the upper-limit speed of interpolation	24,000
P0014	= 0	5) Exponential acceleration/deceleration with bias with constant acceleration/deceleration time	1
P0015	= 2		0
P0011	Time constant of the exponential acceleration/deceleration for interpolation		100
P0012	Bias speed of the exponential acceleration/deceleration for interpolation		0
		Command value: Interpolation feed speed (= F command)	
P0006	Max. interpolation feed speed setting	← Set the upper-limit speed of interpolation	24,000

Parameter Number	Name	Meaning	Default Value
P0014	= 0	6) Single-step linear acceleration/deceleration with constant acceleration/deceleration time	1
P0015	= 3		0
P0013	Time constant of moving average acceleration/deceleration for interpolation		100
		Command value: Interpolation feed speed (= F command)	
P0006	Max. interpolation feed speed setting	← Set the upper-limit speed of interpolation	24,000
P0014	= 1	7) S-curve acceleration/deceleration with constant acceleration/deceleration	1
P0015	= 3		0
P0006	Max. interpolation feed speed setting		100
P0007	Time constant of linear acceleration/deceleration for interpolation (1)		100
P0013	Time constant of moving average acceleration/deceleration for interpolation		100
		Command value: Interpolation feed speed (= F command)	

Parameter Number	Name	Meaning	Default Value
P0014	= 3	8) Asymmetric S-curve acceleration/deceleration with constant acceleration/deceleration	1
P0015	= 3		0
P0006	Max. interpolation feed speed setting		24,000
P0007	Time constant of linear acceleration/deceleration for interpolation (1)		100
P0010	Deceleration constant of the asymmetric acceleration/deceleration for interpolation		100
P0013	Time constant of moving average acceleration/deceleration for interpolation	Command value: Interpolation feed speed (= F command)	100
P0014	= 0	9) S-curve acceleration/deceleration with constant acceleration/deceleration time	1
P0015	= 4		0
P0013	Time constant of moving average acceleration/deceleration for interpolation		100
		Command value: Interpolation feed speed (= F command)	
P0006	Max. interpolation feed speed setting	← Set the upper-limit speed of interpolation	24,000

INFO

If LINEAR INTERPOLATION (MVS) is executed at constant speed continuously in different directions, smooth interpolation is possible provided that automatic acceleration/deceleration with constant acceleration/deceleration time is selected.
If IN-POSITION CHECK (PFN) is executed for the blocks of the linear interpolation, smooth interpolation is not possible because after the MC20 Module checks an interpolation travelling operation, the next interpolation travelling operation will be executed.



5.2.4 Parameter for Override Enabled/Disabled

1) The feed overrides can be set either in 16 steps between 0% and 100% or in 0.1% increments between 0.0% and 3276.7%.

   Use common parameter P0016 to enable or disable the feed overrides.

   a) Override: Enabled for MC control coil (16 steps)

   b) Override: Enabled for MC link register (0.1% increments)

   c) Override: Disabled

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Table 5.10 Parameter for Override Enabled/Disabled

Parameter Number	Bit Number	Use		Coil/Register	
P0016 bn = 0: Enable bn = 1: Disable ("bn: is the bit number)	b0	Axis 1	Independent axis or manual	16 steps from 0% to 100%	MC control coil
	b1	Axis 2			
	b2	Axis 3			
	b3	Axis 4			
	b8	Rapid feed			
	b9	Interpolation feed		16 steps from 0% to 200%	
	b11	Axis 1	Independent axis or manual	0% to 3276.7% in 0.1% increments	MC link register
	b12	Axis 2			
	b13	Axis 3			
	b14	Axis 4			
	b15	Rapid feed			
	b16	Interpolation feed			

All overrides are disabled for the default settings.

If an override is enabled for both an MC control coil and an MC link register, the MC link register will be used. If both overrides are disabled, no override will be used and execution will be at 100% of the speed of the set value or the command value.

INFO Refer to the following to set parameter P0016.

(1) Activate MEMOSOFT.

(2) Move the cursor to "P0016" on the parameter setting screen and press the Enter Key. Then, the following sub-window will appear.

Bit position: Name	ON/OFF	Remarks
b0: Axis 1 (MC control coil)	1	0: Disabled 1: Enabled
b1: Axis 2 (MC control coil)	0	0: Disabled 1: Enabled
b2: Axis 3 (MC control coil)	0	0: Disabled 1: Enabled
b3: Axis 4 (MC control coil)	0	0: Disabled 1: Enabled
b8: Rapid traverse (MC control coil)	0	0: Disabled 1: Enabled
b9: Interpolation feed (MC control coil)	0	0: Disabled 1: Enabled
b11: Axis 1 (MC link register)	1	0: Disabled 1: Enabled
b12: Axis 2 (MC link register)	0	0: Disabled 1: Enabled
b13: Axis 3 (MC link register)	0	0: Disabled 1: Enabled
b14: Axis 4 (MC link register)	0	0: Disabled 1: Enabled
b15: Rapid traverse (MC link register)	0	0: Disabled 1: Enabled
b16: Interpolation feed (MC link register)	0	0: Disabled 1: Enabled

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(3) Move the cursor to the bit to be changed and input "1" or "0."

2) The percentage of **override** can be changed with an MC control coil or an MC link register. The set value or command value will be executed at the speed rate of 100 if parameter P0016 is set to 0 (i.e., disabled).

Coil/Register		Use		Reference	
MC control coils	0% to 100%, 16 steps	Independent axis or manual	Axis 1	QN0145 to QN0148 (0V10 to 0V13)	"N" is the MC20 Module number (N = 1 or 2)
			Axis 2	QN0149 to QN0152 (0V20 to 0V23)	
			Axis 3	QN0153 to QN0156 (0V30 to 0V33)	
			Axis 4	QN0157 to QN0160 (0V40 to 0V43)	
		For rapid traverse		QN0137 to QN0140 (R0V0 to R0V3)	
	0% to 200%, 16 steps	For interpolation feed		QN0141 to QN0144 (F0V0 to F0V3)	
MC link registers	0% to 3276.7% in 0.1% increments	Independent axis or manual	Axis 1	409911, 409984	First reference is for MC20 Module 1; second, for MC Module 2 (default allocations)
			Axis 2	409912, 409985	
			Axis 3	409913, 409986	
			Axis 4	409914, 409987	
		For rapid traverse		409909, 409982	
		For interpolation feed		409910, 409983	

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Override

Use this function to change the set value by the selected percentage.

Refer to *4.1.1 Functions of MC Control Coils* and *1.5.6 Link Input Variables (#□□□□)* of the *Software User's Manual* for details.

IMPORTANT

Overrides cannot be set using version 1.40 of the MEMOSOFT. Set the overrides using the PRM instruction in the ladder program.

5.2.5 Enabling/Disabling Simultaneous Outputs during Manual Operation

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1) The start of analog voltage outputs to the Servopacks can be synchronized when operation is specified for individual axes in the ladder program of the CPU Module in the same scan. Synchronization can also be enable and disabled. This parameter is valid for the following ladder motion instructions: MVA to MVD, JOG, STP, and ZRN.

Parameter P0017 b0 is used to enable or disable synchronization of the start of analog voltage outputs.

Table 5.11 Parameter to Enable/Disable Simultaneous Outputs during Manual Operation

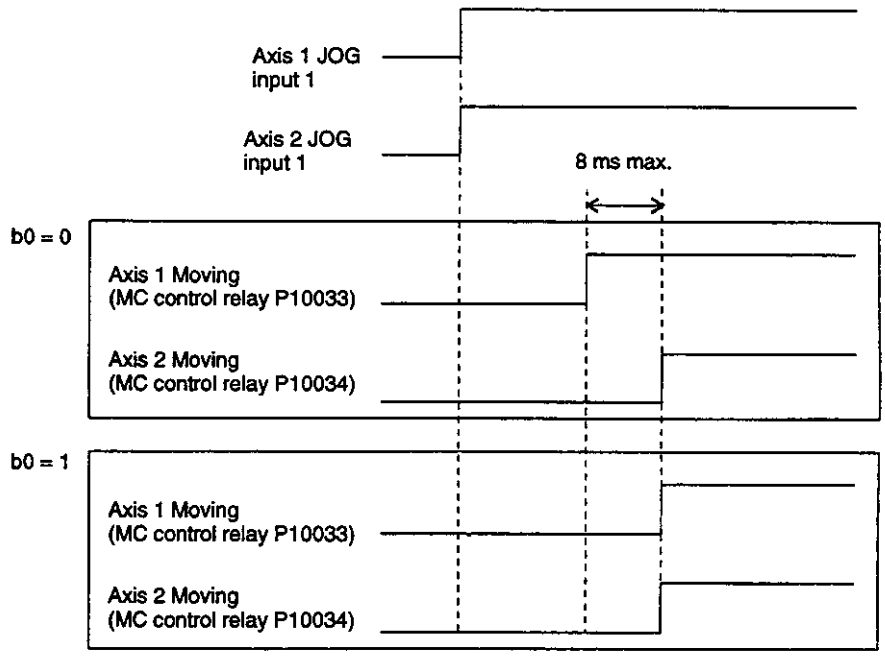
Parameter Number	Bit Number	Meaning
P0017	b0 = 0	Simultaneous outputs disabled for manual operation. The start of outputs during manual operation will not be synchronized.
	b0 = 1	Simultaneous outputs enabled for manual operation. The start of outputs during manual operation will be synchronized.

a) **Non-synchronized Outputs (b0 = 0)**

If input 1 to JOG ladder motion instructions for axis 1 and axis 2 are both turned ON in the same scan, the start of the analog voltage output to the Servopack for axis 2 may be delayed from the start of the output for axis 1 by up to 8 ms maximum.

b) **Synchronized Outputs (b0 = 1)**

If input 1 to JOG ladder motion instructions for axis 1 and axis 2 are both turned ON in the same scan, the start of the analog voltage outputs to the Servopacks will be synchronized. The start, however, may be up to 8 ms later than it would be if b0 were 0.



5.2.6 Axis Alarm Disable

1) Axis operation can be disabled when an A or B rank alarm occurs for another axis. This parameter is valid for the following ladder motion instructions: SVN, MVA to MVD, JOG, STP, and ZRN.

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Parameter P0017 b1 is used to disable or enable axis operations when an A or B rank alarm occurs for another axis.

Table 5.12 Parameter to Set Axis Alarm Disable

Parameter Number	Bit Number	Meaning
P0017	b1 = 0	Axis alarm disable effective. Axis operations will be disabled when A or B rank alarms occur for another axis.
	b1 = 1	Axis alarm disable not effective. Axis operations will not be disabled when A or B rank alarms occur for another axis.

a) **Axis Alarm Disable Effective (b1 = 0)**

Servo ON status and axis operations for SVN, MVA to MVD, JOG, STP, and ZRN will be disabled when an A or B rank alarm has occurred for another axis.

b) **Axis Alarm Disable Not Effective (b1 = 1)**

Servo ON status and axis operations for SVN, MVA to MVD, JOG, STP, and ZRN will not be disabled even when an A or B rank alarm has occurred for another axis.

The MC control coil (QN0097 to QN0100) for the axis being operated must be turned ON to actually enable operation. The parameter setting alone will not enable operation. Servo ON status and axis operation will not be enabled in the following cases.

- When A or B rank common alarms occur
- When an axis alarm occurs for the axis being operated
- During program operation
- When the following alarms occur (These alarms cannot be reset.)

Alarm Code	Alarm Contents
A10	A-axis PG disconnection
A14	A-axis encoder alarm
A15	A-axis communications error
A18	A-axis encoder battery alarm

(A: Axis numbers 1 to 4)

When overtravel input signals are set with the parameter PA601-b0, the following limitation becomes effective.

(1) Axis alarm disable is not effective when an overtravel signal is input at either one of the axis. A02 (forward overtravel) and A03 (reverse overtravel) occur at the axis where overtravel signals are input and axis operation does not start.

(2) Axis alarm disable is effective when overtravel signal is input during axis operation. A02 (forward overtravel) and A03 (reverse overtravel) occur at the axis where overtravel signals are input but other axes continues axis operation.

2) When the axis alarm disable is not effective, Servo ON status and axis operation will be possible during axis alarms if the MC control coil given in the following table for the axis being operated is turned ON.

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MC Control Coil	Axis
QN0097	Axis 1
QN0098	Axis 2
QN0099	Axis 3
QN0100	Axis 4

(N: Module number 1 or 2)

The operation with an alarm occurs during operation will be as follows if the parameter is set to use the axis alarm disable.

- **MC Control Coil ON for Axis Being Operated**
  If an alarm occurs for another axis that is being operated, a deceleration stop or Servo OFF will not be executed for the axis.

- **MC Control Coil OFF for Axis Being Operated**
  If an alarm occurs for another axis that is being operated, a deceleration stop or Servo OFF will be executed for the axis.

Turn OFF the MC control coils for any axes that are affected by other axes (such as when an XY table is being controlled) and turn ON the MC control coils for any axes that are not affected by other axes. Be sure to confirm operation for any axes for which the MC control coil is turned ON.

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3) Axis operations will be possible for when C rank common alarms occur regardless of the setting of this parameter.

5.2.7 Servo OFF Disable

1) A check can be made during programmed operation to see if the Servo is ON for all axes set as basic axes (X, Y, Z, and S). This check can be enabled or disabled.

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Parameter P0017 b2 is used to enable and disable the Servo ON check.

Table 5.13 Parameter to Set Servo OFF Disable

Parameter Number	Bit Number	Meaning
P0017	b2 =0	Servo OFF disable effective. A check will be made during programmed operation to see if the Servo is ON for all basic axes.
	b2 =1	Servo OFF disable not effective. A check will not be made during programmed operation to see if the Servo is ON for all basic axes.

a) **Servo OFF Disable Effective (b2 = 0)**

All basic axes will be checked when programmed operation is started and during programmed operation to see if the Servo is ON for them. If there is one or more axes with the Servo OFF, a Servo Power OFF Alarm (A09) will be generated and programmed operation will stop.

b) **Servo OFF Disable Not Effective (b2 = 1)**

The basic axes will not be checked when programmed operation is started and during programmed operation to see if the Servo is ON for them. If there is a block with a movement command for an axis for which the Servo is OFF, a Servo Power OFF Alarm (A09) will be generated before execution of that block and programmed operation will stop.

Program execution will progress as shown below if the Servo is OFF for the X axis.

TIM P1.0 ; ↵	Executed.
MOV Y100. ; ↵	Executed.
MVS X100. Y100. ; ↵	Not executed. (Servo Power OFF Alarm (A09))
MOV Y100.; ↵	Not executed.

Note If the Servo OFF disable function is used and an axis for which the Servo is OFF is externally moved during MVL execution, and then the Servo is turned ON for the axis and it is moved to a target position, the position may be offset by the amount the axis was externally moved.

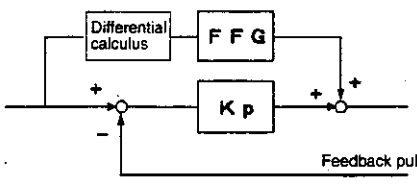
5.3 Axis Parameter Setting

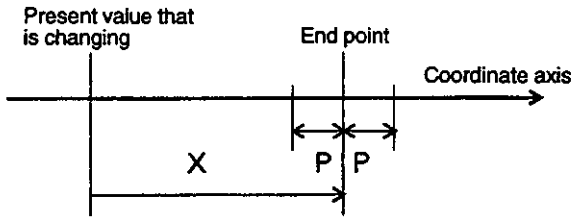
The setting methods of individual axis parameters are explained below. There are basic and high-degree individual axis parameters.

5.3.1 Parameters for Positioning

Use parameters PA101 to PA105 for positioning. Refer to the following table for details. "A" in the parameter number stands for the axis number (1 through 4).

Table 5.14 Parameters for Positioning

Parameter Number	Name	Meaning	Default Value
PA101	Position loop gain (Kp)	• Used to set servo system position loop gains. • Setting range: 1 to 200 (s^{-1}) • The position loop gain is an important constant to determine the response of each servo system. Refer to the following. 20 to 100 (s^{-1}) Good response (Hunting, however, may result) Normal response Determine the most suitable value according to the type and inertia of the machine, and the type of servomotor that you use.	30
PA102	Feed-forward gain (FFG)	• Feed-forward control can shorten the time required for positioning. • Setting range: 0 to 200 (%) • The larger the set value, the smaller the difference between the command position and actual position. **Note** If the set value is too large, the machine may vibrate. 	0

Parameter Number	Name	Meaning	Default Value
PA103	Positioning completion range Related parameter: PA104	• Used to set the permissible positioning completion range used for in-position checking.  P: Positioning completion range If the following condition is satisfied, positioning is deemed to be completed. X = (End point – Present value that is changing) ≦ P • P setting range: 0 to 10,000 (command resolution) • This parameter is used for in-position checking of the following commands. • POSITIONING (MOV) • IN-POSITION CHECK (PFN) • The axis travelling operations executed with HOME RETURN (ZRN) like MOV. • If this parameter is set to 0, the in-position checking will not be performed.	10
PA104	Positioning completion check time Related parameter: PA103	• Used to set the time to execute the above in-position checking. • Setting range: 0 to 100,000 (ms) • After an axis starts decelerating, a Positioning Error Alarm (A07) will occur if the axis is not in the positioning completion range that has been preset. • If this parameter is set to 0, the in-position check time will be deemed to be infinite.	100,000

Parameter Number	Name	Meaning	Default Value
PA105	Following error margin	• Used to set the percentage of the upper-limit margin of a servo system on condition that the expected maximum following error of the servo system is 100%. • Percentage of allowable following error = 100 + M (%) Percentage of following error margin to be set Percentage of expected maximum following error An Address Error Alarm (A04) will occur if the percentage of the following error of a moving axis exceeds the percentage of the permissible following error that has been preset. • Setting range: 0 to 200 (%) • The expected maximum following error can be obtained from the following. • Expected maximum following error $= \frac{\text{No. of maximum command pulses per time unit (PPS)}}{\text{Position loop gain } (s^{-1})}$ • If parameter PA005 is set to 3, i.e., the number of digits to the right of the decimal point is set to 3: No. of maximum command pulses per time unit $= \frac{\text{Maximum feed speed (mm/min)}}{0.001 \times 60} \times \frac{B}{A}$ The maximum feed speed is set with parameter PA201 (maximum feed speed). B/A can be obtained from the following. $\frac{B}{A} = \frac{(PA501) \times (PA502) \times (PA504)}{(PA503) \times (PA505)}$ (pulses/command resolution) **Note** Refer to *5.3.5 Parameters for Machine Systems and Peripheral Equipment for B/A* for details.	200

Parameter Number	Name	Meaning	Default Value
PA105	Following error margin ◀EXAMPLE▶	• Setting Example • Position loop gain = 20 (s^{-1}) • Rapid traverse speed (PA202) = 25 m/min = 25,000 mm/min • If B/A is = $\frac{2,048 \times 4 \times 1}{6,000 \times 1} = 1.3653$ • Expected maximum following error $\frac{25,000}{0.001 \times 60 \times 20} \times 1.3653 = 28.443$ (pulses) The above value is 100% of the maximum following error. If 50% of the maximum following error is set, an alarm will occur if there is a following error exceeding the following value. • Permissible following error = 28,443 x 1.5 = 42,664 (pulses) **Note** If overshooting results in your servo system at the time of positioning acceleration or deceleration, set the following error margin to 100% or more, i.e., the permissible following error should be at least twice as large as the expected maximum following error.	200

5.3.2 Parameters for Speed and Acceleration/Deceleration

1) One of the following types of automatic acceleration/deceleration can be set with MC20 Module for individual axis travelling. "A" in the parameter number stands for the axis number (1 through 4).

   a) Acceleration/Deceleration for positioning and stepping operation (MOV/STEP)
   Parameter (Speed and Acceleration): PA213

   b) Acceleration/Deceleration for JOG operation (JOG)
   Parameter (Speed and Acceleration): PA214

   c) Acceleration/Deceleration for independent axis operation (MVA to MVD)
   Parameter (Speed and Acceleration): PA215

		Acceleration/Deceleration Type			
		0: None	**1: Single-step Linear Type**	**2: Double-step Linear Type**	**3: Asymmetric Linear Type**
Filter Selection (PA217)	0: None	---	1) Single-step linear acceleration/deceleration • Constant acceleration/deceleration	2) Double-step acceleration/deceleration • Constant acceleration/deceleration	3) Asymmetric linear acceleration/deceleration • Constant acceleration/deceleration
	1: Exponent	4) Exponential acceleration/deceleration • Constant acceleration/deceleration time	---	---	---
	2: Exponent with bias	5) Exponential acceleration/deceleration with bias • Constant acceleration/deceleration time	---	---	---
	3: Moving average	6) Single-step linear acceleration/deceleration • Constant acceleration/deceleration time	7) S-curve acceleration/deceleration • Constant acceleration/deceleration	---	8) Asymmetric S-curve acceleration/deceleration • Constant acceleration/deceleration
	4: S-curve	9) S-curve acceleration/deceleration • Constant acceleration/deceleration time	---	---	---

Nine types of automatic acceleration/deceleration can be set.

Note (1) Constant acceleration/deceleration means the acceleration/deceleration time changes if the command speed changes. Constant acceleration/deceleration time means the acceleration/deceleration time does not change if the command speed changes.

(2) Any combination other than the above nine types is not possible.

Note (1) The acceleration/deceleration type of any axis returning home is always single-step linear acceleration/deceleration. Do not set PA216 (Acceleration/Deceleration Type for HOME RETURN (ZRN)) to any value other than 1, or the MC20 Module will ignore the setting.

(2) Parameter PA217 (Filter Selection) is for PA213 to PA216. Therefore, the filter of the MC20 Module in home return operation is valid for single-step linear acceleration/deceleration.

2) The previous automatic acceleration/deceleration settings require the settings of the following parameters including parameters PA213 to PA216 (Acceleration/Deceleration Type Settings) and PA217 (Filter Selection).

Parameter Number	Name	Setting Range	Units
PA201	Maximum feed speed	1 to 240,000	mm/min (deg/min)
PA202	Rapid traverse speed	1 to 240,000	mm/min (deg/min)
PA204	Linear acceleration/deceleration constant (1)	1 to 10,000	ms
PA205	Linear acceleration/deceleration constant (2)	1 to 10,000	ms
PA206	Linear acceleration/deceleration constant switch speed	0 to 240,000	mm/min (deg/min)
PA207	Deceleration constant for asymmetric acceleration/deceleration	1 to 10,000	ms
PA209	Time constant for exponential acceleration/deceleration	2 to 1,000	ms
PA210	Bias speed for exponential acceleration/deceleration	0 to 240,000	mm/min (deg/min)
PA211	Time constant for moving average acceleration/deceleration	2 to 1,000	ms
PA213	Acceleration/deceleration time for positioning (MOV/STEP)	0: None 1: Single-step linear acceleration/deceleration 2: Double-step linear acceleration/deceleration 3: Asymmetric linear acceleration/deceleration	
PA214	Acceleration/deceleration type for JOG operation (JOG)		
PA215	Acceleration/deceleration for independent axis operation (MVA to MVD)		
PA216	Acceleration/deceleration type for HOME RETURN (ZRN)	Always single-step linear acceleration/deceleration	
PA217	Filter selection (for PA213 to PA216)	0: None 1: Exponential acceleration/deceleration 2: Exponential acceleration/deceleration with bias 3: Moving average acceleration/deceleration 4: S-curve acceleration/deceleration	

3) Determine the type of automatic acceleration/deceleration that you want to use. Then, set the values corresponding to the type with parameters PA217 (Filter Selection) and parameters PA213 to PA216 (Acceleration/Deceleration Type).

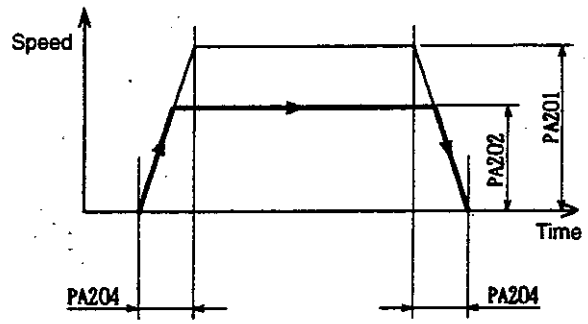
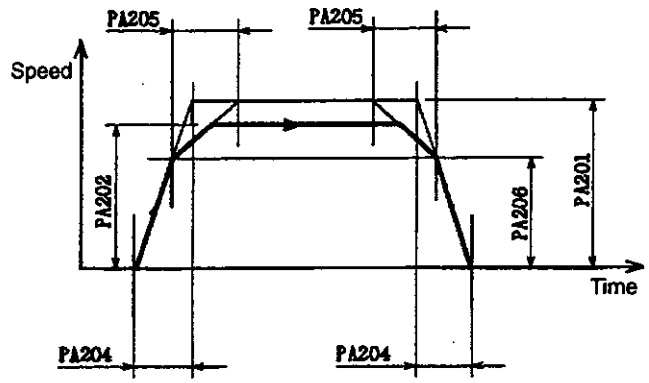
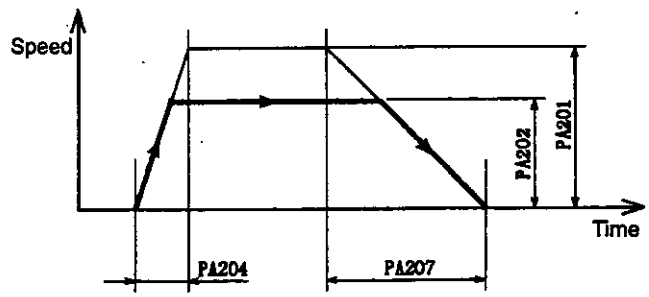
Parameters for Acceleration/Deceleration Type	Applicable Axis Travel
1) PA217 and PA213	Positioning and STEP operation
2) PA217 and PA214	JOG operation
3) PA217 and PA215	Independent axis operation
4) PA217 and PA216	Home return operation

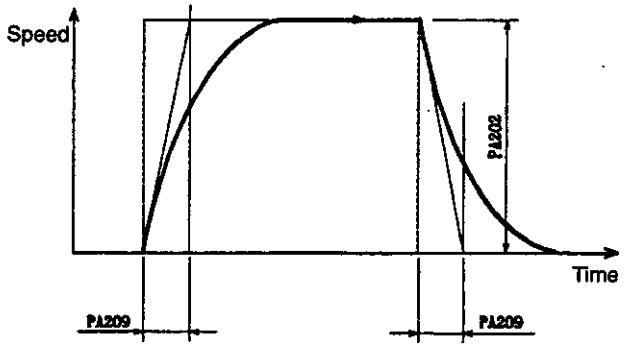
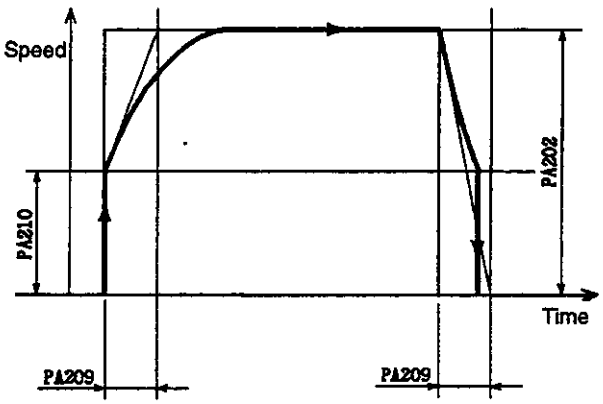
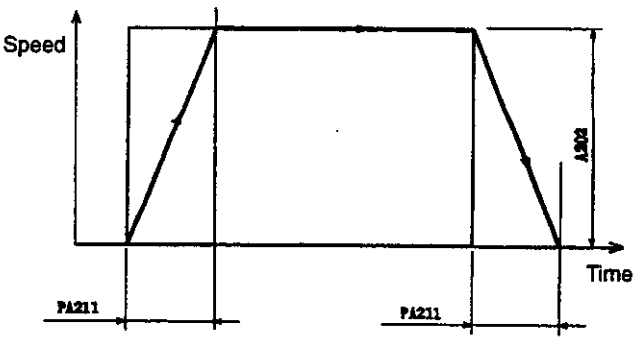
Note (1) Parameter PA217 is used with parameters PA213 to PA216. Therefore, the types of automatic acceleration/deceleration will be limited.

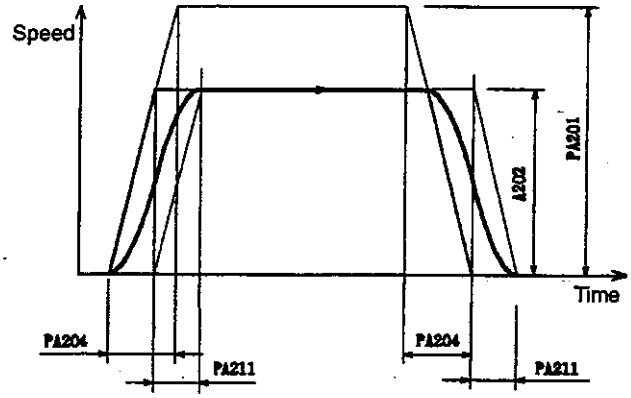
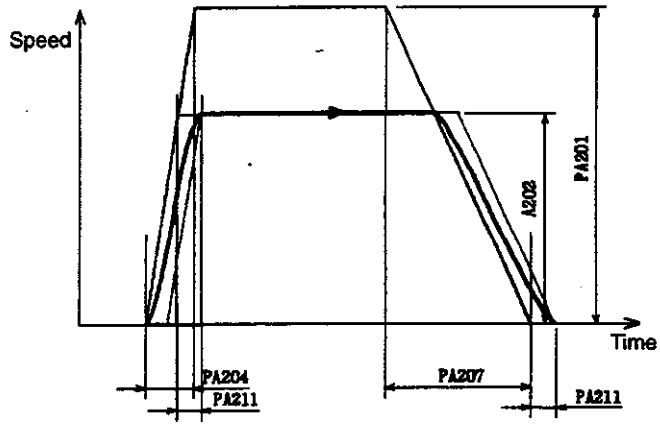
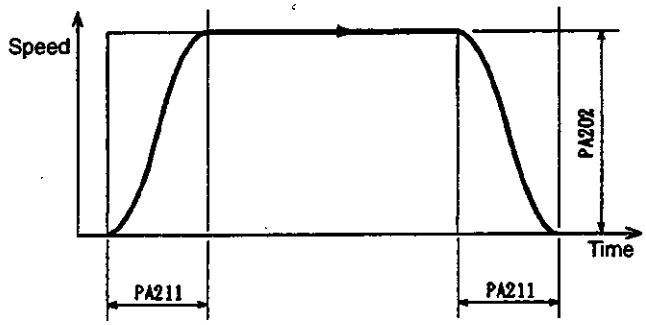
(2) "A" in the parameter number stands for the axis number (1 through 4).

4) Next, set parameters necessary for the type. Refer to the following for all types of automatic acceleration/deceleration and the parameters required for setting them. In the following table, PA213 (Acceleration/Deceleration Time for Positioning (MOV/STEP)) is used. In the case of other axis operations, replace PA213 with PA214, PA215, or PA216.

Table 5.15 Automatic Acceleration/Deceleration Type for Positioning (MOV/STEP)

Parameter Number	Name	Meaning	Default Value
PA213	= 1	1) Single-step linear acceleration/deceleration with constant acceleration/deceleration	1
PA217	= 0		0
PA201	Maximum feed speed		24,000
PA202	Rapid traverse speed		100
PA204	Linear acceleration/deceleration constant (1)		
PA213	= 2	2) Double-step linear acceleration/deceleration with constant acceleration/deceleration	1
PA217	= 0		0
PA201	Maximum feed speed		24,000
PA202	Rapid traverse speed		100
PS204	Linear acceleration/deceleration constant (1)		
PA205	Linear acceleration/deceleration constant (2)		100
PA206	Linear acceleration/deceleration constant switch speed		24,000
PA213	= 3	3) Asymmetric acceleration/deceleration with constant acceleration/deceleration	1
PA217	= 0		0
PA201	Maximum feed speed		24,000
PA202	Rapid traverse speed		24,000
PA204	Linear acceleration/deceleration constant (1)		100
PA207	Deceleration constant for asymmetric acceleration/deceleration		100

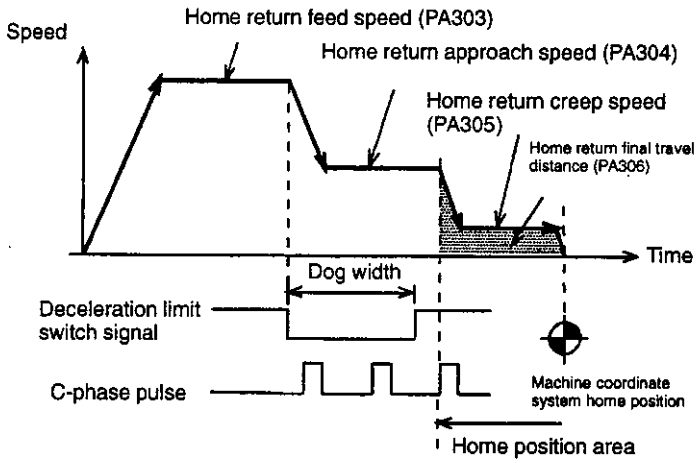
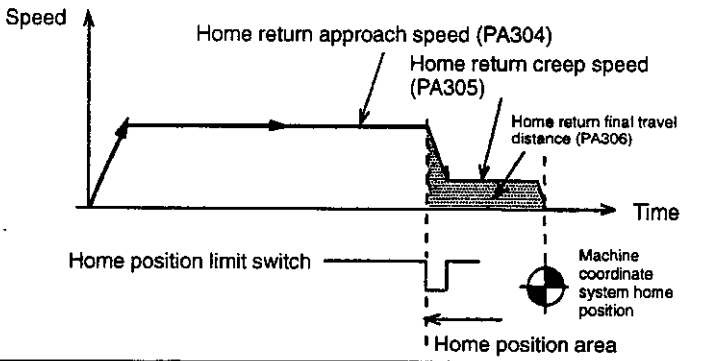
Parameter Number	Name	Meaning	Default Value
PA213	= 0	4) Exponential acceleration/deceleration with constant acceleration/deceleration time	1
PA217	= 1		0
PA202	Rapid traverse speed		24,000
PA209	Time constant for exponential acceleration/deceleration		100
PA201	Maximum feed speed	← Set the maximum feed speed.	24,000
PA213	= 0	5) Exponential acceleration/deceleration with bias and constant acceleration/deceleration time	1
PA217	= 2		0
PA202	Rapid traverse speed		100
PA209	Time constant for exponential acceleration/deceleration		100
PA210	Bias speed for exponential acceleration/deceleration		0
PA201	Maximum feed speed	← Set the maximum feed speed.	24,000
PA213	= 0	6) Single-step linear acceleration/deceleration with constant acceleration/deceleration time	1
PA217	= 3		0
PA202	Rapid traverse speed		24,000
PA211	Time constant for exponential A/D		100
PA201	Maximum feed speed	← Set the maximum feed speed.	24,000

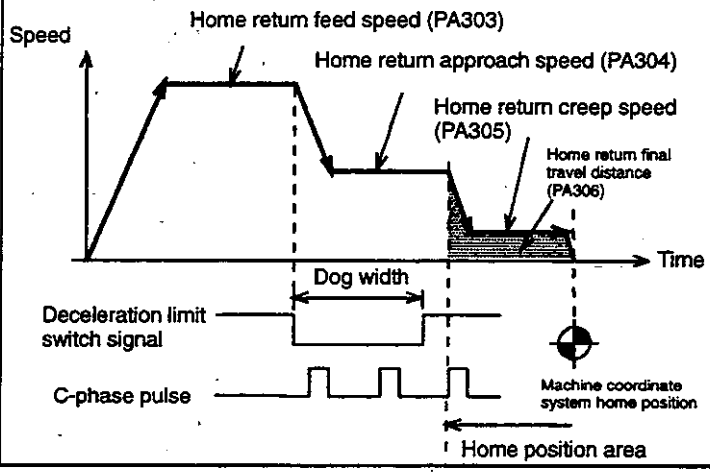
Parameter Number	Name	Meaning	Default Value
PA213	= 1	7) S-curve acceleration/deceleration with constant acceleration/deceleration	1
PA217	= 3		0
PA201	Maximum feed speed		24,000
PA202	Rapid traverse speed		24,000
PA204	Linear acceleration/deceleration constant (1)		100
PA211	Time constant of moving average A/D		100
PA213	= 3	8) S-curve asymmetrical acceleration/deceleration with constant acceleration/deceleration	1
PA217	= 3		0
PA201	Maximum feed speed		24,000
PA202	Rapid traverse speed		24,000
PA204	Linear acceleration/deceleration constant (1)		100
PA207	Deceleration constant for asymmetric acceleration/deceleration		100
PA211	Time constant of moving average A/D		100
PA213	= 0	9) S-curve acceleration/deceleration with constant acceleration/deceleration time	1
PA217	= 4		0
PA202	Rapid traverse speed		24,000
PA211	Time constant of moving average A/D		100
PA201	Maximum feed speed	← Set the maximum feed speed.	24,000

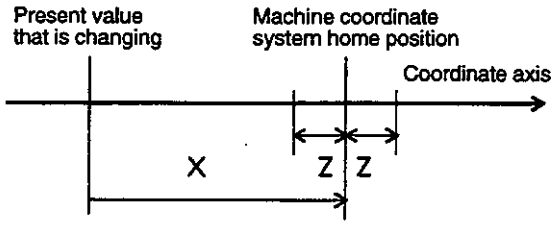
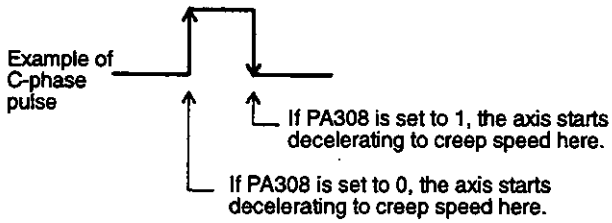
5.3.3 Parameters for Home Return

Use individual parameters PA301 to PA310 for home return operations. Refer to the following table. "A" in the parameter number stands for the axis number (1 through 4).

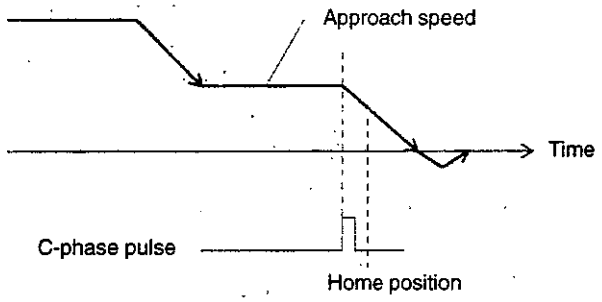
Table 5.16 Parameters for Home Return

Parameter Number	Name	Meaning	Default Value
PA301	Home return mode	• Set this parameter to either one of the following home return operations. 0: Home return operation 1 = Triple-step deceleration with a deceleration limit switch and C-phase pulses 1: Home return operation 2 = Double-step deceleration with a home position limit switch 2: Home return operation 3 = Triple-step deceleration with a deceleration limit switch and home position limit switch 3: Home return operation 3 = Double-step deceleration with C-phase pulses	0
	Example of home return operation 1		
	Example of home return operation 2		
PA302	Home return direction	• Set this parameter to the home return direction. 0: Forward direction = Home return operation in the pulse direction of the coordinates. 1: Reverse direction = Home return operation in the negative direction of the coordinates. • The plus (or minus) direction means the final plus (or minus) direction including the setting of parameter PA506-b0 (for motor revolution direction setting).	0

Parameter Number	Name	Meaning	Default Value
PA303	Home position returning feed speed	• Setting range: 1 to 240,000 (mm/min, deg/min) • This parameter is not used for home return operation 2 or 4.	10,000
PA304	Home position returning approach speed	• Setting range: 1 to 240,000 (mm/min, deg/min)	1,000
PA305	Home position returning creep speed	• Setting range: 1 to 240,000 (mm/min, deg/min)	500
PA306	Home position returning final travelling distance Refer to the timing chart on the right-hand side.	• Setting range: 0 to 99,999,999 (command resolution) • Set the distance from the position where the C-phase pulse or the home position limit switch is detected to the machine coordinate system home position. 	0

Parameter Number	Name	Meaning	Default Value
PA307	Home position output width	• Set this parameter to the permissible home position range for axes.  P: Home position output width If the following condition is satisfied, the axis is deemed to be at the home position. X = (Machine coordinate system home position – Present value that is changing) ≦ Z • Z setting range: 0 to 32,767 pulses • If the controlled axis is at the home position, the following MC control relays will be ON. Reference / Signal Name / Signal Name • PN0073 ZPT1 ON = Axis 1 is at the home position. • PN0074 ZPT2 ON = Axis 2 is at the home position. • PN0075 ZPT3 ON = Axis 3 is at the home position. • PN0076 ZPT4 ON = Axis 4 is at the home position.	100
PA308	Home position pulse polarity selection	• Set this parameter to the polarity that enables the C-phase pulse or home position limit switch to operate. 0: Positive transition 1: Negative transition 	0
PA309	Not used	—	---
PA310	Deceleration limit switch inversion	• Use this parameter to invert deceleration limit switch signals. 0: Disabled 1: Enabled • This is a useful function for limit switches with reversed polarity. With the home return function of the MC20 Module, the MC20 Module will be in decelerating operation after detecting a negative transition signal. If the polarity of the deceleration limit switch is not reversed, set this parameter to "0."	0

Note If parameter PA306 (Home Position Returning Final Travelling Distance) is set to a small value (i.e., if the value is less than the distance required for axis deceleration from approach speed), the axis will pass the home position and then return to the home position from the opposite side.



5.3.4 Parameters for Absolute Position Detection

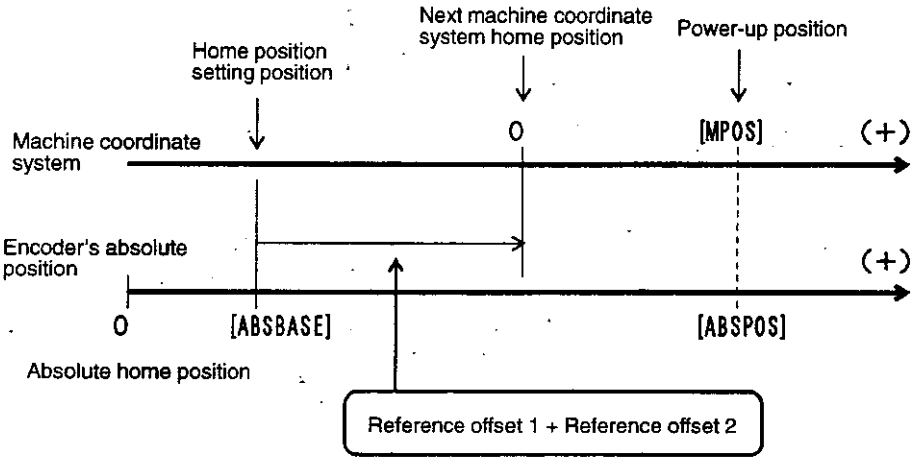
1) Use parameters PA401 to PA404 for absolute position detecting systems.

2) The absolute position detecting system is a system in which the encoder's absolute position data is retrieved and the machine coordinate system is set at power-up. There is, therefore, no need to return to the home position before the program is run.

3) Refer to the following table for details. "A" in the parameter number stands for the axis number (1 through 4).

Table 5.17 Parameters for Absolute Position Detection

<table>
<tr><th>Parameter Number</th><th>Name</th><th>Meaning</th><th>Default Value</th></tr>
<tr><td>PA401</td><td>Absolute encoder allowable error</td><td>• An Absolute System Axis Travel Error Alarm (A12) will occur if the difference in pulse between the machine coordinate value stored in the MC20 Module when it is turned OFF and that detected by the MC20 Module when it is turned ON is larger than the allowable value to which PA401 is set.
• If this parameter is set to "0", the axis movement error check will not be performed.
• Setting range: 0 to 1,000,000 (pulses)
• Recommended set value:
Unless there is a special reason, use the default value.</td><td>40,960</td></tr>
<tr><td>PA402</td><td>Absolute detecting system selection</td><td>• Set this parameter to the encoder and position detecting system that used from the following.
Meaning of Settings
<table><tr><th>Parameter</th><th>Encoder Type</th><th>Position Detecting System</th></tr><tr><td>0</td><td>Incremental encoder</td><td>Incremental position detecting system</td></tr><tr><td>2</td><td>Absolute encoder</td><td>Incremental position detecting system</td></tr><tr><td>3</td><td>Absolute encoder</td><td>Absolute position detecting system</td></tr></table>Note This parameter cannot be set to 1.
• Actual settings are performed by the following bit settings.
b0 = 0: Incremental position detecting system
b0 = 1: Absolute position detecting system
b1 = 0: Incremental encoder
b1 = 1: Absolute encoder</td><td>0</td></tr>
<tr><td>PA403</td><td>Reference offset 1 at home position setting (home position shift distance)</td><td>• Setting range: 0 to 99,999,999 (command resolution)
This parameter cannot be set to any negative value.</td><td>0</td></tr>
</table>

<table>
<tr><th>Parameter Number</th><th>Name</th><th>Meaning</th><th>Default Value</th></tr>
<tr><td>PA404</td><td>Reference offset 2 at home position setting (home position shift adjustment)</td><td>• Setting range: 0 to ±99,999,999 (command resolution)
This parameter can be set to either a positive or negative value.</td><td>0</td></tr>
<tr><td></td><td colspan="3">• The machine coordinate system home position, which is set with home position setting, can be shifted for the value set with parameter PA403 plus that set with PA404.
• If the reference point of the machine controlled with the MC20 Module is different from the machine coordinate system home position, set these reference offset values.
Home position setting and machine coordinate system
 

• After the above settings, including the machine coordinate system setting are done, and the MC20 Module is turned OFF, the MC20 Module will calculate the following and automatically set the same machine coordinate system whenever the MC20 Module is turned ON (i.e., the MC20 Module will be ready to be in program operation whenever the MC20 Module is turned ON).
MPOS (command resolution) = (ABSPOS – ABSBASE) – (Reference offset 1 + Reference offset 2)</td></tr>
<tr><td>PA405</td><td>Servopack type</td><td>• Set this parameter to select the type of the SERVOPACK.
0: Σ- II type (16-bits, 17-bits Absolute encoder)
1: Other types (12-bits, 15-bits Absolute encoder)
Set to 1 when using Σ- II Series SERVOPACK with 16-, 17-bits Absolute Encoder.</td><td>0</td></tr>
</table>

INFO Refer to the following to set parameter PA402.

1) Activate MEMOSOFT.
2) Move the cursor to "PA402" on the parameter setting screen and press the Enter Key. Then, the following sub-window will appear.

Bit position: Name	ON/OFF	Remarks
b0: System	0	0: Incremental 1: Absolute
b1: Encoder	0	0: Incremental 1: Absolute

3) Move the cursor to the bit to be changed and input "1" or "0."

Note It is not possible to set b0 to 1 and b1 to 0, which means it is not possible to set PA402 to 1.

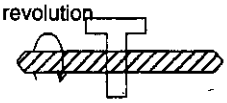
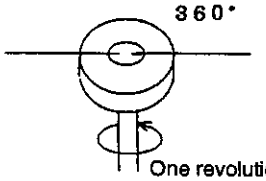
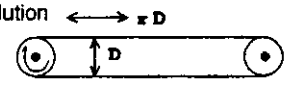
5.3.5 Parameters for Machine System and Peripheral Equipment

1) Use individual axis parameters PA501 to PA513 for the machine system and peripheral equipment. "A" in the parameter number stands for the axis number (1 through 4).

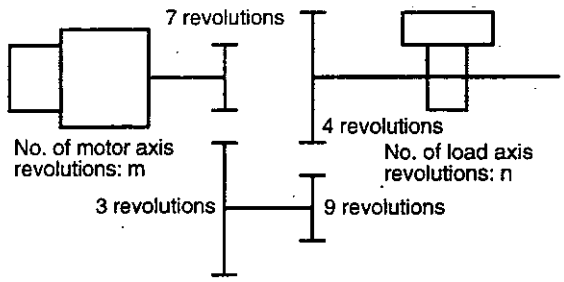
2) **Parameters PA501 to PA505 for Encoders and Machine Systems**

Table 5.18 Parameters for Machine System and Peripheral Equipment 1

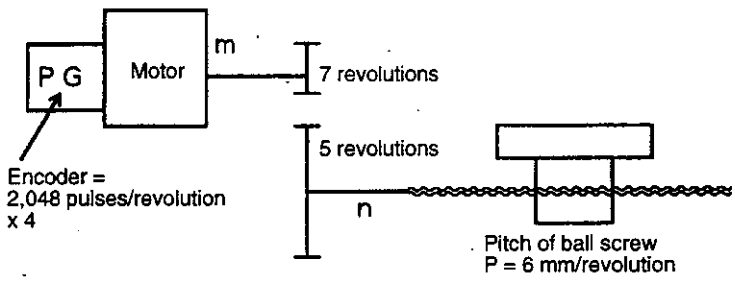
<table>
<tr><th>Parameter Number</th><th>Name</th><th>Meaning</th><th>Default Value</th></tr>
<tr><td>PA501</td><td>Number of encoder pulses</td><td>• Set this parameter to the original number of pulses per encoder revolution.
• Setting range: Max. 32,768 (pulses)</td><td>2,048</td></tr>
<tr><td>PA502</td><td>Encoder pulse signal selection</td><td>• Set this parameter to the number of times with which the pulses encoder revolution is multiplied.
1: AB phase x 1
2: AB phase x 2
4: AB phase x 4</td><td>4</td></tr>
<tr><td>PA503</td><td>One machine rotation/ command resolution

◀EXAMPLE▶</td><td>• Set this parameter to the moving distance of the load per command revolution using the following formula.
PA503 = Moving distance of load per revolution (mm) / Command resolution (mm)
• Refer to the following for examples of load moving distances.
<table>
<tr><th>Moving distance per revolution</th><th>Load</th></tr>
<tr><td>P (mm)</td><td>Ball screw
One revolution
 
P: Ball screw pitch</td></tr>
<tr><td>360 (°)</td><td>Round table
360°
 
One revolution</td></tr>
<tr><td>πD (mm)</td><td>Belt
One revolution ⟷ πD
 
D</td></tr>
</table>
• Setting range: 0 to 1,500,000 (pulses)

Setting Example
• If the movement distance per revolution is 12 mm and the command resolution is 0.001 mm, set the following.
PA503 = 12 mm/0.001 mm = 12,000</td><td>10,000</td></tr>
</table>

Parameter Number	Name	Meaning	Default Value
PA504	Gear ratio (motor rev.) ◀EXAMPLE▶	• Use these parameters to set the gear ratio between the motor and load. If the motor axis turns "m" times while load axis turns "n" times, set PA504 to "m" and PA505 to "n." • Setting range: 1 to 10,000,000 (pulses) **Setting Example**  In the above case, the following gear ratio is obtained. Gear ratio = n/m = 3/7 x 4/9 = 4/21 Therefore set PA504 to 21 and PA505 to 4.	1
PA505	Gear ratio (load rev.)		1
• These parameters have the following restrictions. A = PA503 x PA505 ≦ 2,147,483,647 B = PA501 x PA502 x PA504 ≦ 2,147,483,647 The specifications of the machine system and pulse encoder must satisfy the conditions. **Note** The above B/A is the number of multiplied pulses per command resolution. The following is the recommended condition. 0.01 ≦ B/A ≦ 100			

◀EXAMPLE▶ • **Parameter Setting Example for Movable Resolution (A) for Ball Screw**



In the above case, the parameters must be set to the following values if the command resolution and movable resolution are both 0.001 mm (i.e., P0005 is set to 3)

- PA503 = 6 mm/0.001 mm = 6000
- Deceleration ratio = n/m = 5/7
- PA504 = 7
- PA501 = 2,408 pulses

• PA505 = 5

• PA502 = x 4

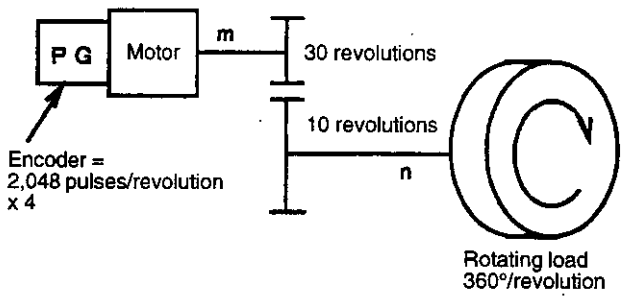
Check if the parameters are within the restricted values.

• A = PA503 x PA505 = 6,000 x 5 = 30,000 ≦ 2,147,483,647

• B = PA504 x PA501 x PA502 = 7 x 2,048 x 4 = 57,344 ≦ 2,147,483,647

• B/A = 57,344/30,000 = 1.911 ≦ 100 and ≧ 0.01

• Parameter Setting Example for Movable Resolution (B) for Rotating Load



In the above case, the parameters must be set to the following values if the command resolution and movable resolution are both 0.1° (i.e., P0005 is set to 1).

• PA503 = 360°/0.1° = 3600

• Deceleration ratio = n/m = 10/30

• PA504 = 30

• PA501 = 2,048 pulses

• PA505 = 10

• PA502 = x 4

Check if the parameters are within the restricted values.

• A = PA503 x PA505 = 3,600 x 10 = 36,000 ≦ 2,147,483,647

• B = PA504 x PA501 x PA502 = 30 x 2,048 x 4 = 245,760 ≦ 2,147,483,647

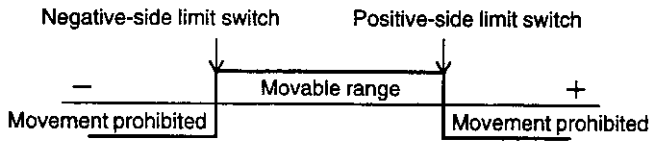
• B/A = 245,760/36,000 = 6.83 ≦ 100 and ≧ 0.01

3) Parameters PA506 to PA513 for Machine Systems

Table 5.19 Parameters for Machine System and Peripheral Equipment 2

<table>
<tr><th>Parameter Number</th><th>Name</th><th>Meaning</th><th>Default Value</th></tr>
<tr><td>PA506-b0</td><td>Motor revolution direction</td><td>• Set this parameter to the motor revolution direction.
<table><tr><th>b0</th><th>Command direction</th><th>Motor revolution direction</th></tr><tr><td rowspan="2">0</td><td>+</td><td>Forward</td></tr><tr><td>–</td><td>Reverse</td></tr><tr><td rowspan="2">1</td><td>+</td><td>Reverse</td></tr><tr><td>–</td><td>Forward</td></tr></table>Note The forward direction means the CW revolution of the motor while standing opposite the load.
• After setting this parameter, reconnect the overtravel limit switch so that the OTFx signal will be connected to the "+" direction side and the OTRx signal will be connected to the "–" direction side.</td><td>0</td></tr>
<tr><td>PA506-b1</td><td>Finite/Infinite length</td><td>• Set this parameter to the finite or infinite length of the controlled axis.
<table><tr><th>b1</th><th>Meaning</th></tr><tr><td>0</td><td>• The finite length is designated (i.e., the moving distance of the axis is limited).
• Maximum command value: ±99,999,999
• The stored stroke limit function is enabled.</td></tr><tr><td>1</td><td>• The infinite length is designated (i.e., the moving distance of the axis is not limited).
• The maximum command values per operation are as follows:
ABS mode: ±(Set value of PA503) – 1
INC mode: ±99,999,999
• The stored stroke limit function is disabled.</td></tr></table></td><td>0</td></tr>
<tr><td>PA506-b2</td><td>Linear/Rotary axis</td><td>• Set this parameter to the type of controlled axis.
<table><tr><th>b2</th><th>Meaning</th></tr><tr><td>0</td><td>The linear axis is designated.
Unit of present value data: mm</td></tr><tr><td>1</td><td>The rotary axis is designated.
Unit of present value data: ° (degrees)</td></tr></table></td><td>0</td></tr>
</table>

<table>
<tr><th>Parameter Number</th><th>Name</th><th>Meaning</th><th>Default Value</th></tr>
<tr><td>PA507</td><td>Backlash compensation
Related parameter: PA510-b1

◀EXAMPLE▶</td><td>• Set this parameter to the required backlash compensation value.
• Setting range: 0 to 32,767 (pulses)
Setting Example
• Backlash compensation value = 10 μm = 0.01 mm
• If the programming resolution and movable resolution are both 0.001 mm, the following backlash compensation value can be obtained.
Backlash compensation value = 0.01/0.001 x B/A (pulses)
Refer to 1) for "B/A."</td><td>0</td></tr>
<tr><td>PA508</td><td>Stored stroke limit (+)</td><td>• Set these parameters to the machine coordinate system positions where the stored stroke limit function is enabled.
• Set PA508 to the positive stroke limit position.</td><td>+99,999,999</td></tr>
<tr><td>PA509</td><td>Stored stroke limit (–)
Related parameter: PA510-b0</td><td>• Set PA509 to the negative stroke limit position.
• Setting range: –99,999,999 to +99,999,999 (command resolution)
• Use PA510-b0 to enable or disable the stored stroke limit function.</td><td>–99,999,999</td></tr>
<tr><td>PA510-b0</td><td>Stored stroke limit usage
Related parameters: PA508 and PA509</td><td>• Use this parameter to enable or disable the stored stroke limit function.
<table>
<tr><td rowspan="2">b0</td><td colspan="2">Software Limit Switch Operating Position</td></tr>
<tr><td>Positive-side Limit</td><td>Negative-side Limit</td></tr>
<tr><td rowspan="2">0</td><td colspan="2">• Disabled</td></tr>
<tr><td>Always +99,999,999</td><td>Always –99,999,999</td></tr>
<tr><td rowspan="2">1</td><td colspan="2">• Enabled</td></tr>
<tr><td>Set with PA508</td><td>Set with PA509</td></tr>
</table>


• When the stored stroke limit function is enabled while the MC20 Module is in operation, the controlled axis decelerates to stop and an alarm occurs. Any operation exceeding the stroke limits is prohibited.
• The stored stroke limit function is valid for any axis with a finite length that has returned home.</td><td>0</td></tr>
</table>

Parameter Number	Name	Meaning	Default Value
PA510-b1	Backlash offset usage Related parameters: PA507	• Use this parameter to enable or disable the backlash compensation function. b1: 0 = • Disabled; 1 = • Enabled. Set PA507 to the backlash compensation value. • The backlash compensation direction is opposite of the home position returning direction.	0
PA511	Servomotor rated revolution	• Set this parameter to the rated revolution of the servomotor of each controlled axis. • Setting range: 100 to 4,500 (r/min)	3,000
PA512	Speed command D/A output	• Set to the speed command voltage of the servomotor of each controlled axis after setting PA511 to the rated revolution of the servomotor. • Setting range: 1 to 10 (V) • A D/A output of 6 V is obtained as a default value when the rated revolution per minute is 3,000.	6
PA513	Servomotor maximum revolution	• Set this parameter to the maximum revolution of the servomotor of each controlled axis. • Setting range: 0 to 10,000 (r/min) • Any speed command exceeding the maximum revolution value to which this parameter is set is reduced to the maximum revolution value.	4,000
PA513	Constant of automatic 0 tune	• This parameter is used for systems. Do not change the default value.	1,000

INFO

1) Setting Parameter PA506

a) Activate MEMOSOFT.

b) Move the cursor to "PA506" on the parameter setting screen and press the Enter Key. Then, the following sub-window will appear.

Bit position: Name	ON/OFF	Remarks
b0: Motor revolution direction	0	0: Forward 1: Reverse
b1: Finite/Infinite	0	0: Finite length 1: Infinite length
b2: Linear/Rotary	0	0: Linear 1: Rotary

c) Move the cursor to the bit to be changed and input "1" or "0."

2) Setting Parameter PA510

a) Activate MEMOSOFT.

b) Move the cursor to "PA510" on the parameter setting screen and press the Enter Key. Then, the following sub-window will appear.

Bit position: Name	ON/OFF	Remarks
b0: Stored stroke limit	0	0: Disabled 1: Enabled
b1: Backlash compensation	0	0: Disabled 1: Enabled

c) Move the cursor to the bit to be changed and input "1" or "0."

5.3.6 Parameters for Servo External I/O

Parameters PA601 to PA603 for Servo I/O Signals
("A" in the parameter number stands for the axis number (1 through 4).)

Table 5.20 Parameters for Servo External I/O

<table>
<tr><th>Parameter Number</th><th>Name</th><th>Meaning</th><th>Default Value</th></tr>
<tr><td>PA601-b0</td><td>Overtravel input signal (OT)</td><td>• Set this parameter to enable or disable the overtravel input signal of the I/O connector.
<table><tr><th>b0</th><th>Meaning</th></tr><tr><td>0</td><td>• Disabled.</td></tr><tr><td>1</td><td>• Enabled. Forward and reverse overtravel input signals OTF1 to OTF4 and OTR1 to OTR4 can be used. (see note)</td></tr></table>Note Use a normally closed contact so that the contact will be open when there is any overtravel.</td><td>1</td></tr>
<tr><td>PA601-b2</td><td>Brake control output signal (BRK)
Related parameters: PA602 and PA603</td><td>• Set this parameter to enable or disable the brake control output signal of the I/O connector.
<table><tr><th>b1</th><th>Meaning</th></tr><tr><td>0</td><td>• Disabled.</td></tr><tr><td>1</td><td>• Enabled. BRK1 to BRK4 can be used. (see note)</td></tr></table>Note If braking is instructed, the open collector output will be ON and the signal level will be L.
• If the braking output signal is enabled, set parameters PA602 and PA603.</td><td>0</td></tr>
<tr><td>PA602</td><td>Brake time</td><td>• Set this parameter to the time during which servo ON (SVON) is on hold when the brake control output signal is ON. Refer to page 5-50.
• Setting range: 8 to 1,000 (ms)</td><td>8</td></tr>
<tr><td>PA603</td><td>Brake ON motor speed</td><td>• Set this parameter to an appropriate value. If the revolution of the motor is less than this value, the brake control output signal will be ON. Refer to page 5-50.
• Setting range: 1 to 10,000 (r/min)</td><td>1</td></tr>
</table>

INFO **Setting Parameter PA601**

1) Activate MEMOSOFT.

2) Move the cursor to "PA601" on the parameter setting screen and press the Enter Key. Then, the following sub-window will appear.

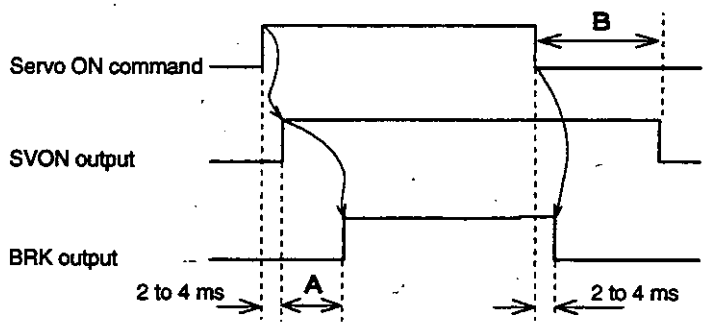
Bit position: Name	ON/OFF	Remarks
b0: OT signal	0	0: Disabled 1: Enabled
b1: Brake release signal	0	0: Disabled 1: Enabled

3) Move the cursor to the bit to be changed and input "1" or "0."

Setting Parameters PA602 and PA603

If PA601-b1 is set to 1 to use the brake signal, set parameters PA602 and PA603. Refer to the following.

1) Controlled Axis Not Moving

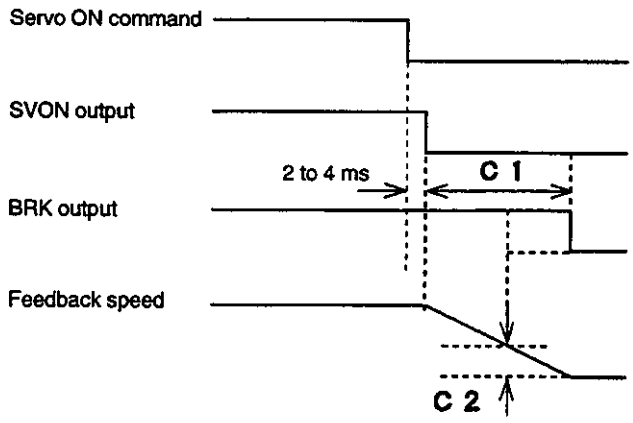


A: Brake release output ON timer (always 8 ms)

B: Servo OFF timer (to be set with PA602)

2) Controlled Axis Moving

- When the controlled axis is moving, BRK□ will be turned OFF if either the C1 or C2 condition is satisfied.



C1: Brake release output OFF timer (always 200 ms)

C2: The feedback speed is the same as that set with the parameter PA603, or less.

Absolute Position Detecting Function

6

This chapter describes an absolute position detecting system that uses an absolute encoder. Be sure to familiarize yourself with this chapter before operating the MC20 Module with a servomotor incorporating an absolute encoder.

6.1 Absolute Position Detecting Function Summary

The absolute position detecting function of the MC20 Module is explained below.

6.1.1 Summary of Function

1) The absolute position detecting system is a system in which the encoder's absolute position data is retrieved and the machine coordinate system is set at power-up. There is, therefore, no need to return to the home position before the program is run.

2) The absolute position detecting system has the following features.

   a) No need to return to the home position after the MC20 Module is turned ON.

   b) The stored stroke limit function of the MC20 Module can be used right after the MC20 Module is turned ON.

   c) No home position dog or overtravel limit switch is required.

3) Using the absolute position detecting function, any of the following operating systems can be selected for the MC20 Module using parameter settings.

   a) Absolute position detecting system with absolute encoder

   b) Incremental position detecting system with absolute encoder

   c) Incremental position detecting system with incremental encoder

6.1.2 Absolute Position Detection

1) **Explanations of the Basic Terms Used in this Section**

   a) Absolute Encoder

   The absolute position of a workpiece is detected with the absolute encoder attached to the servomotor using a semi-closed loop. The servomotor has a detector consisting of an encoder that detects the absolute position per workpiece revolution and a counter that counts the number of revolutions of the workpiece.

b) Absolute Data

The absolute data of the absolute encoder consists of the number of revolutions (N) from the absolute reference position and the position per motor revolution (PO). When the system is turned ON, the MC20 Module will read the absolute data as serial data. Then, the absolute encoder operates like a normal incremental encoder.

- No. of revolutions from absolute reference position: N
- No. of pulses per motor revolution: RP
- Position per motor revolution: PO

The absolute position (P) is obtained from the following.
$P = N \times RP + PO$

The specifications when N (the number of revolutions) exceeds the limit value differ between the Absolute encoder of 12 and 15 bits, and the Absolute encoder of bits 16 and 17.
Set PA405 (Servopack type) to 1 when using Absolute encoder of bits 16 and 17.

c) Absolute Data Backup

The absolute data of the absolute encoder connected to the MC20 Module will be kept on hold with a backup battery if the MC20 Module is turned OFF. The absolute data can be refreshed. The battery is connected to the BAT connector of the MC20 Module. The Yaskawa Model No. : JRMSP-120XCP96000 Battery Module is available.

- Kind of battery: Lithium battery
- Type of battery: ER6VC3N (3.6 V) x 1
- Life: Approximately 1 year

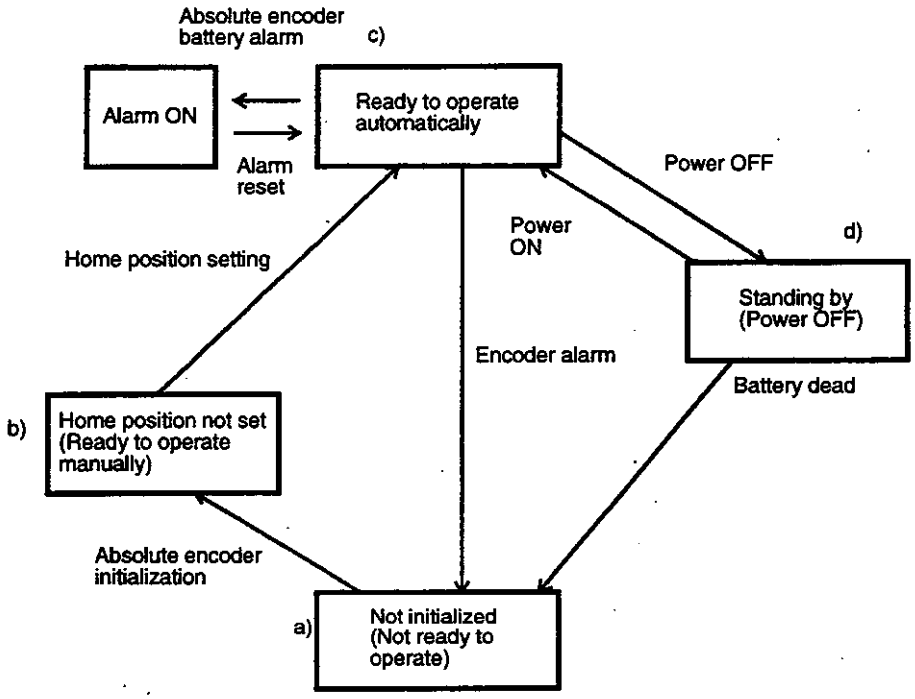
d) Retrieval of Absolute Data

When the MC20 Module is turned ON, the MC20 Module retrieves the absolute data, calculates the absolute position, and automatically sets the machine coordinate system so that the MC20 Module is ready to operate automatically. The MC20 Module also retrieves the absolute data when MODULE RESET (MRS), which is a motion command for ladder logic programs, is executed.

2) Absolute Position Detecting System

Refer to the following for an absolute position detecting system.

Absolute Position Detecting System



The statuses are explained below.

a) **Not Initialized**
The operation of the absolute encoder cannot be guaranteed if the absolute encoder has not been initialized. If the backup battery for the absolute encoder is dead or when the absolute encoder is used for the first time, an alarm will occur. Therefore, the absolute encoder must be initialized in such a case.

b) **Home Position Not Set**
The home position setting to determine the machine coordinate home position has not been determined, in which case an alarm occur when the system is turned ON. Therefore, reset the system and execute HOME POSITION SETTING. If the home position setting has not been determined, the axis can be moved manually.

c) **Ready to Operate Automatically**
The home position setting is completed, the absolute position detecting function is enabled, and the system is ready to operate normally.

d) **Standing By**
While the system is turned OFF, the movement of the machine in the system is detected and the data obtained from the revolution of the absolute encoder is refreshed, during which the battery supplies power to the absolute encoder.

6.2 Startup of Absolute Position Detecting System

The startup of an absolute position detecting system is explained below.

6.2.1 Procedures of System Startup

Before the startup of an absolute position detecting system, check the Servopack and peripheral equipment such as the servomotor of the absolute position detecting system.

The following procedure is required for the startup of an absolute position detecting system.

1) Check all equipment.

Check if the Servopack, servomotor, and cables are suitable for the absolute encoder.

2) Check the related parameters of the Servopack.

Check if the parameters of the Servopack related to absolute position detection are for suitable for the absolute encoder. Also, check the number of encoder pulses.

3) Set the related parameters of the MC20 Module.

Properly set the parameters of the MC20 Module related to absolute position detection.

4) Initialize the absolute encoder.

Set the absolute encoder to the default value.

5) Set the home position.

Set the absolute home position (i.e., machine coordinate home position).

When the above procedure is completed, the system is ready for operation.

The above procedure is required in the following cases.

1) The first startup of the system.

2) After servomotor replacement.

3) When an alarm related to the absolute encoder is ON.

6.2.2 Related Parameter Setting

The axis parameters for absolute position detecting systems are explained below. "A" in the parameter number stands for the axis number (1 through 4).

1) **Parameter Settings Required Before Startup of Absolute Position Detecting Systems**

Parameter Number	Name	Setting Range	Units	Default Value
PA401	Absolute encoder allowable error	0 to 1,000,000	Pulses	40,960
PA402	Absolute detecting system selection	Encoder / Detecting system 0: Incremental / Incremental 2: Absolute / Incremental 3: Absolute / Absolute		0
PA403	Reference offset 1 at home position setting	0 to +99,999,999	Command resolution	0
PA404	Reference offset 2 at home position setting	0 to ±99,999,999	Command resolution	0
PA405	Servopack type	1 : Σ-II type (SGDM-□□ or SGDH-□□) 0 : Other types		0

2) **PA401 Setting**

An alarm will occur if the difference in pulse between the machine coordinate value stored in the MC20 Module when it is turned OFF and that detected by the MC20 Module when it is turned ON is larger than the allowable value that PA401 is set to.

If this parameter is set to "0," no absolute position will be detected.

Unless there is a special reason, use the default value.

3) **PA402 Setting**

Use this parameter for determining the encoder and absolute position detecting system. PA402 can be set to either 0, 2, or 3. Refer to the following table.

Parameter Value	Encoder	Detecting System
PA402 = 0	Incremental encoder	Incremental detecting system
PA402 = 2	Absolute encoder	Incremental detecting system
PA402 = 3	Absolute encoder	Absolute detecting system

Set Value at Setup

Set PA402 to 3.

The absolute position detecting system can be set for each axis individually, which means your system can include both incremental and absolute position detecting axes.

Refer to the following to set PA402.

a) Move the cursor to "PA402" on the parameter setting screen and press the Enter Key. Then, the following sub-window will appear.

Bit position: Name	ON/OFF	Remarks
b0: System	0	0: Incremental 1: Absolute
b1: Encoder	0	0: Incremental 1: Absolute

b) Move the cursor to "b0: System" and enter "1."

c) Move the cursor to "b1: Encoder" and enter "1."

Note It is not possible to set b0 to 1 and b1 to 0, which means it is not possible to set PA402 to 1.

4) **PA403 and PA404 Settings**

The machine coordinate system home position, which is set with home position setting, can be shifted for the value set with parameter PA403 along with that set with PA404.

Parameter Number	Meaning
PA403	Home position shift distance
PA404	Home position shift adjustment

Set Value at Setup

Unless there is a special reason, use the default value.

After starting the absolute position detecting system, use these parameters to shift the machine coordinate home position appropriately.

5) PA405 Setting

Set parameter PA405 (1 : Servopack type) to 1 when using the Servopack with Absolute encoder of bits 16 and 17.

6.2.3 Initialization of Absolute Value Encoder

1) Initialization of Absolute Encoder (12 bit type / 15 bit type)

Initialize the absolute encoder in the following cases.

a) At the time of the first startup of the absolute position detecting system.

b) To set the revolution of the absolute encoder to "0" from the absolute reference position.

c) If the motor is left with no battery connected to the absolute encoder for more than four days.

d) If alarm A12 or A14 is ON.

2) **15-bit Absolute Encoder Initialization**

a) Turn OFF the Servopack and MEMOCON GL120 or GL130.

b) Discharge the electricity of the capacitor of the encoder with either one of the following methods.

(1) **Using Connector on Encoder Side**

(a) Disconnect the encoder connector from the terminal of the encoder.

(b) Short-circuit pins R and S of the terminal with a lead wire.

(c) Wait for two minutes while the pins are being short-circuited.

(d) Disconnect the lead wire and insert the connector to the encoder.

(2) **Using Connector on Servopack Side**

(a) Disconnect the Servopack connecter from the terminal of the Servopack.

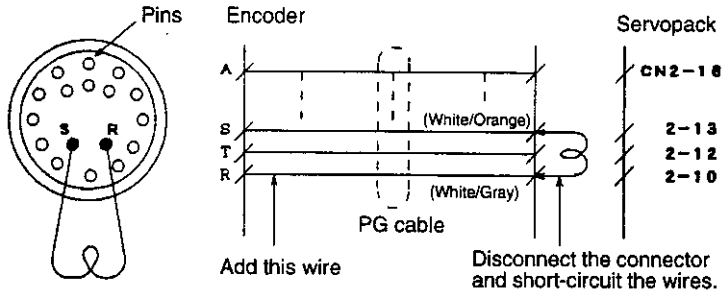
(b) Short-circuit pins 10 and 13 of the connector with a lead wire.

(c) Wait for two minutes while the pins are being short-circuited.

(d) Disconnect the lead wire and insert the connector to the Servopack.

c) Connect the cable correctly and connect a battery to the encoder through the BAT connector of the MC20 Module.

d) Turn ON the system.
If an absolute encoder alarm occurs, initialize the encoder again. If no alarm occurs, the encoder has been initialized.



Initialization with PG cable

3) 12-bit Absolute Encoder Initialization

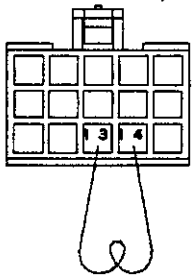
a) Connect the Servopack and MEMOCON GL120 or GL130 correctly.
Turn ON the system and supply power to the system for approximately five minutes, during which the capacitor of the absolute encoder will be charged. Then, turn OFF the system.

b) Reset the absolute data of the encoder with the following methods using the encoder connector.

(1) Disconnect the encoder connector from the terminal of the encoder.

(2) Short-circuit pins 13 and 14 of the terminal with a lead wire for one to two seconds.

(3) Disconnect the lead wire and insert the connector to the encoder.



c) Connect the cable correctly and connect a battery to the encoder through the BAT connector of the MC20 Module.

d) Turn ON the system.
If an absolute encoder alarm occurs, initialize the encoder again. If no alarm occurs, the encoder has been initialized.

4) **16-bit/17-bit Absolute Encoder Initialization**

Perform the setup operation for the absolute encoder in the following circumstances:

a) When starting the machine for the first time.

b) When an encoder backup alarm is generated.

c) When the Servopack's power supply is turned OFF and the encoder's cable is removed.

The setup operation can be performed by using the Hand-held Digital Operator or the Servopack's Panel Operator, or else personal computer monitor software can be employed.

INFO The absolute encoder setup operation is only possible when the servo is OFF. After the setup processing is finished, turn the power back ON again.

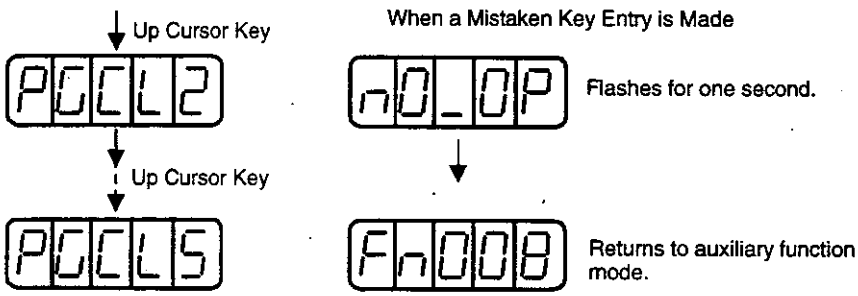
(1) Setup Using the Hand-held Digital Operator

(a) Press the DSPL/SET Key to select the auxiliary function mode.

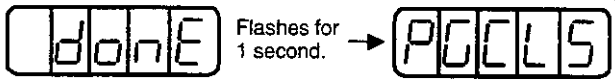
(b) Select the user constant Fn008. Press the Left or Right Cursor Key to select the digit to set, and then press the Up or Down Cursor Key to change the number.

(c) Press the DATA/ENTER Key. The following display will appear.

(d) Pressing the Up Cursor Key will change the display as shown below. Continue pressing the Up Cursor Key until "PGCL5" is displayed. If an erroneous key entry is made, "nO_OP" will flash for one second and the display will return to the auxiliary function mode. In that case, go back to step 3 above and perform the operation again.



(e) When "PGCL5" is displayed, press the DSPL/SET Key. The display will change as follows, and the absolute encoder's multi-turn data will be cleared.



(f) Press the DATA/ENTER Key to return to the auxiliary function mode.

This completes the absolute encoder's setup operation. Turn the power OFF and then back ON again.

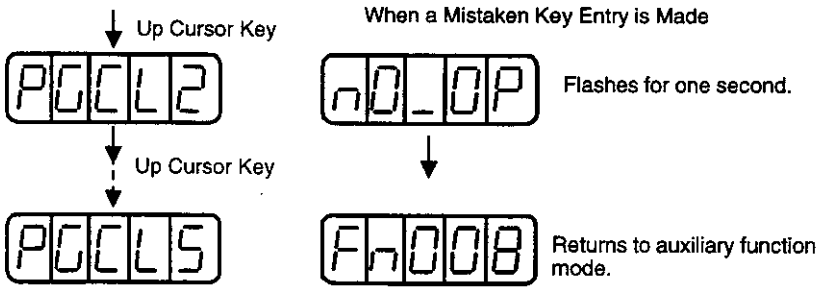
(2) Setup Using the Built-in Panel Operator

(a) Press the DSPL/SET Key to select the auxiliary function mode.

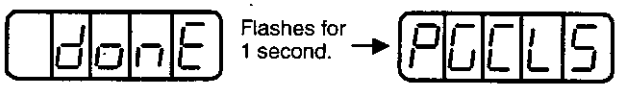
(b) Press the Up or Down Cursor Key to select the user constant Fn008.

(c) Press the DATA/SHIFT Key for at least one second. The following display will appear.

(d) Pressing the Up Cursor Key will change the display as shown below. Continue pressing the Up Cursor Key until "PGCL5" is displayed. If an erroneous key entry is made, "nO_OP" will flash for one second and the display will return to the auxiliary function mode. In that case, go back to step 3 above and perform the operation again.



(e) When "PGCL5" is displayed, press the MODE/SET Key. The display will change as follows, and the absolute encoder's multi-turn data will be cleared.



(f) Press the DATA/SHIFT Key to return to the auxiliary function mode.

This completes the absolute encoder's setup operation. Turn the power OFF and then back ON again.

INFO The following are the model legends of Yaskawa servomotors with an absolute encoder.

12-bit Encoder
□□□□-□□□W□□

15-bit Encoder
□□□□-□□□S□□

16-bit Encoder
□□□□-□□□1□□□

17-bit Encoder
□□□□-□□□2□□□

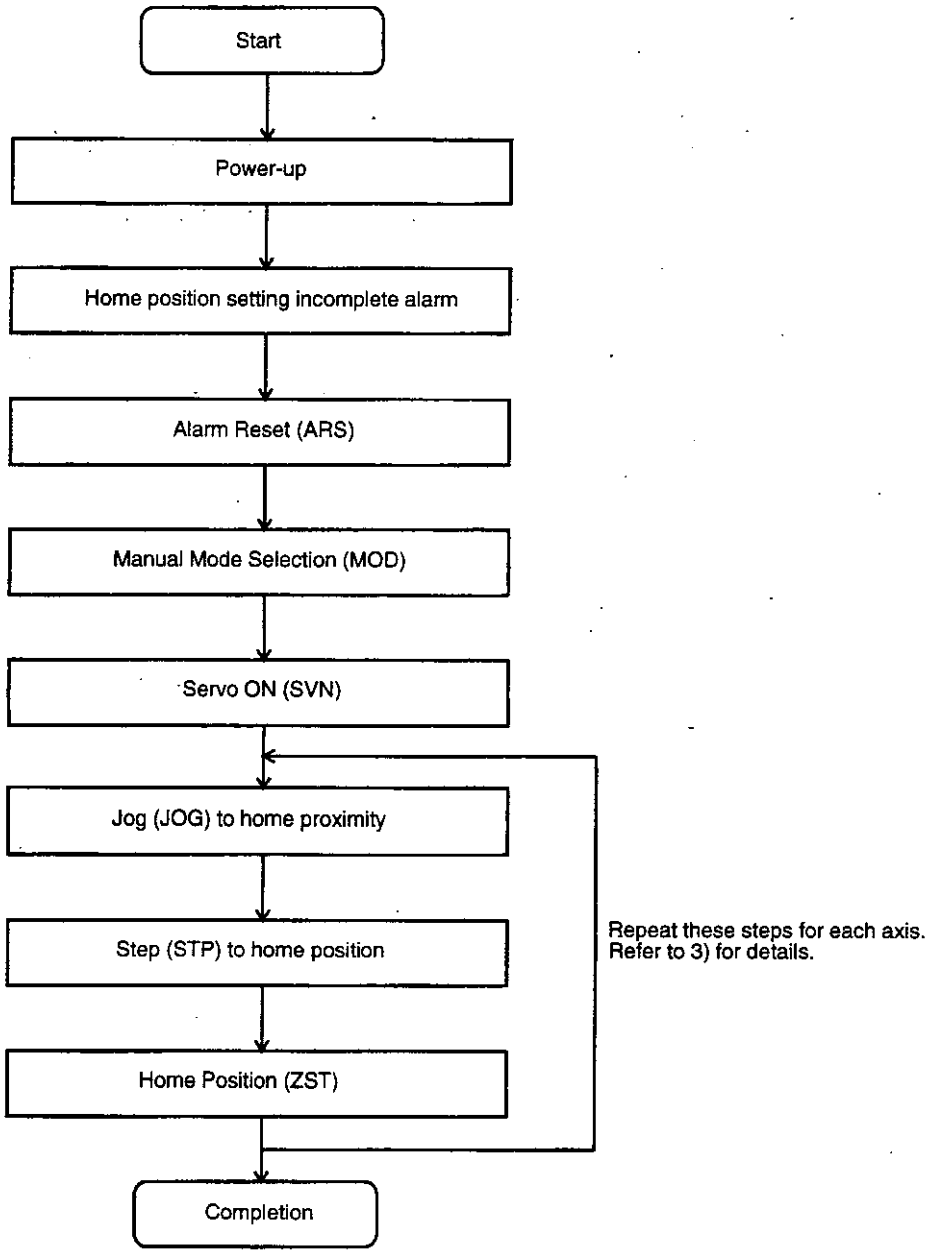
6.3 Home Position Setting

The absolute position detecting system requires machine coordinate home positions, the setting methods of which are described below.

6.3.1 Home Position Setting Procedure

1) After the initialization of the absolute encoder, set the machine coordinate home position to create the machine coordinate system.

2) Home Position Setting Procedure



3) Home Position Setting of Each Axis

a) Execute JOG, which is a motion command for ladder logic programs, to move an axis to home proximity.

b) Execute STEP (STP), which is a motion command for ladder logic programs, to move the axis to the home position.

c) Execute HOME POSITION (ZST), which is a motion command for ladder logic programs, to set the home position of the axis.

d) The MC20 Module will store the absolute data of the encoder at the position as ABS-BASE. Then, the machine coordinate system home position will be set to the shifted position according to the values of reference offset 1 and 2 at home position setting.

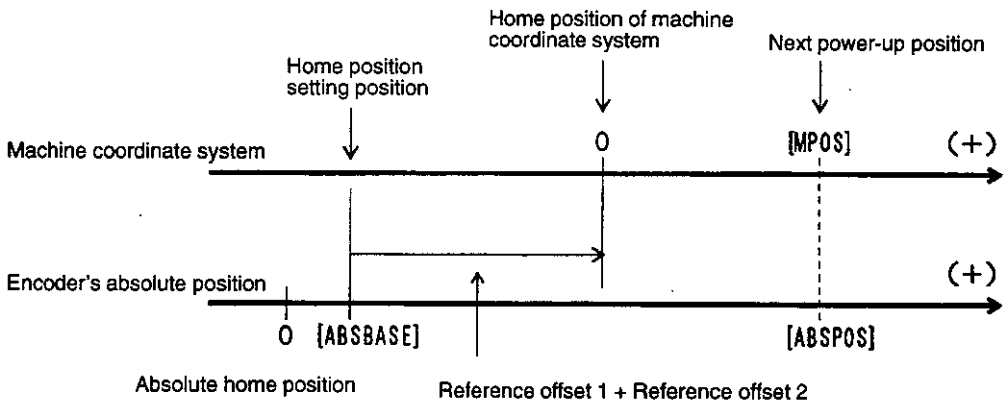
Parameter Number	Meaning	Units
PA403	Reference offset 1 at home position setting (home position shift distance)	Command resolution
PA404	Reference offset 2 at home position setting (home position shift adjustment)	Command resolution

When the home position is set, the MC control relay setting of the axis will be completed.

Note If HOME POSITION (ZST) is executed while the axis is travelling, an alarm will occur.

e) Repeat the above for each axis.

f) After the machine coordinate system of each axis is set, the MC20 Module will be ready to operate automatically or with programs from the Teach Pendant.



- After the above settings are done and the MC20 Module is turned OFF, the MC20 Module will calculate the following and automatically set the same machine coordinate system whenever the MC20 Module is turned ON (i.e., the MC20 Module will be ready to be in program operation whenever the MC20 Module is turned ON).

  MPOS (command resolution) = (ABSPOS – ABSBASE) – (Reference offset 1 + Reference offset 2)

6.3.2 Ladder Program Examples

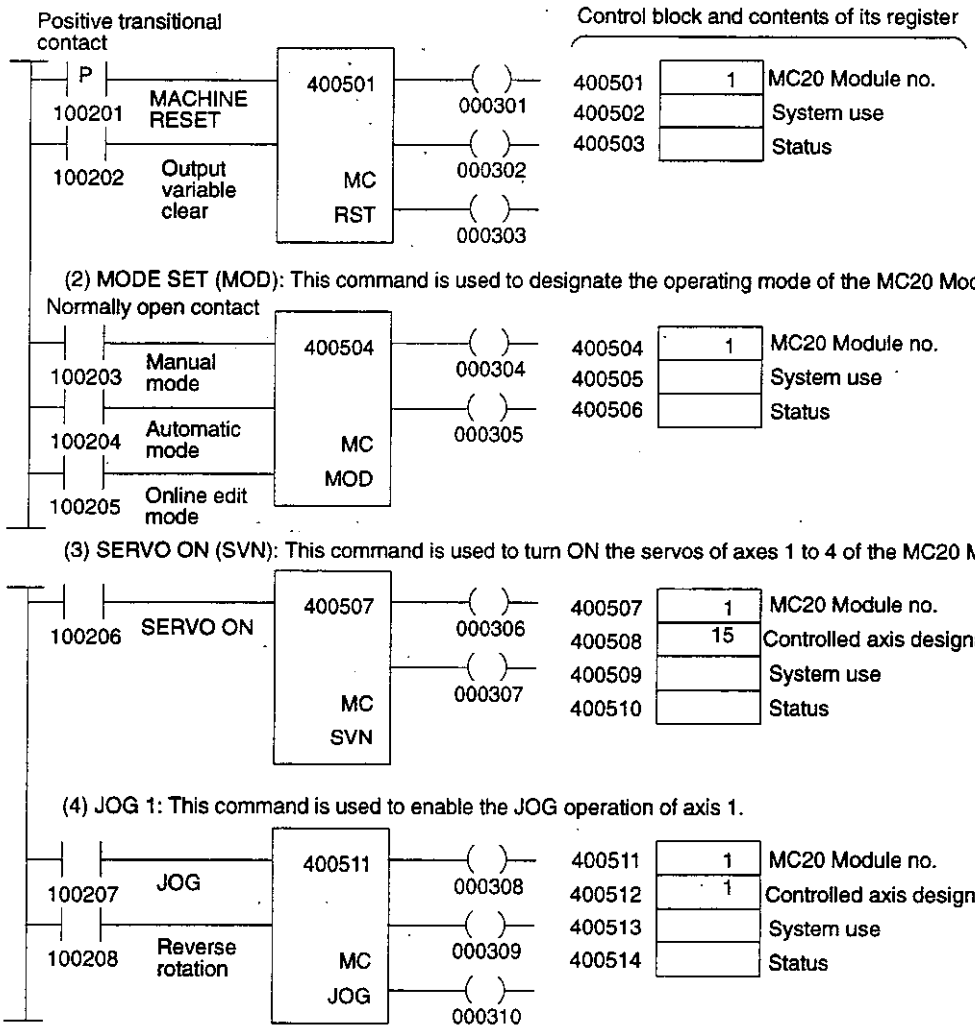
1) An example of a ladder program to set the home position under the following conditions is described below.

   a) MC20 Module no.: 1

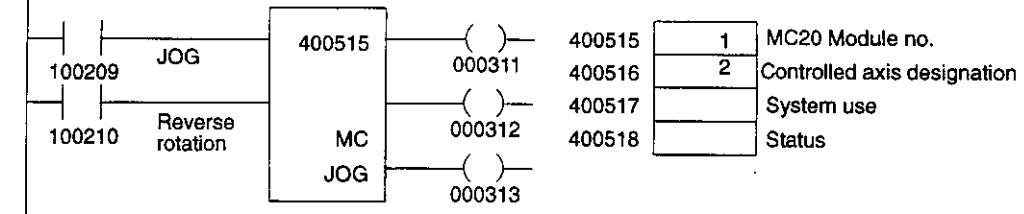
   b) Axis 1: X, axis 2: Y, axis 3: Z, and axis 4: S

c) Position detecting system: Absolute position detection

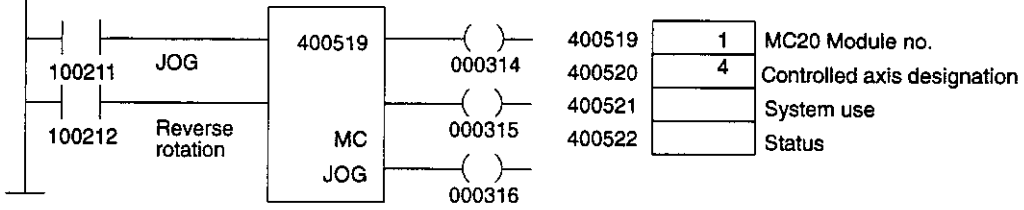
◀EXAMPLE▶ (1) MACHINE RESET (RST): This command is used to reset the alarm status of the MC20 Module.



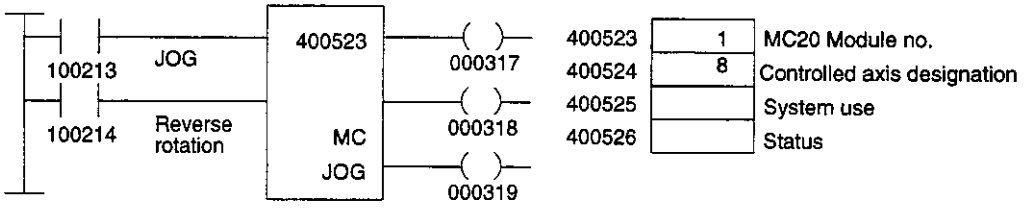
(5) JOG 2: This command is used to enable the JOG operation of axis 2.



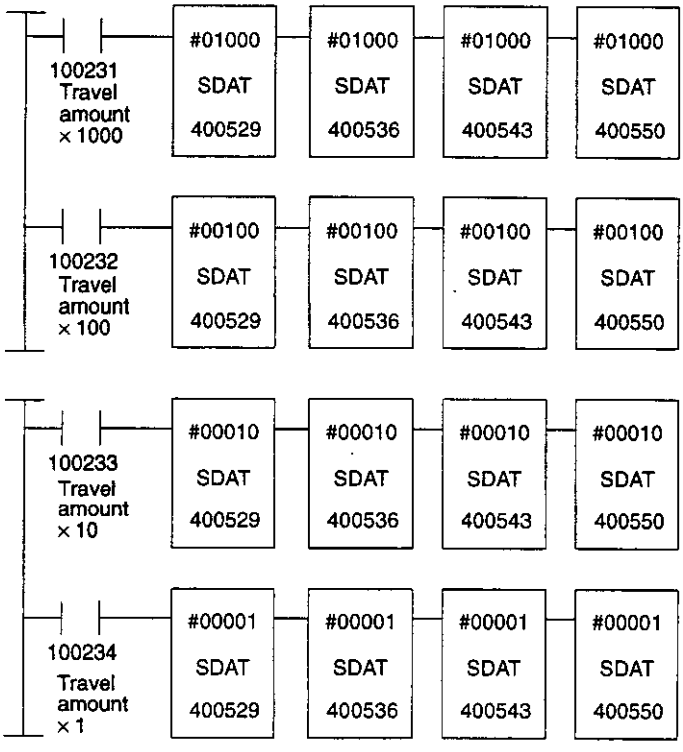
(6) JOG 3: This command is used to enable the JOG operation of axis 3.



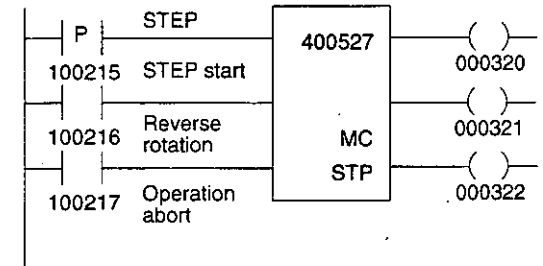
(7) JOG 4: This command is used to enable the JOG operation of axis 4.



(8) Set the travel amount of each axis in STEP operation.

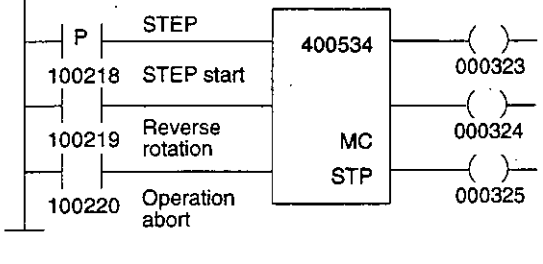


(9) STEP (STP) 1: This command is used to enable the STEP operation of axis 1.



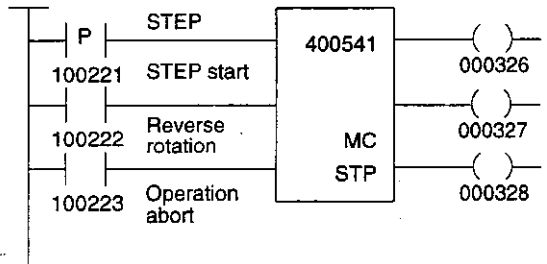
400527	1	MC20 Module no.
400528	1	Controlled axis designation
400529		STEP travel amount L (travel amount of axis in STEP operation)
400530	0	STEP travel amount H
400531	0	Time-out error check time (s)
400532		System use
400533		Status

(10) STEP (STP) 2: This command is used to enable the STEP operation of axis 2.



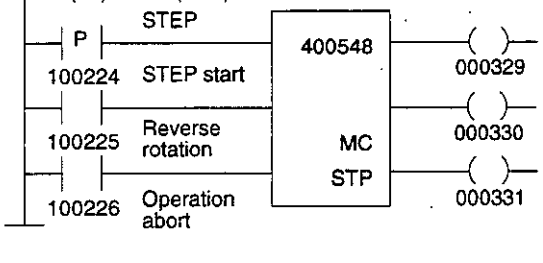
400534	1	MC20 Module no.
400535	2	Controlled axis designation
400536		STEP travel amount L (travel amount of axis in STEP operation)
400537	0	STEP travel amount H
400538	0	Time-out error check time (s)
400539		System use
400540		Status

(11) STEP (STP) 3: This command is used to enable the STEP operation of axis 3.



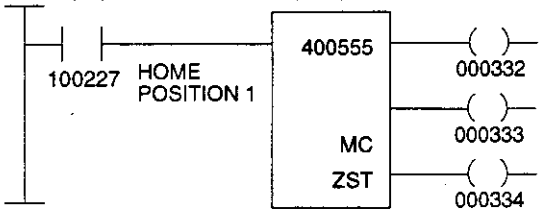
400541	1	MC20 Module no.
400542	4	Controlled axis designation
400543		STEP travel amount L (travel amount of axis in STEP operation)
400544	0	STEP travel amount H
400545	0	Time-out error check time (s)
400546		System use
400547		Status

(12) STEP (STP) 4: This command is used to enable the STEP operation of axis 4.



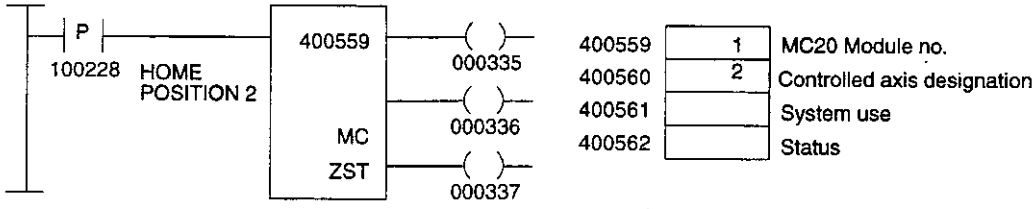
400548	1	MC20 Module no.
400549	8	Controlled axis designation
400550		STEP travel amount L (travel amount of axis in STEP operation)
400551	0	STEP travel amount H
400552	0	Time-out error check time (s)
400553		System use
400554		Status

(13) HOME POSITION (ZST) 1: This command is used to designate the machine coordinate home position of axis 1.

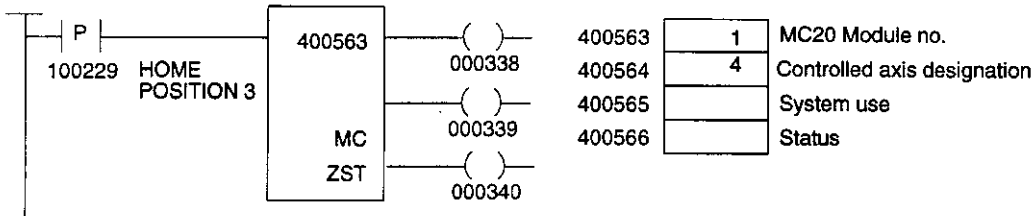


400555	1	MC20 Module no.
400556	1	Controlled axis designation
400557		System use
400558		Status

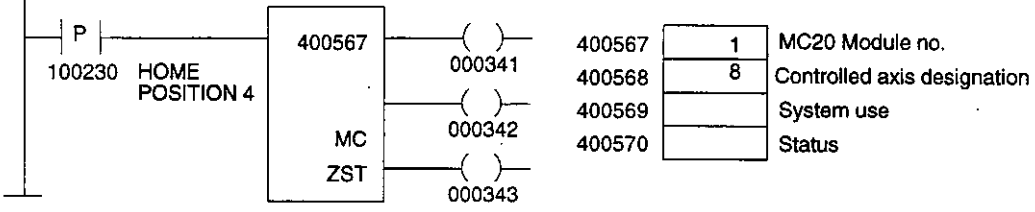
(14) HOME POSITION (ZST) 2: This command is used to designate the machine coordinate home position of axis 2.



(15) HOME POSITION (ZST) 3: This command is used to designate the machine coordinate home position of axis 3.



(16) HOME POSITION (ZST) 4: This command is used to designate the machine coordinate home position of axis 4.



The following will result when the above HOME POSITION commands are executed properly.

Note (1) The present position will be the value added with the home position shift distance designated with PA403 and PA404.

(2) The home position setting completion signal of the MC control relay will be ON.

MC20 Module 1

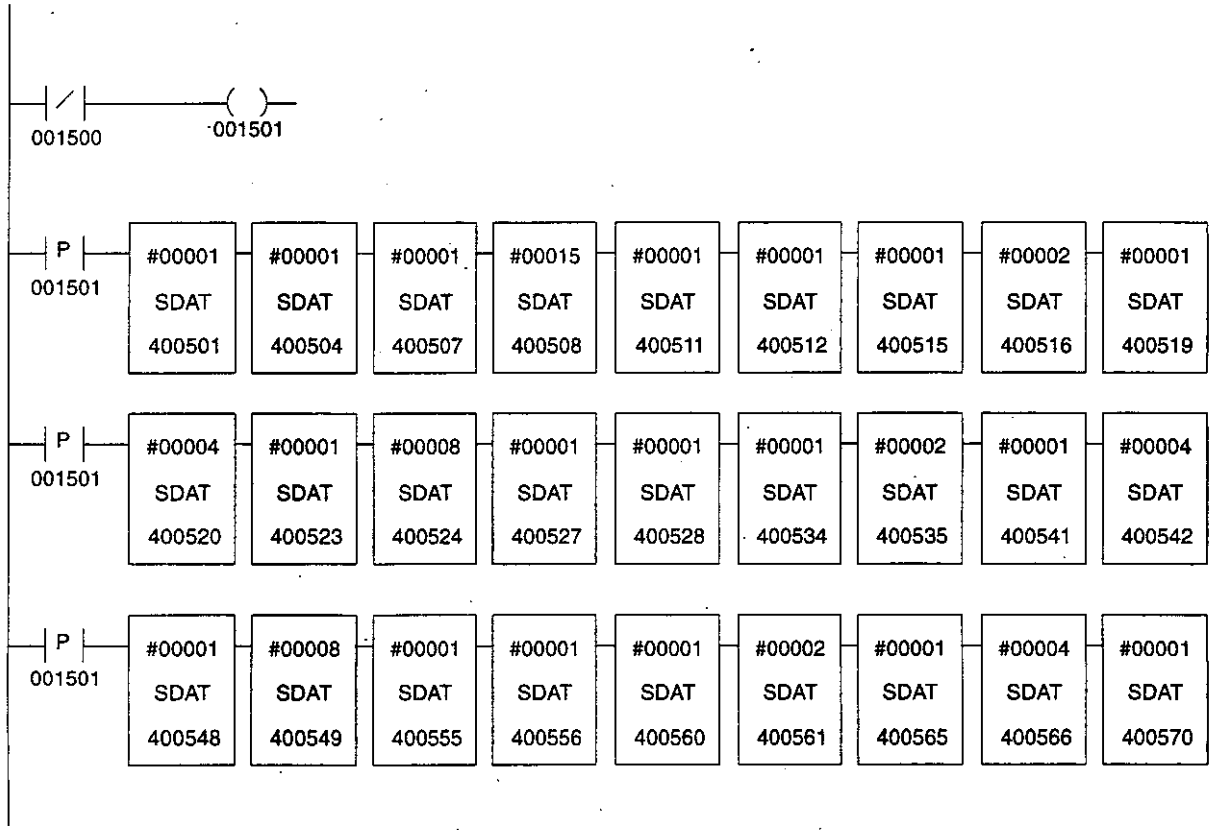
P10113: Completion of setting axis 1 home position
P10114: Completion of setting axis 2 home position
P10115: Completion of setting axis 3 home position
P10116: Completion of setting axis 4 home position

MC20 Module 2

P20113: Completion of setting axis 1 home position
P20114: Completion of setting axis 2 home position
P20115: Completion of setting axis 3 home position
P20116: Completion of setting axis 4 home position

2) The following is an example of a ladder program used to set the control blocks of all motion commands for ladder logic programs to the values shown in the above program.

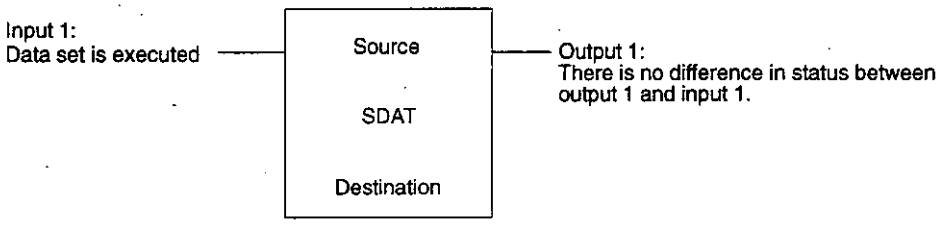
◀EXAMPLE▶ **Example of Program to Set Control Blocks to Numeric Values**



Function of SDAT

When input 1 is ON, the source (i.e., the value on the first line) will be stored to the destination (i.e., the register of the reference on the last line).

16-bit Data Set (SDAT)



6.4 Items Related to Absolute Position Detecting Function

The items related to the absolute position detecting function are described below.

6.4.1 Self-diagnosis of Absolute Position Detecting Function

The following self-diagnosis of the absolute position detecting function is performed.

1) Positioning Check at Power-up

An alarm will occur if the difference between the absolute data stored in the MC20 Module when it is turned OFF and that detected by the MC20 Module when it is turned ON is larger than the allowable value designated with PA401. This alarm can be reset by executing ALARM RESET. If the allowable value is set to 0, this check will not be performed.

2) Battery Voltage Check

a) While the MC20 Module is turned OFF, the absolute data stored in the MC20 Module is backed up by the battery connected to the BAT connector of the MC20 Module. Yaskawa's Battery Module has a battery alarm, which will occur if the voltage of the battery drops to a certain degree.

b) If the battery alarm occurs, replace the battery with a new one within one month.

c) In principle, the battery must be replaced while the MC20 Module occur, or the stored absolute data will be lost in approximately one hour (i.e., the absolute data stored in the MC20 Module will kept for approximately one hour due to the capacitors of the absolute encoder and Battery Module.

Note If the capacitors of both the absolute encoder and Battery Module discharge its electricity, the MC20 Module will not operate and an error will result or an alarm will occur, in which case, the absolute encoder must be initialized. After the battery is dead, the absolute encoder cannot be used as a standard incremental detector.

6.4.2 Related Functions

1) Automatic Operation

The startup of an absolute position detecting system that includes the MC20 Module is required, or an alarm will occur. If the absolute data of the MC20 Module is lost, an alarm will occur. In both cases, the automatic operation of the MC20 Module or the programming operation of the MC20 Module with the Teach Pendant is impossible.

2) Stored Stroke Limit Function

After the startup of an absolute position detecting system that includes the MC20 Module, the stored stroke limit function of the MC20 Module is enabled after power is supplied to the system.

3) Backlash Compensation

The backlash compensation function of the MC20 Module is enabled until it completes home position settings. The backlash compensation function is disabled at the time of first home position setting of the MC20 Module and the next time it is turned ON, at which time the machine coordinate home position will be set. The backlash compensation direction is opposite of the home return direction. Therefore, the backlash compensation function will be enabled the next time the axis travels towards the opposite direction of the home return direction.

Appendix A

Motion Commands

Table A.1 provides the MC20 Module motion commands. These commands are explained in detail in Chapters 2.2 through 2.5.

Table A.2 provides the characters that can be designated for each MC20 Module motion command.

Table A.3 provides the MC20 Module motion commands that can be used together in the same block.

Table A.4 provides the CPU Module motion commands. These commands are explained in detail in Chapter 2.3 through Chapter 2.4.

Table A.5 provides the modes in which each CPU Module motion command can be executed.

Table A.6 describes which CPU Module motion commands can be executed simultaneously.

A.1 Motion Commands

Table A.1 MC20 Module Motion Commands

These commands are classified as follows: M1 through M6 are for modal groups 1 through 6, and NM is for the non-modal group of commands.

Command	Name	Class (see note)	Command Format	Function/Meaning
MOV	POSITIONING	NM	MOV X–Y–Z–S–; ↵ Target position	Executes simultaneous positioning for a maximum four axes at rapid traverse speed.
MVS	LINEAR INTERPOLATION	NM	MVS X–Y–Z–S–F–T–; ↵ Target position	Executes linear travel at tangential velocity F for a maximum four axes simultaneously.
MCW MCC	CIRCULAR INTERPOLATION CW CIRCULAR INTERPOLATION CCW	NM	MCW X–Y–R–F–; ↵ MCC X–Y–I–J–F–T–; ↵	Executes circular travel at tangential velocity F for two axes simultaneously, following radius R or center-point coordinates I and J.
MCW MCC	HELICAL INTERPOLATION CW HELICAL INTERPOLATION CCW	NM	MCW X–Y–R–ZF–F–; ↵ MCC X–Y–I–J–Z– F–T–; ↵	Move three axes simultaneously in a combination of circular interpolation and linear interpolation outside of the circular interpolation plane. Speed designation F becomes the circular interpolation tangential velocity.
PXY PYZ PZX PXS PZS PYS	PLANE XY PLANE YZ PLANE ZX PLANE XS PLANE ZS PLANE YS	M1	MCW PXY X–Y–R– Z–F–; ↵ MCC PXY X–Y–I–J– ZF–F–; ↵	Designates the plane in which circular interpolation is to be executed. Also valid for designating circular interpolation plane in the helical interpolation command.
		M6	PST PXY X–Y–I– J–U–V–; ↵	Also used for designating the PALLET SET (PST) matrix plane for use in PALLET MOVE (PMV).
ZRN	HOME RETURN	NM	ZRN X–Y–Z–S–; ↵ Intermediate position	Returns each axis to its home position after positioning to the intermediate position. The first time after power-up, positioning will return directly to the home position without travelling to the intermediate position.
PMV	PALLET MOVE	NM	PMV P– C–; ↵ Grid point number Pallet number	Positions at rapid traverse speed to the position of the grid point number for the specified pallet number. The grid point data must be saved in advance by means of PALLET SET (PST).
PST	PALLET SET	M5	PST PXY P– X–Y– I–J– U–V–; ↵ Grid point pitch Number of grid points	Saves in memory, for the specified plane, the pallet number and its grid point data. This must be done before PALLET MOVE (PMV) is executed.

Command	Name	Class (see note)	Command Format	Function/Meaning
SKP	SKIP	NM	SKP X–Y–Z–S–F–T–; ↵	Skips the remaining movement and operation proceeds to the next block when the SKIP signal turns ON while the axes are travelling. The position at which the SKIP signal turned ON is saved.
ABS	ABSOLUTE PROGRAMMING MODE	M2	ABS; ↵	Treats all subsequent coordinate words as absolute values.
INC	INCREMENTAL PROGRAMMING MODE	M2	INC; ↵	Treats all incremental coordinate words as absolute values.
POS	CURRENT POSITION SET	NM	POS X–Y–Z–S–; ↵ Desired coordinate values	Changes the current position to the desired coordinate values. Subsequent move commands utilize the new coordinate system.
MVM	MOVE ON MACHINE COORDINATES	NM	MVM MVS X–Y–Z–S– F–; ↵	Moves the position along the machine coordinates. The machine coordinates refer to the coordinates that are automatically set when the home return is executed. These coordinates are not affected by the POS command.
TIM	DWELL TIME	NM	TIM P–; ↵	Pauses operation for the amount of time specified by P, and then proceeds to the next block.
STP	PROGRAM STOP	NM	STP; ↵	Stops the motion program until it is restarted by means of the start operation.
END	PROGRAM END	NM	END; ↵	Ends the motion program.
PFN	IN-POSITION CHECK	NM	MVS X–F– PFN; ↵ or PFN; ↵	Proceeds to the next block after the positioning in the same or previous block enters the positioning completion range (parameter setting).
INP	SECOND IN-POSITION RANGE SETTING	M3	INP X–Y–Z–S–; ↵ Second positioning completion range	Proceeds to the next block after subsequent interpolations enter the second positioning completion range.
SET	SET EXTERNAL OUTPUT	NM	SET M□□; ↵ M code (01 to 96)	Proceeds to the next block after the M code is output and the MFIN signal from the CPU Module is returned.
PNT	PASS NOTCH SIGNAL OUTPUT	M4	PNT X–Y–Z–S–M□□; ↵ Transit point for each axis MOV X–Y–Z–S–;	Outputs the specified M code (01 to 96) when the transit points for all axes have been passed during movement in subsequent blocks.
SNG	IGNORE SINGLE-BLOCK SIGNAL	NM	SNG MOV X–; ↵ SNG MVS Z–F–; ↵	A block with this command will be operated continuously even in the single-block operation mode.
IOW	I/O WAIT	NM	IOW (front output variable = O) (condition I/O variable = Δ) (back output variable C = □); ↵	After the front output variable "O" has been output, outputs the back output variable "□" when the condition I/O variable reaches the "Δ" state.
GSB	SUB-PROGRAM CALL	NM	GSB P□□ L□□; ↵	Executes the program number specified by P as a sub-program for the number of times specified by L.
RET	SUB-PROGRAM END	NM	RET; ↵	Designates the end of the sub-program.

Command	Name	Class (see note)	Command Format	Function/Meaning
PCN *	PCON SIGNAL OUTPUT	NM	PCN X–Y–Z–S–; ↵	Turns ON or OFF the PCON□ signal output for the specified axis.
VCC *	VOLTAGE OUTPUT	NM	VCC X–Y–Z–S–T–; ↵	Outputs the analog voltage as the output for the specified axis.
EXM *	EXTERNAL POSITIONING	NM	EXM X–I–U–Y–J–V–; ↵	When the external positioning signal turns ON, moves only the external positioning travel distance and is completed.
PGS *	RATIO OPERATION	NM	PGS X–I–Y–J–Z–K– MS□; ↵	Operates a slave axis for the travel distance that is calculated by multiplying the travel distance of the master axis by a ratio.
PGR *	RATIO OPERATION CANCEL	NM	PGR; ↵ or PGR X0 Y0; ↵	Cancels the ratio operations for all axes. Cancels the ratio operations for the specified axis or axes.
TSS *	TRAILING SYNCHRONOUS OPERATION	NM	TSS a–P– MS□; ↵ └ X, Y, Z or Z	After synchronizing the trailing axis with the master axis, switches to trailing synchronous mode.
TSR *	TRAILING SYNCHRONOUS OPERATION CANCEL	NM	TSR; ↵	Cancels the trailing synchronous operation.

*: New step-2 functions.

Command	Name	Command Format	Function/Meaning
	<Variables>		
#□□□	Common variable	#1 to #199	• Used for general purposes.
#I□□□	Input variable	#I1 to #I256	• Reads MC coil status.
#O□□□	Output variable	#O1 to #O256	• Outputs MC relay status.
#□□□□	System variable	#1001 to #1018	• Reads system variables such as current position and saved SKIP position.
#□□□□	Link input variable	#1101 to #1116	• Reads MC link register value.
#□□□□	Link output variable	#1201 to #1216	• Transmits values to MC link register.
H□	H variable	H1 to H8	• Used for positions and speeds.
=	<Arithmetic Commands>[1]	#i = 100, #j = #i	Numeric range: 0 to ±99,999,999 Integers only. Digits to the right of the decimal point are discarded. Calculations are carried out from left to right with no order of priority.
+	DEFINE ADD	#i = #j + #k	
–	SUBTRACT	#i = #j – #k	
*	MULTIPLY	#i = #j * #k	
/	DIVIDE	#i = #j / #k	
	COMBINE	#i = #j – #k / #m	

Command	Name	Command Format	Function/Meaning
	<Control Commands>		
IF GOTO	BRANCH	IF <condition> GOTO n; ↵	• When the condition is realized, the program jumps to block n.
WHILE DO DEND	REPEAT	WHILE <condition> DOm; ↵ • • • DEND m; ↵	• While the condition is in effect, the block from DO m to DEND m is repeated.
#E□□□	POINT TABLE POSITION	MOV –#E–; ↵ MOV X#E–Y#E–F–; ↵	A point table for storing the position data for the four axes is created. It is then possible to move to a given position by specifying a point number along with the motion command.

Table A.2 Commands Usable With Motion Commands

In the following table, M1 through M6 stand for modal groups 1 through 6, and NM stands for the non-modal group of commands.

Command	Name	Class	Command Overlap	Characters That Can Be Designated			
				N X Y Z S	R I J K L	XF YF ZF SF	F P C L M T
MOV	POSITIONING	NM	Yes	O O O O O			
MVS	LINEAR INTERPOLATION			O O O O O			O O
MCW	CIRCULAR INTERPOLATION CW			O O O O O	O O O O O		O O
MCC	CIRCULAR INTERPOLATION CCW			O O O O O	O O O O O		O O
MCW	HELICAL INTERPOLATION CW			O O O O O	O O O O O	O O O O	O O
MCC	HELICAL INTERPOLATION CCW			O O O O O	O O O O O	O O O O	O O
PXY PYZ PZX PXS PZS PYS	PLANE XY PLANE YZ PLANE ZX PLANE XS PLANE ZS PLANE YS	M1 M6	Yes	O O O O O O			
ZRN	HOME RETURN	NM	No	O O O O O			
PMV	PALLET MOVE	NM	No	O			O O
PST	PALLET SET	M5	Yes	O O O O O	O O O O	(U, V, W, T)	O
SKP	SKIP	NM	No	O O O O O			O O
ABS	ABSOLUTE PROGRAMMING MODE	M2	Yes	O			
INC	INCREMENTAL PROGRAMMING MODE			O			
POS	CURRENT POSITION SET	NM	No	O O O O O			
MVM	MOVE ON MACHINE COORDINATES	NM	Yes	O			
TIM	DWELL TIME	NM	No	O			O
STP	PROGRAM STOP	NM	No	O			
END	PROGRAM END	NM	No	O			
PFN	IN-POSITION CHECK	NM	Yes	O			
INP	SECOND IN-POSITION RANGE SETTING	M3	No	O			
SET	SET EXTERNAL OUTPUT	NM	Yes	O			O
PNT	PASS NOTCH SIGNAL OUTPUT	M4	Yes	O O O O O			O

Command	Name	Class	Command Overlap	Characters That Can Be Designated			
				N X Y Z S	R I J K L	XF YF ZF SF	F P C L M T
SNG	IGNORE SINGLE-BLOCK SIGNAL	NM	Yes	O			
IOW	I/O WAIT	NM	No	O			
GSB	SUB-PROGRAM CALL	NM	No	O			O O
RET	SUB-PROGRAM END	NM	No	O			
PCN	PCON SIGNAL OUTPUT	NM	No	O O O O O			
VCC	VOLTAGE OUTPUT	NM	No	O O O O O			O
EXM	EXTERNAL POSITIONING	NM	No	O O O O O	O O O O	(U, V, W, T)	
PGS	RATIO OPERATION	NM	No	O O O O O	O O O O	(MS□)	
PGR	RATIO OPERATION CANCEL	NM	No	O O O O O			
TSS	TRAILING SYNCHRONOUS OPERATION	NM	No	O O O O O		(MS□)	O
TSR	TRAILING SYNCHRONOUS OPERATION CANCEL	NM	No	O			

Note

1) Commands marked with "O (Yes)" in the "Command Overlap" column can be designated in the same block with other commands. Commands in the same group in this table (i.e., MOV to MCC, PXY to PYS, and ABS to INC) cannot be used together in the same block. For details, refer to *Table A.3 Commands Compatible Within the Same Block.*

2) A numeral (0 to 9), an H variable (H1 to H8) and a common variable (#1 to #199) can be added after the designated character.

Table A.3 Commands Compatible Within the Same Block

The following table shows which commands can be used together in the same block. An "O" indicates that the two commands can be used together and an "X" indicates that they cannot.

Command	Compatible Commands																																			
	MOV	MVS	MCW	MCC	PXY	PYZ	PZX	PXS	PYS	PZS	ZRN	PMV	PST	SKP	ABS	INC	POS	MVM	TIM	STP	END	PFN	INP	SET	PNT	SNG	IOW	GSB	RET	=+−*/	IF	GOTO	WHILE	DO	DEND
MOV	X	X	X	X	O	O	O	O	O	O	X	X	X	X	O	O	X	O	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
MVS	X	X	X	X	O	O	O	O	O	O	X	X	X	X	O	O	X	O	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
MCW	X	X	X	X	O	O	O	O	O	O	X	X	X	X	O	O	X	O	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
MCC	X	X	X	X	O	O	O	O	O	O	X	X	X	X	O	O	X	O	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
PXY	O	O	O	O	X	X	X	X	X	X	X	O	O	X	O	O	X	O	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
PYZ	O	O	O	O	X	X	X	X	X	X	X	O	O	X	O	O	X	O	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
PZX	O	O	O	O	X	X	X	X	X	X	X	O	O	X	O	O	X	O	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
PXS	O	O	O	O	X	X	X	X	X	X	X	O	O	X	O	O	X	O	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
PYS	O	O	O	O	X	X	X	X	X	X	X	O	O	X	O	O	X	O	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
PZS	O	O	O	O	X	X	X	X	X	X	X	O	O	X	O	O	X	O	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
ZRN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
PMV	X	X	X	X	O	O	O	O	O	O	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
PST	X	X	X	X	O	O	O	O	O	O	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
SKP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X

Command	Compatible Commands																																				
	MOV	MVS	MCW	MCC	PXY	PYZ	PZX	PXS	PYS	PZS	ZRN	PMV	PST	SKP	ABS	INC	POS	MVM	TIM	STP	END	PFN	INP	SET	PNT	SNG	IOW	GSB	RET	=+−*/	IF	GOTO	WHILE	DO	DEND
ABS	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	X	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
INC	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	X	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
POS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
MVM	O	O	O	O	O	O	O	O	O	O	X	X	X	X	O	O	X	X	X	X	X	O	X	X	O	O	X	X	X	X	X	X	X	X	X	X
TIM	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
STP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
END	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
PFN	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O	O	O	O	O	O	O	O	O	O	O	O
INP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
SET	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
PNT	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
SNG	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O	O	O	O	O	O	O	O
IOW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
GSB	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
RET	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
PCN*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
VCC*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
EXM*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
PGS*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
PGR*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	X
TSS*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	X
TSR*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
=, +, −, *, /	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X
IF	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	O	X	X	X	X
GOTO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	O	X	X	X	X	X
WHILE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	O	X	X
DO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	O	X	X	X
DEND	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X

*: New step-2 functions.

Note The circular and helical interpolation versions of MCW and MCC are compatible with the same commands.

Table A.4 CPU Module Motion Commands

Command	Name	Function/Meaning
MOD	MODE SET	Switches the MC20 Module operation mode.
SVN	SERVO ON	Turns the servomotor power ON and OFF.
MVL	PROGRAM RUN	Specifies the program and block numbers, and runs the program.
MVA, MVB, MVC, MVD	Independent Axis Operations	Normally operates independent axes A to D.
	Independent Axis Voltage Outputs (See note.)	Outputs the analog voltage (voltage output) from independent axes A to D.
	Independent Axis Ratio Operations (See note.)	Performs ratio operations with independent axes A to D as slave axes.
ZRN	HOME RETURN	Returns to home position in an incremental or absolute position detecting system.
JOG	JOG	Executes jogging.
STP	STEP	Executes stepping.
SMD	SINGLE BLOCK MODE	Switches to single block operation mode.
MLK	MACHINE LOCK MODE	Causes the controlled axes to be stationary but the current position data changes according to program running.
MRS	MODULE RESET	Resets MC20 Module to status directly after power-up.
RST	MACHINE RESET	Resets alarm and refreshes parameters to last set value. If axes are travelling, a deceleration stop is executed.
ESP	EMERGENCY STOP NOTIFICATION	Notifies the MC20 Module that the emergency stop button has been pressed.
ARS	ALARM RESET	Resets the MC20 Module alarm.
MON	MONITOR	Monitors all internal data, including alarms, parameters, and program numbers.
POS	COORDINATE SETTING	Changes current position data.
PRM	PARAMETER SETTING	Sets data for parameters.
VAR	H VARIABLE SETTING	Sets data for H1 to H8 variables.
PTBL	POINT TABLE SETTING	Sets data for point table.
ZST	HOME POSITION SETTING	Sets the home position for the absolute position detecting system.

Note New step-2 functions

Table A.5 Operation Modes and Applicable Commands

Command			Operation Mode			
Symbol		Name	Manual	Automatic	Online Edit	Edit
MOD		MODE SET	○	○	○	○
SVN		SERVO ON	○	○	○	○
MVL		PROGRAM RUN	X	○	X	X
MVA, MVB, MVC, MVD		Independent Axis Operations	○	○	○	○
		Independent Axis Voltage Outputs (See note.)	○	○	○	○
		Independent Axis Ratio Operations (See note.)	○	○	○	○
Program run axes	ZRN	HOME RETURN	○	X	X	X
	JOG	JOG	○	X	○	X
	STP	STEP	○	X	○	X
Independent axes	ZRN	HOME RETURN	○	○	○	○
	JOG	JOG	○	○	○	○
	STP	STEP	○	○	○	○
SMD		SINGLE BLOCK MODE	○	○	○	○
MLK		MACHINE LOCK MODE	○	○	○	○
MRS		MODULE RESET	○	○	○	○
RST		MACHINE RESET	○	○	○	○
ESP		EMERGENCY STOP NOTIFICATION	○	○	○	○
ARS		ALARM RESET	○	○	○	○
MON		MONITOR	○	○	○	○
POS		COORDINATE SETTING	○	○	○	○
PRM		PARAMETER SETTING	○	○	○	○
VAR		H VARIABLE SETTING	○	○	○	○
PTBL		POINT TABLE SETTING	○	○	○	○
ZST		HOME POSITION SETTING	○	○	○	○

Note New step-2 functions

○: Commands that can be executed in that mode.
X : Commands that cannot be executed in that mode.

Table A.6 Commands that Can be Executed Simultaneously

Command in Progress		Command Executed Simultaneously																						
Symbol	Name	MOD	SVN	MVL	MVA	MVB	MVC	MVD	ZRN	JOG	STP	SMD	MLK	MRS	RST	ESP	ARS	MON	POS	PRM	VAR	PTBL	ZST
MOD	MODE SET	X	○	X	○	○	○	○	X	X	X	○	○	○	○	○	○	○	○	○	○	○	○
SVN	SERVO ON	○	Δ	X	X	X	X	X	X	X	X	○	○	○	○	○	○	○	X	○	○	○	X
MVL	PROGRAM RUN	○	○	X	Δ	Δ	Δ	Δ	X	X	X	○	○	○	○	○	○	○	Δ	X	X	X	X
MVA, MVB, MVC, MVD	Independent Axis Operations	○	○	○	X	○	○	○	Δ	Δ	Δ	○	○	○	○	○	○	○	Δ	X	○	X	X
	Independent Axis Voltage Outputs (See note.)	○	○	○	○	X	○	○	Δ	Δ	Δ	○	○	○	○	○	○	○	Δ	X	○	X	X
	Independent Axis Ratio Operations (See note.)	○	○	○	○	○	X	○	Δ	Δ	Δ	○	○	○	○	○	○	○	Δ	X	○	X	X
ZRN	HOME RETURN	○	○	X	Δ	Δ	Δ	Δ	Δ	Δ	Δ	○	○	○	○	○	○	○	Δ	X	○	○	X
JOG	JOG	○	○	X	Δ	Δ	Δ	Δ	Δ	Δ	Δ	○	○	○	○	○	○	○	Δ	X	○	○	X
STP	STEP	○	○	X	Δ	Δ	Δ	Δ	Δ	Δ	Δ	○	○	○	○	○	○	○	Δ	X	○	○	X
SMD	SINGLE BLOCK MODE	○	○	○	○	○	○	○	○	○	○	X	○	○	○	○	○	○	○	○	○	○	○
MLK	MACHINE LOCK MODE	○	○	○	○	○	○	○	○	○	○	○	X	○	○	○	○	○	○	○	○	○	X
MRS	MODULE RESET	X	X	X	X	X	X	X	X	X	X	X	○	○	X	X	X	X	X	X	X	X	X
RST	MACHINE RESET	○	X	X	X	X	X	X	X	X	X	X	○	X	X	○	○	○	○	X	○	○	X
ESP	EMERGENCY STOP NOTIFICATION	○	X	X	X	X	X	X	X	X	X	○	○	○	○	X	○	○	X	○	○	○	X
ARS	ALARM RESET	○	○	X	X	X	X	X	X	X	X	○	○	○	○	○	X	○	○	○	○	○	X
MON	MONITOR	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	X	○	○	○	○	○
POS	COORDINATE SETTING	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	X	X	X	X	X
PRM	PARAMETER SETTING	○	○	X	X	X	X	X	X	X	X	○	○	○	○	○	○	○	X	X	X	X	X
VAR	H VARIABLE SETTING	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	X	X	X	X	○
PTBL	POINT TABLE SETTING	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	X	X	X	X	○
ZST	HOME POSITION SETTING	○	X	X	X	X	X	X	X	X	X	○	X	X	X	X	X	○	X	X	○	○	Δ

Note New step-2 functions

○: Commands that can be executed simultaneously.
Δ : Commands that can be executed simultaneously if a different axis is specified.
X : Commands that cannot be executed simultaneously.

Appendix B

Parameters

- Constants that are specifically required for the operations of the MC 20 Module are called parameters. Set these parameters to optimum values depending on the machine specifications or capacities of the servo drivers to be used.

There are 4 types of parameters, shown in the following table.

Type	Meaning
A	Parameters that must be set for standard usage.
B	Parameters set when required.
C	Parameters normally left unchanged.
D	Parameters not set by the user. (Do not change the factory settings.)

- The "default values" are the parameter settings made at the factory.

All new parameters do not become effective immediately after they are rewritten using the Programming Device or the Teach Pendant. They become effective according to the timing specified in the "Effective timing" column as shown in the following table.

1) Reset
New parameter settings for these parameters are effective after the MACHINE RESET (RST) has been executed.

2) Power-up
New parameter settings for these parameters (and all other parameters) are effective after the power is turned ON or the MODULE RESET (MRS) is executed.

- If the parameter is rewritten using the PARAMETER SETTING (PRM) command of the ladder motion commands, the rewritten parameter becomes effective after the MACHINE RESET (RST) command is executed.

B.1 Parameters

Table B.1 Common Parameters (Controlled Axes)

No.	Name	Setting Range	Units	Related Parameters	Read/Write (See note 1)		Effective Timing (See note 2)	Default Value	Type
					Ladder	Teach Pendant			
P0000	Not used	---	---	---	---	---	---	---	---
P0001	Axis-1 name specification	Axis X: b0 = 1 Axis Y: b1 = 1 Axis Z: b2 = 1 Axis S: b3 = 1 Axis A: b4 = 1 Axis B: b5 = 1 Axis C: b6 = 1 Axis D: b7 = 1	Set axis X, Y, Z, S, A, B, C, or D in the Programming Device Set. Set "–" if the axis is not used.		× (No)	×	Power-up	X	C
P0002	Axis-2 name specification				×	×	Power-up	Y	C
P0003	Axis-3 name specification				×	×	Power-up	Z	C
P0004	Axis-4 name specification				×	×	Power-up	S	C
P0005	Decimal point position	1 to 3			×	×	Reset	3	B
P0006	Max. interpolation feed speed setting	1 to 240,000	mm/min (deg/min)		○ (Yes)	○	Reset	24,000	A
P0007	Time constant of linear A/D for interpolation (1) (See note 3)	1 to 10,000	ms		○	○	Reset	100	A
P0008	Time constant of linear A/D for interpolation (2) (See note 3)	1 to 10,000	ms		○	○	Reset	100	B
P0009	Linear A/D constant switch speed for interpolation	0 to 240,000	mm/min (deg/min)		○	○	Reset	24,000	B
P0010	Deceleration constant of the asymmetric A/D for interpolation	1 to 10,000	ms		○	○	Reset	100	B
P0011	Time constant of the exponential A/D for interpolation	2 to 1,000	ms		○	○	Reset	100	B
P0012	Bias speed of the exponential A/D for interpolation	0 to 240,000	mm/min (deg/min)		○	○	Reset	0	B
P0013	Time constant of moving average A/D for interpolation	2 to 1,000	ms		○	○	Reset	100	B
P0014	A/D setting for interpolation	0: None 1: Single-step linear A/D 2: Double-step linear A/D 3: Asymmetric A/D			○	○	Reset	1	B

No.	Name	Setting Range	Units	Related Parameters	Read/Write (See note 1) Ladder	Read/Write (See note 1) Teach Pendant	Effective Timing (See note 2)	Default Value	Type
P0015	Filter selection for interpolation	0: None 1: Exponential A/D 2: Exponential A/D 3: Moving average A/D 4: S-curve A/D			○	○	Reset	0	B
P0016	Override enabled/ disabled bn = 0: Disabled bn = 1: Enabled	Overrides Using MC Control Coils: 16 Steps		202	○	○	Reset	0	B
		b0: Axis 1 b1: Axis 2 b2: Axis 3 b3: Axis 4	For independent axis and manual operation						
		b8: Rapid traverse b9: Interpolation feed	For program run						
	Ver. B08	Overrides Using MC Link Registers: 0.1% Increments							
		b11: Axis 1 b12: Axis 2 b13: Axis 3 b14: Axis 4	For independent axis and manual operation						
		b15: Rapid traverse b16: Interpolation feed	For program run						
P0017	Function selections 4 bn=0: Disabled bn=1: Enabled	b0: Manual operation simultaneous outputs b1: Axis alarm disable b2: Servo OFF disable			×	×	Power-up	0	B

Note 1) "○ (Yes)" in the "Read/Write" column indicates the parameter can be changed from the ladder logic program (Ladder or Teach Pendant).

2) Effective Timing:

Item	Meaning
Power-up	The parameters rewritten with the Programming Device or Teach Pendant are valid when the MC20 Module is turned OFF and ON or MODULE RESET (MRS) is executed.
Reset	The parameters rewritten with the Programming Device or Teach Pendant are valid in the following cases. • When MACHINE RESET (RST) is executed. • When MODULE RESET (MRS) is executed. • When the MC20 is turned OFF and ON.

3) "A/D" stands for acceleration/deceleration.

Table B.2 Axis Parameters (Positioning)

No.	Name	Setting Range	Units	Related Parameters	Read/Write		Effective Timing	Default Value	Type
					Ladder	Teach Pendant			
PA101	Position loop gain (Kp)	0 to 200	s^{-1}		○ (Yes)	○	Reset	30	A
PA102	Feed-forward gain	0 to 200	%		○	○	Reset	0	A
PA103	Positioning completion range	0 to 10,000	Command resolution	104	○	○	Reset	10	A
PA104	Positioning completion check time	0 to 100,000	ms	103	○	○	Reset	100,000	A
PA105	Following error margin	0 to 200	%	101	○	○	Reset	200	A

Note 1) "A" in the parameter number stands for the axis number (1 through 4).

2) "○ (Yes)" in the Read/Write column indicates the parameter can be changed from the ladder logic program (Ladder or Teach Pendant).

Table B.3 Axis Parameters (Speed, Acceleration)

No.	Name	Setting Range	Units	Related Parameters	Read/Write		Effective Timing	Default Value	Type
					Ladder	Teach Pendant			
PA201	Maximum feed speed	1 to 240,000	mm/min (deg/min)		○ (Yes)	○	Reset	24,000	A
PA202	Rapid traverse speed	1 to 240,000	mm/min (deg/min)	201, 204, 205, 206	○	○	Reset	24,000	A
PA203	Not used							0	
PA204	Linear A/D constant (1)	1 to 10,000	ms	201	○	○	Reset	100	A
PA205	Linear A/D constant (2)	1 to 10,000	ms	201, 202, 204, 206	○	○	Reset	100	B
PA206	Linear A/D constant switching speed	0 to 240,000	mm/min (deg/min)	201, 202, 204, 205	○	○	Reset	24,000	B
PA207	Deceleration constant for asymmetric A/D	1 to 10,000	ms	201, 213 to 216	○	○	Reset	100	B
PA208	Not used							0	
PA209	Time constant for exponential A/D	2 to 1,000	ms	210, 217	○	○	Reset	100	B
PA210	Bias speed for exponential A/D	0 to 240,000	mm/min (deg/min)	209, 217	○	○	Reset	0	B
PA211	Time constant for moving average A/D	2 to 1,000	ms	217	○	○	Reset	100	B
PA212	Not used								
PA213	A/D type for positioning (MOV/STEP)	0: None 1: Single-step linear A/D 2: Double-step linear A/D 3: Asymmetric A/D		204 to 207	○	○	Reset	1	B
PA214	A/D type for JOG operation (JOG)				○	○	Reset	1	B
PA215	A/D type for independent axis operation (MVA to MVD)				○	○	Reset	1	B
PA216	A/D type for HOME RETURN (ZRN)	Always single-step linear A/D (See note)			---	---	---	---	---
PA217	Filter selection (common filter for PA213 to PA216)	0: None 1: Exponential A/D 2: Exponential A/D with bias 3: Moving average A/D 4: S-curve A/D		209, 210, 211	○	○	Reset	0	B

Note 1) "A" in the parameter number stands for the axis number (1 through 4).

2) The term "A/D" stands for acceleration/deceleration.

3) "○ (Yes)" in the "Read/Write" column indicates that the parameter can be changed from the ladder logic program (Ladder or Teach Pendant).

Table B.4 Axis Parameters (Home Return)

No.	Name	Setting Range	Units	Related Parameters	Read/Write		Effective Timing	Default Value	Type
					Ladder	Teach Pendant			
PA301	Home return mode	0 : DEC+C 1: ZERO 2: DEC+ZERO 3: C		302 to 308	× (No)	×	Power-up	0	B
PA302	Home return direction	0: Positive 1: Negative			×	×	Power-up	0	B
PA303	Home position returning feed speed	1 to 240,000	mm/min (deg/min)		○ (Yes)	○	Reset	10,000	B
PA304	Home position returning approach speed	1 to 240,000	mm/min (deg/min)		○	○	Reset	1,000	B
PA305	Home position returning creep speed	1 to 240,000	mm/min (deg/min)		○	○	Reset	500	B
PA306	Home position returning final travelling distance	0 to 99,999,999	Command resolution		○	○	Reset	0	B
PA307	Home position output width	0 to 32,767	Pulse		○	○	Reset	100	B
PA308	Home position pulse polarity selection	0, 1	0: Positive transition 1: Negative transition		×	×	Power-up	0	C
PA309	Not used	—	—	—	—	—	—	—	—
PA310	Deceleration limit switch inversion	0: Disabled 1: Enabled			×	×	Power-up	0	C

Note 1) "A" in the parameter number stands for the axis number (1 through 4).

2) "○ (Yes)" in the "Read/Write" column indicates the parameter can be changed from the ladder logic program (Ladder or Teach Pendant).

Table B.5 Axis Parameters (Absolute Detecting System)

No.	Name	Setting Range	Units	Related Parameters	Read/Write		Effective Timing	Default Value	Type
					Ladder	Teach Pendant			
PA401	Absolute encoder allowable error	0 to 1,000,000	Pulse	402	× (No)	×	Power-up	40,960	A
PA402	Absolute detecting system selection	• Meaning: Encoder / Detecting System 0: Incremental / Incremental 2: Absolute / Incremental 3: Absolute / Absolute • Setting method: Bit b0 = System: 0: Incremental 1: Absolute b1 = Encoder: 0: Incremental 1: Absolute		401, 403, 404	×	×	Power-up	0	C
PA403	Reference offset 1 at home position setting (Home position shift distance)	0 to +99,999,999	Command resolution	404, 402	×	×	Power-up	0	B
PA404	Reference offset 2 at home position setting (home position shift adjustment)	0 to ±99,999,999	Command resolution	403, 402	×	×	Power-up	0	B
PA405	Servopack type	1 : Σ-II type (SGDM-□□ or SGDH-□□) 0 : Other types			×	×	Power-up	0	C

Note 1) "A" in the parameter number stands for the axis number (1 through 4).

2) These parameters can not be changed from the ladder logic program (Ladder or Teach Pendant).

Table B.6 Axis Parameters (Machine System and Peripheral Equipment)

No.	Name	Setting Range	Units	Related Parameters	Read/Write		Effective Timing	Default Value	Type
					Ladder	Teach Pendant			
PA501	Number of encoder pulses	1 to 32,768	Pulse	502	× (No)	×	Power-up	2,048	C
PA502	Encoder pulse signal selection	1: AB phase x 1 2: AB phase x 2 4: AB phase x 4		501	×	×	Power-up	4	B
PA503	One machine rotation/command resolution	1 to 1,500,000	Command resolution		×	×	Power-up	10,000	A

No.	Name	Setting Range	Units	Related Parameters	Read/Write		Effective Timing	Default Value	Type
					Ladder	Teach Pendant			
PA504	Gear ratio (motor rev.)	1 to 10,000,000	Revolution		×	×	Power-up	1	A
PA505	Gear ratio (load rev.)	1 to 10,000,000	Revolution		×	×	Power-up	1	A
PA506	Mode settings:				×	×	Power-up		
	b0: Motor revolution direction	0: Forward, 1: Reverse		---				0	B
	b1: Finite/Infinite length	0: Finite length, 1: Infinite length		510-b0				0	B
	b2: Linear/Rotary axis	0: Linear axis, 1: Rotary axis		---				0	C
		0: Servo, 1: Voltage output							
	b3: Axis type	0: Do not use, 1: Use		506-b4				0	C
	b4: Counter			506-b3				0	B
PA507	Backlash compensation	0 to 32,767	Pulse	510-b1	○	○	Reset	0	B
PA508	Stored stroke limit (+)	–99,999,999 to +99,999,999	Command resolution	510-b0	○	○	Reset	+99,999,999	B
PA509	Stored stroke limit (–)	–99,999,999 to +99,999,999	Command resolution	510-b0	○	○	Reset	–99,999,999	B
PA510	Function selection 2:				×	×	Power-up		
	b0: Stored stroke limit usage	0: Disabled 1: Enabled		508, 509				0	B
	b1: Backlash offset usage	0: Disabled 1: Enabled		507				0	B
PA511	Servomotor rated revolution	100 to 4,500	r/min		×	×	Reset	3,000	B
PA512	Speed command D/A output	1 to 10	V		×	×	Reset	6	B
PA513	Servomotor maximum revolution	0 to 10,000	r/min		×	×	Reset	4,000	B
PA514	Constant of automatic 0 tune	1,000 to 9,999	ms					1,000	D

Note 1) "A" in the parameter number stands for the axis number (1 through 4).

2) "○ (Yes)" in the "Read/Write" column indicates the parameter can be changed from the ladder logic program (Ladder or Teach Pendant).

Table B.7 Axis Parameters (Servo External I/O)

No.	Name	Setting Range	Units	Related Parameters	Read/Write		Effective Timing	Default Value	Type
					Ladder	Teach Pendant			
PA601	Function selection 3: b0: Overtravel input signal (OT) b1: Brake control output signal (BRK)	 0: Disabled 1: Enabled 0: Disabled 1: Enabled		 602, 603	× (No)	×	Power-up	 1 0	 B B
PA602	Brake time (Tb) (= servo OFF)	8 to 1,000	ms	601-b2 603	○	○	Reset	8	B
PA603	Brake ON motor speed	1 to 10,000	r/min	601-b2 602	○	○	Reset	1	B

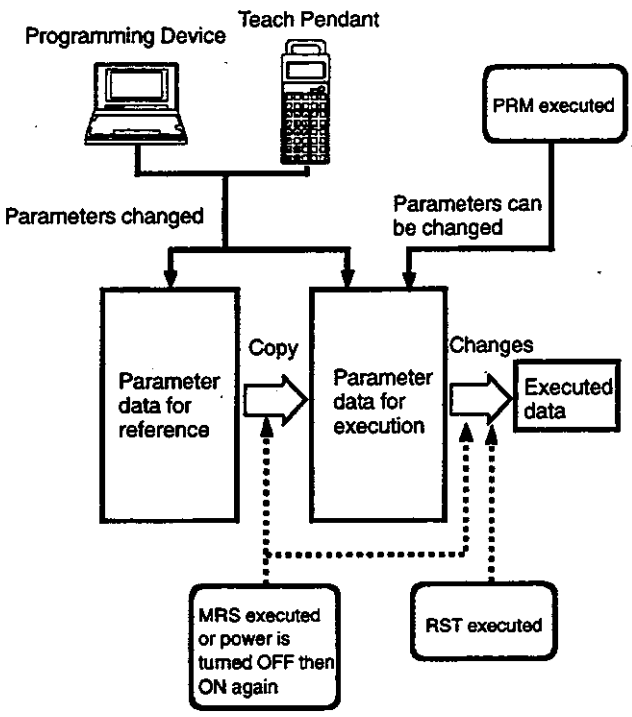
Note 1) "A" in the parameter number stands for the axis number (1 through 4).

2) "○ (Yes)" in the "Read/Write" column indicates the parameter can be changed from the ladder logic program (Ladder or Teach Pendant).

Changing Parameters

1) Changes to parameters may not be effective, even when the parameters have been overwritten. For details refer to the following diagram, and be sure to rewrite parameters correctly.

2) The following diagram illustrates how parameters can be changed by either using the Teach Pendant or a Programming Device, or by using the PARAMETER SETTING (PRM) command.



- PRM: PARAMETER SETTING (PRM) command
- MRS: MODULE RESET (MRS) command
- RST: MACHINE RESET (RST) command

Refer to *2.3 CPU Module* and *2.4 Peripheral Equipment* for more details.

3) When using a Teach Pendant or Programming Device to change the parameters, both the parameter data for reference and the parameter data for execution must be changed.

When MODULE RESET (MRS) is then executed, the data for execution will be created from the parameter data for execution, into which the parameter data for reference has been copied. At this point, the changes to parameters will become valid.

If MACHINE RESET (RST) is executed after parameters have been changed using a Teach Pendant or Programming Device, the changed parameters will become valid. The valid timing column is restricted however, to the reset parameters.

4) When PARAMETER SETTING (PRM) is executed, only the parameter data for execution will be changed. When MACHINE RESET (RST) is executed after that, data for execution will be created from the parameter data for execution. At this point, the parameters changed using PARAMETER SETTING (PRM) will become valid.

Note If MODULE RESET (MRS) is executed after PARAMETER SETTING (PRM) has been executed, or the power is turned OFF then ON again, those parameters that were changed using PARAMETER SETTING (PRM) will be cancelled and the parameters previously set using the Teach Pendant or Programming Device will become valid.

Appendix C

Alarm Displays

The tables in this appendix show the alarm displays and their likely causes and remedies. Messages will not be displayed on a Teach Pendant, as shown in the following table.

Device	Alarm Code Display	Message Display
Programming Device	Yes	Yes
Teach Pendant	Yes	No

C.1 Alarm Displays

Table C.1 Common Alarms

The error ranks are divided as follows.

A: Servo OFF
B: Decelerating to stop
C: Program operation stopped

Code	Message	Likely Cause(s)	Remedy	Rank
001	Program capacity exceeded	There isn't enough area for the program.	Delete unneeded programs.	C
002	1-block character exceeded	The number of characters in 1 block has exceeded 128. There isn't a ";" within 1 block.	Correct the program. (Reduce the number of characters.)	C
003	No program number	Can't find the specified program.	Load the program or correct it.	C
004	Address error	There isn't any data after the symbol. There isn't a symbol before the data. The address designation is improper.	Correct the program.	C
005	Numerical value designation error	A minus sign, zero, or decimal point has been used incorrectly. The decimal point placement is incorrect.	Correct the program. Check the decimal point position parameter. (P0005)	C
006	Character error	There is an unusable character in a significant information area.	Correct the program.	C
007	Data digit number error	The input data digits are incorrect.	Correct the program. (Data digit number)	C
008	Command error	An unusable command has been used.	Correct the program.	C
009	Multi-command error	Commands that can't be executed at the same time have been executed in 1 block.	Correct the program.	C
010	F designation undefined	There isn't an interpolation feed speed: F designation during interpolation operation.	Correct the program.	C
011	No radius designation for circular interpolation	The radius has been set to "0" in a circular interpolation command.	Correct the program. (Either R or I and J)	C
012	Not used.	---	---	---
013	Not used.	---	---	---
014	Pass notch signal output command error	A position greater than the maximum programmable value was designated with an "infinite length" axis.	Check the function setting parameters. Correct the program.	C
015	Not used.	---	---	---
016	Plane designation error	The interpolation plane designation is missing or incorrect. The plane designation is missing or incorrect in a PST command.	Correct the program.	C
017	H variable error	A designated value in H1 through H8 is incorrect.	Correct the program.	C
018	No sub-program number	P□□ isn't specified in the GSB command's block.	Correct the program.	C
019	Not used.	---	---	---
020	Not used.	---	---	---

Code	Message	Likely Cause(s)	Remedy	Rank
021	Sub-program nesting error	Five or more levels were nested in a sub-program.	Correct the program so that there are 4 or less nesting levels.	C
022	Program end error	There isn't an END command at the end of the program. There isn't a RET command at the end of a sub-program.	Add an END command at the end of the program. Add a RET command at the end of the sub-program.	C
023	Not used.	---	---	---
024	Axis undefined	The axis you want to use isn't valid. The servo isn't ON for the axis you want to use.	Correct the program. Check the system setting parameters. Check the servo ON circuit. Check the servo alarm.	C
025	Zero division	A division by zero was performed.	Correct the program. Check related parameters.	C
026	Arithmetic overflow	An overflow occurred in an arithmetic.	Correct the program. Check related parameters.	C
027	Branch command error	There isn't a destination in a branch command.	Correct the program.	C
028	Repeat command error	There isn't an end command (DEND) for the repeat command. The repeatable range is duplicated. There are more than 3 repeatable nesting levels. The repeat number designation is incorrect.	Correct the program.	C
029	Matrix setting command error	The set value of the matrix setting command is outside the proper range. The grid point setting is outside the proper range.	Correct the program.	C
030	Point table setting error	The point table setting is outside the proper range.	Correct the program.	C
031	Not used.	---	---	---
032	Not used.	---	---	---
033	M code designation error	The M code designation is incorrect.	Correct the program.	C
034	Operation block "=" error	The location of the "=" in an arithmetic expression is incorrect.	Correct the program.	C
035	Variable designation error	A common, input, H, or point table variable designation is incorrect.	Correct the program.	C
036	Operator designation error	An operator designation in an arithmetic expression is incorrect.	Correct the program.	C
037	Waiting for input signal command error	The specification of a waiting for input signal command (IOW) is incorrect.	Correct the program.	C
038	Comparison operator designation error	The comparison operator designation in a conditional expression is incorrect.	Correct the program.	C
039	F designation value exceeded	The command value of the interpolation feed speed: F designation exceeds the maximum.	Correct the program.	C
040	Number of terms in expression exceeded	There are more than 11 terms in the expression.	Correct the program.	C
041	Axis duplicated designation	A moving axis has been designated to move with another command.	Correct the program.	C

Code	Message	Likely Cause(s)	Remedy	Rank
042	ABSO designation range exceeded	An axis with infinite length designation has been designated to move to a position exceeding the allowable range with the MC20 Module in absolute mode.	Correct the program.	C
043	Not used.	---	---	---
044	Zero signal duplication command	Another axis returned to home position using HOME RETURN while EXTERNAL POSITIONING (EXM) or TRAILING SYNCHRONOUS OPERATION were being executed.	Correct the program	B
045 to 078	Not used.	---	---	---
079	Parameter destruction	The backup battery has been removed. There is an error in the power system. There is a problem with the MC20 Module.	Check the CPU Module's battery. Check the power system. Set the parameters and program again. Contact your Yaskawa representative if the problem recurs.	A
080	Axis name duplicated designation	An axis name has been duplicated.	Correct the parameters.	A
081	Emergency stop	Emergency stop	Clear the emergency stop. Check the emergency stop input.	A
082	Illegal parameter	There is a problem with the group of parameters that have been set. For example, the parameter combination might be incorrect.	Set the parameters again.	A
083	Not used.	---	---	---
084	E^2PROM error	There is an error in the gain adjustment or zero adjustment written in EEPROM.	Contact your Yaskawa representative.	A
085 to 090	Not used.	---	---	---

Table C.2 Individual Axis Alarms

Code	Message	Likely Cause(s)	Remedy	Rank
A01	Servo Amp abnormal	Servo Amp error.	Check for Servo Amp errors. Contact your Yaskawa representative if the problem recurs even after the Servo Amp is reset.	A
A02	Overtravel (+)	The overtravel (+) signal went ON. Operating error or program error. Parameter setting error.	Check the overtravel limit switch, bring it back in the opposite direction after resetting. Check parameters related to overtravel alarm detection. Check the overtravel input signal.	B
A03	Overtravel (–)	The overtravel (–) signal went ON. Operating error or program error Parameter setting error.		
A04	Excessively following error	The following error of the servo system is too large.	Check connections between the MC20 Module, Servo Amps, and motor. Check the settings of the system setting parameters and parameters related to the servo. Check other factors such as the mechanical load.	A

Code	Message	Likely Cause(s)	Remedy	Rank
A05	Stored stroke limit (+)	An attempt was made to move beyond the possible movement range of the stored stroke limit.	After checking the program and operation, reset and bring it back in the opposite direction.	B
A06	Stored stroke limit (–)	Operating error or program error. Parameter setting error.	Check parameters related to the stored stroke limit.	
A07	Positioning error	Positioning can't be performed correctly. (Without an axis move command, an error greater than PA103 settings continued for a period longer than the PA104 settings.)	Check parameters related to the servo. Check connections between the Servo Amps and motors. Check other factors such as the mechanical load.	A
A08	Servo ON/OFF time-out	Servo Amp error. MC20 Module faulty.	Check for Servo Amp errors. Contact your Yaskawa representative if the problem recurs even after the Servo Amp is reset.	A
A09	Servo power OFF	Movement of the controlled axis was ordered but the servo power wasn't ON.	Reset the alarm and then turn ON the servo power.	A
A10	Encoder disconnected	Encoder's wiring faulty or disconnected. Encoder or Servo Amp faulty. MC20 Module faulty.	Check the encoder's wiring. Contact your Yaskawa representative.	A
A11	Speed cannot be followed	The rapid transverse speed (PA201) for the master axis has exceeded the maximum feed speed (PA201) of the follow-up axis during TRAILING SYNCHRONOUS OPERATION. The rapid transverse speed (PA201) for the master axis has exceeded the maximum feed speed (PA201) of the slave axis during ratio operation. The slave axis has exceeded the maximum feed speed (PA201) during ratio operation.	Reduce the rapid transverse speed (PA201) of the master axis. Reduce the rapid transverse speed (PA201) of the master axis. Reduce the ratio.	B
A12	Absolute detecting system axis move error	In the system that absolute encoder is used; The axis travelled while power was OFF. Parameter setting error. Absolute encoder error.	Reset after checking the mechanical position and display position. Check the system setting parameters. Check the absolute encoder's wiring. Initialize the absolute encoder.	A
A13	Not used	---	---	---
A14	Absolute encoder alarm	In the system that absolute encoder is used; Absolute encoder alarm.	Check the alarm information with the Servopack's Digital Operator. Initialize the absolute encoder.	A
A15	Absolute encoder communication error	In the system that absolute encoder is used; Absolute encoder communication error.	Check the wiring between the MC20 Module and Servo Amp. Check the "SEN" signal. Check the 24 VDC power.	A
A16	Home position setting incomplete	In the system that absolute encoder is used; The "home position setting" hasn't been made.	Perform the "home position setting" operation.	B

Code	Message	Likely Cause(s)	Remedy	Rank
A17	Home position set during travelling	In the system that absolute encoder is used; Positioning wasn't completed when the home position was set. The home position was set while the axis was moving.	Check the positioning completion range parameter. Perform the "home position setting" operation after movement is completed.	B
A18	Absolute encoder battery alarm	In the system that absolute encoder is used; Battery alarm from absolute encoder.	Check the connection to the BAT connector on the MC20 Module. Check the wiring between the MC Module and the servo amp and between the servo amp and the motor. Perform the following if the battery voltage is low. 1) Replace the battery with a new one. 2) Initialize the absolute encoder. Refer to *6.2.3 Initialization of Absolute Value Encoder* 3) Set the home position. Refer to *6.3 Home Position Setting.*	A
A19	Not used.	---	---	---
A20	Not used.	---	---	---

Note "A" in the code stands for the axis number (1 through 4).

Appendix D

Battery Module

The Battery Module is connected to MEMOCON GL120, GL130 Motion Modules (MC20 or MC10) to supply backup power to the absolute encoders. Backup power is provided by the large-capacity capacitor and lithium battery built into the Battery Module. A battery voltage drop detection function also detects voltage drops for the lithium battery and provides warnings of the need to replace the battery both on the front panel indicators and external outputs.

D.1 Battery Module Appearance

The appearance of the Battery Module and the names of components are shown in the following illustration. The model number is JRMSP-120XCP96000.

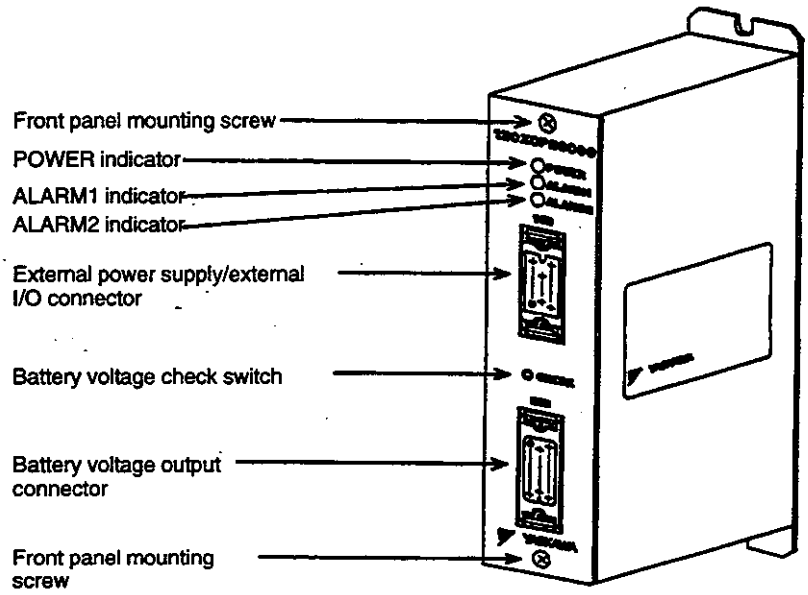


Figure D.1 Battery Module Appearance

D.2 General Specifications

The general specifications of the Battery Module are provided in the following table.

Table D.1 General Specifications of Battery Module

Item		Specification
Environmental Conditions	Ambient Operating Temperature	0 to 60 °C
	Storage Temperature	–25 to 70 °C
	Operating Humidity	30% to 95% (with no condensation)
	Storage Humidity	5% to 95% (with no condensation)
	Pollution Level	Pollution level 1 according to JIS B 3501
	Corrosive Gas	No corrosive gas
	Operating Altitude	Less than 2,000 m above sea level
Mechanical Operating Conditions	Vibration Resistance	10 to 57 Hz with half-amplitude of 0.075 mm 57 to 150 Hz with fixed acceleration of 9.8 m/s^2 10 sweep times each for 8 min in X, Y, and Z directions (according to JIS B 3502)
	Shock Resistance	Peak acceleration of 147 m/s^2 twice for 11 ms in X, Y, and Z directions (according to JIS B 3502)
Installation Requirements	Configuration	Wall-mounted
	Cooling Method	Natural cooling
	Mass	Approximately 500 g
	External Dimensions	35 x 160 x 73 mm (W x H x D)

D.3 Battery Module Specifications

The specifications of the Battery Module are provided in the following table.

Table D.2 Battery Module Specifications

Item	Specification		
Name	Absolute Encoder Battery Module		
Module Number	JRMSP-120XCP96000		
Number of Axes Supplied Power	8 axes max.		
Indicators	POWER: Lit when 24 VDC is supplied to 1CN. Not lit when the battery voltage check is being performed. ALARM1: Lit when battery voltage is 3.3 V or less. ALARM2: Lit when battery voltage is 3.0 V or less.		
Battery Specifications	Model: ER6VC3N (Yaskawa specifications: with connector) Voltage: 3.6 V Current capacity: 2,000 mAh		
Allowable Days between Voltage Drop Detection and Battery Replacement	Replace within 14 days after ALARM1 indicator lights (battery voltage of 3.3 V or less) The above specification assumes that all 8 axes are connected, that no power is being supplied to the Motion Module or servo amps, and that the motors are not turned by any force, external or otherwise.		
External Input Signals	Signal form: 24 VDC, sourcing input (or sinking input) Input current: 5 mA OFF current: 1 mA max. Input conditions: ON voltage: (Power supply voltage – 9 V) or more (9 V or more for sinking inputs) OFF voltage:(Power supply voltage – 5 V) or less Input impedance: 4.7 kΩ		
	Signal Name	CHK	Battery voltage check command. Battery voltage is rechecked when signal turns ON.
External Output Signals	Signal form: 24 VDC, sinking outputs (open-collector) Load current: 50 mA; OFF current: 1mA max. Load voltage: 20.4 to 28.8 VDC 35 VDC (peak) ON voltage: 1.5 V, 50 mA		
	Signal Name	ALM1	Alarm 1; OFF when battery voltage is 3.3 V or less
		ALM2	Alarm 2; OFF when battery voltage is 3.0 V or less
		PON	Power ON; ON when 24 VDC is supplied to 1CN. (OFF when the battery voltage check is being performed.)
Signal Delays	Between power supply and ALM1/ALM2 output: 100 ms max. Between CHK signal input and ALM1/ALM2 output: 10 ms max.		
Protective Circuits	Battery charge-prevention diode		
Power Supply Voltage	20.4 to 28.8 VDC (supplied from external source)		
Power Supply Current Consumption	0.2 A max.		

D.4 Functions

The functions of the Battery Module are described in this section.

1) Absolute Encoder Backup

The Battery Module uses a large-capacity capacitor and lithium battery to supply backup power to the absolute encoders to back up rotation data. When the power supply to the MEMOCON GL120 or GL130 turns OFF, the rotation data in the absolute encoders is backed up by the large-capacity capacitors in the Battery Module. When the voltage of the capacitor drops below that of the lithium battery, the rotation data in the absolute encoders is backed up by the lithium battery.

Note The motion program, parameter, and point table data in the MC20 Module and the parameter data in the MC10 Module are not backed up by the Battery Module.

2) Maximum of 8-axis Absolute Encoder Backup

The Battery Module is connected to the BAT connector of the MEMOCON GL120, GL130 Motion Module to back up the rotation data for absolute encoders for up to 8 axes. Each MC20 Module supports absolute encoders for up to 4 axes, so one Battery Module can be connected to up to two MC20 Modules. Each MC10 Module supports an absolute encoders for 1 axis, so one Battery Module can be connected to up to eight MC10 Modules.

3) Backup Time

Backup is possible for up to one year without any power supply when the Battery Module is connected to the absolute encoders for eight axes. If the encoders are rotated when power is not supplied, however, the greater power consumption cause by the rotation will reduce the backup time.

4) Lithium Battery Voltage Drop Check

The voltage of the lithium battery in the Battery Module can be checked and the results display on indicators and output via an external signals. The battery voltage is checked at the following times.

a) When power to the Battery Module is turned ON.

b) When the battery voltage check switch on the Battery Module is pressed.

c) When the battery voltage check signal (CHK) turns ON.

Note 1) Although the lithium battery voltage check sequence is executed and the results output when the external power supply (24 VDC) is turned ON, the battery voltage check is not

automatically executed while power is ON and will not be executed while power is ON unless specifically designated. There will be no indication given externally even if the voltage of the battery drops while power is ON. It is therefore recommended that the battery voltage check signal (CHK) be used to periodically to check the voltage of the lithium battery in 24-hour operating systems. The voltage check, however, will reduce the capacity of the battery and we therefore recommend that the battery check be performed no more than once a day.

2) The status of the lithium battery can also be checked while power is ON by pressing the battery voltage check switch on the Battery Module. Press this switch with the end of a fine-point precision screwdriver or similar device.

5) Alarm Display and Output

When a voltage drop is detected for the lithium battery in the Battery Module, external alarms are generated via both indicators and outputs. The relationships among the status of the lithium battery, the indicators, and the outputs are shown in the following table.

Table D.3 Lithium Battery Status, Indicators, and Outputs

Battery Status	Indicators	Outputs	Conditions
Sufficient capacity	ALARM1 OFF	ALM1 ON	Battery voltage > 3.3 V
	ALARM2 OFF	ALM2 ON	
Battery needs replaced	ALARM1 ON	ALM1 OFF	3.0 V < Battery voltage ≤ 3.3 V
	ALARM2 OFF	ALM2 ON	
Absolute encoder data may not be preserved	ALARM1 ON	ALM1 OFF	Battery voltage ≤ 3.0 V
	ALARM2 ON	ALM2 OFF	

Note

1) Lithium batteries, by their nature, quickly loose capacity once the voltage begins to drop. Always replace the lithium battery as soon as possible, preferably within one week after the ALARM1 indicator light.

2) The status of the indicators and outputs signals of the Battery Module are preserved when power turns OFF or until the next time the voltage is checked.

6) Lithium Battery Voltage Measurements

The status of the indicators and output signals can be used to determine when the lithium battery voltage check is being performed. The relationships among the operating status, indicators, and output signals are shown in the following table.

Table D.4 Lithium Battery Status, Indicators, and Outputs

Operating Status	Indicators	Outputs	Remarks
External power supply ON	POWER ON	PON ON	—
External power supply OFF or battery voltage being checked	POWER OFF	PON OFF	The status of the ALARM1 and ALARM2 indicators and the ALM1 and ALM2 output signals is indeterminate.

Note 1) The voltage of the lithium battery is checked when the power supply is turned ON, when the battery voltage check signal (CHK) is turned ON for 1 ms or longer, or when the battery voltage check switch is pressed.

2) If the battery voltage check signal (CHK) remains ON or if the battery voltage check switch is pressed continuously, the POWER indicator will remain unlit and the PON output signal will remain OFF. Use a pulse signal for the battery voltage check signal (CHK) and do not press the battery voltage check switch continuously.

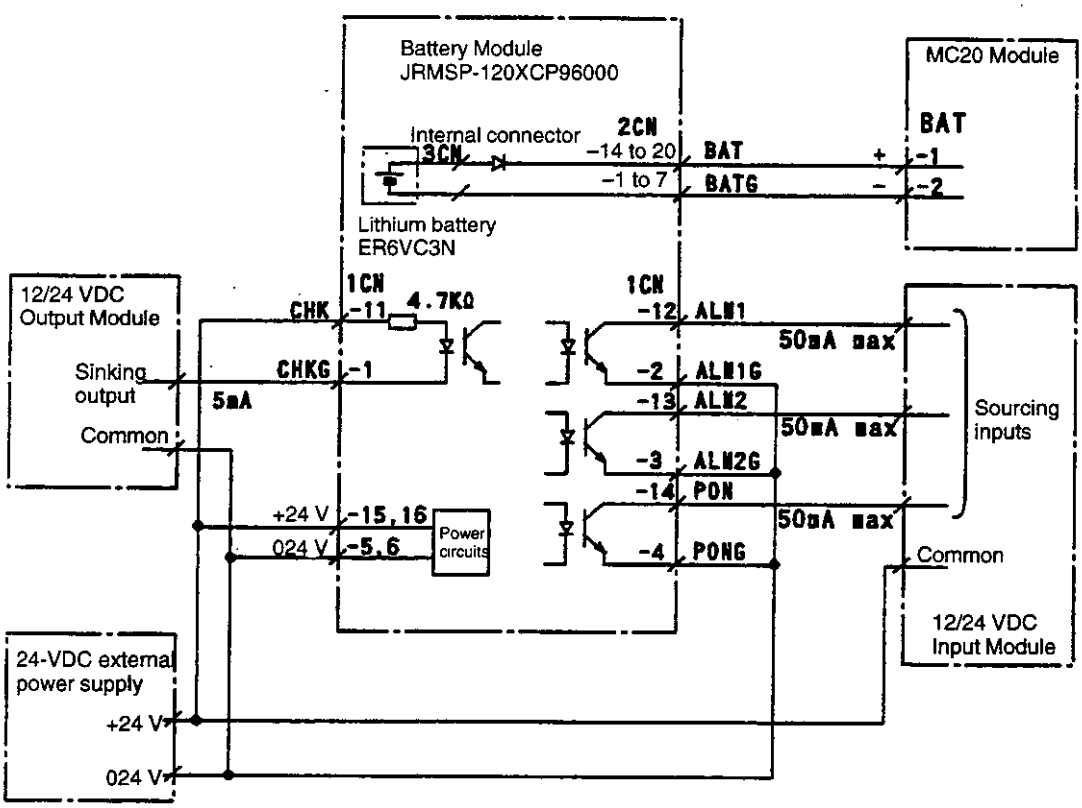
D.5 Connecting the Motion Module

1) Overview

This section explains how to connect the Battery Module to the MEMOCON GL120, GL130 Motion Modules (MC20 or MC10 Modules).

2) System Connections

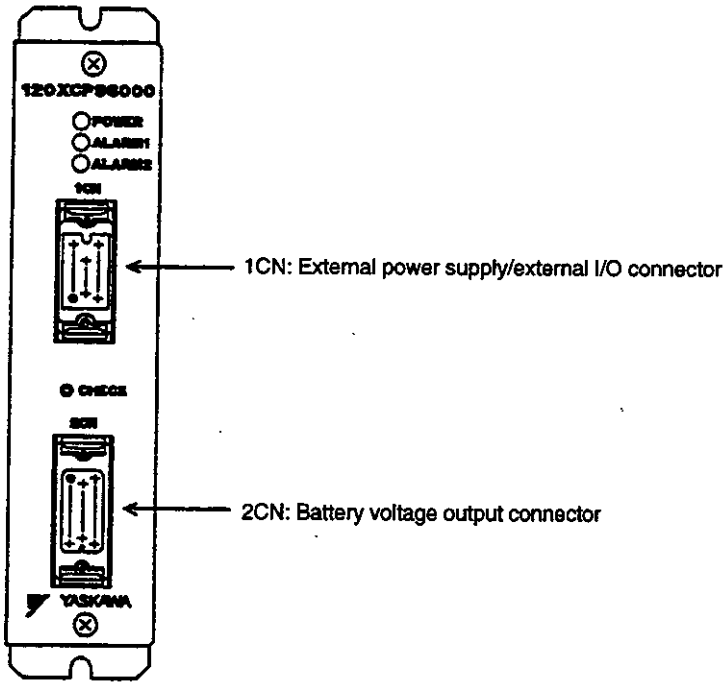
An example of system connections between an MC20 Module, I/O Modules, and the Battery Module is shown in the following illustration.



Note 1) Yaskawa does not provide connection cables. Please prepare your own cables.

2) Cable connectors for the external power supply/external I/O connector (1CN) and the battery voltage output connector (2CN) on the Battery Module are provided with the Battery Module. The cable connector for the battery connector (BAT) on the Motion Module is provided with the Motion Module.

3) Battery Module Connectors



Name	Connector	Pins	Connector		Maker
			On Module	On Cable	
External power supply/external I/O connector	1CN	16	MR-16RMA4	MR-16F MR-16L	Honda Tsushin Kogyo
Battery voltage output connector	2CN	20	MR-20RFA4	MR-20M MR-20L	Honda Tsushin Kogyo

Note 1) The model number on the top line for cable connectors is for the body (soldered) and the bottom line is for the hood.

2) Cable connectors are provided with the Battery Module.

4) Connector Pin Arrangements

a) 1CN: External Power Supply/External I/O Connector

A 24-V external power source, alarm outputs, a battery voltage check input, etc., are connected to the external power supply/external I/O connector (1CN). The connector pin arrangement is shown in the following illustration.

Connector: MR-16F (Honda Tsushin Kogyo, soldered)

6	024V	External power input				16	+24V	External power input
5	024V	External power input	10	Not connected		15	+24V	External power input
4	PONG	Power ON GND	9	Not connected		14	PON	Power ON output
3	ALM2G	Voltage drop 1 GND	8	Not connected		13	ALM2	Voltage drop 1 output
2	ALM1G	Voltage drop 2 GND	7	Not connected		12	ALM1	Voltage drop 2 output
1	CHKG	Battery voltage check GND				11	CHK	Battery voltage check input

b) 2CN: Battery Voltage Output Connector

Backup voltage is supplied from the battery voltage output connector (2CN) through the Motion Modules to the absolute encoders. The connector pin arrangement is shown in the following illustration.

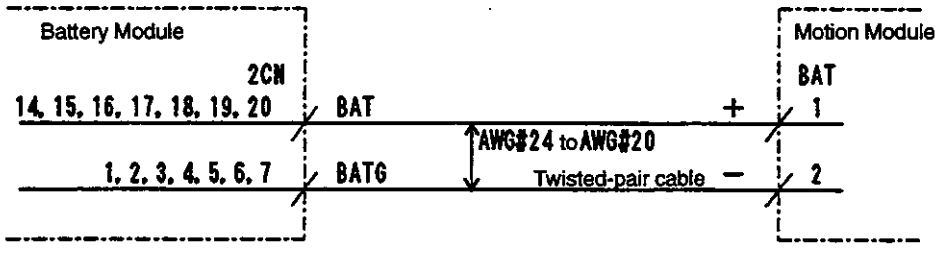
Connector: MR—20M (Honda Tsushin Kogyo, soldered)

1	BATG	Battery voltage GND	8	Not connected	14	BAT	Battery voltage output
2	BATG	Battery voltage GND	9	Not connected	15	BAT	Battery voltage output
3	BATG	Battery voltage GND	10	Not connected	16	BAT	Battery voltage output
4	BATG	Battery voltage GND	11	Not connected	17	BAT	Battery voltage output
5	BATG	Battery voltage GND	12	Not connected	18	BAT	Battery voltage output
6	BATG	Battery voltage GND	13	Not connected	19	BAT	Battery voltage output
7	BATG	Battery voltage GND			20	BAT	Battery voltage output

5) Connecting the Motion Modules

The battery connector (BAT) on the Motion Module is connected to the battery voltage output connector (2CN) on the Battery Module as described next.

a) Device Connections



b) Motion Module Connector Pin Arrangement

A terminal block connector (MiniCOMBICON made by Phoenix Contact Co.) with screw terminals is provided as the battery connector on the Motion Module. The plug for this connector is provided with the Motion Module. The connector pin arrangement is shown in the following table.

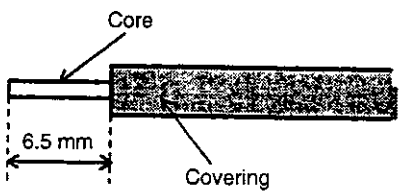
Pin	Signal Name	Name	Remarks
1	+	Battery voltage input	BAT: MC1.5/2-STF-3.81-AU (made by Phoenix Contact Co., screw terminals)
2	–	Battery voltage GND	

Note Although there is a charge-prevention diode for the lithium battery in the battery voltage output section of the Battery Module to prevent reverse voltage, be very careful to connect the terminals correctly.

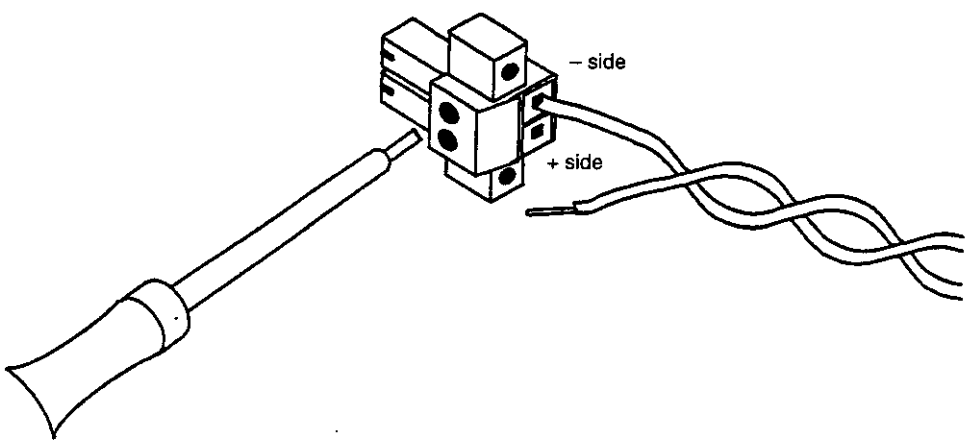
c) Cable Preparations

Use twisted-pair cables of wires that are AWG#24 to AWG#20 (0.2 mm^2 to 0.51 mm^2) to connect the Battery Module to the Motion Module. Prepare the cables as described next.

(1) Remove the covering of the wires for approximately 6.5 mm from the end of the wires



(2) Secure the ends of the wires by pressing the core firmly to the back of the plug and tightening the screws to a tightening torque of between approximately 0.3 and 0.4 Nm.



Note Although the above step is possible with a precision flat-blade screwdriver (tip size: 0.4 x 2.5 mm), we recommend the following special screwdriver to ensure sufficient tightening torque: SZN/K (made by Phoenix Contact Co.)

D.6 Battery Replacement

1) When a voltage drop is detected for the lithium battery, the ALARM1 indicator will light and the ALM1 output signal will turn OFF. These indicate that the lithium battery in the Battery Module must be replaced. The procedure described in this section can be used to replace the battery while leaving data in the absolute recorders.

2) Prepare the following items before replacing the lithium battery.

   a) Phillips screwdriver

   b) Replacement lithium battery: ER6VC3N (Made by Yaskawa : with connector)
   The model number of the lithium battery alone is ER6VC3 (made by Toshiba), but the connector connection is made to Yaskawa specifications. Consult with Yaskawa before ordering only the battery.

3) Use the following procedure to replace the lithium battery.

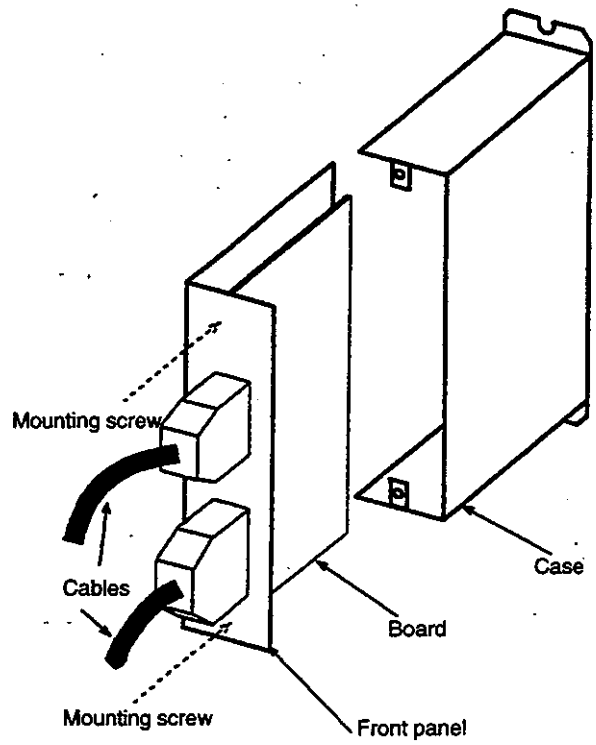
   a) Turn ON the power to the system. The power must be ON for at least 10 min. before proceeding to the next step.

   b) Turn OFF the power supply to the Battery Module. Once the power supply to the Battery Module has been turned OFF, it does not matter whether or not power is supplied to the system (to the Servopacks).

   c) Remove the front panel from the Battery Module using the following procedure.

      (1) Remove the mounting screws from the front panel. There are two screws, one at the top and one at the bottom.

(2) Pull the front panel out from the case with the cables still connected.



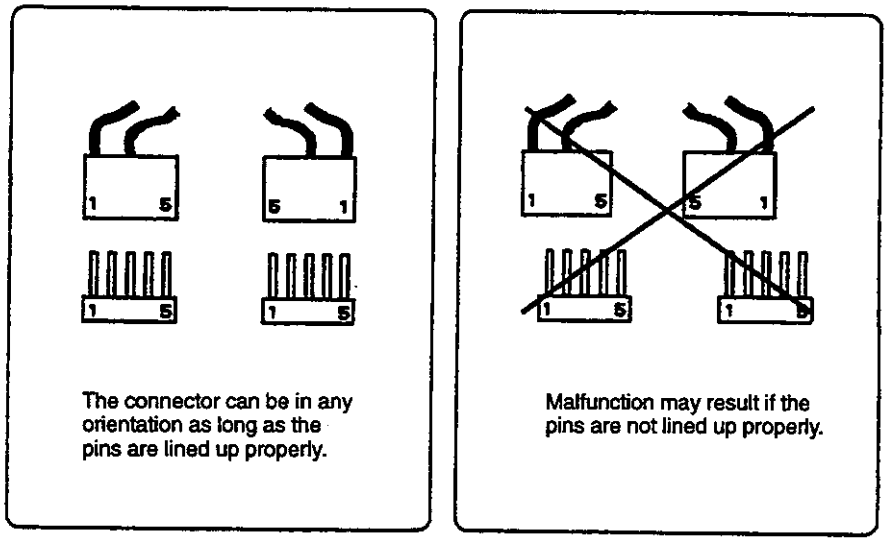
Note 1) Be very careful not to damage the boards when pulling out the front panel.

2) Do not apply unnecessary force to the case.

d) Replace the lithium battery using the following procedure.

(1) Remove the lithium battery being sure not to touch board circuits with your fingers or screwdriver.

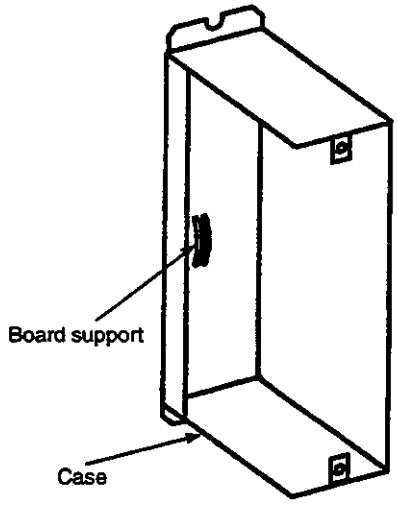
(2) Connect the new battery being sure that the connector pins are properly lined up. The orientation of the connector makes no differences as long as the pins are lined up with the connector. Failure to line up the pins may result in malfunction.



e) Reattach the front panel to the Battery Module using the following procedure.

(1) Attach the front panel by pressing the board into the case so that the board fits into the board support at the back of the case.

(2) Attach and tighten the mounting screws for the front panel.



f) Confirm that the cables are firmly connected to the connectors on the front panel, and then turn ON the power supply to the Battery Module.

g) Check the operation of the indicators and output signals as follows:

(1) **Indicators**
The POWER indicator should be lit and the ALARM1 and ALARM2 indicators should not be lit.

(2) **Output Signals**
The ALM1 and ALM2 signals ON when the PON turns ON.

(3) If the POWER indicator is not lit or either one of or both of the ALARM1 and ALARM2 indicators are lit, an error has occurred. Repeat the procedure from step b) on page D-13.

Possible Errors: Either 1) the lithium battery is not connected properly, or 2) the external power supply/external I/O connector (1CN) is not connected properly or has a broken wire.

As long as no errors have occurred, this completes the battery replacement procedure. Turn ON the power supply to the system if required.

Note

1) Supply power to the Battery Module and absolute encoders for at least 10 min before replacing the lithium battery so that the capacitors can be charged.

2) Do not touch the board circuits with your fingers or screwdriver.

3) Be sure that the battery connector pins are properly lined up. If the pins are not lined up properly, problems can occur with the lithium battery.

4) If problems occur with the absolute encoders, refer to the methods for setting up the absolute encoders described in the Servopack technical sheet.

⚠ **Caution** The lithium battery in the Battery Module can rupture if charged, causing a potentially dangerous situation. Never charge a lithium battery.

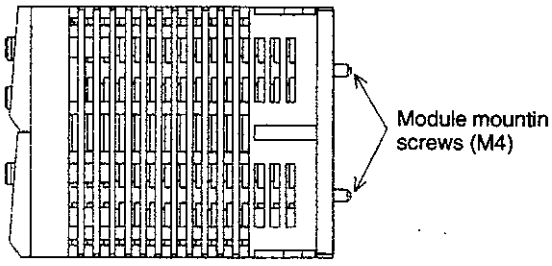
Appendix E

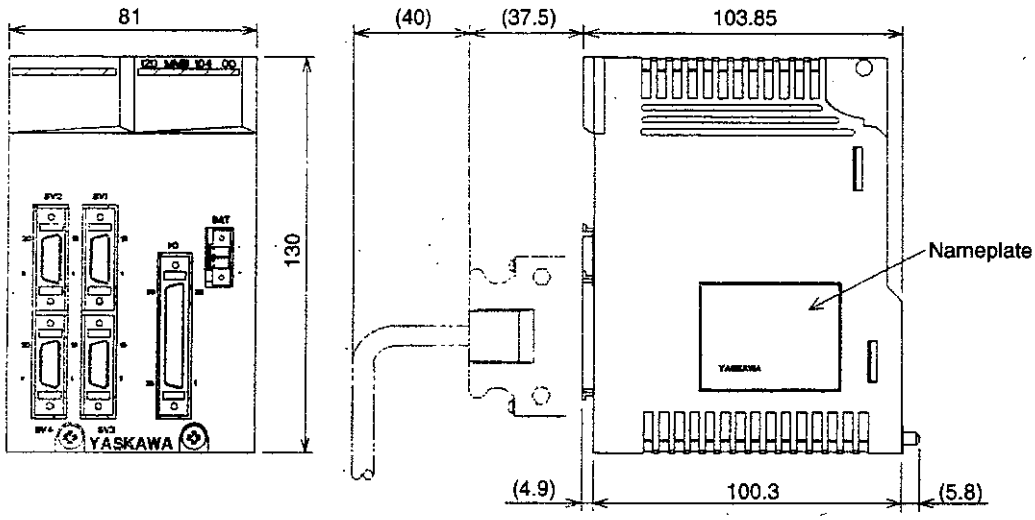
External Diagrams

This appendix provides dimensional diagrams of the MC20 Module and the Battery Module.

E.1 4-axis Motion Module (JAMSC-120MMB10400)

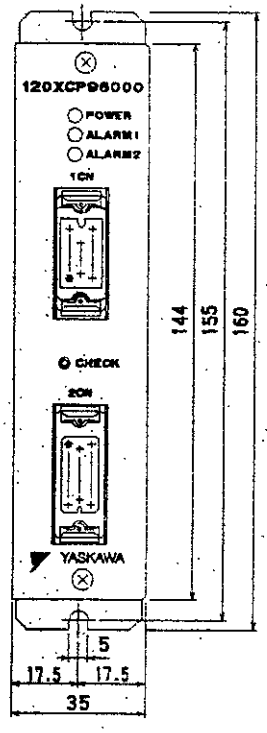
Unit : mm
Approx. mass : 510g

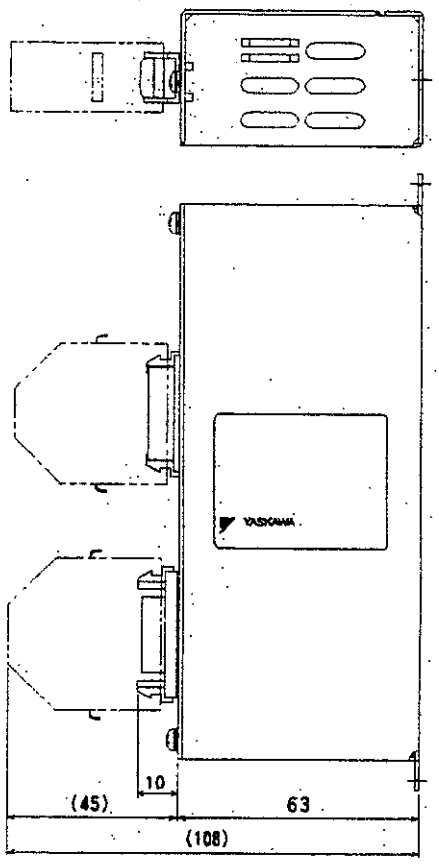




E.2 Battery Module (JRMSP-120XCP96000)

Unit : mm
Approx. mass : 500g





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MOTION MODULE MC20
HARDWARE USER'S MANUAL

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