User's Manual

Positioning Module
(with MECHATROLINK-II Interface)

Applicable Modules:

Model Code	Model Name
F3NC96-0N	Positioning Module (with MECHATROLINK-II ~~Support~~ Interface)

YOKOGAWA ◆

Yokogawa Electric Corporation

Applicable Product:

● **Range-free Multi-controller FA-M3**

   - Model code : F3NC96-0N

   - Name   : Positioning Module (with MECHATROLINK-II Interface)

The document number and document model code for this manual are given below.

Refer to the document number in all communications; also refer to the document number and the document model code when purchasing additional copies of this manual.

   - Document No.   :   IM 34M6H60-02E

   - Document Model Code :   DOCIM

Important

■ About This Manual

- This Manual should be passed on to the end user.
- Before using the product, read this manual thoroughly to have a clear understanding of the product.
- This manual explains the functions of this product, but there is no guarantee that they will suit the particular purpose of the user.
- Under absolutely no circumstances may the contents of this manual be transcribed or copied, in part or in whole, without permission.
- The contents of this manual are subject to change without prior notice.
- Every effort has been made to ensure accuracy in the preparation of this manual. However, should any errors or omissions come to the attention of the user, please contact the nearest Yokogawa Electric representative or sales office.

■ Safety Precautions when Using/Maintaining the Product

- The following safety symbols are used on the product as well as in this manual.

Danger. This symbol on the product indicates that the operator must follow the instructions laid out in this instruction manual to avoid the risk of personnel injuries, fatalities, or damage to the instrument. Where indicated by this symbol, the manual describes what special care the operator must exercise to prevent electrical shock or other dangers that may result in injury or the loss of life.

Protective Ground Terminal. Before using the instrument, be sure to ground this terminal.

Function Ground Terminal. Before using the instrument, be sure to ground this terminal.

Alternating current. Indicates alternating current.

Direct current. Indicates direct current.

The following symbols are used only in the instruction manual.

⚠ WARNING

Indicates a "Warning".

Draws attention to information essential to prevent hardware damage, software damage or system failure.

⚠ CAUTION

Indicates a "Caution"

Draws attention to information essential to the understanding of operation and functions.

TIP

Indicates a "TIP"

Gives information that complements the present topic.

SEE ALSO

Indicates a "SEE ALSO" reference.

Identifies a source to which to refer.

- For the protection and safe use of the product and the system controlled by it, be sure to follow the instructions and precautions on safety stated in this manual whenever handling the product. Take special note that if you handle the product in a manner other than prescribed in these instructions, the protection feature of the product may be damaged or impaired. In such cases, Yokogawa cannot guarantee the quality, performance, function and safety of the product.

- When installing protection and/or safety circuits such as lightning protection devices and equipment for the product and control system as well as designing or installing separate protection and/or safety circuits for fool-proof design and fail-safe design of processes and lines using the product and the system controlled by it, the user should implement it using devices and equipment, additional to this product.

- If component parts or consumable are to be replaced, be sure to use parts specified by Yokogawa.

- This product is not designed or manufactured to be used in critical applications which directly affect or threaten human lives and safety — such as nuclear power equipment, devices using radioactivity, railway facilities, aviation equipment, air navigation facilities, aviation facilities or medical equipment. If so used, it is the user's responsibility to include in the system additional equipment and devices that ensure personnel safety.

- Do not attempt to modify the product.

■ Exemption from Responsibility

- Yokogawa Electric Corporation (hereinafter simply referred to as Yokogawa Electric) makes no warranties regarding the product except those stated in the WARRANTY that is provided separately.

- Yokogawa Electric assumes no liability to any party for any loss or damage, direct or indirect, caused by the use or any unpredictable defect of the product.

■ Software Supplied by the Company

- Yokogawa Electric makes no other warranties expressed or implied except as provided in its warranty clause for software supplied by the company.

- Use the software with one computer only. You must purchase another copy of the software for use with each additional computer.

- Copying the software for any purposes other than backup is strictly prohibited.

- Store the original media, such as CD-ROM, containing the software in a safe place.

- Reverse engineering, such as decompiling of the software, is strictly prohibited.

- No portion of the software supplied by Yokogawa Electric may be transferred, exchanged, sublet or leased for use by any third party without prior permission by Yokogawa Electric.

■ General Requirements for Using the FA-M3 Controller

● Avoid installing the FA-M3 controller in the following locations:

- Where the instrument will be exposed to direct sunlight, or where the operating temperature exceeds the range 0°C to 55°C (32°F to 131°F).

- Where the relative humidity is outside the range 10% to 90%, or where sudden temperature changes may occur and cause condensation.

- Where corrosive or flammable gases are present.

- Where the instrument will be exposed to direct mechanical vibration or shock.

- Where the instrument may be exposed to extreme levels of radioactivity.

● Use the correct types of wire for external wiring:

- Use copper wire with temperature ratings greater than 75°C (167°F).

● Securely tighten screws:

- Securely tighten module mounting screws and terminal screws to avoid problems such as faulty operation.

- Tighten terminal block screws with the correct tightening torque as given in this manual.

● Securely lock connecting cables:

- Securely lock the connectors of cables, and check them thoroughly before turning on the power.

● Interlock with emergency-stop circuitry using external relays:

- Equipment incorporating the FA-M3 controller must be furnished with emergency-stop circuitry that uses external relays. This circuitry should be set up to interlock correctly with controller status (stop/run).

● Low impedance grounding:

- For safety reasons, connect the [FG] grounding terminal to a Japanese Industrial Standards (JIS) Class D Ground[*1] (Japanese Industrial Standards (JIS) Class 3 Ground). For compliance to CE Marking, use braided or other wires that can ensure low impedance even at high frequencies for grounding.

  *1 Japanese Industrial Standard (JIS) Class D Ground means grounding resistance of 100Ω max.

● Configure and route cables with noise control considerations:

- Perform installation and wiring that segregates system parts that may likely become noise sources and system parts that are susceptible to noise. Segregation can be achieved by measures such as segregating by distance, installing a filter or segregating the grounding system.

● Configure for CE Marking Conformance:

- For compliance to CE Marking, perform installation and cable routing according to the description on compliance to CE Marking in the "Hardware Manual" (IM34M6C11-01E).

● Keep spare parts on hand:

- Stock up on maintenance parts including spare modules, in advance.

- **Discharge static electricity before operating the system:**
  - Because static charge can accumulate in dry conditions, first touch grounded metal to discharge any static electricity before touching the system.

- **Never use solvents such as paint thinner for cleaning:**
  - Gently clean the surfaces of the FA-M3 controller with a cloth that has been soaked in water or a neutral detergent and wringed.
  - Do not use volatile solvents such as benzine or paint thinner or chemicals for cleaning, as they may cause deformity, discoloration, or malfunctioning.

- **Avoid storing the FA-M3 controller in places with high temperature or humidity:**
  - Since the CPU module has a built-in battery, avoid storage in places with high temperature or humidity.
  - Since the service life of the battery is drastically reduced by exposure to high temperatures, take special care (storage temperature should be from –20°C to 75°C).
  - There is a built-in lithium battery in a CPU module and temperature control module which serves as backup power supply for programs, device information and configuration information. The service life of this battery is more than 10 years in standby mode at room temperature. Take note that the service life of the battery may be shortened when installed or stored at locations of extreme low or high temperatures. Therefore, we recommend that modules with built-in batteries be stored at room temperature.

- **Always turn off the power before installing or removing modules:**
  - Failing to turn off the power supply when installing or removing modules, may result in damage.

- **Do not touch components in the module:**
  - In some modules you can remove the right-side cover and install ROM packs or change switch settings. While doing this, do not touch any components on the printed-circuit board, otherwise components may be damaged and modules may fail to work.

- **Do not wire unused terminals:**
  - Do not wire unused terminals of external connection terminal blocks or unused pins of connectors of the module. Doing so may affect the function of the module.

◼ Waste Electrical and Electronic Equipment

Waste Electrical and Electronic Equipment (WEEE), Directive 2002/96/EC

(This directive is only valid in the EU.)

This product complies with the WEEE Directive (2002/96/EC) marking requirement. The following marking indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category

With reference to the equipment types in the WEEE directive Annex 1, this product is classified as a "Monitoring and Control instrumentation" product.

Do not dispose in domestic household waste.

When disposing products in the EU, contact your local Yokogawa Europe B. V. office.

Introduction

■ Overview of the Manual

This manual describes the specifications and functions of the F3NC96-0N positioning module (with MECHATROLINK-II Interface), which is to be installed in an I/O slot of the FA-M3, as well as information required for operating these modules.

■ Related Instruction Manuals

The manuals to be read depend on the CPU module to be used.
You should read the latest versions of the following instructions manuals, as required.

- **For information on the functions of the F3SP66 or F3SP67 sequence CPU modules, refer to:**
    - Sequence CPU – Functions User's Manual (for F3SP66-4S, F3SP67-6S) (IM34M6P14-01E)
    - Sequence CPU – Network Functions User's Manual (for F3SP66-4S, F3SP67-6S) (IM34M6P14-02E)

- **For information on the functions of the F3SP28, F3SP38, F3SP53, F3SP58, or F3SP59 sequence CPU modules, refer to:**
    - Sequence CPU – Functions User' Manual (for F3SP28-3N/3S, F3SP38-6N/6S, F3SP53-4H/4S, F3SP58-6H/6S, F3SP59-7S) (IM34M6P13-01E)

- **For information on the functions of the F3SP21, F3SP25, F3SP35, F3SP05, or F3SP08 sequence CPU modules, refer to:**
    - Sequence CPU – Functions User's Manual (for F3SP21, F3SP25, and F3SP35) (IM34M6P12-02E)

- **For information on the instructions used with sequence CPUs, refer to:**
    - Sequence CPU – Instructions User's Manual (IM34M6P12-03E)

- **When creating programs using ladder language, refer to:**
    - FA-M3 Programming Tool WideField2 User's Manual (IM34M6Q15-01E)

- **For hardware information common to all sequence CPU modules, refer to:**
    - Hardware Manual (IM34M6C11-01E).

- **For information on CPU modules for Windows CE (F3RP42-5P, F3RP44-5P, F3RP45-5P), refer to:**
    - Network CPU Module (IM34M6M51-04E)

Copyrights and Trademarks

■ Copyrights

Copyrights of the programs and online manual included in this CD-ROM belong to Yokogawa Electric Corporation.

This online manual may be printed but PDF security settings have been made to prevent alteration of its contents.

This online manual may only be printed and used for the sole purpose of operating this product. When using a printed copy of the online manual, pay attention to possible inconsistencies with the latest version of the online manual. Ensure that the edition agrees with the latest CD-ROM version.

Copying, passing, selling or distribution (including transferring over computer networks) of the contents of the online manual, in part or in whole, to any third party, is strictly prohibited. Registering or recording onto videotapes and other media is also prohibited without expressed permission of Yokogawa Electric Corporation.

■ Trademarks

The trade and company names that are referred to in this document are either trademarks or registered trademarks of their respective companies.

FA-M3
Positioning Module
(with MECHATROLINK-II Interface)

IM 34M6H60-02E   1st Edition

CONTENTS

1.   Overview

This positioning module is to be installed in the base unit of a FA-M3 range free controller system, and supports MECHATROLINK-II communications.

■ What is MECHATROLINK-II Communications?

● Overview

MECHATROLINK-II communications is an open architecture, high-speed motion field network proposed by Yaskawa Electric Corporation, which enables distributed control of multiple FA units (servo systems, inverters, I/O modules, etc.) by one FA controller.

Compared to MECHATROLINK-I, the MECHATROLINK-II transmission specification provides for higher speed (10 Mbps versus 4 Mbps) and additional functions.

MECHATROLINK-II has the following features:

- Synchronous communication through cyclic transmission
- High speed transmission of 10 Mbps
- Communication cycle time options allow optimization based on the number of connected stations and transmission volume. (This module provides two communication cycle time options: 1 ms for 8 axes or 2 ms for 15 axes)
- Reduced wiring cost through the use of a single shielded twisted-pair interface cable.
- Low FA controller load as transmission control by the Transmission LSI manufactured by Yaskawa Electric includes error detection and retransmission within a communication cycle.
- Allows other FA support tools to be connected to a FA controller, acting as the master.

● Network Connection

MECHATROLINK-II communications allows one C1 master to be connected to a maximum of 30 slaves and an optional C2 master. (The positioning module itself supports connection to a maximum of 15 slaves.)

Figure 1.1 shows the network connection for MECHATROLINK-II communications.
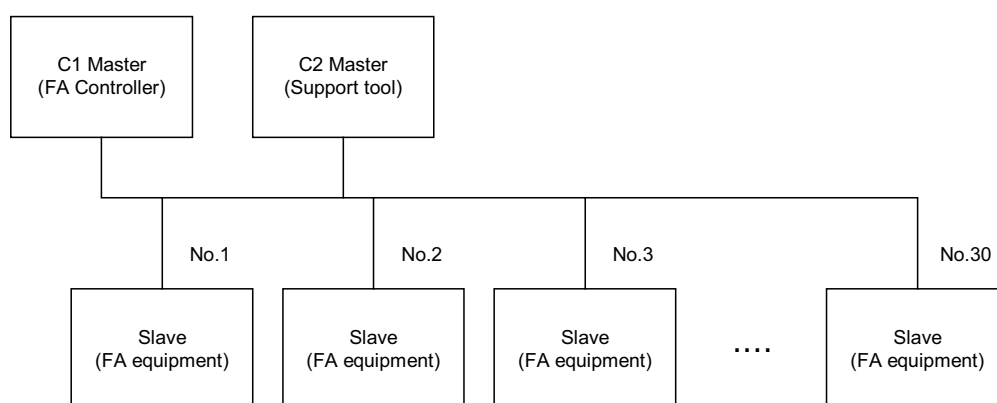
Figure 1.1 Network Connections for MECHATROLINK-II Communications

■ Module Features

The positioning module provides an interface (C1 master) to a high-speed motion field network based on MECHATROLINK-II, a standard proposed by Yaskawa Electric. It transmits MECHATROLINK-II commands to external equipment (slaves) according to instructions from a CPU module, and receives MECHATROLINK-II responses from external equipment.

It enables:

(1) Independent axis movement using MECHATROLINK-II commands

(2) Linear interpolation movement (starting and stopping multiples axes simultaneously)

(3) Reading of the statuses (target position, current position, etc.) of external equipment

(4) Reading and writing of parameters of external equipment

This module has the following features:

- Positioning control of up to 15 axes per module using one slot.
- Easy connection of controller and motors using connectors reduces wiring cost.
- High-speed transmission of 10 Mbps with cycle time of 1 ms for 8 axes or 2 ms for 15 axes enables control data (target position, current position, etc.) to be transmitted and received in real time to achieve fast response and synchronization of peripherals.
- Command transmission enables maximum utilization of motor performance (high speed, high resolution) to achieve fast and accurate positioning control.
- Supports versatile positioning control including linear interpolation motion of up to 15 axes, as well as change in speed or target position during motion.
- Currently supports servomotors manufactured by Yaskawa Electric. Future support for stepping motors, inverters, I/O equipment and other equipment is expected.

■ Module Operation

Figure 1.2 shows the principle behind the operation of the positioning module.

● (1) Independent axis movement using MECHATROLINK-II commands

The procedure for initiating a positioning movement by sending a MECHATROLINK-II command is given below.

- From the CPU module, a program writes the command code ($35) for positioning command (POSING: $35), as well as other command parameters such as target position (reference unit) and target speed (reference unit/s) to the command parameters area.
- After writing completes, the program turns on the Send Command output relay. The corresponding MECHATROLINK-II command is transmitted to the external equipment (e.g. servo driver) to initiate the desired positioning movement in the external equipment.
- The Response Received input relay turns on when a response to the transmitted MECHATROLINK-II command is received.
- The Positioning Completed input relay turns on subsequently when the positioning movement completes.

The acceleration/deceleration curve and acceleration/deceleration constants are preset in the external equipment (e.g. servo driver) using parameters.

● Linear interpolation movement (starting and stopping multiples axes simultaneously)

The procedure for performing linear interpolation is given below.

- From the CPU module, a program writes the command code ($100) for the interpolation command, as well as other command parameters for the interpolation movement such as acceleration time (in ms), deceleration time (in ms), interpolation axes, target position (reference unit) and target speed (reference unit/s) to the command parameters area.
- After writing completes, the program turns on the Send Command output relay. The module computes the target position at each communication cycle, and transmits the computed target position to all external equipment involved in the linear interpolation movement simultaneously using MECHATROLINK-II commands to initiate the desired positioning movement.
- The Response Received input relay turns on when positioning movement begins.
- The Positioning Completed input relay turns on subsequently when positioning movement completes.
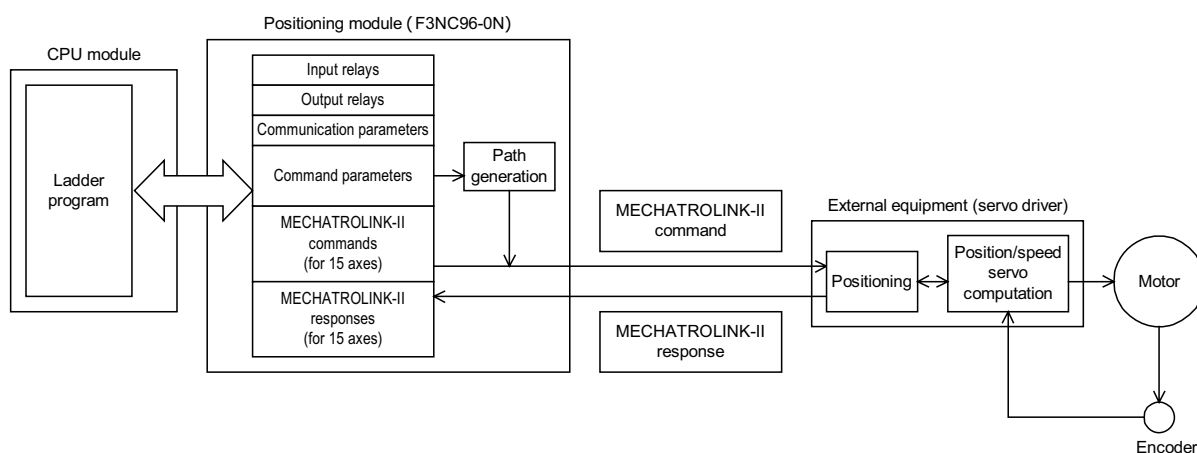
Figure 1.2   Operating Principle of the Positioning Module

2. Overview of Positioning Functions

The positioning module (with MECHATROLINK-II Interface) provides MECHATROLINK-II command positioning functions using a MECHATROLINK-II communication interface, as well as interpolation movement command positioning functions, which compute and send position references required for implementing an interpolation movement.

2.1 MECHATROLINK-II Command Positioning Functions

This section describes the positioning functions of MECHATROLINK-II commands that are executable by the module.

For details on the operation of each of these commands, as well as other MECHATROLINK-II commands, refer to the relevant manuals published by Yaskawa Electric Corporation, as given in the table below.

Table 2.1   List of Technical Manuals Related to MECHATROLINK-II Communications (Published by Yaskawa Electric Corporation)

Document Name	Document Number	Description
Σ-III SeriesSGM*S/SGDS User's Manual for MECHATROLINK-II Communications	SIE80000011B	Describes the SGDS type SERVOPACK.
Σ-II Series SGM☐H/SGDH User's Manual	SIE80000005C	Describes the SGDH type SERVOPACK.
Σ-II SeriesSGDH MECHATROLINK-II Application Module User's Manual	SIEC71080001C	Describes the application module for MECHATROLINK-II communications.

■ Positioning Command (POSING: $35)

This command performs positioning movement to a given position reference.

As shown in Figure 2.1, the command moves an axis to a target position (P1) using a specified fast-forward speed.

The speed and position data can be changed during execution by sending a command that contains modified reference values.

If the new position provides inadequate allowance for the deceleration distance, or if the new position is in the reverse direction relative to the current movement direction, the module decelerates and stops the movement (the DEN status remains at zero) before initiating positioning to the new position.

To check for execution completion, check that the Output Completed (DEN) status=1.
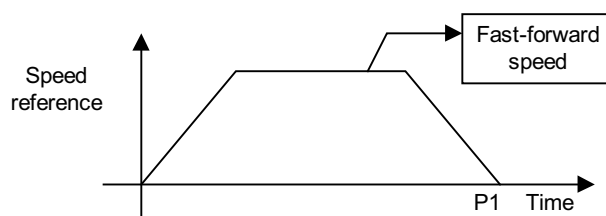
Figure 2.1   Speed Reference of Positioning Command (POSING: $35)

■ Constant Speed Feed Command (FEED: $36)

This command executes constant speed movement at a specified feed speed.

Figure 2.2 shows the movement curve.

Executing the Stop Motion command (HOLD: $25) decelerates and stops the movement. The speed and direction can be changed during execution by sending a command containing modified reference values.

If a change in movement direction is required, the module decelerates and stops the axis before initiating movement in the reverse direction.

To check for execution completion, check that the Output Completed (DEN) status=1.
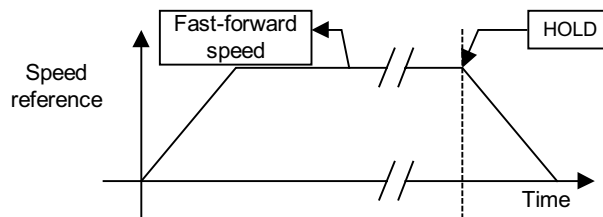
Figure 2.2   Speed Reference of Constant Speed Feed Command (FEED: $36)

■ Stop Motion Command (HOLD: $25)

This command stops movement according to a deceleration pattern, which can be specified using command options.

To check for execution completion, check that the Output Completed (DEN) status=1.

■ External Input Positioning Command (EX_POSING: $39)

This command executes fast-forward movement according to the External Positioning Signal input.

When the external positioning signal input goes high, the module latches the current counter position, then moves, decelerates and stops the axis, by traveling through a distance specified by a parameter.

If the distance required for deceleration to rest is shorter than the specified distance, the module decelerates and stops the movement according to the deceleration pattern and then executes a return to the target position before ending command execution.

Figure 2.3 and Figure 2.4 shows the operation sequences of an External Input Positioning command executed under different initial movement conditions.

To check for execution completion, check that the Output Completed (DEN) status=1.
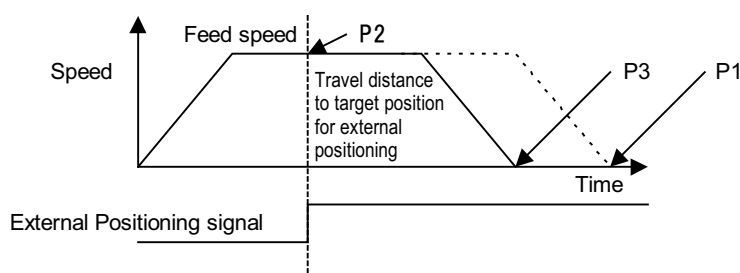
Figure 2.3   Speed Reference for External Input Positioning Command (EX_POSING: $39)
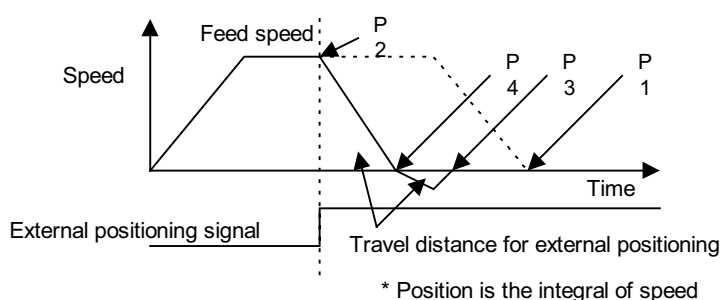
Figure 2.4   Speed Reference When Specified Travel for External Input Positioning is Insufficient for Deceleration

■ Home Command (ZRET: $3A)

This command executions a return to the home position using the Deceleration LS and Latch signals.

The Latch Signal parameter determines the latch signal to be used.

To check for execution completion, check that the Output Completed (DEN) status=1.
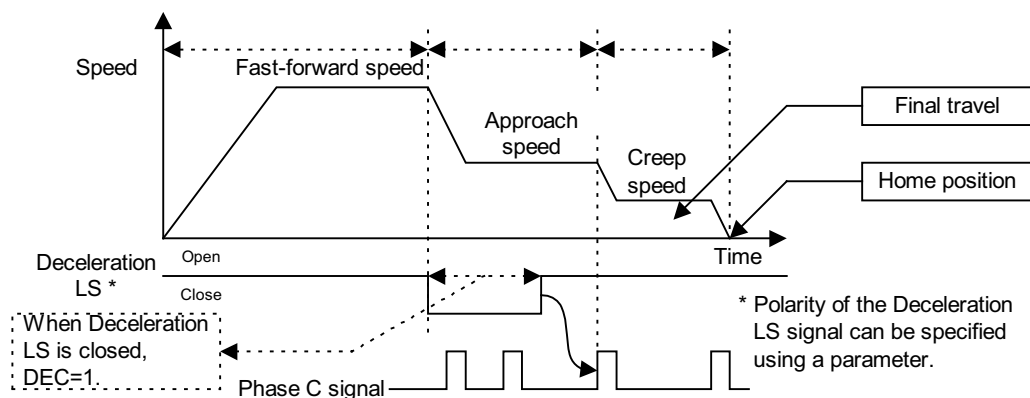
Figure 2.5   Homing Sequence at Driver End (when using Phase C signal)

2.2 Interpolation Command Positioning Functions

This section describes the positioning functions of interpolation commands that are executable by the module.

■ Start Positioning ($0100)

This command executes linear interpolation movement (starting and stopping multiples axes simultaneously) for up to 15 axes.

The axis from which the command is issued is known as the "reference axis" (or command axis), while the other axes involved in the interpolation movement are known as "interpolation axes".

Interpolation axes are specified using the Interpolation Axes parameter of the reference axis at the time of command execution.

While a linear interpolation movement is in progress, another linear interpolation movement can be executed using a different set of axes, which are at rest. Up to 15 axes can be made to move this way. Executing two or more linear interpolation movements with overlapping sets of axes is, however, not allowed.

Target position and speed must be specified for each movement axis (reference axis and interpolation axes). In order that all movement axes can stop at the same time, this module computes the attained speed of each axis to accommodate the axis that requires the longest travel time (as detected by the module). Each axis then moves according to its attained speed, regardless of its preset speed.

To stop a linear interpolation movement in progress, execute a Decelerate and Stop command ($0200) or a Stop Immediately command ($0300) against the reference axis, which is the axis from which the Start Positioning command was originally issued.

To change the speed or target position during a linear interpolation movement, execute a Change Speed command ($0400) or a Change Target Position command ($0500) against the reference axis, which is the axis from which the Start Positioning command was originally issued.
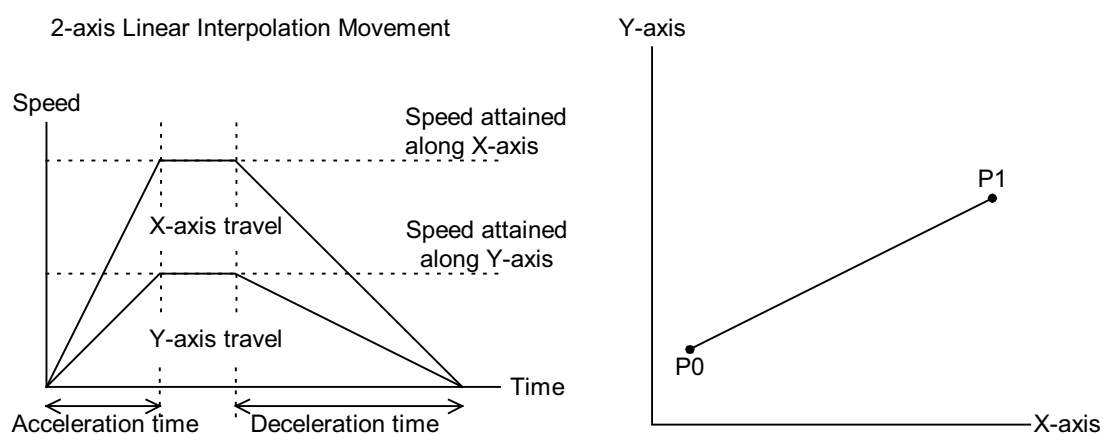
Figure 2.6   Linear Interpolation Movement Initiated by Start Positioning Command

■ Change Speed ($0400)

This command can be executed to change the speed of moving axes during a linear interpolation movement.

Changing the set of movement axes during linear interpolation movement is, however, not allowed. Executing a Change Speed command is also not allowed while a target position change is in progress.

When the axes approach the target position after a speed change, they decelerate and stop according to the deceleration time specified in the Change Speed command.
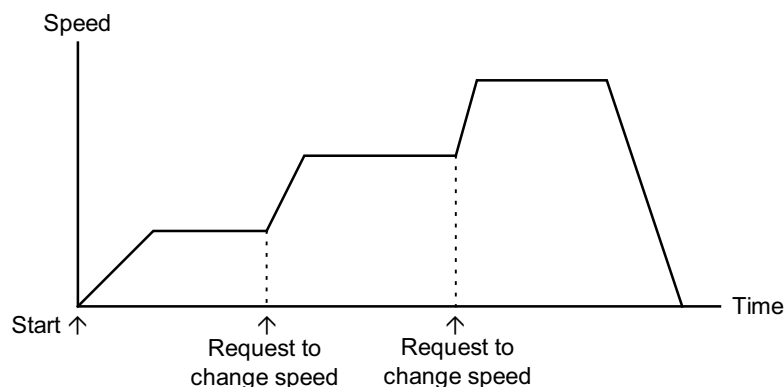
Figure 2.7   Speed Change Movement Initiated by Change Speed Command

■ Change Target Position ($0500)

The Change Target Position command is executed to change the target position during a linear interpolation movement.

Changing the set of movement axes during linear interpolation movement is, however, not allowed. Execution of a Change Target Position command is also not allowed while a target position change is in progress.

The target speed can also be changed together with the target position using a Change Target Position Command.

To change a target position in 'positioning completed' state, execute a Start Positioning command instead.
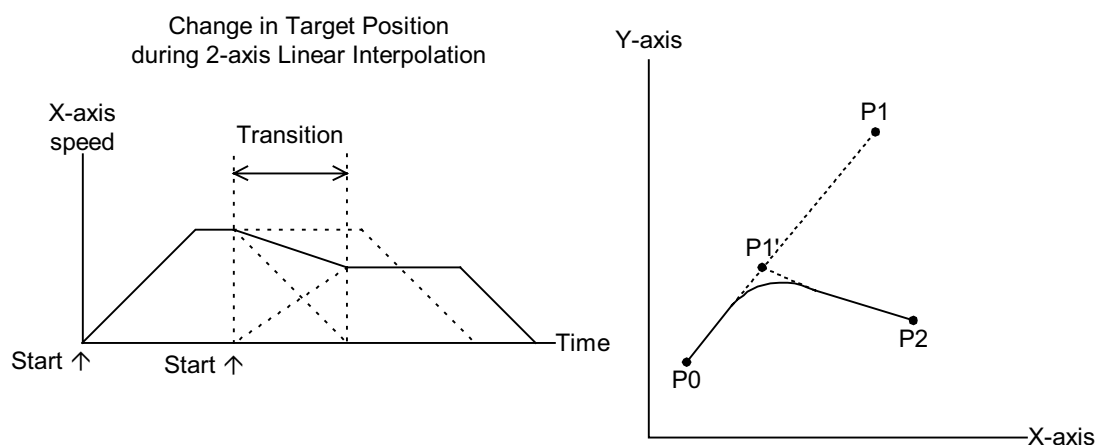
Figure 2.8   Target Position Change Movement Initiated By Change Target Position Command

3. Module Specifications

3.1 Specifications

■ Model Name and Suffix Code

Table 3.1   Model Name and Suffix Code

Model	Suffix Code	Style Code	Option Code	Description
F3NC96	-0N	......	......	15 axes Supports MECHATROLINK-II communications

■ Compatible CPU Modules

This module is compatible with the following CPU modules.

Table 3.2   CPU Module Restrictions

CPU Module	Style Code and ROM Version
F3SP28-3N, F3SP38-6N F3SP53-4H, F3SP58-6H	Rev. 7 or later
Other CPUs	No restriction

■ General Specifications

Table 3.3 General Specifications

Item		Specification
Interface		MECHATROLINK-II compliant
Transmission rate		10 Mbps
Transmission bytes		32 bytes
Cycle time versus number of stations		1.0 ms for up to 8 axes, 2.0 ms for up to 15 axes (user selectable)
Network Topology		Bus (multi-drop)
Communication method		Master/slave synchronous
Transmission media		2-wire shielded twisted pair cable (proprietary cable)
Maximum transmission distance		50 m (total length)
Minimum distance between stations		0.5 m
Positioning functions	Position reference	-2, 147, 483, 648 to 2, 147, 483, 647 (reference unit)
	Functions	- Linear interpolation movement (starting and stopping multiples axes simultaneously) - Independent axis movement using MECHATROLINK-II commands (dependant on connected external equipment and supported MECHATROLINK-II commands)
	Others	- Reading of statuses (target position, current position, etc.) of external equipment - Reading and writing of parameters of external equipment
Number of installed modules		8 modules max. (120 axes max.)
Current consumption		570 mA (5V DC)
External connection		One MECHATROLINK-II communication port
External dimensions		28.9 (W) × 100 (H) × 83.2 (D) mm *
Weight		120 g
Operating ambient temperature		0 to 55°C
Operating ambient humidity		10 to 90% RH (non-condensing)
Operating ambient atmosphere		Must be free of corrosive gases, flammable gases and heavy dust
Storage ambient temperature		-20 to 75°C
Storage ambient humidity		10 to 90% RH (non-condensing)

*:   Excluding protrusions (for details, see external dimensions drawing)

3.2 Compatible External Equipment

■ Products of Yaskawa Electric Corporation

- **∑-III series SGDS-□□□1□A SERVOPACK**

- **∑-II series SGDH-□E SERVOPACK**
  SGDH-□E SERVOPACK must be installed with MECHATROLINK-II Application Module (JUSP-NS115).

3.3 Scope of MECHATROLINK-II Interface

This section lists the MECHATROLINK-II commands that are executable by the module.

◎: Executable by a user using axis MECHATROLINK-II command parameters.

○: Executable by a user using extended MECHATROLINK-II command parameters.

△: Not executable by a user but is executed automatically by the positioning module or external equipment.

✕: Not supported

■ MECHATROLINK-II Common Commands

Table 3.4   List of MECHATROLINK-II Common Commands

Command Code	Command	Function	Processing Classification	Synchronous Classification	Supported ?
$00	NOP	No operation	N	A	◎
$01	PRM_RD	Read parameter	D	A	◎
$02	PRM_WR	Write parameter	D	A	◎
$03	ID_RD	Read ID	D	A	○
$04	CONFIG	Set up device	C	A	◎
$05	ALM_RD	Read alarm or warning	D	A	○
$06	ALM_CLR	Clear alarm or warning	C	A	◎
$07	–	–	–	–	–
$08	–	–	–	–	–
$09	–	–	–	–	–
$0A	–	–	–	–	–
$0B	–	–	–	–	–
$0C	–	–	–	–	–
$0D	SYNC_SET	Start synchronous communications	N	A	◎
$0E	CONNECT	MECHATROLINK-II connection	N	A	△
$0F	DISCONNECT	Disconnect	N	A	△
$10	–	–	–	–	–
$11	–	–	–	–	–
$12	–	–	–	–	–
$13	–	–	–	–	–
$14	–	–	–	–	–
$15	–	–	–	–	–
$16	–	–	–	–	–
$17	–	–	–	–	–
$18	–	–	–	–	–
$19	–	–	–	–	–
$1A	–	–	–	–	–
$1B	PPRM_RD	Read non-volatile parameter	D	A	✕ [*1]
$1C	PPRM_WR	Write non-volatile parameter	D	A	◎
$1D	–	–	–	–	–
$1E	–	–	–	–	–
$1F	–	–	–	–	–

*1:   This command is not executable because it is not supported by the ∑III series SGDS-□□□1□A SERVOPACK.

Table 3.5   Processing Classifications and Synchronous Classifications

Symbol	Processing Classification
N	Network commands
D	Data communications commands
C	Control commands
M	Motion commands
X	Compound commands

Symbol	Synchronous Classification
S	Synchronous
A	Asynchronous

■ MECHATROLINK-II Common Motion Commands

Table 3.6   List of MECHATROLINK-II Common Motion Commands

Command Code	Command	Function	Processing Classification	Synchronous Classification	Supported?
$20	POS_SET	Set coordinates	D	A	◎
$21	BRK_ON	Apply brake	C	A	◎ *2
$22	BRK_OFF	Release brake	C	A	◎ *2
$23	SENS_ON	Turn sensor ON	C	A	◎
$24	SENS_OFF	Turn sensor OFF	C	A	◎
$25	HOLD	Stop motion	M	A	◎
$26	MLOCK_ON	Machine lock ON	C	A	× *1
$27	MLOCK_OFF	Machine lock OFF	C	A	× *1
$28	LTMOD_ON	Request latch mode	C	A	◎
$29	LTMOD_OFF	Release latch mode	C	A	◎
$2A	–	–	–	–	–
$2B	–	–	–	–	–
$2C	–	–	–	–	–
$2D	–	–	–	–	–
$2E	–	–	–	–	–
$2F	–	–	–	–	–

*1:   These commands are not executable because they are not supported by the Σ III series SGDS-□□□1□A SERVOPACK.

*2:   Apply or release brake by operating the external equipment itself.

Table 3.7   Processing Classifications and Synchronous Classifications

Symbol	Processing Classification
N	Network commands
D	Data communications commands
C	Control commands
M	Motion commands
X	Compound commands

Symbol	Synchronous Classification
S	Synchronous
A	Asynchronous

■ MECHATROLINK-II Standard Servo Commands

Table 3.8   List of MECHATROLINK-II Standard Servo Commands

Command Code	Command	Function	Processing Classification	Synchronous Classification	Supported?
$30	SMON	Status monitoring	D	A	◎
$31	SV_ON	Turn servo ON	C	A	◎
$32	SV_OFF	Turn servo OFF	C	A	◎
$33	–	–	–	–	–
$34	INTERPOLATE	Interpolation feed	M	S	△
$35	POSING	Positioning	M	A	◎
$36	FEED	Constant speed feed	M	A	◎
$37	–	–	–	–	–
$38	LATCH	Interpolation feed with position detection	M	S	×
$39	EX_POSING	External input positioning	M	A	◎
$3A	ZRET	Home	M	A	◎
$3B	–	–	–	–	–
$3C	VELCTRL	Velocity control	M	A	◎
$3D	TRQCTRL	Torque control	M	A	◎
$3E	ADJ	Adjust	D	A	○
$3F	SVCTRL	General-purpose servo control	X	S, A	×

Table 3.9   Processing Classifications and Synchronous Classifications

Symbol	Processing Classification
N	Network commands
D	Data communications commands
C	Control commands
M	Motion commands
X	Compound commands

Symbol	Synchronous Classification
S	Synchronous
A	Asynchronous

■ MECHATROLINK-II Subcommands

Table 3.10   List of MECHATROLINK-II Subcommands

Command Code	Command	Function	Supported?
$00	NOP	No operation	△
$01	PRM_RD	Read parameter	×
$02	PRM_WR	Write parameter	×
$05	ALM_RD	Read alarm or warning	×
$1B	PPRM_RD	Read non-volatile parameter	×[1]
$1C	PPRM_WR	Write non-volatile parameter	×
$28	LTMOD_ON	Request latch mode	×
$29	LTMOD_OFF	Release latch mode	×
$30	SMON	Status monitoring	△

*1 :   This command is not executable because it is not supported by the ∑III series SGDS-□□□1□A SERVOPACK.

3.4 Components and Their Functions

■ External View and Construction

The outer appearance of the module is shown in the figure below.
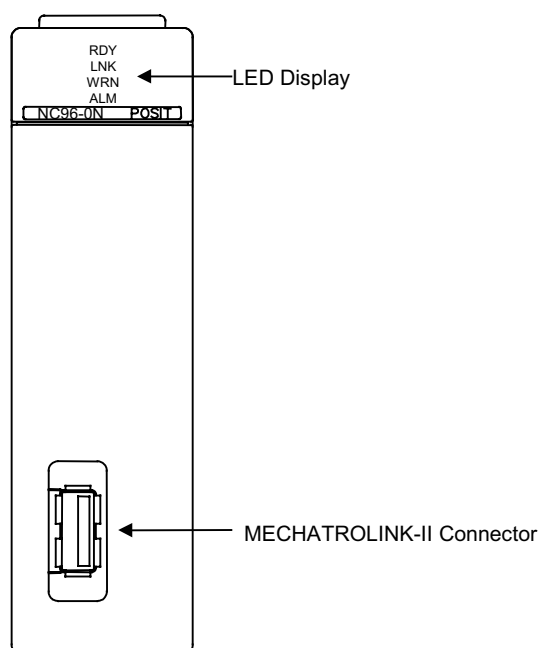
Figure 3.1   External View and Part Names

■ Component Functions

● LED Indicators

The various LED indicators turn on or turn off to indicate the operating status of the module.

Table 3.11   LED Indicators

Name	(color)	Description	Lit	Not Lit
RDY	(green)	Status of internal circuitry	Normal	Error
LNK	(green)	MECHATROLINK-II communication status	Communicating	Not communicating
WRN	(yellow)	Warning status	Warning detected	No warning
ALM	(red)	Error status	Error detected	No error

● MECHATROLINK-II Connector

This connector is used for connecting MECHATROLINK-II-compliant external equipment.

3.5   External Dimensions
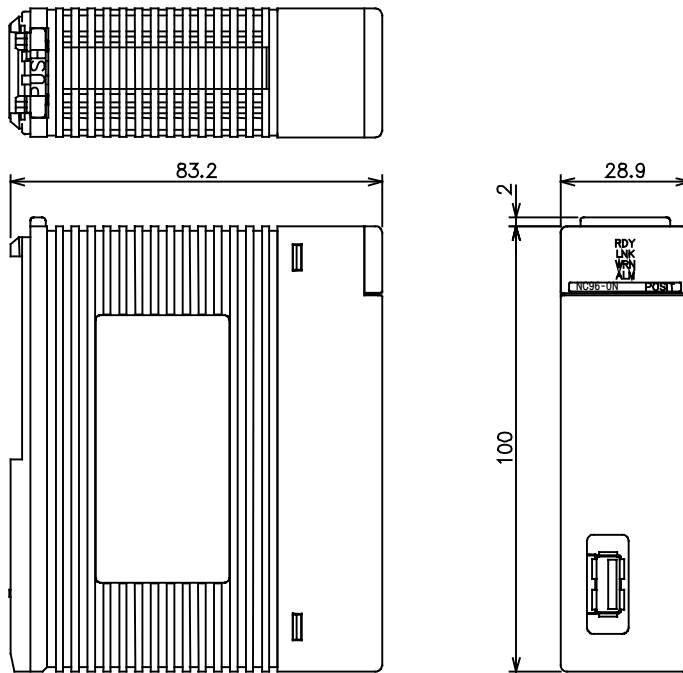
Figure 3.2   External Dimensions Drawing

3.6   Attaching/Detaching the Module

■ Attaching the Module

Figure 3.3 shows how to attach this module to the base module. First hook the anchor slot at the bottom of the module to be attached onto the anchor pin on the bottom of the base module.   Push the top of the module toward the base module until the anchor/release button clicks into place.

⚠ CAUTION

Always switch off the power before attaching or detaching the module.

Base Module

Anchor pin

Positioning module

F01.VSD
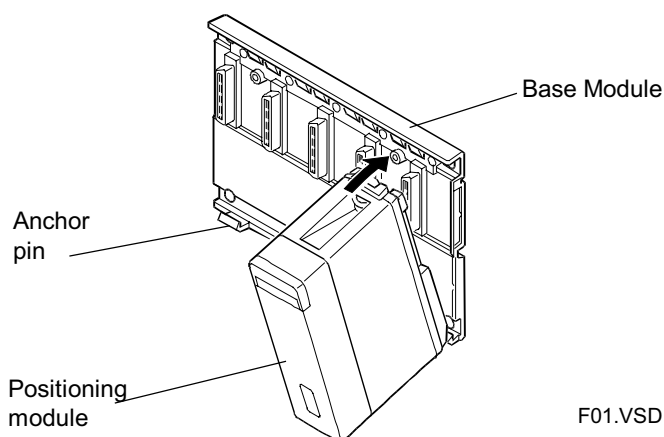
Figure 3.3   Attaching/Detaching the Module

⚠ CAUTION

Do not bend the connector on the rear of the module by force during the above operation. If the module is pushed with improper force, the connector may bend causing an error.

■ Detaching the Module

To remove this module from the base module, reverse the above operation.

Press the anchor/release button on the top of this module to unlock it and tilt the module away from the base module.

■ Attaching the Module in Intense Vibration Environments

If the module is used in intense vibration environments, fasten the module with a screw.

Use screws of type listed in the table below.

Insert these screws into the screw holes on top of the module and tighten them with a Phillips screwdriver.

Required Screw
Binding head machine screw M4 of 12 to 15 mm long (washer screw of 14-15 mm long)

F02R1.VSD
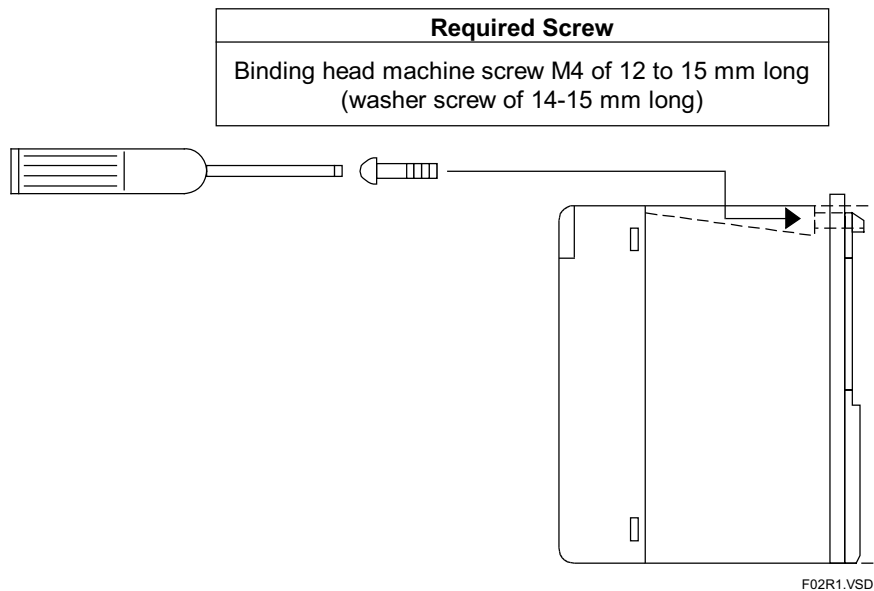
Figure 3.4   Securing Module Using Screws

3.7 Connecting to External Equipment

The positioning module uses a proprietary cable for connecting to MECHATROLINK-II-compliant external equipment.

■ MECHATROLINK-II Connector

The figure below shows the pin assignment of the module's MECHATROLINK-II connector.

Pin Number	Signal Name	Function Name
1	–	Not connected
2	/S	Serial data I/O
3	S	
4	–	Not connected

Note: The connector shell is connected to the FG terminal.

Internal circuitry is insulated using a pulse transformer.

A built-in 130 Ω terminating resistor is installed between the /S and S signals.

Figure 3.5   Pin Assignment of MECHATROLINK-II Connector

■ MECHATROLINK-II Communication Cable and Terminator (manufactured by Yaskawa Electric Corporation

The table below shows the specifications for the communication cable and terminator for MECHATROLINK-II communications.

Table 3.12   MECHATROLINK-II Communication Cable (with connectors on both ends)

Type	Model Code
MECHATROLINK-II communication cable	JEPMC-W6002-□□
	JEPMC-W6003-□□

Table 3.13   Connector for MECHATROLINK-II Communication Cable

Manufacturer	Manufacturer's Model Code
DDK, Ltd.	DUSB-APA41-B1-C50

Table 3.14   MECHATROLINK-II Terminator

Type	Model Code
MECHATROLINK-II terminator	JEPMC-W6022

■ Precautions on Wiring of MECHATROLINK-II Cable

Always take note of the following precautions when wiring MECHATROLINK-II communication cables.

● Number of connected stations

The maximum number of stations that can be connected depends on the configured transmission cycle time.

This module provides two communication cycle time options: 1 ms for 8 axes or 2 ms for 15 axes.

● Cable

Always use the proprietary cable specified above for wiring.

● **Cable length**

The total cable length must not exceed 50 m.

● **Cable length between stations**

The cable length between two stations must be at least 0.5 m.

● **Termination**

A terminator must be installed on the external equipment of the terminal station.

The wiring diagram for MECHATROLINK-II communications is shown below.
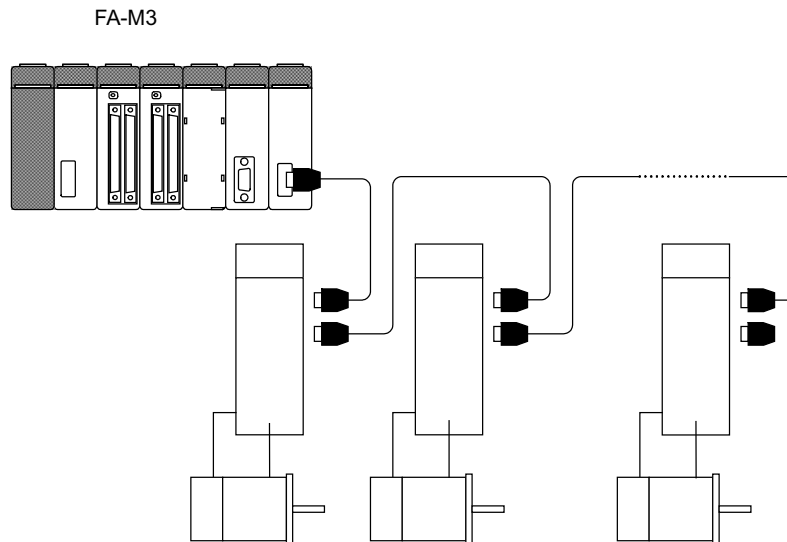
Figure 3.6   Wiring Diagram for MECHATROLINK-II Communications

4. Input/Output Relays, Parameters and Statuses

4.1 List of Input/Output Relays

This module provides 32 input relays and output relays for interfacing with the CPU module of a FA-M3 system.

4.1.1 Input Relays

Figure 4.1 shows a list of input relays that are provided with the module.

Each input relay can be made to raise an interrupt signal to the CPU module when it switches from OFF to ON.

In the table, "□□□" denotes the FA-M3 slot number where the module is mounted.

Table 4.1   List of Input Relays

Input Relay No.	Signal Name	Description	Relation with Other Relays
X□□□01	AX1 Response Received	Turns on when a MECHATROLINK-II response for axis 1 is received.	Turning off Y□□□33 also turns off this relay.
X□□□02	AX2 Response Received	Turns on when a MECHATROLINK-II response for axis 2 is received.	Turning off Y□□□34 also turns off this relay.
X□□□03	AX3 Response Received	Turns on when a MECHATROLINK-II response for axis 3 is received.	Turning off Y□□□35 also turns off this relay.
X□□□04	AX4 Response Received	Turns on when a MECHATROLINK-II response for axis 4 is received.	Turning off Y□□□36 also turns off this relay.
X□□□05	AX5 Response Received	Turns on when a MECHATROLINK-II response for axis 5 is received.	Turning off Y□□□37 also turns off this relay.
X□□□06	AX6 Response Received	Turns on when a MECHATROLINK-II response for axis 6 is received.	Turning off Y□□□38 also turns off this relay.
X□□□07	AX7 Response Received	Turns on when a MECHATROLINK-II response for axis 7 is received.	Turning off Y□□□39 also turns off this relay.
X□□□08	AX8 Response Received	Turns on when a MECHATROLINK-II response for axis 8 is received.	Turning off Y□□□40 also turns off this relay.
X□□□09	AX9 Response Received	Turns on when a MECHATROLINK-II response for axis 9 is received.	Turning off Y□□□41 also turns off this relay.
X□□□10	AX10 Response Received	Turns on when a MECHATROLINK-II response for axis 10 is received.	Turning off Y□□□42 also turns off this relay.
X□□□11	AX11 Response Received	Turns on when a MECHATROLINK-II response for axis 11 is received.	Turning off Y□□□43 also turns off this relay.
X□□□12	AX12 Response Received	Turns on when a MECHATROLINK-II response for axis 12 is received.	Turning off Y□□□44 also turns off this relay.
X□□□13	AX13 Response Received	Turns on when a MECHATROLINK-II response for axis 13 is received.	Turning off Y□□□45 also turns off this relay.
X□□□14	AX14 Response Received	Turns on when a MECHATROLINK-II response for axis 14 is received.	Turning off Y□□□46 also turns off this relay.
X□□□15	AX15 Response Received	Turns on when a MECHATROLINK-II response for axis 15 is received.	Turning off Y□□□47 also turns off this relay.
X□□□16	Communication Status	Turns on while MECHATROLINK-II communication is in progress; turns off otherwise.	Turning on Y□□□48 to initiate communication turns on this relay when communication begins. Turning off Y□□□48 also turns off this relay.

Input Relay No.	Signal Name	Description	Relation with Other Relays
X□□□17	AX1 Positioning Completed	Turns on when axis 1 is in positioning completed state.	
X□□□18	AX2 Positioning Completed	Turns on when axis 2 is in positioning completed state.	
X□□□19	AX3 Positioning Completed	Turns on when axis 3 is in positioning completed state.	
X□□□20	AX4 Positioning Completed	Turns on when axis 4 is in positioning completed state.	
X□□□21	AX5 Positioning Completed	Turns on when axis 5 is in positioning completed state.	
X□□□22	AX6 Positioning Completed	Turns on when axis 6 is in positioning completed state.	
X□□□23	AX7 Positioning Completed	Turns on when axis 7 is in positioning completed state.	
X□□□24	AX8 Positioning Completed	Turns on when axis 8 is in positioning completed state.	
X□□□25	AX9 Positioning Completed	Turns on when axis 9 is in positioning completed state.	
X□□□26	AX10 Positioning Completed	Turns on when axis 10 is in positioning completed state.	
X□□□27	AX11 Positioning Completed	Turns on when axis 11 is in positioning completed state.	
X□□□28	AX12 Positioning Completed	Turns on when axis 12 is in positioning completed state.	
X□□□29	AX13 Positioning Completed	Turns on when axis 13 is in positioning completed state.	
X□□□30	AX14 Positioning Completed	Turns on when axis 14 is in positioning completed state.	
X□□□31	AX15 Positioning Completed	Turns on when axis 15 is in positioning completed state.	
X□□□32	Error/Warning Detected	Turns on when an error or warning is detected by the module or any axis.	Turning on Y□□□64 to clear all errors and warnings turns off this relay if errors and warnings are successfully cleared.

4.1.2   Output Relays

Figure 4.2 shows a list of output relays that are provided with the module.

In the table, "□□□" denotes the FA-M3 slot number where the module is mounted.

Table 4.2   List of Output Relays

Output Relay No.	Signal Name	Description	Relation with Other Relays
Y□□□33	AX1 Send Command	Request to send MECHATROLINK-II command for axis 1.	Turn off this relay after confirming that X□□□01 has turned on.
Y□□□34	AX2 Send Command	Request to send MECHATROLINK-II command for axis 2	Turn off this relay after confirming that X□□□02 has turned on.
Y□□□35	AX3 Send Command	Request to send MECHATROLINK-II command for axis 3	Turn off this relay after confirming that X□□□03 has turned on.
Y□□□36	AX4 Send Command	Request to send MECHATROLINK-II command for axis 4	Turn off this relay after confirming that X□□□04 has turned on.
Y□□□37	AX5 Send Command	Request to send MECHATROLINK-II command for axis 5	Turn off this relay after confirming that X□□□05 has turned on.
Y□□□38	AX6 Send Command	Request to send MECHATROLINK-II command for axis 6	Turn off this relay after confirming that X□□□06 has turned on.
Y□□□39	AX7 Send Command	Request to send MECHATROLINK-II command for axis 7	Turn off this relay after confirming that X□□□07 has turned on.
Y□□□40	AX8 Send Command	Request to send MECHATROLINK-II command for axis 8	Turn off this relay after confirming that X□□□08 has turned on.
Y□□□41	AX9 Send Command	Request to send MECHATROLINK-II command for axis 9	Turn off this relay after confirming that X□□□09 has turned on.
Y□□□42	AX10 Send Command	Request to send MECHATROLINK-II command for axis 10	Turn off this relay after confirming that X□□□10 has turned on.
Y□□□43	AX11 Send Command	Request to send MECHATROLINK-II command for axis 11	Turn off this relay after confirming that X□□□11 has turned on.
Y□□□44	AX12 Send Command	Request to send MECHATROLINK-II command for axis 12	Turn off this relay after confirming that X□□□12 has turned on.
Y□□□45	AX13 Send Command	Request to send MECHATROLINK-II command for axis 13	Turn off this relay after confirming that X□□□13 has turned on.
Y□□□46	AX14 Send Command	Request to send MECHATROLINK-II command for axis 14	Turn off this relay after confirming that X□□□14 has turned on.
Y□□□47	AX15 Send Command	Request to send MECHATROLINK-II command for axis 15	Turn off this relay after confirming that X□□□15 has turned on.
Y□□□48	Start/Stop Communication	Request to start or stop MECHATROLINK-II communication	X□□□16 shows the current communication status.

Output Relay No.	Signal Name	Description	Relation with Other Relays
Y□□□49	(system reserved)		
Y□□□50	(system reserved)		
Y□□□51	(system reserved)		
Y□□□52	(system reserved)		
Y□□□53	(system reserved)		
Y□□□54	(system reserved)		
Y□□□55	(system reserved)		
Y□□□56	(system reserved)		
Y□□□57	(system reserved)		
Y□□□58	(system reserved)		
Y□□□59	(system reserved)		
Y□□□60	(system reserved)		
Y□□□61	(system reserved)		
Y□□□62	(system reserved)		
Y□□□63	(system reserved)		
Y□□□64	Clear Error/warning	Request to clear all errors and warnings	Turn off this relay after confirming that X□□□32 has turned off.

✋ CAUTION

In a multi-CPU system, only one CPU module can be configured to use the positioning module. For details on CPU configuration, see "FA-M3 Programming Tool WideField2 User's Manual" (IM34M6Q15-01E).

4.1.3   Operation of Input/Output Relays

■ Input Relays

● Response Received relays (X□□□01 to X□□□15)

(1) When sending MECHATROLINK-II commands

The Response Received relay of an axis turns on when a MECHATROLINK-II response is received for a MECHATROLINK-II command, whose transmission was initiated by a rising edge of the Send Command relay (Y□□□33 to Y□□□47) of the axis.

To confirm that a response has been received, check that the command code (COMMAND) stored in the received MECHATROLINK-II response tallies with the command code of the transmitted MECHATROLINK-II command, and that the axis is ready to receive commands (CMDRDY bit of STATUS = 1).

Turning off the Send Command relay of an axis (Y□□□33 to Y□□□47) turns off the corresponding Response Received relay.

(2) When executing interpolation movement commands

The Response Received relay of an axis turns on to indicate normal processing of an interpolation movement command, whose execution was initiated by a rising edge in the Send Command relay (Y□□□33 to Y□□□47) of the axis.

Turning off the Send Command relay of an axis (Y□□□33 to Y□□□47) turns off the corresponding Response Received relay.

● Communication Status relay (X□□□16)

The Communication Status relay turns on when MECHATROLINK-II communication initialization, which was initiated by a rising edge in the Start/Stop Communication relay (Y□□□48), is successfully completed to indicate that the module is ready to send and receive MECHATROLINK-II commands.

Turning off the Start/Stop Communication relay (Y□□□48) to stop MECHATROLINK-II communication also turns off this relay.

If MECHATROLINK-II communication initialization is not successful, this relay does not turn on. If so, you should check the configuration and wiring of external equipment, and the communication parameter values.

If you have changed any communication parameter value, re-initiate communication after powering on the external equipment and FA-M3.

● Positioning Completed relays (X□□□17 to X□□□31)

(1) When sending MECHATROLINK-II commands

The Positioning Completed relay for an axis turns on when the axis is in Positioning Completed state.

This relay turns off when a positioning movement, which is initiated by a MECHATROLINK-II command, begins.

The relay turns on or turns off according to the Positioning Completed Status (PSET) bit of STATUS of a MECHATROLINK-II response.

(2) When executing interpolation movement commands

The Positioning Completed relay for an axis turns on when the axis is in Positioning Completed state.

This relay turns off when a positioning movement, which is initiated by an interpolation movement command, begins.

After a positioning movement, which is initiated by an interpolation movement command, is completed, the relay turns on or turns off according to the Positioning Completed Status (PSET) bit of STATUS of the MECHATROLINK-II response.

● **Error/Warning Detected relay (X□□□32)**

    The Error/Warning Detected relay turns on when an error or warning is detected by the module or any axis.

    The relay turns off when all errors and warnings are cleared.

    The relay turns on when the STATUS of a MECHATROLINK-II response received from external equipment indicates an alarm (ALARM bit=1) or a warning (WARNG bit=1), or when the module detects a communication alarm (communication error, watchdog timer error or command timeout error, etc.) or a parameter setup error when executing an interpolation movement command.

    To clear all reported errors and warnings, turn on the Clear Error/Warning relay (Y□□□64). If an error or warning condition persists even after turning on the Clear Error/Warning relay (Y□□□64), the Error/Warning Detected relay remains ON.

    For details on how to find out the cause of an error or warning when the Error/Warning Detected relay is ON, see Section 5.5, "Detecting Errors, Warnings and Communication Alarms".

■ Output Relays

● Send Command relays (Y□□□33 to Y□□□47)

(1) When sending MECHATROLINK-II commands

Turning on the Send Command relay for an axis after setting the Command Code (COMMAND) axis command parameter to a MECHATROLINK-II command code transmits the specified MECHATROLINK-II command. Extended MECHATROLINK-II command parameter data is transmitted as is if the command code (Command Code) is specified as -1.

The corresponding Response Received input relay (X□□□01 to X□□□15) turns on when a MECHATROLINK-II response to the transmitted MECHATROLINK-II command is received.

Turning off the Send Command output relay thereafter also turns off the corresponding Response Received input relay (X□□□01 to X□□□15).

The MECHATROLINK-II response data is stored in the axis MECHATROLINK-II response parameters, axis statuses and common statuses.

MECHATROLINK-II response data is stored as is in the Extended MECHATROLINK-II response parameter area if the command code (Command Code) was specified as -1.

(2) When executing interpolation movement commands

Turning on the Send Command relay for an axis after setting the Command Code (COMMAND) axis command parameter to an interpolation movement command code executes the specified interpolation movement command.

The Response Received relay (X□□□01 to X□□□15) turns on when the executed command is successfully processed.

Turning off the Send Command output relay thereafter also turns off the corresponding Response Received input relay (X□□□01 to X□□□15).

● Start/Stop Communication relay (Y□□□48)

Turning on the Start/Stop Communication relay initializes MECHATROLINK-II communication for the axes specified in the MECHATROLINK-II communication parameters.

The Communication Status relay (X□□□16) turns on when MECHATROLINK-II communication initialization is successfully completed to indicate that the module is ready to send and receive MECHATROLINK-II commands.

Always keep the Start/Stop Communication relay ON while operating the module. Turning off this relay stops MECHATROLINK-II communication, and turns off the Communication Status relay. It also stops the operation of connected external equipment.

● Clear Error/Warning relay (Y□□□64)

Turning on the Clear Error/Warning relay clears warnings and errors on all axes. It also clears any communication alarm (communication error, watchdog timer error, command timeout error, etc.) detected by the module and any parameter setup error detected for an interpolation movement command execution.

The Error/Warning Detected relay (X□□□32) turns off if all errors and warnings are cleared successfully.

If an error/warning condition persists even after turning on the Clear Error/Warning relay, the Error/Warning Detected relay (X□□□32) remains ON.

4.2 List of Parameters and Statuses

Table 4.3 shows the layout of the parameter areas and the status areas provided for interfacing with the module. A CPU module writes parameters to the parameter areas and reads status values from the status areas. For details of individual parameters and statuses, see Subsections 4.2.1 to 4.2.7.

In Tables 4.4, 4.6, 4.8 to 4.12, a parameter or status that is listed with two position data numbers stores two-word data. The smaller position data number represents the low word, while the larger position data number represents the high word.

"□□" in a 4-digit data position number denotes an axis number, ranging from 01 to 15, for axes 1 to 15.

Each data position number represents one data word. Always use word-based WRITE and READ instructions when accessing the module from a sequence program. Using long word-based instructions will result in incorrect access. Similarly, always use word-based instructions when accessing the module from a BASIC program.

⚠ CAUTION

When the CPU module reads 2-word status data from the positioning module, concurrency of the high-order word and low-order word of 2-word data is not assured due to conflicts between the timing of reading from the CPU module and the data update cycle of the positioning module.

To ensure that the high-order word and low-order word of 2-word data are concurrent when reading from a sequence CPU, use the READ command to read the data twice consecutively and verify that the data read are the same in both instances. If the HRD command is used, data concurrency is not assured even if you confirm that the data are the same.

Data concurrency cannot be assured when reading from a BASIC CPU.

Table 4.3   Layout of Parameter and Status Areas

Data Position Number	Description
0001 to 0008	Module information statuses
0009 to 0030	(System reserved)
0031 to 0100	MECHATROLINK-II communication parameters

0101 to 0160
0161 to 0180
0181 to 0200
	Axis 1: MECHATROLINK-II command parameters
	            MECHATROLINK-II response parameters
	            Statuses

0201 to 0300	Axis 2: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
0301 to 0400	Axis 3: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
0401 to 0500	Axis 4: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
0501 to 0600	Axis 5: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
0601 to 0700	Axis 6: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
0701 to 0800	Axis 7: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
0801 to 0900	Axis 8: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
0901 to 1000	Axis 9: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
1001 to 1100	Axis 10: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
1101 to 1200	Axis 11: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
1201 to 1300	Axis 12: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
1301 to 1400	Axis 13: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
1401 to 1500	Axis 14: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
1501 to 1600	Axis 15: MECHATROLINK-II command parameters MECHATROLINK-II response parameters Statuses
1601 to 1700	Common statuses
1701 to 1850 1851 to 2000	Extended MECHATROLINK-II command parameters Extended MECHATROLINK-II response parameters
2001 onwards	(system reserved)

For details on the module information statuses of position data numbers 0001 to 0008, see Subsection 4.2.7, "Module Information Statuses".

4.2.1　MECHATROLINK-II Communication Parameters

This subsection lists and describes MECHATROLINK-II communication parameters.

■ List of MECHATROLINK-II Communication Parameters

Table 4.4　　List of MECHATROLINK-II Communication Parameters

Data Position Number	Data Name	Data Description
0031	AX1 Station Address	0 (unconnected), $41 to $4F
0032	AX2 Station Address	0 (unconnected), $41 to $4F
0033	AX3 Station Address	0 (unconnected), $41 to $4F
0034	AX4 Station Address	0 (unconnected), $41 to $4F
0035	AX5 Station Address	0 (unconnected), $41 to $4F
0036	AX6 Station Address	0 (unconnected), $41 to $4F
0037	AX7 Station Address	0 (unconnected), $41 to $4F
0038	AX8 Station Address	0 (unconnected), $41 to $4F
0039	AX9 Station Address	0 (unconnected), $41 to $4F
0040	AX10 Station Address	0 (unconnected), $41 to $4F
0041	AX11 Station Address	0 (unconnected), $41 to $4F
0042	AX12 Station Address	0 (unconnected), $41 to $4F
0043	AX13 Station Address	0 (unconnected), $41 to $4F
0044	AX14 Station Address	0 (unconnected), $41 to $4F
0045	AX15 Station Address	0 (unconnected), $41 to $4F
0046	C2 Master	0: unconnected; 1: connected
0047	(system reserved)	Always 0
0048	(system reserved)	Always 0
0049	Communication Cycle Time	0: 1 ms, 1: 2 ms　　(Communication cycle time of 1 ms is disallowed when more than 8 axes are connected)
0050 to 0100	(system reserved)	Always 0

■ Description of MECHATROLINK-II Communication Parameters

● Axis Stations Address

The Axis Station Address of each axis (axes 1 to 15) specifies the station address of an external machine.

Table 4.5　　Switch Setup of External Equipment and Station Address

SW1	Bit 3 of SW2	Stations Address
0	OFF	Invalid (do not set switch to this position)
1	OFF	$41 (factory setting)
2	OFF	$42
3	OFF	$43
4	OFF	$44
5	OFF	$45
6	OFF	$46
7	OFF	$47
8	OFF	$48
9	OFF	$49
10	OFF	$4A
11	OFF	$4B
12	OFF	$4C
13	OFF	$4D
14	OFF	$4E
15	OFF	$4F

● **C2 Master**

Specifies whether a C2 master is to be connected.

● **Communication Cycle Time**

This parameter specifies the communication cycle time.

If communication cycle time is set to 1 ms, no more than eight axes can be connected.

4.2.2   Axis Command Parameters

This subsection lists and describes axis command parameters.

The data content and data range of each MECHATROLINK-II command parameter depends on the type of external equipment that is connected. For details on individual parameters, see the user's manual of the connected external equipment.

We describe here the command parameters applicable for ∑-III Series SGDS-□□□1□A servo drivers manufactured by Yaskawa Electric Corporation.

■ List of Axis Command Parameters

Table 4.6   List of Axis Command Parameters

Data Position Number	Data Name	Data Description
□□01	Command Code (COMMAND)	$0000 to $00FF (MECHATROLINK-II commands) $FFFF (Extended MECHATROLINK-II commands) $0100 to $FF00 (Interpolation movement commands)
□□02 / □□03	(system reserved)	
□□04	Latch Signal (LT_SGNL)	Bits 0 and 1: Latch Signal (0 to 3)
□□05	Option1 (OPTION1)	Bits 3 and 4: ACC/DCC Curve (0 to 2)
□□06	Option2 (OPTION2)	Bits 0and 1: Gain Switch (0 to 3) Bit 4: Speed Loop P/PI Control Switch (0: PI control, 1: P control) Bit 5: Clear Position Integral (0: no; 1: yes) Bit 6: ~~Forward Torque Limit~~ (0: no; 1: yes) Bit 7: ~~Reverse Torque Limit~~ (0: no; 1: yes)
□□07 / □□08	Target Position (TPOS)	-1,073,741,823 to 1,073,741,823 (reference unit)
□□09 / □□10	Target Speed (TSPD)	-131,068,000 to 131,068,000 (reference unit/s)
□□11	(system reserved)	
□□12	Monitor 2 Selection (MOD_SEL)	$0000 to $000F, default: $0003 (APOS)
□□13	(system reserved)	
□□14	Coordinate Selection (PS_SUBCMD)	Bit 7: Reference Point Enable (0: disabled, 1: enabled) Bits 3 to 0: Coordinate Selection (3: APOS)
□□15 / □□16	Preset Coordinate (POS_DATA)	-1,073,741,823 to 1,073,741,823 (reference unit)
□□17	Parameter No. (NO)	$0000 to $FFFF
□□18	Parameter Data Size (SIZE)	2 or 4
□□19 / □□20	Parameter Data (PARAMETER)	Parameter value to be written
□□21 / □□22	(system reserved)	
□□23	Hold Mode (HOLD_MOD)	0: Decelerate & stop, 1: Stop immediately
□□24	Alarm Clear Mode (ALM_CLR_MOD)	0: Clear current alarm, 1: Clear alarm history
□□25	Forward Torque Limit (P_TLIM) or Torque Feed Forward (TFF)	0 to $4000
□□26	Reverse Torque Limit (N_TLIM)	0 to $4000
□□27 / □□28	Speed reference (VREF)	0 to $40000000
□□29 / □□30	Speed Limit (VLIM)	0 to $40000000
□□31 / □□32	Torque Reference (TQREF)	0 to $40000000
□□33	Monitor 3 Selection (MOD_SEL)	$0000 to $000F, default: $0008 (FSPD)
□□34	Monitor 4 Selection (MOD_SEL)	$0000 to $000F, default: $000B (TRQ)
□□35 to □□40	(system reserved)	
□□41 / □□42	Target Position (for interpolation movement commands)	-2,147,483,648 to 2,147,483,647 (reference unit)
□□43 / □□44	Target Speed (for interpolation movement commands)	1 to 2,147,483,647 (reference unit/s)
□□45	Interpolation Axes (for interpolation movement commands)	Bits 0 to 7 (for axes 1 to 8)
□□46	Acceleration Time (for interpolation movement commands)	0 to 32767 [ms]
□□47	Deceleration Time (for interpolation movement commands)	0 to 32767 [ms]
□□48 to □□60	(system reserved)	

Note: □□ denotes an axis number (01 to 15).

■ Description of Axis Command Parameters

● Command Code (COMMAND)

Specify the command code for the MECHATROLINK-II command to be transmitted or the interpolation movement command to be executed.

$FFFF   : Transmits extended MECHATROLINK-II command parameter data as is.

$0000 to $00FF   : Transmits MECHATROLINK-II command parameter data for an axis.

$0100 to $0500   : Executes interpolation movement command

$0100: Start positioning

$0200: Decelerate & stop

$0300: Stop immediately

$0400: Change speed

$0500: Change target position

● Latch Signal (LT_SGNL)

Select the signal for latching position data.

```
15 14 13 12 11 10 9  8  7  6  5  4  3  2  1  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  X  X
                                          |  |
                                          └  └ ── - Latch Signal (LT_SGNL)
                                                     0: Encoder Phase C (CPHAS)
                                                     1: External Signal 1 (EXT1)
                                                     2: External Signal 2 (EXT2)
                                                     3: External Signal 3 (EXT3)
```

● Option 1 (OPTION1)

```
15 14 13 12 11 10 9  8  7  6  5  4  3  2  1  0
 0  0  0  0  0  0  0  0  0  0  0  0  X  X  0  0  0
                                    |  |
                                    └  └ ─ ─ ─ ─ - ACC/DCC Curve
                                                   0: Linear ACC/DCC (no ACC/DCC filter)
                                                   1: ACC/DCC by index function
                                                   2: Simple S-shaped ACC/DCC (moving average)
```

● **Option 2 (OPTION2)**

```
15 14 13 12 11 10 9  8  7  6  5  4  3  2  1  0
 0  0  0  0  0  0  0  0  X  X  X  X  0  0  X  X
```
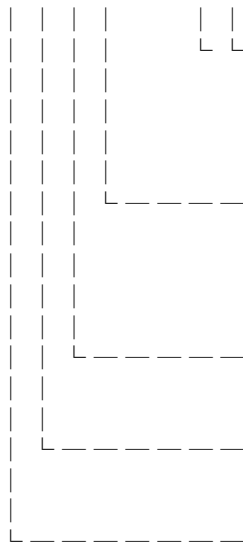
- Gain Switch
  0: First gain
  1: Second gain
  2: Third gain
  3: Fourth gain

- Speed Loop P/PI Control
  0: PI control (mode switch can be used for switching to P control)
  1: P control

- Clear Position Integral
  0: No, 1: Yes

- Forward Torque Limit
  0: No, 1: Yes

- Reverse Torque Limit
  0: No, 1: Yes

● **Target Position (TPOS)**

Specify the target position.

● **Target Speed (TSPD)**

Specify the target speed.

- **Monitor 2 Selection (MON_SEL), Monitor 3 Selection (MON_SEL), Monitor 4 Selection (MON_SEL)**

    Select the monitored information to be returned as MECHATROLINK-II response data.

    Monitor 1 is always fixed to 'POS'.

Table 4.7   **Codes for Monitor Selection**

Name	Code	Description	Unit
POS	0	Reference position in the reference coordinate system	Reference unit
MPOS	1	Refence position in the mechanical coordinate system	Reference unit
PERR	2	Position error	Reference unit
APOS	3	Absolute position	Reference unit
LPOS	4	Counter latched position	Reference unit
IPOS	5	Internal position in the reference coordinate system	Reference unit
TPOS	6	Target position	Reference unit
-	7	–	–
FSPD	8	Feedback speed	Reference unit / s
CSPD	9	Reference speed (position reference output)	Reference unit / s
TSPD	A	Target speed	Reference unit / s
TRQ	B	Torque reference	%
-	C	–	–
-	D	–	–
OMN1	E	Option monitor 1	–
OMN2	F	Option monitor 2	–

- **Coordinate Selection (PS_SUBCMD)**

    Specify whether to enable or disable the reference point (REFE), and select the coordinate system (POS_SEL) when Command Code (COMMAND) is 'POS_SET' ($20).

    ```
    15 14 13 12 11 10 9  8  7  6  5  4  3  2  1  0
     0  0  0  0  0  0  0  0  X  0  0  0  X  X  X  X
                            |           | | | |
                            |           └ └ └ └   - Coordinate Selection (POS_SEL)
                            |                       3: Absolute position (APOS)
                            |
                            └ — — — — — — —       - Reference Point Enable (REFE)
                                                    0: Disabled
                                                    1: Enabled
    ```
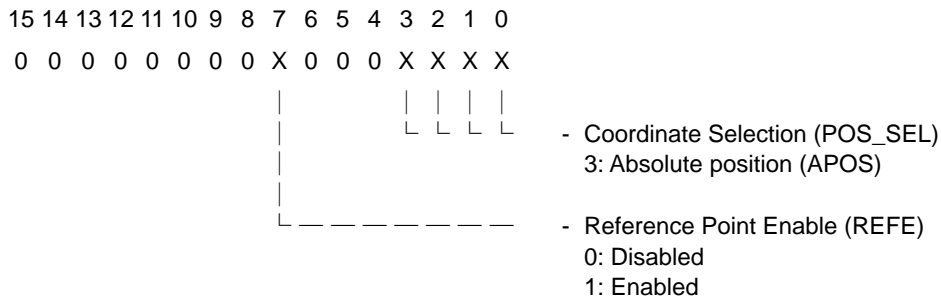
- **Preset Coordinate (POS_DATA)**

    Specify preset values for the selected coordinate system when Command Code (COMMAND) is 'POS_SET' ($20).

- **Parameter No. (NO), Parameter Data Size (SIZE) and Parameter Data (PARAMETER)**

  Specify the parameter no. (NO) and parameter data size (SIZE) when Command Code (COMMAND) is 'PRM_RD' ($01).

  Specify the parameter no. (NO), parameter data size (SIZE) and parameter data (PARAMETER) when Command Code (COMMAND) is 'PRM_WR' ($02) or 'PPRM_WR' ($1C).

- **Hold Mode (HOLD_MOD)**

  Specify the hold mode when Command Code (COMMAND) is 'HOLD' ($25).

  0: Decelerate & stop according to the deceleration parameter value

  1: Stop immediately (stop and complete output)

- **Alarm Clear Mode (ALM_CLR_MOD)**

  Specify the alarm clear mode when Command Code (COMMAND) is 'ALM_CLR' ($06).

  0: Clear current alarm or warning status

  1: Clear alarm status history

- **Forward Torque Limit (P_TLIM) or Torque Feed Forward (TFF)**

  Specify the forward torque limit (P_TLIM) or torque feed forward (TFF) when Command Code (COMMAND) is 'VELCTRL' ($3C).

- **Reverse Torque Limit (N_TLIM)**

  Specify the reverse torque limit (N_TLIM) when Command Code (COMMAND) is 'VELCTRL' ($3C).

- **Speed Reference (VREF)**

  Specify the speed reference (VREF) when Command Code (COMMAND) is 'VELCTRL' ($3C).

- **Speed Limit (VLIM)**

  Specify the speed limit (VLIM) when Command Code (COMMAND) is 'TRQCTRL' ($3D).

- **Torque Reference (TQREF)**

  Specify the torque reference (TQREF) when Command Code (COMMAND) is 'TRQCTRL' ($3D).

● **Target Position (for interpolation movement commands)**

Specify the target position when executing an interpolation movement command.

This parameter must be specified for the reference axis, as well as each interpolation axis.

● **Target Speed (for interpolation movement commands)**

Specify the target speed when executing an interpolation movement command.

This parameter must be specified for the reference axis, as well as each interpolation axis.

● **Interpolation Axes (for interpolation movement commands)**

Specify the set of axes to be moved in tandem with the reference axis during interpolation movement using bit data.

This parameter is only valid when specified for the reference axis. It is ignored when specified for an interpolation axis.

```
15 14 13 12 11 10 9  8  7  6  5  4  3  2  1  0
 0  X  X  X  X  X  X  X  X  X  X  X  X  X  X  X
    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  └─   - Axis 1 (0: no; 1: yes)
    |  |  |  |  |  |  |  |  |  |  |  |  |  |  └──    - Axis 2 (0: no; 1: yes)
    |  |  |  |  |  |  |  |  |  |  |  |  |  └───     - Axis 3 (0: no; 1: yes)
    |  |  |  |  |  |  |  |  |  |  |  |  └────      - Axis 4 (0: no; 1: yes)
    |  |  |  |  |  |  |  |  |  |  |  └─────       - Axis 5 (0: no; 1: yes)
    |  |  |  |  |  |  |  |  |  |  └──────        - Axis 6 (0: no; 1: yes)
    |  |  |  |  |  |  |  |  |  └───────         - Axis 7 (0: no; 1: yes)
    |  |  |  |  |  |  |  |  └────────          - Axis 8 (0: no; 1: yes)
    |  |  |  |  |  |  |  └─────────           - Axis 9 (0: no; 1: yes)
    |  |  |  |  |  |  └──────────            - Axis 10 (0: no; 1: yes)
    |  |  |  |  |  └───────────             - Axis 11 (0: no; 1: yes)
    |  |  |  |  └────────────              - Axis 12 (0: no; 1: yes)
    |  |  |  └─────────────               - Axis 13 (0: no; 1: yes)
    |  |  └──────────────                - Axis 14 (0: no; 1: yes)
    |  └───────────────                 - Axis 15 (0: no; 1: yes)
```
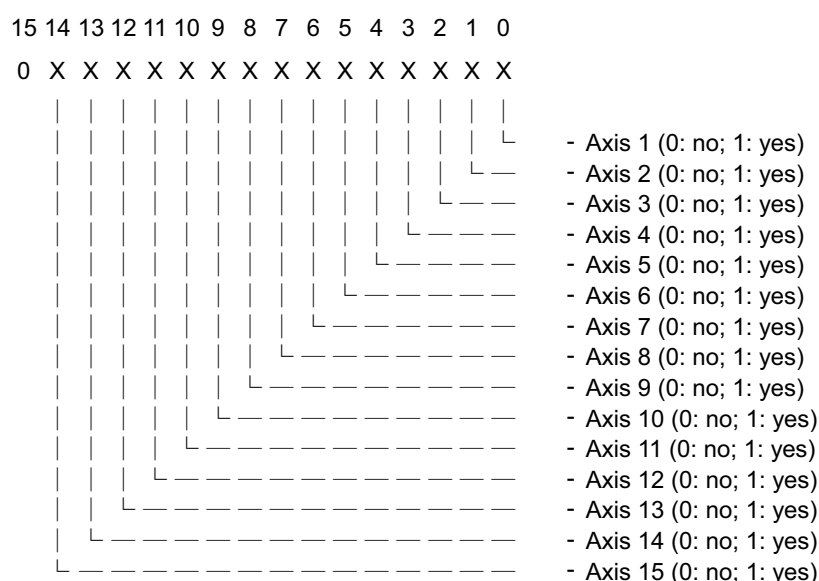
● **Acceleration Time (for interpolation movement commands)**

Specify the acceleration time for an interpolation movement.

This parameter is only valid when specified for the reference axis. It is ignored when specified for an interpolation axis.

● **Deceleration Time (for interpolation movement commands)**

Specify the deceleration time for an interpolation movement.

This parameter is only valid when specified for the reference axis. It is ignored when specified for an interpolation axis.

4.2.3   Axis MECHATROLINK-II Response Parameters

This subsection lists and describes MECHATROLINK-II response parameters for each axis.

The data content and data range of each response parameter depends on the external equipment that is connected. For details on individual parameters, see the user's manual of the connected external equipment.

We describe here the response parameters applicable for ∑-III Series SGDS-□□□1□A servo drivers manufactured by Yaskawa Electric Corporation.

■ List of Axis MECHATROLINK-II Response Parameters

Table 4.8   List of Axis MECHATROLINK-II Response Parameters

Data Position Number	Data Name	Data Description
□□61	(system reserved)	
□□62	Coordinate Selection (PS_SUBCMD)	Bit 7: Reference Point Enable (0: disabled, 1: enabled) Bits 3 to 0: Coordinate Selection (3: APOS)
□□63 / □□64	Preset Coordinate (POS_DATA)	-1,073,741,823 to 1,073,741,823 (reference unit)
□□65	Parameter No. (NO)	$0000 to $FFFF
□□66	Parameter Data Size (SIZE)	2 or 4
□□67 / □□68	Parameter Data (PARAMETER)	Parameter data returned after reading
□□69 to □□80	(system reserved)	

Note: □□ denotes an axis number (01 to 15).

■ Description of Axis MECHATROLINK-II Response Parameters

● Coordinate Selection (PS_SUBCMD)

Returns the values of Reference Point Enable (REFE) and Coordinate Selection (POS_SET) for a transmitted MECHATROLINK-II command with Command Code (COMMAND) 'POS_SET' ($20).

```
15 14 13 12 11 10 9  8  7  6  5  4  3  2  1  0

0  0  0  0  0  0  0  0  X  0  0  0  X  X  X  X
                       |           | | | |
                       |           L L L L    - Coordinate Selection (POS_SEL)
                       |                         3: Absolute position (APOS)
                       |
                       L _ _ _ _ _ _ _        - Reference Point Enable (REFE)
                                                 0: Disabled
                                                 1: Enabled
```

● Preset Coordinate (POS_DATA)

Returns the preset coordinate value (POS_DATA) for a transmitted MECHATROLINK-II command with Command Code (COMMAND) 'POS_SET' ($20).

- **Parameter No. (NO), Parameter Data Size (SIZE) and Parameter Data (PARAMETER)**

  Returns the values of the parameter no. (NO), parameter data size (SIZE) and parameter data (PARAMETER) when the command code (COMMAND) of the transmitted MECHATROLINK-II command is 'PRM_RD' ($01), 'PRM_WR' ($02) or 'PPRM_WR' ($1C).

4.2.4   Axis Statuses

This subsection lists and describes the axis statuses.

The data content of each status depends on the external equipment that is connected. For details on individual statuses, see the user's manual of the connected external equipment.

We describe here the statuses applicable for ∑-III Series SGDS-□□□1□A servo drivers manufactured by Yaskawa Electric Corporation.

■ List of Axis Statuses

Table 4.9   List of Axis Statuses

Data Position Number	Data Name	Data Description
□□81	Alarm Code (ALARM)	$0002 to $00F1 ($0099 or $0000 when operation is normal)
□□82	Status (STATUS)	Bits 0 to 15
□□83 / □□84	Monitor 1 (MONITOR1)	Monitored data 1 (always fixed to 'POS')
□□85 / □□86	Monitor 2 (MONITOR2)	Monitored data 2
□□87	I/O Signal Monitor (I/O)	Bits 0 to 15
□□88	(system reserved)	
□□89 / □□90	Counter Latched Position (LPOS)	-1,073,741,823 to 1,073,741,823 (reference unit)
□□91 / □□92	Monitor 3 (MONITOR3)	Monitored data 3
□□93 / □□94	Monitor 4 (MONITOR4)	Monitored data 4
□□95	Substatus (SUBSTATUS)	Bits 0 to 15
□□96	Interpolation Status	Bits 0 to 15
□□97 / □□98	Remaining Travel Status	-2,147,483,648 to 2,147,483,647 (reference unit)
□□99 to □□00	(system reserved)	

Note: □□ denotes an axis number (01 to 15).

■ Description of Axis Statuses

● Alarm Code (ALARM)

Stores read data for alarm code. If operation is normal, $0099 or $0000 is returned.

● Status (STATUS)

Stores read data for status.
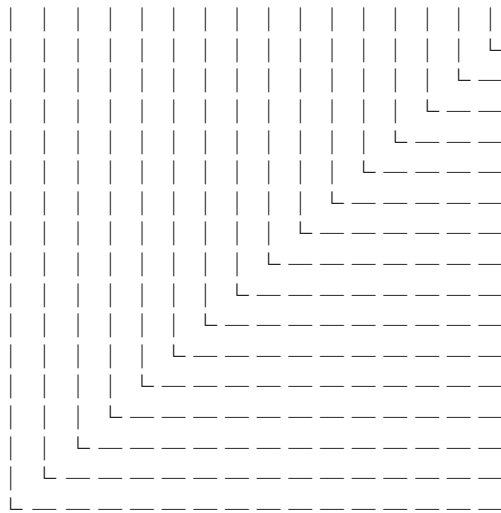
```
15 14 13 12 11 10 9  8  7  6  5  4  3  2  1  0
X  X  X  X  X  X  X  X  X  X  X  X  X  X  X  X
│  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │
│  │  │  │  │  │  │  │  │  │  │  │  │  │  │  └─   -  Alarm (ALARM)
│  │  │  │  │  │  │  │  │  │  │  │  │  │  └──    -  Warning (WARNG)
│  │  │  │  │  │  │  │  │  │  │  │  │  └───     -  Command Ready (CMDRDY)
│  │  │  │  │  │  │  │  │  │  │  │  └────       -  Servo ON (SVON)
│  │  │  │  │  │  │  │  │  │  │  └─────         -  Main Power ON (PON)
│  │  │  │  │  │  │  │  │  │  └──────           -  Machine Lock (MLOCK)
│  │  │  │  │  │  │  │  │  └───────             -  Home Position (ZPOINT)
│  │  │  │  │  │  │  │  └────────               -  Positioning Completed (PSET)
│  │  │  │  │  │  │  └─────────                 -  Output Completed (DEN)
│  │  │  │  │  │  └──────────                   -  Torque Limit (T_LIM)
│  │  │  │  │  └───────────                     -  Latch Completed (L_CMP)
│  │  │  │  └────────────                       -  Positioning Proximity (NEAR)
│  │  │  └─────────────                         -  Forward Software Limit (P-SOT)
│  │  └──────────────                           -  Reverse Software Limit (N-SOT)
│  └───────────────                             -  (system reserved)
└────────────────                               -  (system reserved)
```

● Monitor 1 (MONITOR1), Monitor 2 (MONITOR2), Monitor 3 (MONITOR3), Monitor 4 (MONITOR4)

Stores read data for Monitor 1, Monitor 2, Monitor 3 and Monitor 4.

Monitor 1 is always fixed to 'POS'.

● **I/O Signal Monitor (I/O)**

Stores read data for I/O signals.

```
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
 X  X  X  X  X  X X X X X X X X X X X
```
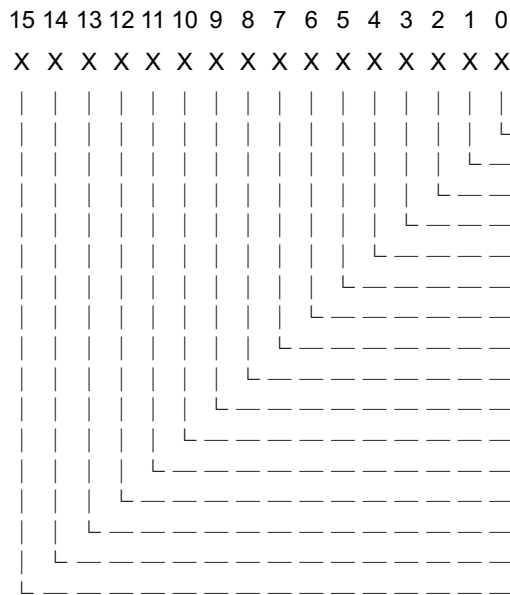
- Forward Limit Switch Input (P-OT)
- Reverse Limit Switch Input (N-OT)
- DCC Limit Switch Input (DEC)
- Encoder Phase A Input (PA)
- Encoder Phase B Input (PB)
- Encoder Phase C Input (PC)
- External Latch Input 1 (EXT1)
- External Latch Input 2 (EXT2)
- External Latch Input 3 (EXT3)
- Brake Output (BRK)
- (system reserved)
- (system reserved)
- CN1 input selected in Pn81E.0
- CN1 input selected in Pn81E.1
- CN1 input selected in Pn81E.2
- CN1 input selected in Pn81E.3

● **Counter Latched Position (LPOS)**

Stores read data for the counter latched position (LPOS), which was latched when the latch signal went high for a transmitted MECHATROLINK-II command with Command Code (COMMAND) set to 'EX_POSING' ($39) or 'LTMOD_ON' ($28).

● **Substatus (SUBSTATUS)**

Stores status data.

```
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
 0  0  0  0  0  0 0 0 0 0 0 0 0 X X X
```
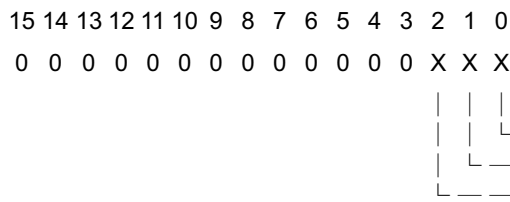
- Subcommand Alarm (SBALARM)
- Subcommand Warning (SBWARNG)
- Subcommand Ready (SBCMDRDY)

● **Interpolation Status**

Stores the status of an interpolation movement in progress.

```
15 14 13 12 11 10 9  8  7  6  5  4  3  2  1  0
 0  X  0  0  0  0  0  0  0  0  0  X  X  X  X  X
    │                          │  │  │  │  │
    │                          │  │  │  │  └─   - Accelerating (at beginning of movement)
    │                          │  │  │  └──     - Moving at constant speed
    │                          │  │  └───       - Decelerating (in decelerate and stop movement)
    │                          │  └────         - Changing speed
    │                          └─────           - Changing target position
    │
    └──────────────────────────────            - Interpolating (Module is generating path)
```

● **Remaining Travel Status**

Stores the remaining distance to the target position for an interpolation movement in progress.

If a Decelerate & Stop movement is executed during movement, this status stores the remaining distance to the position for deceleration and stopping.

If a Change Target Position movement is executed during movement, this status stores the remaining distance to the new target position after the Change Target Position movement completes execution.

⚠ **CAUTION**

When the CPU module reads 2-word status data from the positioning module, concurrency of the high-order word and low-order word of 2-word data is not assured due to conflicts between the timing of reading from the CPU module and the data update cycle of the positioning module.

To ensure that the high-order word and low-order word of 2-word data are concurrent when reading from a sequence CPU, use the READ command to read the data twice consecutively and verify that the data read are the same in both instances. If the HRD command is used, data concurrency is not assured even if you confirm that the data are the same.

Data concurrency cannot be assured when reading from a BASIC CPU.

4.2.5   Common Statuses

This subsection lists and describes the common statuses.

■ List of Common Statuses

Table 4.10   List of Common Statuses

Data Position Number	Data Name	Data Description
1601	Alarm Axis Bits	Bit data for module, AX15, AX14, …, AX2 and AX1
1602	Warning Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1
1603	Command Ready (CMDRDY) Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1
1604	Servo ON (SVON) Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1
1605	Main Power ON (PON) Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1
1606	Machine Lock (MLOCK) Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1
1607	Home Position (ZPOINT) Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1
1608	Positioning Completed (PSET) Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1
1609	Output Completed (DEN) Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1
1610	Torque Limit (T_LIM) Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1
1611	Latch Completed (L_CMP) Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1
1612	Positioning Proximity (NEAR) Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1
1613	Forward Software Limit (P-SOT) Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1
1614	Reverse Software Limit (N-SOT) Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1
1615 to 1622	(system reserved)	
1623	Module Alarm Code	Communication error, watchdog timer error, command timeout error, parameter setup error (for interpolation movement commands), etc.
1624	Module Detailed Alarm Code	'0' and bit data for AX15, AX14, …, AX2 and AX1
1625 to 1700	(system reserved)	

■ Description of Common Statuses

● Alarm Axis Bits

Stores bit data that indicates the alarm status of the positioning module and each axis.

The alarm module bit turns on when a communication alarm (communication error, watchdog timer error, command timeout error, etc.) is detected by the module, or when a parameter setup error is detected when an interpolation movement command is executed.

The alarm bit for an axis turns on when external equipment detects an alarm for an axis, and notifies the positioning module through a MECHATROLINK-II response.

For more details, see Section 5.5, "Detecting Errors, Warnings and Communication Alarms".

1: Alarm detected

0: No alarm detected

```
15 14 13 12 11 10 9  8  7  6  5  4  3  2  1  0
X  X  X  X  X  X  X  X  X  X  X  X  X  X  X  X
 │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  └     - Axis 1
 │  │  │  │  │  │  │  │  │  │  │  │  │  │  └ ─      - Axis 2
 │  │  │  │  │  │  │  │  │  │  │  │  │  └ ─ ─       - Axis 3
 │  │  │  │  │  │  │  │  │  │  │  │  └ ─ ─ ─        - Axis 4
 │  │  │  │  │  │  │  │  │  │  └ ─ ─ ─ ─            - Axis 5
 │  │  │  │  │  │  │  │  │  └ ─ ─ ─ ─ ─             - Axis 6
 │  │  │  │  │  │  │  │  └ ─ ─ ─ ─ ─ ─              - Axis 7
 │  │  │  │  │  │  │  └ ─ ─ ─ ─ ─ ─ ─               - Axis 8
 │  │  │  │  │  │  └ ─ ─ ─ ─ ─ ─ ─ ─                - Axis 9
 │  │  │  │  │  └ ─ ─ ─ ─ ─ ─ ─ ─ ─                 - Axis 10
 │  │  │  │  └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─                  - Axis 11
 │  │  │  └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─                   - Axis 12
 │  │  └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─                    - Axis 13
 │  └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─                     - Axis 14
 └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─                      - Axis 15
 └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─                    - Module
```
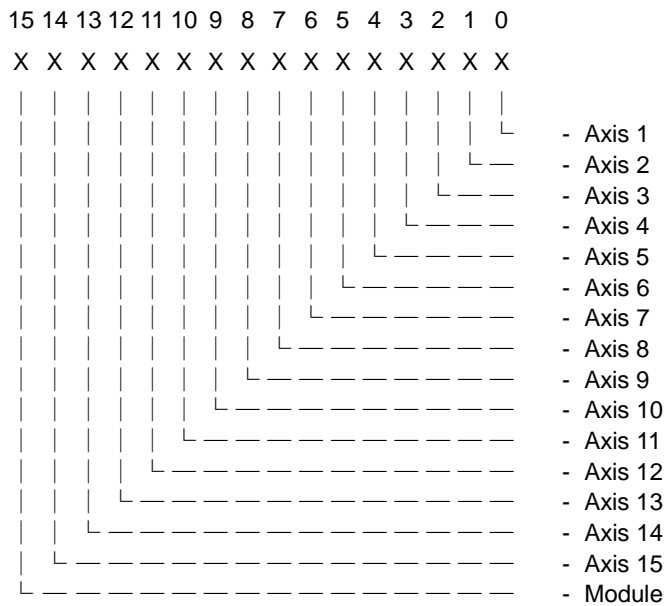
● **Warning Axis Bits**

Stores bit data that indicates the warning status of each axis.

The warning bit for an axis turns on when ~~when~~ external equipment detects a warning for an axis, and notifies the positioning module through a MECHATROLINK-II response.

For more details, see Section 5.5, "Detecting Errors, Warnings and Communication Alarms".

1: Warning detected

0: No warning detected

```
15 14 13 12 11 10 9  8  7  6  5  4  3  2  1  0
 0  X  X  X  X  X  X  X  X  X  X  X  X  X  X  X
          │  │  │  │  │  │  │  │  │  │  │  │  │  │  │
          │  │  │  │  │  │  │  │  │  │  │  │  │  │  └        - Axis 1
          │  │  │  │  │  │  │  │  │  │  │  │  │  └ —        - Axis 2
          │  │  │  │  │  │  │  │  │  │  │  │  └ — —        - Axis 3
          │  │  │  │  │  │  │  │  │  │  │  └ — — —        - Axis 4
          │  │  │  │  │  │  │  │  │  │  └ — — — —        - Axis 5
          │  │  │  │  │  │  │  │  │  └ — — — — —        - Axis 6
          │  │  │  │  │  │  │  │  └ — — — — — —        - Axis 7
          │  │  │  │  │  │  │  └ — — — — — — —        - Axis 8
          │  │  │  │  │  │  └ — — — — — — — —        - Axis 9
          │  │  │  │  │  └ — — — — — — — — —        - Axis 10
          │  │  │  │  └ — — — — — — — — — —        - Axis 11
          │  │  │  └ — — — — — — — — — — —        - Axis 12
          │  │  └ — — — — — — — — — — — —        - Axis 13
          │  └ — — — — — — — — — — — — —        - Axis 14
          └ — — — — — — — — — — — — — —        - Axis 15
```
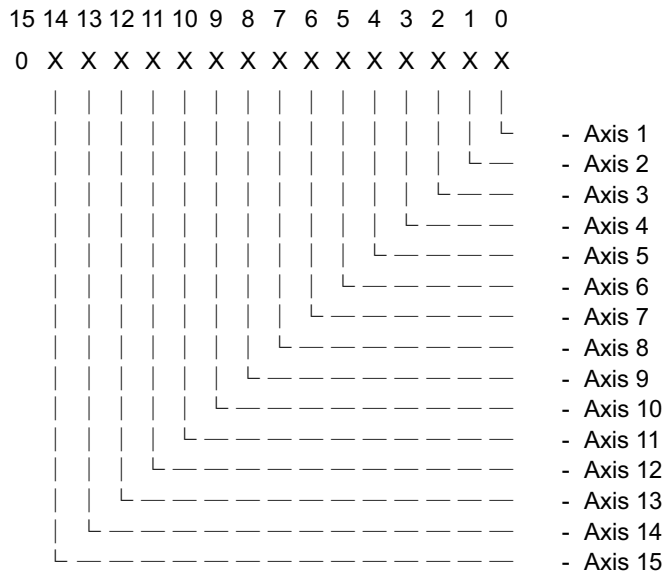
- **Command Ready Axis Bits, Servo ON Axis Bits**
  Main Power On Axis Bits, Machine Lock Axis Bits,
  Home Position Axis Bits, Positioning Completed Axis Bits
  Output Completed Axis Bits, Torque Limit Axis Bits,
  Latch Completed Axis Bits, Positioning Proximity Axis Bits,
  Forward Software Limit Axis Bits, Reverse Software Limit Axis Bits

  Each of these status stores bit data that indicates the respective status for each axis.

```
15 14 13 12 11 10 9  8  7  6  5  4  3  2  1  0
 0  X  X  X  X  X  X  X  X  X  X  X  X  X  X  X
    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  └      - Axis 1
    |  |  |  |  |  |  |  |  |  |  |  |  |  |  └ ─       - Axis 2
    |  |  |  |  |  |  |  |  |  |  |  |  |  └ ─ ─        - Axis 3
    |  |  |  |  |  |  |  |  |  |  |  |  └ ─ ─ ─         - Axis 4
    |  |  |  |  |  |  |  |  |  |  └ ─ ─ ─ ─             - Axis 5
    |  |  |  |  |  |  |  |  |  └ ─ ─ ─ ─ ─              - Axis 6
    |  |  |  |  |  |  |  |  └ ─ ─ ─ ─ ─ ─               - Axis 7
    |  |  |  |  |  |  |  └ ─ ─ ─ ─ ─ ─ ─                - Axis 8
    |  |  |  |  |  |  └ ─ ─ ─ ─ ─ ─ ─ ─                 - Axis 9
    |  |  |  |  |  └ ─ ─ ─ ─ ─ ─ ─ ─ ─                  - Axis 10
    |  |  |  |  └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─                   - Axis 11
    |  |  |  └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─                    - Axis 12
    |  |  └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─                     - Axis 13
    |  └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─                      - Axis 14
    └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─                       - Axis 15
```
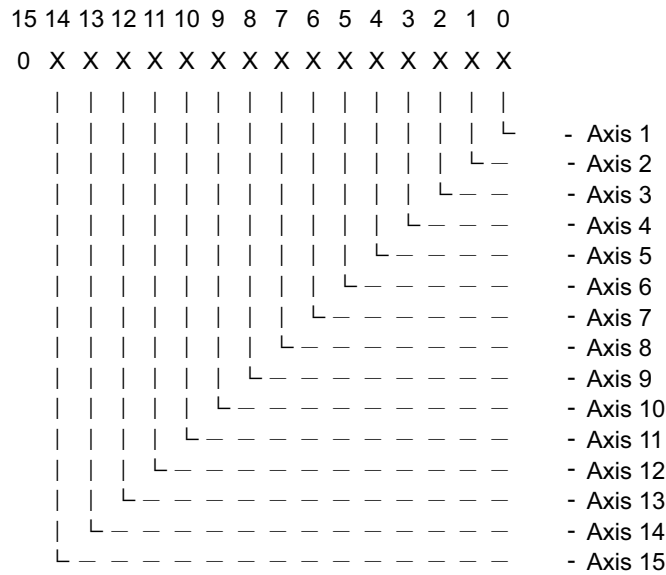
● **Module Alarm Code**

Stores read data for the alarm code when a module alarm is detected.

This status is meaningful only when the module bit of Alarm Axis Bits (ALARM) has value 1. If multiple alarms are detected concurrently, the alarm code of the first alarm to be detected is stored.

The alarm code may indicate a communication alarm (communication error, watchdog timer error, command timeout error, etc.) or a parameter setup error for an interpolation movement command.

For more details, see Section 5.5, "Detecting Errors, Warnings and Communication Alarms".

● **Module Detailed Alarm Code**

Stores bit data that indicates the axis where a module alarm is encountered.

This status is meaningful only when the module bit of Alarm Axis Bits (ALARM) has value 1.

For more details, see Section 5.5, "Detecting Errors, Warnings and Communication Alarms".

　1: Module alarm detected

　0: No module alarm detected

```
15 14 13 12 11 10 9  8  7  6  5  4  3  2  1  0
 0  X  X  X  X  X  X  X  X  X  X  X  X  X  X  X
    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  └         - Axis 1
    |  |  |  |  |  |  |  |  |  |  |  |  |  |  └ —         - Axis 2
    |  |  |  |  |  |  |  |  |  |  |  |  |  └ — —         - Axis 3
    |  |  |  |  |  |  |  |  |  |  |  |  └ — — —         - Axis 4
    |  |  |  |  |  |  |  |  |  |  |  └ — — — —         - Axis 5
    |  |  |  |  |  |  |  |  |  |  └ — — — — —         - Axis 6
    |  |  |  |  |  |  |  |  |  └ — — — — — —         - Axis 7
    |  |  |  |  |  |  |  |  └ — — — — — — —         - Axis 8
    |  |  |  |  |  |  |  └ — — — — — — — —         - Axis 9
    |  |  |  |  |  |  └ — — — — — — — — —         - Axis 10
    |  |  |  |  |  └ — — — — — — — — — —         - Axis 11
    |  |  |  |  └ — — — — — — — — — — —         - Axis 12
    |  |  |  └ — — — — — — — — — — — —         - Axis 13
    |  |  └ — — — — — — — — — — — — —         - Axis 14
    |  └ — — — — — — — — — — — — — —         - Axis 15
```
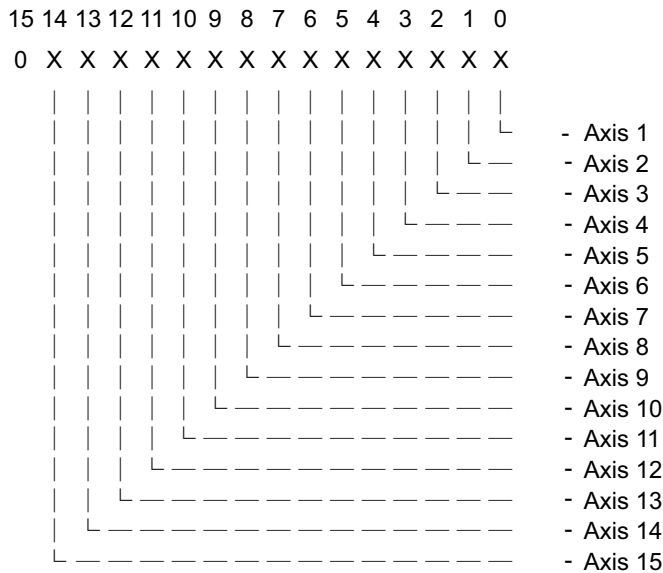
4.2.6 Extended MECHATROLINK-II Command and Response Parameters

This subsection lists and describes extended MECHATROLINK-II command and response parameters. These parameters are used when a ladder program is used to directly write a MECHATROLINK-II command to be transmitted to external equipment.

The data of each MECHATROLINK-II command and MECHATROLINK-II response depend on the external equipment that is connected. For details on individual MECHATROLINK-II commands and responses, see the user's manual of the connected external equipment.

■ List of Extended MECHATROLINK-II Command and Response Parameters

Table 4.11   List of Extended MECHATROLINK-II Command and Response Parameters

Data Position Number	Data Name
1701 to 1710	AX1 Extended MECHATROLINK-II command parameters
1711 to 1720	AX2 Extended MECHATROLINK-II command parameters
1721 to 1730	AX3 Extended MECHATROLINK-II command parameters
1731 to 1740	AX4 Extended MECHATROLINK-II command parameters
1741 to 1750	AX5 Extended MECHATROLINK-II command parameters
1751 to 1760	AX6 Extended MECHATROLINK-II command parameters
1761 to 1770	AX7 Extended MECHATROLINK-II command parameters
1771 to 1780	AX8 Extended MECHATROLINK-II command parameters
1781 to 1790	AX9 Extended MECHATROLINK-II command parameters
1791 to 1800	AX10 Extended MECHATROLINK-II command parameters
1801 to 1810	AX11 Extended MECHATROLINK-II command parameters
1811 to 1820	AX12 Extended MECHATROLINK-II command parameters
1821 to 1830	AX13 Extended MECHATROLINK-II command parameters
1831 to 1840	AX14 Extended MECHATROLINK-II command parameters
1841 to 1850	AX15 Extended MECHATROLINK-II command parameters

Data Position Number	Data Name
1851 to 1860	AX1 Extended MECHATROLINK-II response parameters
1861 to 1870	AX2 Extended MECHATROLINK-II response parameters
1871 to 1880	AX3 Extended MECHATROLINK-II response parameters
1881 to 1890	AX4 Extended MECHATROLINK-II response parameters
1891 to 1900	AX5 Extended MECHATROLINK-II response parameters
1901 to 1910	AX6 Extended MECHATROLINK-II response parameters
1911 to 1920	AX7 Extended MECHATROLINK-II response parameters
1921 to 1930	AX8 Extended MECHATROLINK-II response parameters
1931 to 1940	AX9 Extended MECHATROLINK-II response parameters
1941 to 1950	AX10 Extended MECHATROLINK-II response parameters
1951 to 1960	AX11 Extended MECHATROLINK-II response parameters-
1961 to 1970	AX12 Extended MECHATROLINK-II response parameters
1971 to 1980	AX13 Extended MECHATROLINK-II response parameters
1981 to 1990	AX14 Extended MECHATROLINK-II response parameters
1991 to 2000	AX15 Extended MECHATROLINK-II response parameters

■ **Description of Extended MECHATROLINK-II Command and Response Parameters**

● **Axis Extended MECHATROLINK-II Command Parameters**

Specify the parameters for the MECHATROLINK-II command to be transmitted.

Specified extended MECHATROLINK-II command parameter data is transmitted as is if the command code (COMMAND) axis MECHATROLINK-II command parameter is specified as -1.

● **Axis Extended MECHATROLINK-II Response Parameters**

These parameters return the response for a transmitted MECHATROLINK-II command.

These parameters return the response to a MECHATROLINK-II command transmitted according to the extended MECHATROLINK-II command parameter values.

4.2.7 Module Information Statuses

The Module Information Statuses stores the model name and revision of the positioning module.

Do not write any data to these statuses as it will result in loss of module information data.

Table 4.12   List of Module Information Statuses

Data Position Number	Data Description
0001	"F3"
0002	"NC"
0003	"96"
0004	"0N"
0005	" "
0006	" "
0007	"RV"
0008	"□□" (□□ denotes the module revision)

5.   Using the Positioning Module
5.1   Startup Preparation

Figure 5.1 shows a flowchart for commissioning the positioning module in an FA-M3 system.

Workflow	Task Description	SEE ALSO
Build overall system configuration		
Install module to base unit		3.6 Attaching/Detaching the Module
Install and setup external equipment	Set up station addresses of external equipment using hardware rotary switch	User's manual of external equipment
Connect to external equipment	Use dedicated cable.	3.7 Connecting to External Equipment
Power on external equipment		
Power on FA-M3		
Set up MECHATROLINK-II communication parameters (data position no: 0031 to 0100)	Set up station addresses of external equipment to enable communications with the module	5.2 Starting and Stopping MECHATROLINK-II Communication
Turn on Start/Stop Communication relay (Y□□□48)	Initialize and start MECHATROLINK-II communications	
Communication Status relay (X□□□16) ON?	If the Communication Status relay does not turn on, check the setup and wiring of external equipment, and MECHATROLINK-II communication parameter values. Always power off and power on external equipment and the FA-M3 after changing MECHATROLINK-II communication parameter values.	5.3 Sending MECHATROLINK-II Commands 5.4 Reading Statuses 5.5 Detecting Errors, Warnings and Communication Alarms
Start operation	Set up MECHATROLINK-II command parameters for the relevant axes, and transmit the command to external equipment by turning on the Send Command relay.	5.6 Clearing Errors and Warnings 5.7 Executing Interpolation Movement Commands 6. Accessing the Module 7 Troubleshooting

Figure 5.1   Startup Preparation Flowchart

5.2 Starting and Stopping MECHATROLINK-II Communications

This section describes how to set up the station addresses of external equipment corresponding to axes 1 to 15 of the positioning module in the MECHATROLINK-II communication parameter area, initialize MECHATROLINK-II communications, and begin communications.

You may sometimes need to change MECHATROLINK-II communication parameter values to match a change in external equipment configuration, or to rectify invalid parameter values when MECHATROLINK-II communication initialization is unsuccessful. If so, always power off and power on the external equipment and the FA-M3, and restart communication after changing the communication parameter values.

Once you have set up the MECHATROLINK-II communication parameters and issued a request to start communication, modification of parameter values will not be allowed.

■ Starting Communications

● Procedure for Starting Communications
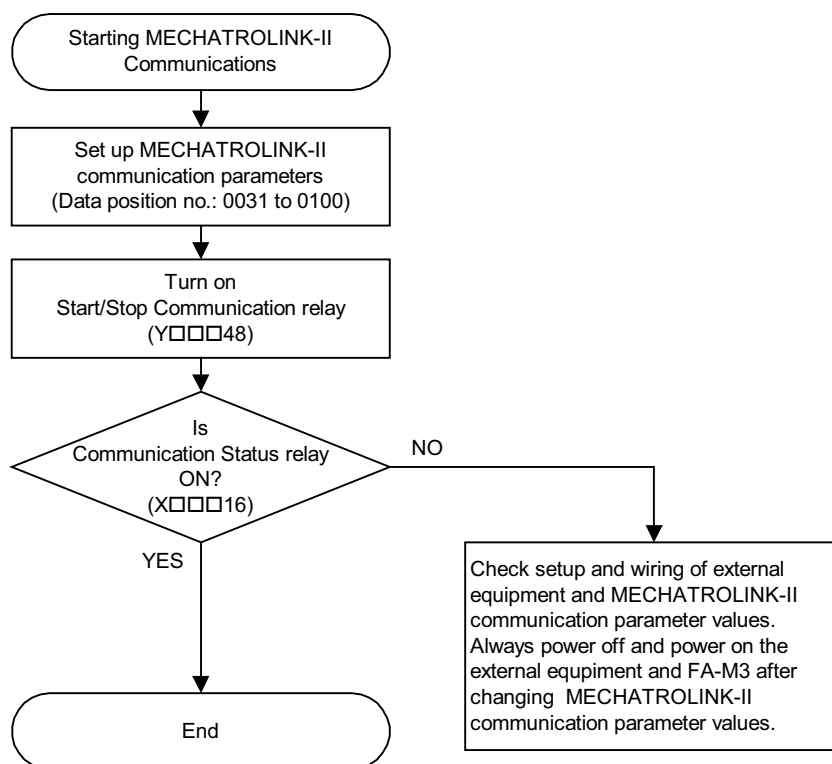
Figure 5.2   Procedure for Starting MECHATROLINK-II Communications

● **Writing MECHATROLINK-II Communication Parameters**

You can write MECHATROLINK-II communication parameters to the module using a WRITE instruction in a ladder program. Always set the station addresses of unconnected axes to 0.

Table 5.1   MECHATROLINK-II Communication Parameters

Data Position Number	Data Name	Data Description
0031	AX1 Station Address	0 (unconnected), $41 to $4F
0032	AX2 Station Address	0 (unconnected), $41 to $4F
0033	AX3 Station Address	0 (unconnected), $41 to $4F
0034	AX4 Station Address	0 (unconnected), $41 to $4F
0035	AX5 Station Address	0 (unconnected), $41 to $4F
0036	AX6 Station Address	0 (unconnected), $41 to $4F
0037	AX7 Station Address	0 (unconnected), $41 to $4F
0038	AX8 Station Address	0 (unconnected), $41 to $4F
0039	AX9 Station Address	0 (unconnected), $41 to $4F
0040	AX10 Station Address	0 (unconnected), $41 to $4F
0041	AX11 Station Address	0 (unconnected), $41 to $4F
0042	AX12 Station Address	0 (unconnected), $41 to $4F
0043	AX13 Station Address	0 (unconnected), $41 to $4F
0044	AX14 Station Address	0 (unconnected), $41 to $4F
0045	AX15 Station Address	0 (unconnected), $41 to $4F
0046	C2 Master	0: unconnected; 1: connected
0047	(system reserved)	Always 0
0048	(system reserved)	Always 0
0049	Communication Cycle Time	0: 1 ms, 1: 2 ms (1 ms is not allowed when more than 8 axes are connected)
0050 to 0100	(system reserved)	Always 0

● **Start/Stop Communication relay**

Turning on the Start/Stop Communication relay after writing MECHATROLINK-II communication parameter values initializes MECHATROLINK-II communications. The Communication Status relay turns on when MECHATROLINK-II communication initialization is successfully completed to indicate that the module is ready to send and receive MECHATROLINK-II commands.

Always keep the Start/Stop Communication relay ON while operating the module. Turning off this relay stops MECHATROLINK-II communications, and turns off the Communication Status relay. It also stops the operation of connected external equipment.

Table 5.2   Relays for Issuing Request to Start or Stop MECHATROLINK-II Communication

Output Relay No.	Signal Name	Description	Relation with Other Relays
Y□□□48	Start/stop Communication	Request to start or stop MECHATROLINK-II communications	X□□□16 shows the current communication status.

Input Relay No.	Signal Name	Description	Relation with Other Relays
X□□□16	Communication Status	Turns on while MECHATROLINK-II communications is in progress; turns off otherwise.	Turning on Y□□□48 to initiate communications turns on this relay when communication begins. Turning off Y□□□48 turns off this relay.

Note: In the table, "□□□" denotes the slot number of the FA-M3 unit where the module is mounted.

■ Commands Sent When Communication is Initiated

When a program turns on the Start/Stop Communication relay after writing MECHATROLINK-II communication parameter values, the positioning module automatically sends the following MECHATROLINK-II commands, and initiates communication with the specified axes according to the MECHATROLINK-II communication parameter values.

(1) Sends NOP command
(2) Sends DISCONNECT command
(3) Sends CONNECT command
(4) Sends SENS_ON command
(5) Sends SMON command

Table 5.4   MECHATROLINK-II Commands Sent When Communication is Initiated

Byte	NOP	DISCONNECT	CONNECT	SENS_ON	SMON
1	$00	$0F	$0E	$23	$30
2					
3					
4					
5			$21		
6			$82		
7			$01		
8					
9					
10					
11					
12					
13					$00
14					□□11 [1]
15					
16	WDT	WDT	WDT	WDT	WDT

Note: Empty cells contain value $00.

[1]:   "□□11" denotes the value of Monitor 2 Selection of Axis MECHATROLINK-II Command Parameters.

■ Communication Parameters Setup Example

● Procedure

(1) Specify the station addresses of external equipment to be connected in data position numbers 0031 to 0045.

(2) Specify whether a C2 master is to be connected in data position number 0046.

(4) Specify the communication cycle time in data position number 0049.

(3) Turn on the Start/Stop Communication relay.

● Sample Program

This sample program issues a request to the positioning module installed in slot 3 to initiate communication with external equipment having station addresses $41, $42 and $43. It confirms whether MECHATROLINK-II communication is successfully initiated by checking whether relay X00316 has turned on.
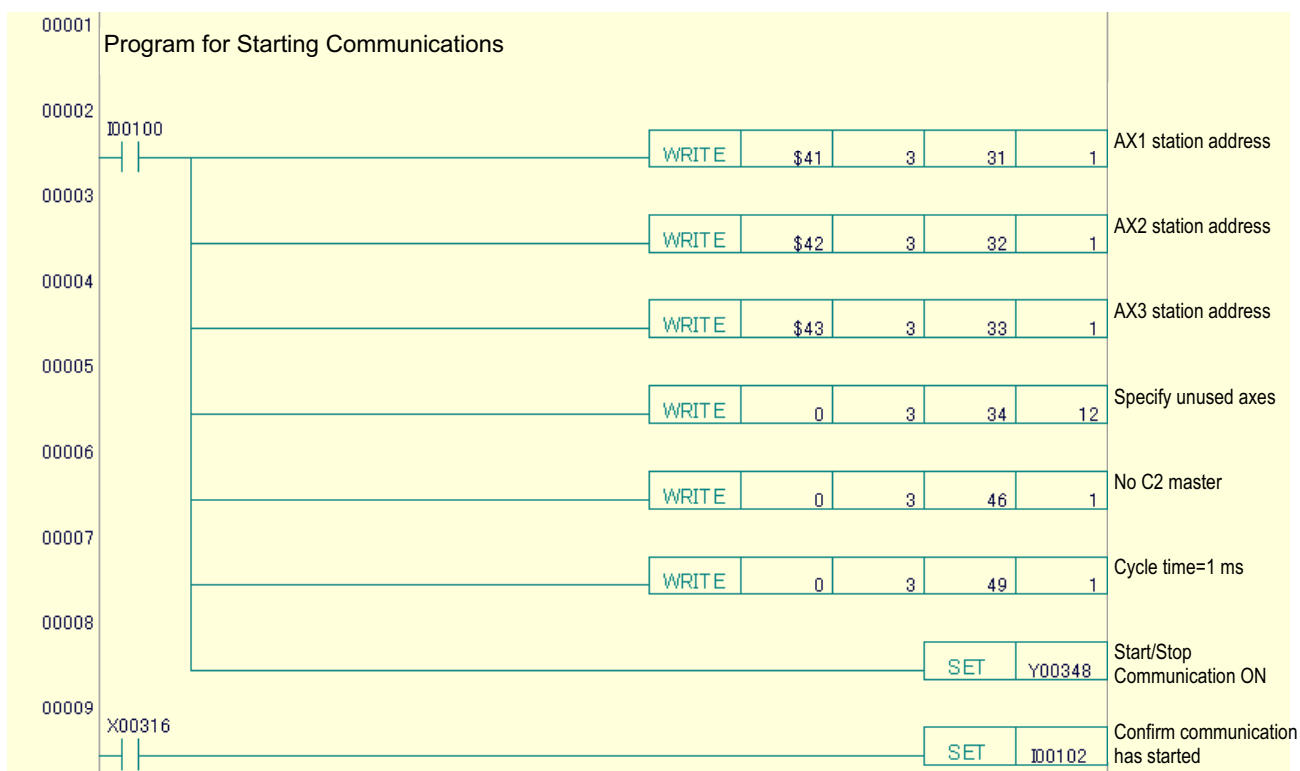
■ Precautions

Once you set up the MECHATROLINK-II communication parameters and issue a request to start communication, modification of the parameters will be disallowed.

You may sometimes need to change MECHATROLINK-II communication parameter values to match a change in external equipment configuration, or to rectify invalid parameter values when MECHATROLINK-II communication initialization is unsuccessful. If so, always power off and power on the external equipment and the FA-M3, and restart communication after changing the communication parameter values.

5.3   Sending MECHATROLINK-II Commands

This section describes how to send MECHATROLINK-II commands to external equipment corresponding to axes 1 to 15 of the positioning module. It also describes how to receive MECHATROLINK-II responses for transmitted MECHATROLINK-II commands.

The positioning module performs no error status checking of the destination external equipment and no range checking of the parameter values to be transmitted.

You should therefore check the execution status of a transmitted command by checking the alarm code (ALARM) and status (STATUS) of the received MECHATROLINK-II response.

■ Sending a Command

● Procedure for Sending a Command

```
       ( Sending MECHATROLINK-II Command )
                        │
                        ▼
   ┌────────────────────────────────────────────┐
   │ Set up axis MECHATROLINK-II command          │
   │ parameters or extended MECHATROLINK-II       │
   │ command parameters                           │
   │ (Data position no.: □□01 to □□60, 1701 to 1850)│
   └────────────────────────────────────────────┘
                        │
                        ▼
   ┌────────────────────────────────┐
   │ Turn on Send Command relay       │
   │ (Y□□□33 to Y□□□47)               │
   └────────────────────────────────┘
                        │
                        ▼
   ┌────────────────────────────────┐
   │ Check if Response Received relay │
   │ has turned on                    │
   │ (X□□□01 to X□□□15)               │
   └────────────────────────────────┘
                        │
                        ▼
              Is Error/Warning          YES
              Detected relay ON?  ─────────────┐
              (X□□□32)                          │
                        │ NO                     │
                        ▼                        │
   ┌────────────────────────────────────────────┐
   │ Read axis MECHATROLINK-II response           │
   │ parameters or extended MECHATROLINK-II       │
   │ response parameters                          │
   │ (Data position no.: □□61 to □□80, 1851 to 2000)│
   └────────────────────────────────────────────┘
                        │                        │
              NO         ▼                        │
       ┌──── MECHATROLINK-II command              │
       │     execution completed?                 │
       │     (STATUS)                             │
       │         │ YES                            ▼
       │         ▼            ┌────────────────────────────┐
       │       ( End )        │ Read alarm code (ALARM) of  │
       │                      │ axis statuses, remove the   │
       │                      │ cause of error or warning,  │
       │                      │ clear warning or error, and │
       │                      │ resend MECHATROLINK-II      │
       │                      │ command.                    │
       │                      └────────────────────────────┘
```

Figure 5.3   Procedure for Sending MECHATROLINK-II Commands

● **Acceptance Conditions for MECHATROLINK-II Commands**

- MECHATROLINK-II communication is in progress.

- Send Command relay is OFF.

- Response Received relay is OFF.

- No interpolation movement in progress.

A command is ignored if any of the above conditions is not true.

● **Writing MECHATROLINK-II Command Parameters**

Axis MECHATROLINK-II command parameters and extended MECHATROLINK-II command parameters can be written to the module using a WRITE instruction in a ladder program.

For details on the required parameters of each MECHATROLINK-II command, see Subsection 5.3.1, "Parameters and Statuses of MECHATROLINK-II Commands". For details on the format conversion performed on a MECHATROLINK-II command before actual transmission, see Subsection 5.3.2, "An Example of MECHATROLINK-II Command Format Conversion".

● **Send Command relay**

Turning on the Send Command relay of an axis after writing MECHATROLINK-II command parameter values sends a MECHATROLINK-II command. The Response Received input relay for the axis turns on when a response to the transmitted MECHATROLINK-II command is received.

Confirm that the Response Received relay has turned on before turning off the Send Command relay. Turning off the Send Command relay for an axis also turns off the corresponding Response Received relay.

Table 5.5   Relays for Sending MECHATROLINK-II Commands

Output Relay No.	Signal Name	Description	Relation with Other Relays
Y□□□33	AX1 Send Command	Request to send MECHATROLINK-II command for axis 1	Turn off this relay after confirming that X□□□01 has turned on.
Y□□□34	AX2 Send Command	Request to send MECHATROLINK-II command for axis 2	Turn off this relay after confirming that X□□□02 has turned on.
Y□□□35	AX3 Send Command	Request to send MECHATROLINK-II command for axis 3	Turn off this relay after confirming that X□□□03 has turned on.
Y□□□36	AX4 Send Command	Request to send MECHATROLINK-II command for axis 4	Turn off this relay after confirming that X□□□04 has turned on.
Y□□□37	AX5 Send Command	Request to send MECHATROLINK-II command for axis 5	Turn off this relay after confirming that X□□□05 has turned on.
Y□□□38	AX6 Send Command	Request to send MECHATROLINK-II command for axis 6	Turn off this relay after confirming that X□□□06 has turned on.
Y□□□39	AX7 Send Command	Request to send MECHATROLINK-II command for axis 7	Turn off this relay after confirming that X□□□07 has turned on.
Y□□□40	AX8 Send Command	Request to send MECHATROLINK-II command for axis 8	Turn off this relay after confirming that X□□□08 has turned on.
Y□□□41	AX9 Send Command	Request to send MECHATROLINK-II command for axis 9	Turn off this relay after confirming that X□□□09 has turned on.
Y□□□42	AX10 Send Command	Request to send MECHATROLINK-II command for axis 10	Turn off this relay after confirming that X□□□10 has turned on.
Y□□□43	AX11 Send Command	Request to send MECHATROLINK-II command for axis 11	Turn off this relay after confirming that X□□□11 has turned on.
Y□□□44	AX12 Send Command	Request to send MECHATROLINK-II command for axis 12	Turn off this relay after confirming that X□□□12 has turned on.
Y□□□45	AX13 Send Command	Request to send MECHATROLINK-II command for axis 13	Turn off this relay after confirming that X□□□13 has turned on.
Y□□□46	AX14 Send Command	Request to send MECHATROLINK-II command for axis 14	Turn off this relay after confirming that X□□□14 has turned on.
Y□□□47	AX15 Send Command	Request to send MECHATROLINK-II command for axis 15	Turn off this relay after confirming that X□□□15 has turned on.

Input Relay No.	Signal Name	Description	Relation with Other Relays
X□□□01	AX1 Response Received	Turns on when a MECHATROLINK-II response for axis 1 is received.	Turning off Y□□□33 also turns off this relay.
X□□□02	AX2 Response Received	Turns on when a MECHATROLINK-II response for axis 2 is received.	Turning off Y□□□34 also turns off this relay.
X□□□03	AX3 Response Received	Turns on when a MECHATROLINK-II response for axis 3 is received.	Turning off Y□□□35 also turns off this relay.
X□□□04	AX4 Response Received	Turns on when a MECHATROLINK-II response for axis 4 is received.	Turning off Y□□□36 also turns off this relay.
X□□□05	AX5 Response Received	Turns on when a MECHATROLINK-II response for axis 5 is received.	Turning off Y□□□37 also turns off this relay.
X□□□06	AX6 Response Received	Turns on when a MECHATROLINK-II response for axis 6 is received.	Turning off Y□□□38 also turns off this relay.
X□□□07	AX7 Response Received	Turns on when a MECHATROLINK-II response for axis 7 is received.	Turning off Y□□□39 also turns off this relay.
X□□□08	AX8 Response Received	Turns on when a MECHATROLINK-II response for axis 8 is received.	Turning off Y□□□40 also turns off this relay.
X□□□09	AX9 Response Received	Turns on when a MECHATROLINK-II response for axis 9 is received.	Turning off Y□□□41 also turns off this relay.
X□□□10	AX10 Response Received	Turns on when a MECHATROLINK-II response for axis 10 is received.	Turning off Y□□□42 also turns off this relay.
X□□□11	AX11 Response Received	Turns on when a MECHATROLINK-II response for axis 11 is received.	Turning off Y□□□43 also turns off this relay.
X□□□12	AX12 Response Received	Turns on when a MECHATROLINK-II response for axis 12 is received.	Turning off Y□□□44 also turns off this relay.
X□□□13	AX13 Response Received	Turns on when a MECHATROLINK-II response for axis 13 is received.	Turning off Y□□□45 also turns off this relay.
X□□□14	AX14 Response Received	Turns on when a MECHATROLINK-II response for axis 14 is received.	Turning off Y□□□46 also turns off this relay.
X□□□15	AX15 Response Received	Turns on when a MECHATROLINK-II response for axis 15 is received.	Turning off Y□□□47 also turns off this relay.

Note: In the table, "□□□" denotes the slot number of the FA-M3 unit where the module is mounted.

● **Reading MECHATROLINK-II Response Parameters**

The Response Received relay for an axis turns ON when a MECHATROLINK-II response is received for the axis. The MECHATROLINK-II response parameter values or extended MECHATROLINK-II response parameter values can then be read using a READ instruction in a ladder program.

For details on the response parameters that may be returned for each MECHATROLINK-II command, see Subsection 5.3.1, "Parameters and Statuses of MECHATROLINK-II Commands".

● **Checking if a MECHATROLINK-II Command Has Completed Execution**

Execution of some MECHATROLINK-II commands such as HOLD ($25), SV_ON ($31), SV_OFF ($32), POSING ($35), EX_POSING ($39) and ZRET ($3A) continues even after a MECHATROLINK-II response has been received.

You can check the completion of these MECHATROLINK-II commands by reading the following relays and statuses from a ladder program and checking the values of the relevant status bits.

- Positioning Completed relay (X□□□17 to X□□□31)
- Error/Warning Detected relay (X□□□32)
- Alarm Code (ALARM) and Status (STATUS) of axis statuses
- Various axis bit pattern statuses of common statuses

■ **An Example for Sending MECHATROLINK-II Commands**

● **Procedure**

(1) Specify the MECHATROLINK-II command code and required parameter values in data position numbers □□01 to □□60. To transmit an extended MECHATROLINK-II command, specify value –1 for the command code (COMMAND) and specify the data to be transmitted in the extended MECHATROLINK-II command parameter area.

(2) Turn on the Send Command relay (Y□□□33 to Y□□□47).

(3) Confirm that the Response Received relay (X□□□01 to X□□□15) has turned on.

(4) Confirm that positioning has completed by checking the Positioning Completed relay and statuses as required for each command.

● **Sample Program for Sending Turn Servo ON (SV_ON) Command**

This sample program issues a SV_ON request for axis 1 to the positioning module mounted in slot 3.

After issuing the command, it confirms completion of the command execution by checking that the Servo ON (SVON) bit of STATUS has turned ON.
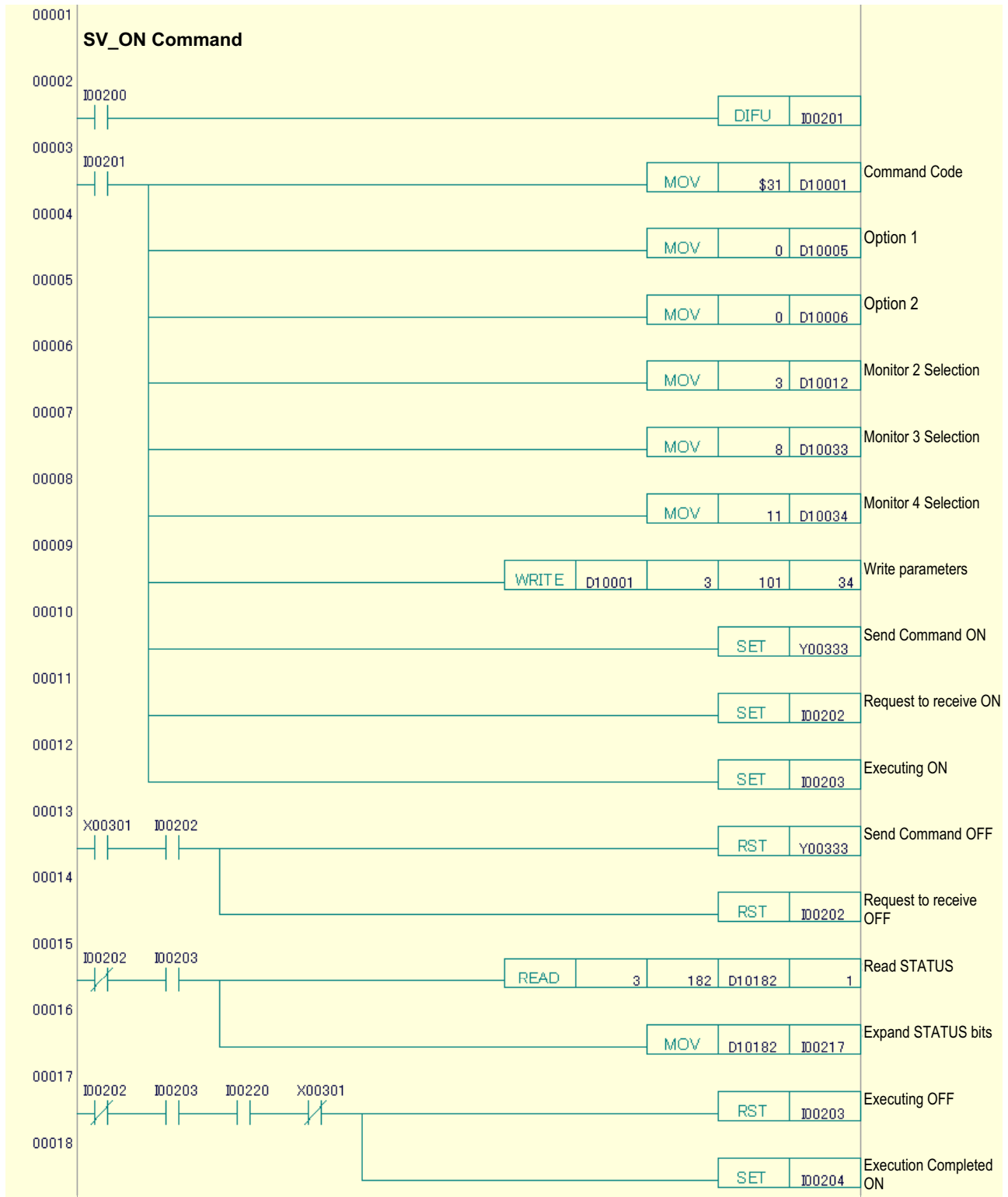
● **Sample Program for Sending Turn Servo OFF (SV_OFF) Command**

This sample program issues a SV_OFF request for axis 1 to the positioning module mounted in slot 3.

After issuing the command, it confirms completion of the command execution by checking that the Servo ON (SVON) bit of STATUS has turned OFF

```
00001
            SV_OFF Command
00002  I00300
        ─┤├─                                          DIFU   I00301
00003  I00301
        ─┤├─                                   MOV    $32   D10001     Command Code
00004                                          MOV      3   D10012     Monitor 2 Selection
00005                                          MOV      8   D10033     Monitor 3 Selection
00006                                          MOV     11   D10034     Monitor 4 Selection
00007                            WRITE  D10001    3    101    34        Write parameters
00008                                          SET    Y00333            Send Command ON
00009                                          SET    I00302            Request to receive ON
00010                                          SET    I00303            Executing ON
00011  X00301  I00302
        ─┤├─────┤├─                            RST    Y00333            Send Command OFF
00012                                          RST    I00302            Request to receive OFF
00013  I00302  I00303
        ─┤/├────┤├─              READ     3    182  D10182   1           Read STATUS
00014                                          MOV  D10182  I00317       Expand STATUS bits
00015  I00302  I00303  I00320  X00301
        ─┤/├────┤├────┤/├────┤/├─              RST    I00303            Executing OFF
00016                                          SET    I00304            Execution Completed ON
```

● Sample Program for Sending Home (ZRET) Command

This sample program issues a ZRET command for axis 1 to the positioning module mounted in slot 3.

After issuing the command, it confirms completion of the command execution by checking that both the Home Position (ZPOINT) bit and Output Completed (DEN) bit of STATUS have turned on.

```
00001
                ZRET command
00002
        I00400                                               ┌──────┬────────┐
        ─┤├─                                                 │ DIFU │ I00401 │
                                                             └──────┴────────┘
00003
        I00401                                               ┌──────┬────┬────────┐
        ─┤├─┬─                                               │ MOV  │$3A │ D10001 │   Command Code
            │                                                └──────┴────┴────────┘
00004       │                                                ┌──────┬────┬────────┐
            │                                                │ MOV  │  1 │ D10004 │   Latch Signal
            │                                                └──────┴────┴────────┘
00005       │                                                ┌──────┬────┬────────┐
            │                                                │ MOV  │  0 │ D10005 │   Option 1
            │                                                └──────┴────┴────────┘
00006       │                                                ┌──────┬────┬────────┐
            │                                                │ MOV  │  0 │ D10006 │   Option 2
            │                                                └──────┴────┴────────┘
00007       │                                               L┌──────┬───────┬────────┐
            │                                                │ MOV  │ 10000 │ D10009 │   Target Speed
            │                                                └──────┴───────┴────────┘
00008       │                                                ┌──────┬────┬────────┐
            │                                                │ MOV  │  3 │ D10012 │   Monitor 2 Selection
            │                                                └──────┴────┴────────┘
00009       │                                                ┌──────┬────┬────────┐
            │                                                │ MOV  │  8 │ D10033 │   Monitor 3 Selection
            │                                                └──────┴────┴────────┘
00010       │                                                ┌──────┬────┬────────┐
            │                                                │ MOV  │ 11 │ D10034 │   Monitor 4 Selection
            │                                                └──────┴────┴────────┘
00011       │                               ┌───────┬────────┬─────┬──────┐
            │                               │ WRITE │ D10001 │  3  │ 101  │ 34 │   Write parameters
            │                               └───────┴────────┴─────┴──────┘
00012       │                                                ┌──────┬────────┐
            │                                                │ SET  │ Y00333 │   Send Command ON
            │                                                └──────┴────────┘
00013       │                                                ┌──────┬────────┐
            │                                                │ SET  │ I00402 │   Request to receive ON
            │                                                └──────┴────────┘
00014       │                                                ┌──────┬────────┐
            └─                                               │ SET  │ I00403 │   Executing ON
                                                             └──────┴────────┘
00015   X00301   I00402                                      ┌──────┬────────┐
        ─┤├─────┤├─┬─                                        │ RST  │ Y00333 │   Send Command OFF
                  │                                          └──────┴────────┘
00016             │                                          ┌──────┬────────┐
                  └─                                         │ RST  │ I00402 │   Request to receive OFF
                                                             └──────┴────────┘
00017   I00402   I00403                        ┌──────┬─────┬──────────┬───┐
        ─┤/├─────┤├─┬─                          │ READ │  3  │ 182 │ D10182 │ 1 │   Read STATUS
                  │                             └──────┴─────┴──────────┴───┘
00018             │                                          ┌──────┬────────┬────────┐
                  └─                                         │ MOV  │ D10182 │ I00417 │   Expand STATUS bits
                                                             └──────┴────────┴────────┘
00019   I00402   I00403   I00423   I00424   X00301           ┌──────┬────────┐
        ─┤/├─────┤├─────┤├─────┤├─────┤/├─┬─                 │ RST  │ I00403 │   Executing OFF
                                           │                 └──────┴────────┘
00020                                      │                 ┌──────┬────────┐
                                           └─                │ SET  │ I00404 │   Execution Completed ON
                                                             └──────┴────────┘
```

● **Sample Program for Sending Set Coordinates (POS_SET) Command**

This sample program issues a POS_SET command for axis 1 to the positioning module mounted in slot 3.

After issuing the command, it confirms completion of the command execution by checking the axis MECHATROLINK-II response parameter values.
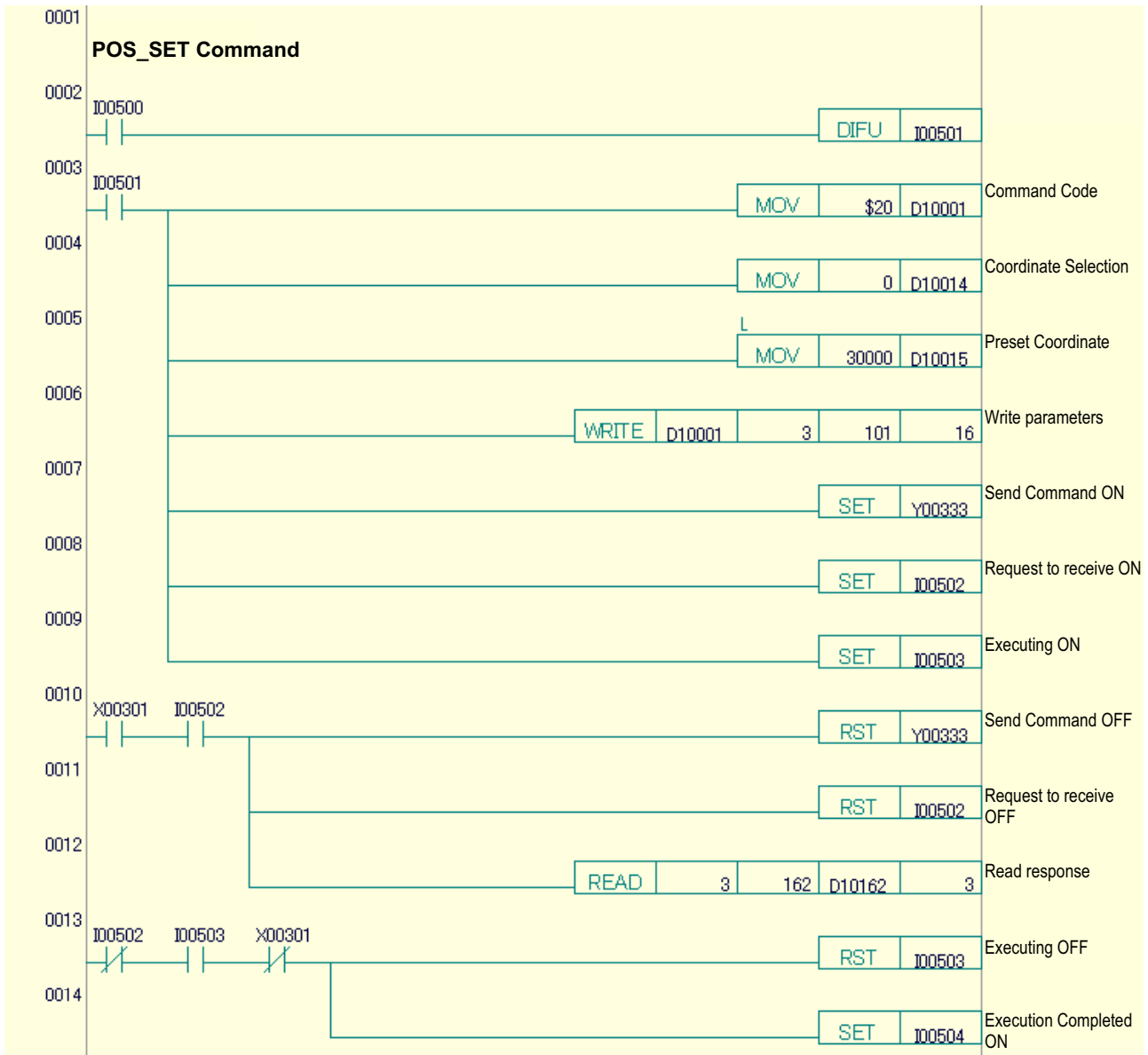
● **Sample Program for Sending Constant Speed Feed (FEED) Command**

This sample program issues a FEED command for axis 1 to the positioning module mounted in slot 3.

After the command is issued, movement continues until another command is issued.

```
00001
        FEED Command

00002
        I00600                                          ┌──────┬────────┐
        ─┤├─                                            │ DIFU │ I00601 │
                                                        └──────┴────────┘
00003
        I00601                                  ┌──────┬─────┬────────┐   Command Code
        ─┤├─────┬─────────────────────────────  │ MOV  │ $36 │ D10001 │
                │                                └──────┴─────┴────────┘
00004
                │                                ┌──────┬─────┬────────┐   Option 1
                │                                │ MOV  │   0 │ D10005 │
                │                                └──────┴─────┴────────┘
00005
                │                                ┌──────┬─────┬────────┐   Option 2
                │                                │ MOV  │   0 │ D10006 │
                │                                └──────┴─────┴────────┘
00006
                │                                   L
                │                                ┌──────┬───────┬────────┐ Target Speed
                │                                │ MOV  │ 10000 │ D10009 │
                │                                └──────┴───────┴────────┘
00007
                │                                ┌──────┬─────┬────────┐   Monitor 2 Selection
                │                                │ MOV  │   3 │ D10012 │
                │                                └──────┴─────┴────────┘
00008
                │                                ┌──────┬─────┬────────┐   Monitor 3 Selection
                │                                │ MOV  │   8 │ D10033 │
                │                                └──────┴─────┴────────┘
00009
                │                                ┌──────┬─────┬────────┐   Monitor 4 Selection
                │                                │ MOV  │  11 │ D10034 │
                │                                └──────┴─────┴────────┘
00010
                │                        ┌───────┬────────┬───┬─────┬────┐ Write parameters
                │                        │ WRITE │ D10001 │ 3 │ 101 │ 34 │
                │                        └───────┴────────┴───┴─────┴────┘
00011
                │                                ┌──────┬────────┐         Send Command ON
                │                                │ SET  │ Y00333 │
                │                                └──────┴────────┘
00012
                │                                ┌──────┬────────┐         Request to receive ON
                │                                │ SET  │ I00602 │
                │                                └──────┴────────┘
00013
                └─                               ┌──────┬────────┐         Executing ON
                                                 │ SET  │ I00603 │
                                                 └──────┴────────┘
00014
        X00301  I00602                           ┌──────┬────────┐         Send Command OFF
        ─┤├──────┤├──────┬─────────────────────  │ RST  │ Y00333 │
                         │                        └──────┴────────┘
00015
                         │                        ┌──────┬────────┐        Request to receive
                         │                        │ RST  │ I00602 │        OFF
                         │                        └──────┴────────┘
00016
        I00602  I00603  X00301                    ┌──────┬────────┐        Executing OFF
        ─┤/├─────┤├──────┤/├──────┬─────────────  │ RST  │ I00603 │
                                  │               └──────┴────────┘
00017
                                  │               ┌──────┬────────┐        Execution Completed
                                  │               │ SET  │ I00604 │        ON
                                  │               └──────┴────────┘
                                  │
```

● **Sample Program for Sending Positioning (POSING) Command**

This sample program issues a POSING command for axis 1 to the positioning module mounted in slot 3.

After issuing the command, it confirms completion of the command execution by checking that the Positioning Completed relay has turned on.

```
00001
        POSING Command

00002
   I00700                                          DIFU    I00701

00003
   I00701                                 MOV     $35   D10001    Command Code

00004
                                          MOV       0   D10005    Option 1

00005
                                          MOV       0   D10006    Option 2

00006                                   L
                                          MOV   20000   D10007    Target Position

00007                                   L
                                          MOV   10000   D10009    Target Speed

00008
                                          MOV       3   D10012    Monitor 2 Selection

00009
                                          MOV       8   D10033    Monitor 3 Selection

00010
                                          MOV      11   D10034    Monitor 4 Selection

00011
                           WRITE  D10001      3     101     34    Write parameters

00012
                                          SET    Y00333    Send Command ON

00013
                                          SET    I00702    Request to receive ON

00014
                                          SET    I00703    Executing ON

00015
   X00301  I00702                         RST    Y00333    Send Command OFF

00016
                                          RST    I00702    Request to receive OFF

00017
   I00702  I00703  X00317  X00301         RST    I00703    Executing OFF

00018
                                          SET    I00704    Execution Completed ON
```

● **Sample Program for Sending Stop Motion (HOLD) Command**

This sample program issues a HOLD command for axis 1 to the positioning module mounted in slot 3.

After issuing the command, it confirms completion of the command execution by checking that both the Positioning Completed relay and the Output Completed (DEN) bit of STATUS have turned on.

```
00001
            HOLD Command

00002
     I00800
     ─┤├─────────────────────────────────────────── DIFU │ I00801

00003
     I00801
     ─┤├─────────────────────────── MOV │  $25 │ D10001    Command Code

00004
                                     MOV │    0 │ D10005    Option 1

00005
                                     MOV │    0 │ D10006    Option 2

00006
                                     MOV │    3 │ D10012    Monitor 2 Selection

00007
                                     MOV │    0 │ D10023    Hold Mode

00008
                                     MOV │    8 │ D10033    Monitor 3 Selection

00009
                                     MOV │   11 │ D10034    Monitor 4 Selection

00010
                         WRITE │ D10001 │   3 │  101 │  34   Write parameters

00011
                                     SET │ Y00333           Send Command ON

00012
                                     SET │ I00802           Request to receive ON

00013
                                     SET │ I00803           Executing ON

00014
     X00301  I00802
     ─┤├─────┤├─────────────────────── RST │ Y00333         Send Command OFF

00015
                                     RST │ I00802           Request to receive OFF

00016
     I00802  I00803
     ─┤/├────┤├───────────── READ │   3 │  182 │ D10182 │  1  Read STATUS

00017
                                     MOV │ D10182 │ I00817   Expand STATUS bits

00018
     I00802  I00803  X00317  I00825  X00301
     ─┤/├────┤├──────┤├──────┤├──────┤/├──── RST │ I00803   Executing OFF

00019
                                     SET │ I00804           Execution Completed ON
```

● **Sample Program for Sending Status Monitoring (SMON) Command**

This sample program issues a SMON command for axis 1 to the positioning module mounted in slot 3.

```
00001
        SMON Command

00002
      I01000                                            ┌──────┬───────┐
      ──┤ ├──────────────────────────────────────────│ DIFU │ I01001│
                                                        └──────┴───────┘
00003
      I01001                                            ┌──────┬───────┐
      ──┤ ├───────┬───────────────────────────────────│ MOV  │ $30  │ D10001 │    Command Code
              │                                         └──────┴───────┘
00004         │                                         ┌──────┬───────┐
              ├───────────────────────────────────────│ MOV  │   3  │ D10012 │    Monitor 2 Selection
              │                                         └──────┴───────┘
00005         │                                         ┌──────┬───────┐
              ├───────────────────────────────────────│ MOV  │   8  │ D10033 │    Monitor 3 Selection
              │                                         └──────┴───────┘
00006         │                                         ┌──────┬───────┐
              ├───────────────────────────────────────│ MOV  │  11  │ D10034 │    Monitor 4 Selection
              │                                         └──────┴───────┘
00007         │                          ┌───────┬────────┬─────┬─────┐
              ├──────────────────────────│ WRITE │ D10001 │  3  │ 101 │ 34 │      Write parameters
              │                          └───────┴────────┴─────┴─────┘
00008         │                                         ┌──────┬───────┐
              ├───────────────────────────────────────│ SET  │ Y00333│           Send Command ON
              │                                         └──────┴───────┘
00009         │                                         ┌──────┬───────┐
              ├───────────────────────────────────────│ SET  │ I01002│           Request to receive ON
              │                                         └──────┴───────┘
00010         │                                         ┌──────┬───────┐
              └───────────────────────────────────────│ SET  │ I01003│           Executing ON
                                                        └──────┴───────┘
00011
      X00301  I01002                                    ┌──────┬───────┐
      ──┤ ├────┤ ├────┬──────────────────────────────│ RST  │ Y00333│           Send Command OFF
                    │                                   └──────┴───────┘
00012               │                                   ┌──────┬───────┐
                    └──────────────────────────────────│ RST  │ I01002│           Request to receive OFF
                                                        └──────┴───────┘
00013
      I01002  I01003  X00301                            ┌──────┬───────┐
      ──┤/├────┤ ├────┤/├───┬───────────────────────│ RST  │ I01003│           Executing OFF
                          │                             └──────┴───────┘
00014                     │                             ┌──────┬───────┐
                          └────────────────────────────│ SET  │ I01004│           Execution Completed
                                                        └──────┴───────┘           ON
```

● **Sample Program for Sending Write Parameter (PRM_WR) Command**

This sample program issues a PRM_WR command for axis 1 to the positioning module mounted in slot 3.

After issuing the command, it confirms completion of the command execution by checking the response.
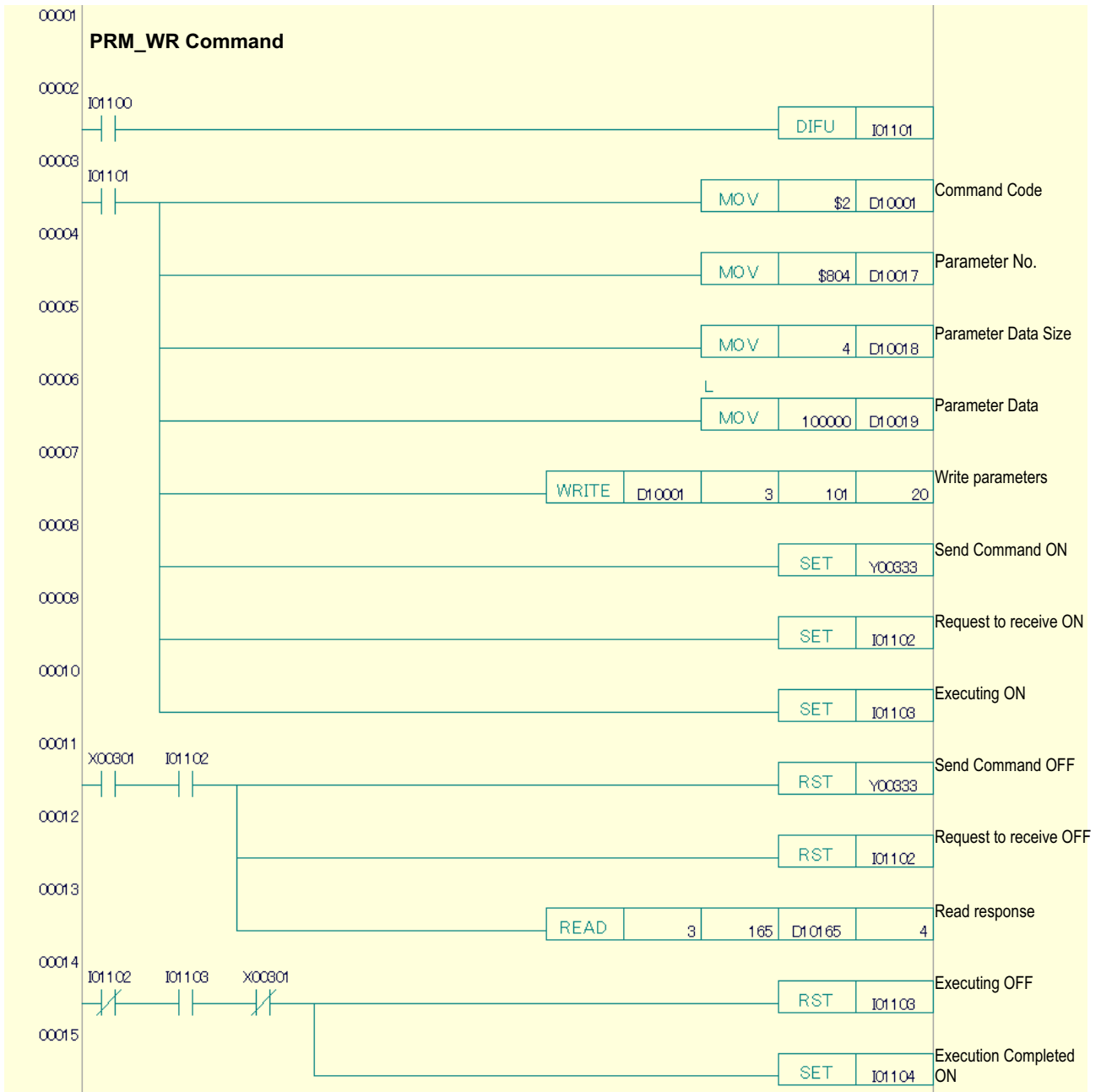
● **Sample Program for Sending Read ID (ID_RD) Command**

This sample program issues an ID_RD command for axis 1 to the positioning module mounted in slot 3.

After issuing the command, it confirms completion of the command execution by checking the extended MECHATROLINK-II response.

The program writes the following "ID_RD" MECHATROLINK-II command directly to the extended MECHATROLINK-II command parameter area, and then transmits the extended command.

Table 5.6   ID_RD MECHATROLINK-II Command

Byte	ID_RD
1	$03
2	$00
3	$00
4	$00
5	$20
6	$02
7	$08
8	$00
9	$00
10	$00
11	$00
12	$00
13	$00
14	$00
15	$00
16	WDT

ID_RD Command

```
0001
        ID_RD Command
0002
        I00900                                              ┌──────┬────────┐
        ─┤ ├─                                               │ DIFU │ I00901 │
                                                            └──────┴────────┘
0003
        I00901                          ┌───────┬────┬───┬─────┬───┐
        ─┤ ├──────┬─────────────────────│ WRITE │ -1 │ 3 │ 101 │ 1 │   Command Code
                  │                      └───────┴────┴───┴─────┴───┘
0004      │                                       ┌─────┬──────┬────────┐
          │                                       │ MOV │ $300 │ D10001 │   Data
          │                                       └─────┴──────┴────────┘
0005      │                                       ┌─────┬───┬────────┐
          │                                       │ MOV │ 0 │ D10002 │   Data
          │                                       └─────┴───┴────────┘
0006      │                                       ┌─────┬───────┬────────┐
          │                                       │ MOV │ $2002 │ D10003 │   Data
          │                                       └─────┴───────┴────────┘
0007      │                                       ┌─────┬──────┬────────┐
          │                                       │ MOV │ $800 │ D10004 │   Data
          │                                       └─────┴──────┴────────┘
0008      │                                       ┌─────┬───┬────────┐
          │                                       │ MOV │ 0 │ D10005 │   Data
          │                                       └─────┴───┴────────┘
0009      │                                       ┌─────┬───┬────────┐
          │                                       │ MOV │ 0 │ D10006 │   Data
          │                                       └─────┴───┴────────┘
0010      │                                       ┌─────┬───┬────────┐
          │                                       │ MOV │ 0 │ D10007 │   Data
          │                                       └─────┴───┴────────┘
0011      │                                       ┌─────┬───┬────────┐
          │                                       │ MOV │ 0 │ D10008 │   Data
          │                                       └─────┴───┴────────┘
0012      │                        ┌───────┬────────┬───┬──────┬───┐
          │                        │ WRITE │ D10001 │ 3 │ 1701 │ 8 │   Write parameters
          │                        └───────┴────────┴───┴──────┴───┘
0013      │                                            ┌─────┬────────┐
          │                                            │ SET │ Y00333 │   Send Command ON
          │                                            └─────┴────────┘
0014      │                                            ┌─────┬────────┐
          │                                            │ SET │ I00902 │   Request to receive ON
          │                                            └─────┴────────┘
0015      │                                            ┌─────┬────────┐
          └────────────────────────────────────────────│ SET │ I00903 │   Executing ON
                                                        └─────┴────────┘
0016
        X00301  I00902                                  ┌─────┬────────┐
        ─┤ ├────┤ ├───────┬────────────────────────────│ RST │ Y00333 │   Send Command OFF
                          │                             └─────┴────────┘
0017                      │                             ┌─────┬────────┐
                          ├─────────────────────────────│ RST │ I00902 │   Request to receive OFF
                          │                             └─────┴────────┘
0018                      │          ┌──────┬───┬──────┬────────┬────┐
                          └──────────│ READ │ 3 │ 1851 │ D01851 │ 10 │   Read response
                                     └──────┴───┴──────┴────────┴────┘
0019
        I00902  I00903  X00301                          ┌─────┬────────┐
        ─┤/├────┤ ├─────┤/├──────┬────────────────────── │ RST │ I00903 │   Executing OFF
                                 │                       └─────┴────────┘
0020                             │                       ┌─────┬────────┐
                                 └───────────────────────│ SET │ I00904 │   Execution Completed ON
                                                         └─────┴────────┘
```

5.3.1 Parameters and Statuses of MECHATROLINK-II Commands

The following tables list the required command parameters, as well as the response parameters and statuses that may be returned for each MECHATROLINK-II command.

In the table, "□□" denotes an axis number (01 to 15).

The MECHATROLINK-II commands that are executable by the positioning module is indicated as follows:

◎: Executable by a user using axis MECHATROLINK-II command parameters.

○: Executable by a user using extended MECHATROLINK-II command parameters.

△: Not executable by a user but is executed automatically by the positioning module or external equipment.

✕: Not supported

■ MECHATROLINK-II Common Commands

● Command parameters

Data Position Number	Data Name	NOP	PRM_RD	PRM_WR	ID_RD	CONFIG	ALM_RD	ALM_CLR	SYNC_SET	CONNECT	DISCONNECT	PPRM_RD	PPRM_WR
		◎	◎	◎	○	◎	○	◎	◎	△	△	×	◎
□□01	Command Code	00	01	02	-1	04	-1	06	0D	0E	0F	1B	1C
□□02 / □□03	(system reserved)												
□□04	Latch Signal (LT_SGNL)												
□□05	Option 1 (OPTION1)												
□□06	Option 2 (OPTION2)												
□□07 / □□08	Target Position (TPOS)												
□□09 / □□10	Target Speed (TSPD)												
□□11	(system reserved)												
□□12	Monitor 2 Selection (MOD_SEL)												
□□13	(system reserved)												
□□14	Coord. Selection (PS_SUBCMD)												
□□15 / □□16	Preset Coordinate (POS_DATA)												
□□17	Parameter No. (NO)		○	○									○
□□18	Parameter Data Size (SIZE)		○	○									○
□□19 / □□20	Parameter Data (PARAMETER)			○									○
□□21 / □□22	(system reserved)												
□□23	Hold Mode (HOLD_MOD)												
□□24	Alarm Clear Mode (ALM_CLR_MOD)							○					
□□25	Forward Torque Limit (P_TLIM)/ or Torque Feed Forward (TFF)												
□□26	Reverse Torque Limit (N_TLIM)												
□□27 / □□28	Speed Reference (VREF)												
□□29 / □□30	Speed Limit (VLIM)												
□□31 / □□32	Torque Reference (TQREF)												
□□33	Monitor 3 Selection (MOD_SEL)												
□□34	Monitor 4 Selection (MOD_SEL)												
1701 to 1850	Extended command parameters				○		○						

● Response parameters

□□62	Coord. Selection (PS_SUBCMD)												
□□63 / □□64	Preset Coordinate (POS_DATA)												
□□65	Parameter No. (NO)		○	○									○
□□66	Parameter Data Size (SIZE)		○	○									○
□□67 / □□68	Parameter Data (PARAMETER)		○	○									○
1851 to 2000	Extended response parameters				○		○						

● Statuses

□□81	Alarm Code (ALARM)	○	○	○	○	○	○	○	○	○			○
□□82	Status (STATUS)	○	○	○	○	○	○	○	○	○			○
□□83 / □□84	Monitor 1 (MONITOR1)												
□□85 / □□86	Monitor 2 (MONITOR2)												
□□87	I/O Signal Monitor (I/O)												
□□88	(system reserved)												
□□89 / □□90	Counter Latched Position (LPOS)												
□□91 / □□92	Monitor 3 (MONITOR3)												
□□93 / □□94	Monitor 4 (MONITOR4)												
□□95	Substatus (SUBSTATUS)												
□□96	Interpolation Status												
□□97 / □□98	Remaining Travel Status												
1601 to 1700	Common statuses	○	○	○	○	○	○	○	○	○			○

■ MECHATROLINK-II Common Motion Commands

● Command parameters

Data Position Number	Data Name	POS_SET	BRK_ON	BRK_OFF	SENS_ON	SENS_OFF	HOLD	MLCK_ON	MLOCK_OFF	LTMOD_ON	LTMOD_OFF
		◎	◎	◎	◎	◎	◎	×	×	◎	◎
□□01	Command Code	20	21	22	23	24	25	26	27	28	29
□□02 / □□03	(system reserved)										
□□04	Latch Signal (LT_SGNL)									○	
□□05	Option 1 (OPTION1)						○				
□□06	Option 2 (OPTION2)						○				
□□07 / □□08	Target Position (TPOS)										
□□09 / □□10	Target Speed (TSPD)										
□□11	(system reserved)										
□□12	Monitor 2 Selection (MOD_SEL)		○	○	○	○	○			○	○
□□13	(system reserved)										
□□14	Coord. Selection (PS_SUBCMD)	○									
□□15 / □□16	Preset Coordinate (POS_DATA)	○									
□□17	Parameter No. (NO)										
□□18	Parameter Data Size (SIZE)										
□□19 / □□20	Parameter Data (PARAMETER)										
□□21 / □□22	(system reserved)										
□□23	Hold Mode (HOLD_MOD)						○				
□□24	Alarm Clear Mode (ALM_CLR_MOD)										
□□25	Forward Torque Limit (P_TLIM)/ or Torque Feed Forward (TFF)										
□□26	Reverse Torque Limit (N_TLIM)										
□□27 / □□28	Speed Reference (VREF)										
□□29 / □□30	Speed Limit (VLIM)										
□□31 / □□32	Torque Reference (TQREF)										
□□33	Monitor 3 Selection (MOD_SEL)						○			○	○
□□34	Monitor 4 Selection (MOD_SEL)						○			○	○
1701 to 1850	Extended command parameters										

● Response parameters

Data Position Number	Data Name	POS_SET	BRK_ON	BRK_OFF	SENS_ON	SENS_OFF	HOLD	MLCK_ON	MLOCK_OFF	LTMOD_ON	LTMOD_OFF
□□62	Coord. Selection (PS_SUBCMD)	○									
□□63 / □□64	Preset Coordinate (POS_DATA)	○									
□□65	Parameter No. (NO)										
□□66	Parameter Data Size (SIZE)										
□□67 / □□68	Parameter Data (PARAMETER)										
1851 to 2000	Extended response parameters										

● Statuses

Data Position Number	Data Name	POS_SET	BRK_ON	BRK_OFF	SENS_ON	SENS_OFF	HOLD	MLCK_ON	MLOCK_OFF	LTMOD_ON	LTMOD_OFF
□□81	Alarm Code (ALARM)	○	○	○	○	○	○			○	○
□□82	Status (STATUS)	○	○	○	○	○	○			○	○
□□83 / □□84	Monitor 1 (MONITOR1)		○	○	○	○	○			○	○
□□85 / □□86	Monitor 2 (MONITOR2)		○	○	○	○	○			○	○
□□87	I/O Signal Monitor (I/O)		○	○	○	○	○			○	○
□□88	(system reserved)										
□□89 / □□90	Counter Latched Position (LPOS)									○	
□□91 / □□92	Monitor 3 (MONITOR3)						○			○	○
□□93 / □□94	Monitor 4 (MONITOR4)						○			○	○
□□95	Substatus (SUBSTATUS)						○			○	○
□□96	Interpolation Status										
□□97 / □□98	Remaining Travel Status										
1601 to 1700	Common statuses	○	○	○	○	○	○			○	○

■ MECHATROLINK-II Standard Servo Commands

● Command parameters

Data Position Number	Data Name	SMON	SV_ON	SV_OFF	INTERPOLATE	POSING	FEED	LATCH	EX_POSING	ZRET	VELCTRL	TRQCTRL	ADJ	SVCTRL
		◎	◎	◎	△	◎	◎	×	◎	◎	◎	◎	○	×
□□01	Command Code	30	31	32	34	35	36	38	39	3A	3C	3D	-1	3F
□□02 / □□03	(system reserved)													
□□04	Latch Signal (LT_SGNL)								○	○				
□□05	Option 1 (OPTION1)		○		○	○	○		○	○	○	○		
□□06	Option 2 (OPTION2)		○		○	○	○		○	○	○	○		
□□07 / □□08	Target Position (TPOS)				○	○			○					
□□09 / □□10	Target Speed (TSPD)					○	○		○	○				
□□11	(system reserved)													
□□12	Monitor 2 Selection (MOD_SEL)	○	○	○	○	○	○		○	○	○	○	○	
□□13	(system reserved)													
□□14	Coord. Selection (PS_SUBCMD)													
□□15 / □□16	Preset Coordinate (POS_DATA)													
□□17	Parameter No. (NO)													
□□18	Parameter Data Size (SIZE)													
□□19 / □□20	Parameter Data (PARAMETER)													
□□21 / □□22	(system reserved)													
□□23	Hold Mode (HOLD_MOD)													
□□24	Alarm Clear Mode (ALM_CLR_MOD)													
□□25	Forward Torque Limit (P_TLIM)/ or Torque Feed Forward (TFF)										○			
□□26	Reverse Torque Limit (N_TLIM)										○			
□□27 / □□28	Speed Reference (VREF)										○			
□□29 / □□30	Speed Limit (VLIM)											○		
□□31 / □□32	Torque Reference (TQREF)											○		
□□33	Monitor 3 Selection (MOD_SEL)	○	○	○	○	○	○		○	○	○	○		
□□34	Monitor 4 Selection (MOD_SEL)	○	○	○	○	○	○		○	○	○	○		
1701 to 1850	Extended command parameters												○	

● Response parameters

Data Position Number	Data Name	SMON	SV_ON	SV_OFF	INTERPOLATE	POSING	FEED	LATCH	EX_POSING	ZRET	VELCTRL	TRQCTRL	ADJ	SVCTRL
□□62	Coord. Selection (PS_SUBCMD)													
□□63 / □□64	Preset Coordinate (POS_DATA)													
□□65	Parameter No. (NO)													
□□66	Parameter Data Size (SIZE)													
□□67 / □□68	Parameter Data (PARAMETER)													
1851 to 2000	Extended response parameters												○	

● Statuses

Data Position Number	Data Name	SMON	SV_ON	SV_OFF	INTERPOLATE	POSING	FEED	LATCH	EX_POSING	ZRET	VELCTRL	TRQCTRL	ADJ	SVCTRL
□□81	Alarm Code (ALARM)	○	○	○	○	○	○		○	○	○	○	○	
□□82	Status (STATUS)	○	○	○	○	○	○		○	○	○	○	○	
□□83 / □□84	Monitor 1 (MONITOR1)	○	○	○	○	○	○		○	○	○	○		
□□85 / □□86	Monitor 2 (MONITOR2)	○	○	○	○	○	○		○	○	○	○		
□□87	I/O Signal Monitor (I/O)	○	○	○	○	○	○		○	○	○	○		
□□88	(system reserved)													
□□89 / □□90	Counter Latched Position (LPOS)								○					
□□91 / □□92	Monitor 3 (MONITOR3)	○	○	○	○	○	○		○	○	○	○		
□□93 / □□94	Monitor 4 (MONITOR4)	○	○	○	○	○	○		○	○	○	○		
□□95	Substatus (SUBSTATUS)	○	○	○	○	○	○		○	○	○	○		
□□96	Interpolation Status													
□□97 / □□98	Remaining Travel Status													
1601 to 1700	Common statuses	○	○	○	○	○	○		○	○	○	○	○	

5.3.2 An Example of MECHATROLINK-II Command Format Conversion

■ MECHATROLINK-II Command

Axis MECHATROLINK-II command parameters or extended MECHATROLINK-II command parameters that are written to the positioning module are converted into a MECHATROLINK-II command as shown below before transmission to external equipment. The following example illustrates the conversion for the POSING command.

● **Converting axis MECHATROLINK-II command parameter data to a MECHATROLINK-II command**

Table 5.7   Axis MECHATROLINK-II Command Parameters

Data Position Number	Data Name	Data Size			
		1 word (16 bits)		1 word (16 bits)	
□□01	Command Code (COMMAND)	00	AA		
□□04	Latch Signal (LT_SGNL)	00	BB		
□□05	Option 1 (OPTION1)	00	CC		
□□06	Option 2 (OPTION2)	00	DD		
□□08 / □□07	Target Position (TPOS)	EE	FF	GG	HH
□□10 / □□09	Target Speed (TSPD)	II	JJ	KK	LL
□□11	(system reserved)	000	M		
□□12	Monitor 2 Selection (MON_SEL)	000	N		

Table 5.8   MECHATROLINK-II Command

Byte No.	Command	ByteData (8 bits)		
1	COMMAND	AA		
2	LT_SGNL	BB		
3	OPTION	CC		
4		DD		
5	TPOS	FF		
6		EE		
7		HH		
8		GG		
9	TSPD	JJ		
10		II		
11		LL		
12		KK		
13	MON_SEL	N	M	M is always 0 ('POS')
14		0		
15		0		
16	WDT	WDT		

● **Converting extended MECHATROLINK-II command parameter data to a MECHATROLINK-II command**

Table 5.9   Extended MECHATROLINK-II Command Parameters

Data Position Number	Data Size	
	1 word (16 bits)	
1701	AA	BB
1702	CC	DD
1703	EE	FF
1704	GG	HH
1705	II	JJ
1706	KK	LL
1707	MM	NN
1708	OO	00

MECHATROLINK-II Command

Byte No.	Byte Data
1	AA
2	BB
3	CC
4	DD
5	EE
6	FF
7	GG
8	HH
9	II
10	JJ
11	KK
12	LL
13	MM
14	NN
15	OO
16	WDT

■ MECHATROLINK-II Response

MECHATROLINK-II response data received from external equipment can be read from axis statuses or extended MECHATROLINK-II response parameters as shown below. The following example illustrates the case for the POSING command.

● Converting MECHATROLINK-II response to axis statuses and axis MECHATROLINK-II response parameter data

Table 5.10   MECHATROLINK-II Response

Byte No.	Command	Byte Data	
1	COMMAND	AA	
2	ALARM	BB	
3	STATUS	CC	
4		DD	
5	MONITOR1	EE	
6		FF	
7		GG	
8		HH	
9	MONITOR2	II	
10		JJ	
11		KK	
12		LL	
13	MON_SEL	M	N
14	I/O	OO	
15		PP	
16	RWDT	RWDT	

Table 5.11   Axis Statuses

Data Position Number	Data Name	Data Size			
		1 word (16 bits)		1 word (16 bits)	
□□81	Alarm Code (ALARM)	00	BB		
□□82	Status (STATUS)	DD	CC		
□□84 □□83	Monitor 1 (MONITOR1)	FF	EE	HH	GG
□□86 □□85	Monitor 2 (MONITOR2)	JJ	II	LL	KK
□□87	I/O Signal Monitor (I/O)	PP	OO		

● Converting MECHATROLINK-II response to extended MECHATROLINK-II response parameter data

Table 5.12   MECHATROLINK-II Response

Byte No.	Byte Data (8 bits)
1	AA
2	BB
3	CC
4	DD
5	EE
6	FF
7	GG
8	HH
9	II
10	JJ
11	KK
12	LL
13	MM
14	NN
15	OO
16	RWDT

Extended MECHATROLINK-II Response Parameters

Data Position Number	Data Size	
	1 word (16 bits)	
1851	AA	BB
1852	CC	DD
1853	EE	FF
1854	GG	HH
1855	II	JJ
1856	KK	LL
1857	MM	NN
1858	OO	RWDT

5.4　Reading Statuses

The positioning module allows statuses of external equipment corresponding to axes 1 to 15 to be read from input relays, axis statuses and common statuses. Status data is refreshed at fixed intervals defined by the Communication Period parameter.

The statuses that are updated depend on the transmitted MECHATROLINK-II command.

For details on the statuses that are updated for each MECHATROLINK-II command, see Subsection 5.3.1, "Parameters and Statuses of MECHATROLINK-II Commands".

After receiving a response for a transmitted MECHATROLINK-II command (but not an extended MECHATROLINK-II command) that is not updated by axis status monitoring, the positioning module automatically sends a SMON ($30) command to update the axis status monitor data.

■ Reading Statuses

● Reading statuses

Input relays can be read using a ladder program. Axis statuses and common statuses can be read using READ instructions in a ladder program.

● Input relays

Table 5.13 lists the input relays.

Table 5.13　　List of Input Relays

Input Relay No.	Signal Name	Description	Relation with Other Relays
X□□□17	AX1 Positioning Completed	Turns on when axis 1 is in positioning completed state.	
X□□□18	AX2 Positioning Completed	Turns on when axis 2 is in positioning completed state.	
X□□□19	AX3 Positioning Completed	Turns on when axis 3 is in positioning completed state.	
X□□□20	AX4 Positioning Completed	Turns on when axis 4 is in positioning completed state.	
X□□□21	AX5 Positioning Completed	Turns on when axis 5 is in positioning completed state.	
X□□□22	AX6 Positioning Completed	Turns on when axis 6 is in positioning completed state.	
X□□□23	AX7 Positioning Completed	Turns on when axis 7 is in positioning completed state.	
X□□□24	AX8 Positioning Completed	Turns on when axis 8 is in positioning completed state.	
X□□□25	AX9 Positioning Completed	Turns on when axis 9 is in positioning completed state.	
X□□□26	AX10 Positioning Completed	Turns on when axis 10 is in positioning completed state.	
X□□□27	AX11 Positioning Completed	Turns on when axis 11 is in positioning completed state.	
X□□□28	AX12 Positioning Completed	Turns on when axis 12 is in positioning completed state.	
X□□□29	AX13 Positioning Completed	Turns on when axis 13 is in positioning completed state.	
X□□□30	AX14 Positioning Completed	Turns on when axis 14 is in positioning completed state.	
X□□□31	AX15 Positioning Completed	Turns on when axis 15 is in positioning completed state.	
X□□□32	Error/Warning Detected	Turns on when error or warning is detected on the module or any axis.	Turning on Y□□□64 to clear all errors and warnings also turns off this relay.

Note:　In the table, "□□□" denotes the slot number of the FA-M3 unit where the module is mounted.

● **Axis statuses**

Table 5.14 lists the axis statuses. For details of axis statuses, see Subsection 4.2.4, "Axis Statuses".

Table 5.14   List of Axis Statuses

Data Position Number	Data Name	Data Description
□□81	Alarm Code (ALARM)	$0002 to $00F1 ($0099 or $0000 when normal)
□□82	Status (STATUS)	D15 to D0
□□83 / □□84	Monitor 1 (MONITOR1)	Monitored data 1 (always fixed to 'POS')
□□85 / □□86	Monitor 2 (MONITOR2)	Monitored data 2
□□87	I/O Signal Monitor (I/O)	D15 to D0
□□88	(system reserved)	
□□89 / □□90	Counter Latched Position (LPOS)	-1,073,741,823 to 1,073,741,823 (reference unit)
□□91 / □□92	Monitor 3 (MONITOR3)	Monitored data 3
□□93 / □□94	Monitor 4 (MONITOR4)	Monitored data 4
□□95	Substatus (SUBSTATUS)	D15 to D0
□□96	Interpolation Status	D15 to D0
□□97 / □□98	Remaining Travel Status	-2,147,483,648 to 2,147,483,647 (reference unit)

Note: In the table, "□□" denotes an axis number (01 to 15).

● **Common statuses**

Table 5.15 lists the common statuses. For details of common statuses, see Subsection 4.2.5, "Common Statuses".

Table 5.15   List of Common Statuses

Data Position Number	Data Name	Data Description
1601	Alarm Axis Bits	Bit data for module, AX15, AX14,…, AX2 and AX1
1602	Warning Axis Bits	'0' and bit data for AX15, AX14,…, AX2 and AX1
1603	Command Ready (CMDRDY) Axis Bits	'0' and bit data for AX15, AX14,…, AX2 and AX1
1604	Servo ON (SVON) Axis Bits	'0' and bit data for AX15, AX14,…, AX2 and AX1
1605	Main Power On (PON) Axis Bits	'0' and bit data for AX15, AX14,…, AX2 and AX1
1606	Machine Lock (MLOCK) Axis Bits	'0' and bit data for AX15, AX14,…, AX2 and AX1
1607	Home Position (ZPOINT) Axis Bits	'0' and bit data for AX15, AX14,…, AX2 and AX1
1608	Positioning Completed (PSET) Axis Bits	'0' and bit data for AX15, AX14,…, AX2 and AX1
1609	Output Completed (DEN) Axis Bits	'0' and bit data for AX15, AX14,…, AX2 and AX1
1610	Torque Limit (T_LIM) Axis Bits	'0' and bit data for AX15, AX14,…, AX2 and AX1
1611	Latch Completed (L_CMP) Axis Bits	'0' and bit data for AX15, AX14,…, AX2 and AX1
1612	Positioning Proximity (NEAR) Axis Bits	'0' and bit data for AX15, AX14,…, AX2 and AX1
1613	Forward Software Limit (P-SOT) Axis Bits	'0' and bit data for AX15, AX14,…, AX2 and AX1
1614	Reverse Software Limit (N-SOT) Axis Bits	'0' and bit data for AX15
1615 to 1622	(system reserved)	
1623	Module Alarm Code	Command error, watchdog timeout error, command timeout error, parameter setup error (for interpolation movement commands)
1624	Module Detailed Alarm Code	'0' and bit data for AX15, AX14, …, AX2 and AX1

■ Example for Reading Statuses

● Sample program

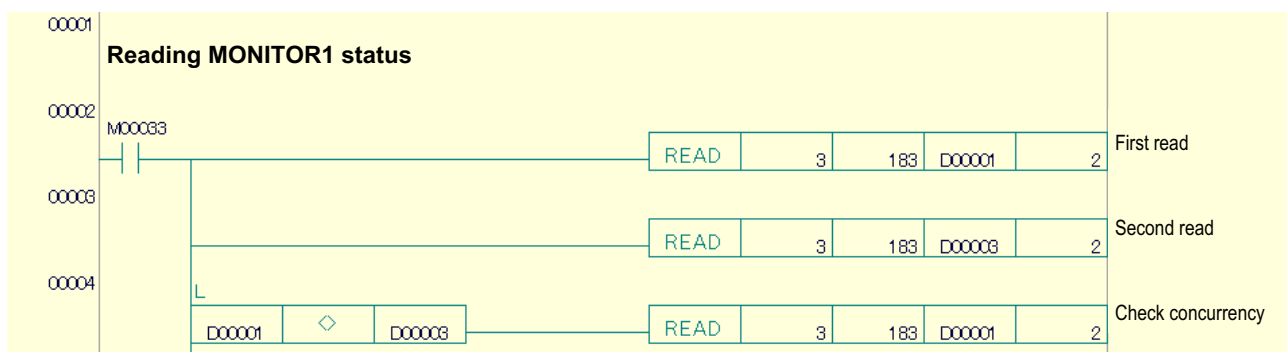This sample program reads axis statuses for axes 1 to 3 for the positioning module mounted in slot 3.

```
00001
        Read Statuses

00002
        Axis 1

00003
        M00033
          | |                                    READ    3   181  D10081   18

00004
        Axis 2

00005
        M00033
          | |                                    READ    3   281  D10181   18

00006
        Axis 3

00007
        M00033
          | |                                    READ    3   381  D10281   18
```
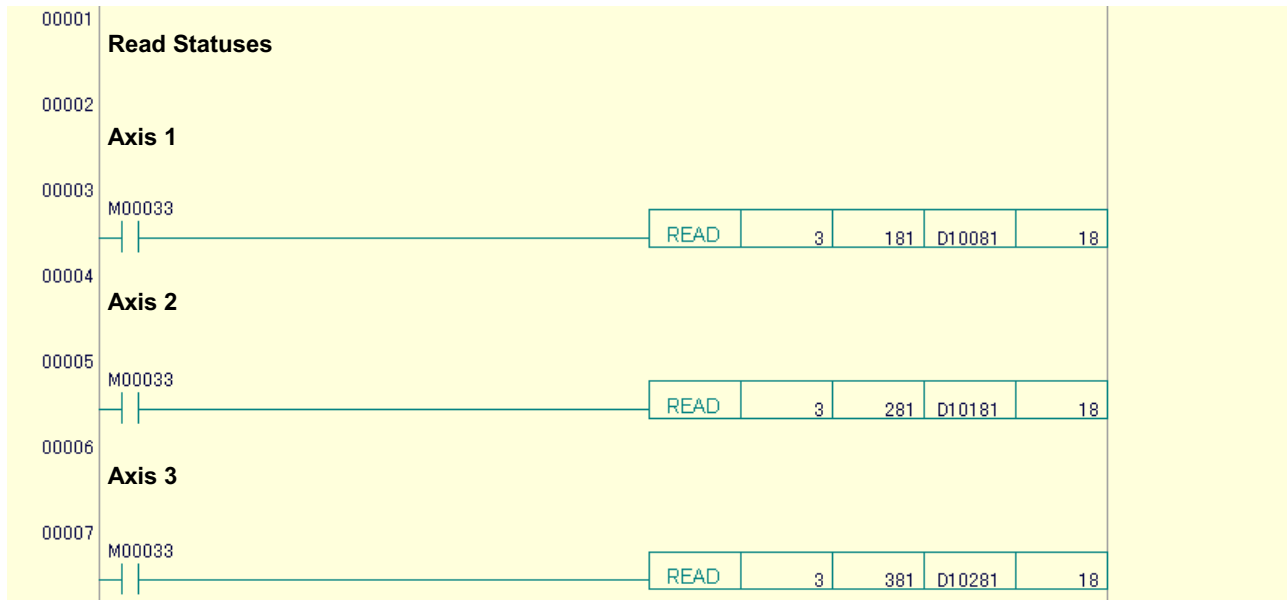
■ Precautions

When the CPU module reads 2-word status data such as Monitor 1 to 4 (MONITOR 1-4) of axis statuses from the positioning module using the word-based Special Module Read instruction (READ), concurrency of the high-order word and low-order word of 2-word data is not assured due to conflicts between the timing of reading from the CPU module and the data update period of the positioning module.

To ensure that the high-order word and low-order word of 2-word data are concurrent when reading from a sequence CPU, use the READ command to read the data twice consecutively and verify that the data read are the same in both instances. If the HRD command is used, data concurrency is not assured even if you confirm that the data are the same.

Data concurrency cannot be assured when reading from a BASIC CPU.

● Sample program

This sample program reads axis status named 'Monitor 1' (MONITOR1) of axis 1 for the positioning module mounted in slot 3.

```
00001
       Reading MONITOR1 status

00002
       M00033
         ─┤├──────────────────────────────  READ    3    183   D00001     2     First read

00003
                                              READ    3    183   D00003     2     Second read

00004
         L
          ┌────────┐   ◇   ┌────────┐
          │ D00001 │──────│ D00003 │──────  READ    3    183   D00001     2     Check concurrency
          └────────┘       └────────┘
```

5.5 Detecting Errors, Warnings and Communication Alarms

Errors and warnings reported by the positioning module can be classified into two types. The first type of errors and warnings is detected by the module itself, while the second type of errors and warnings is detected by external equipment and reported to the module via MECHATROLINK-II communications. The Error/Warning Detected relay turns on for both types of errors and warnings.

The module itself may detect a MECHATROLINK-II communication alarm (communication error, watchdog timer error, command timeout error, etc.) or parameter setup error when an interpolation movement command is executed. When this happens, the module bit of Alarm Axis Bits of common statuses turns on, and alarm information is stored in Module Alarm Code and Module Detailed Alarm Code of common statuses.

External equipment may report a MECHATROLINK-II communication alarm (communication error, watchdog timer error or command warning) or an error or warning due to external equipment fault. External equipment reports such errors or warnings to the positioning module by returning a MECHATROLINK-II response with the Alarm bit (ALARM) or Warning bit (WARNG) of STATUS turned on. When this happens, the corresponding bit of the Alarm Axis Bits or Warning Axis Bits of common statuses turns on, and alarm information is stored in Alarm Code (ALARM) of axis statuses.

■ Communication Alarms Detected by the Module

● Communication error

In MECHATROLINK-II communications, data exchange with external equipment is carried out during each communication cycle.

A communication error is generated if 'not received' status is detected for two or more consecutive cycles when receive data is read from external equipment.

● Watchdog timer error

In MECHATROLINK-II communications, the master station and slave stations exchange synchronization data (WDT/RWDT) during each communication cycle. This data exchange allows the master and its slaves to:

- Synchronize their communication cycles, and detect any synchronization lag, and
- Detect system errors (CPU errors).

A watchdog timer error is generated if the watchdog timer value in received data read from external equipment is not equal to the previous watchdog timer value plus 1.

● Command timeout error

A command timeout error is generated if no MECHATROLINK-II response is received for a MECHATROLINK-II command ten seconds after transmission. It is assumed that a command processing error is encountered by the external equipment.

■ Errors Detected When an Interpolation Movement Command is Executed

● **Parameter setup error**

A parameter setup error is generated when an invalid parameter value is specified for an interpolation movement command.

For instance, this may happen when a Start Positioning command is executed with a specified parameter value that is out of valid range.

If a parameter setup error is detected during movement, the movement is decelerated and stopped.

● **Motion axis error**

A motion axis error is generated if an interpolation movement is executed with respect to a moving axis using a different set of interpolation axes.

Some examples include executing a Start Positioning command for a moving axis or executing a Change Target Position command for a moving axis using a MECHATROLINK-II command. Other examples include executing a Change Speed command or Change Target Position command while a target position change is in progress. Bit 4 of Interpolation Status of axis statuses is ON while a target position change is in progress.

● **Internal computation error**

An internal computation error is generated when internal computation by the positioning module produces an invalid value.

Internal computation errors do not normally happen.

■ Errors and Warnings Detected by an Axis

For details on errors and warnings that may be reported by an axis, see the user's manual of the connected external equipment.

■ Checking for Errors and Warnings

● Error/Warning Detected relay

The Error/Warning Detected relay turns on when the positioning module or external equipment detects an error or warning.

Table 5.16   Relays for Checking Errors or Warnings

Input Relay No.	Signal Name	Description	Relation with Other Relays
X□□□32	Error/Warning Detected	Turns on when an error or warning is detected by the module or any axis.	Turning on Y□□□64 to clear all errors and warnings also turns off this relay.

Note: In the table, "□□□" denotes the slot number of the FA-M3 unit where the module is mounted.

● Alarm Axis Bits, Module Alarm Code and Module Detailed Alarm Code

When the positioning module detects a MECHATROLINK-II communication alarm or a parameter setup error when executing an interpolation movement command, the module bit of Alarm Axis Bits of common statutses turns on, and alarm information is stored in Module Alarm Code and Module Detailed Alarm Code.

The Module Alarm Code and Module Detailed Alarm Code are meaningful only when the module bit of Alarm Axis Bits (ALARM) has value 1.

When an error or warning is detected by external equipment, the corresponding bit of the Alarm Axis Bits or Warning Axis Bits of common statuses turns on, and alarm information is stored in Alarm Code (ALARM) of axis statuses.

Table 5.17   List of Statuses for Checking Errors or Warnings

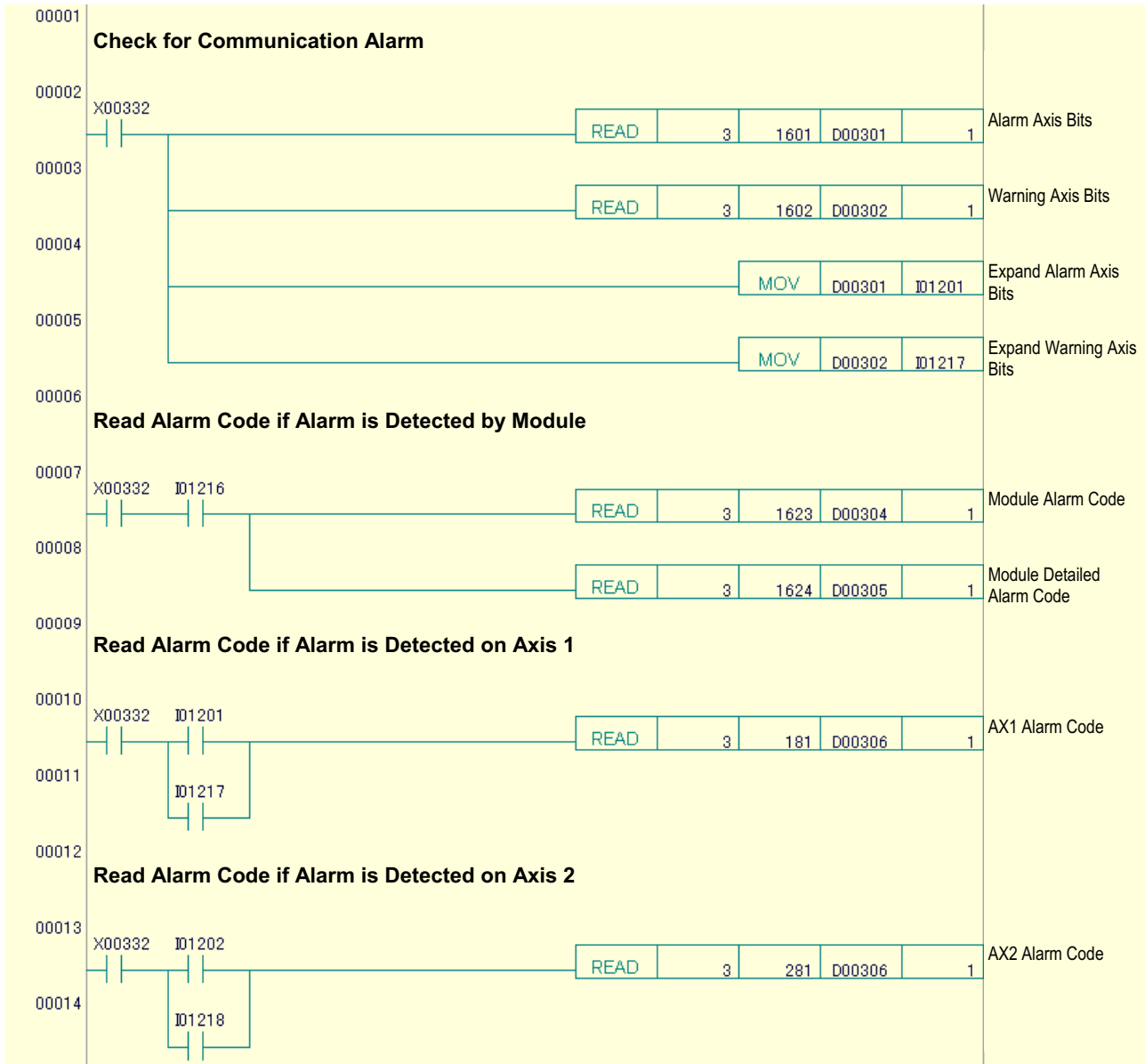| Data Position Number	Data Name	Data Description
1601	Alarm Axis Bits	Bit data for module, AX15, AX14, …, AX2 and AX1
1602	Warning Axis Bits	'0' and bit data for AX15, AX14, …, AX2 and AX1

Data Position Number	Data Name	Data Description
1623	Module Alarm Code	Communication error, watchdog timer error, command timeout error, parameter setup error (for interpolation movement commands), etc.
1624	Module Detailed Alarm Code	'0' and bit data for AX15, AX14, …, AX2 and AX1

Data Position Number	Data Name	Data Description
□□81	Alarm Code (ALARM)	$0002 to $00F1 ($0099 or $0000 when normal)

■ Example of Checking for Errors and Warnings

● Sample program

This sample program checks for errors and warnings of axes 1 and 2 for the positioning module mounted in slot 3.

```
00001
            Check for Communication Alarm

00002
       X00332
        ─┤├───┬─────────────────────── READ    3   1601   D00301   1     Alarm Axis Bits
00003        │
             ├─────────────────────── READ    3   1602   D00302   1     Warning Axis Bits
00004        │
             ├─────────────────────── MOV    D00301   I01201              Expand Alarm Axis
                                                                          Bits
00005        │
             └─────────────────────── MOV    D00302   I01217              Expand Warning Axis
                                                                          Bits
00006
            Read Alarm Code if Alarm is Detected by Module

00007
       X00332   I01216
        ─┤├──────┤├───┬─────────────── READ    3   1623   D00304   1     Module Alarm Code
00008             │
                  └─────────────── READ    3   1624   D00305   1     Module Detailed
                                                                      Alarm Code
00009
            Read Alarm Code if Alarm is Detected on Axis 1

00010
       X00332   I01201
        ─┤├──┬───┤├───┬─────────────── READ    3   181    D00306   1     AX1 Alarm Code
00011        │       │
             │ I01217 │
             └───┤├───┘
00012
            Read Alarm Code if Alarm is Detected on Axis 2

00013
       X00332   I01202
        ─┤├──┬───┤├───┬─────────────── READ    3   281    D00306   1     AX2 Alarm Code
00014        │       │
             │ I01218 │
             └───┤├───┘
```

5.6　Clearing Errors and Warnings

This section describes how to clear communication alarms (communication error, watchdog timer error, command timeout error, etc.) and parameter setup errors of interpolation movement commands detected by the module, as well as errors and warnings reported by external equipment.

Errors and warnings can be cleared only while MECHATROLINK-II communication is in progress.

The positioning module clears errors and warnings by automatically sending ALRM_CLR ($06) commands and SYNC_SET ($0D) commands to all axes where an error or warning is encountered. ALRM_CLR and SYNC_SET commands are however not sent to external machines that are in the midst of command transmission.

■ Procedure for Clearing Errors and Warnings

● Procedure for clearing errors and warnings
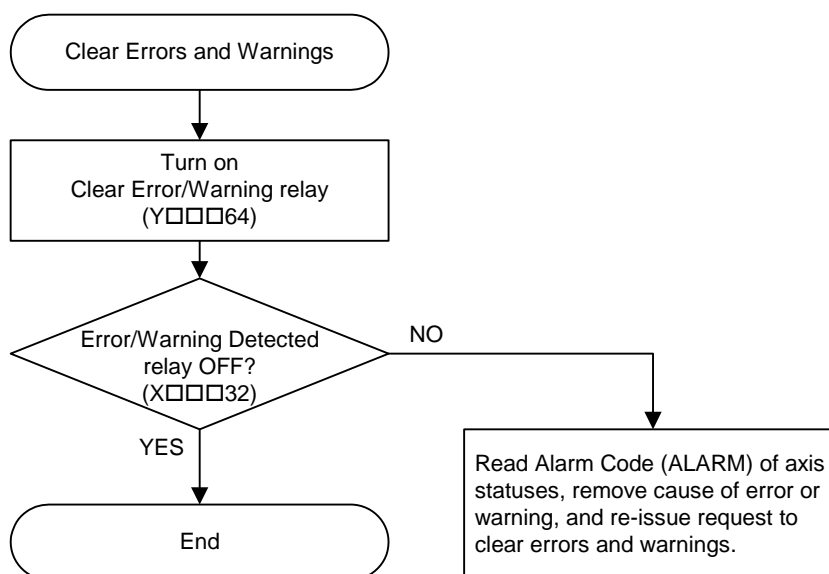
Figure 5.4　Procedure for Clearing Errors and Warnings

● Clearing Error/Warning relay

Turning on the Clear Error/Warning relay clears all reported errors and warnings. The Error/Warning Detected relay turns off if all errors and warnings are cleared successfully.

Confirm that the Error/Warning Detected relay has turned off before turning off the Clear Error/Warning relay. If an error/warning condition persists even after turning on the Clear Error/Warning relay, the Error/Warning Detected relay remains ON.

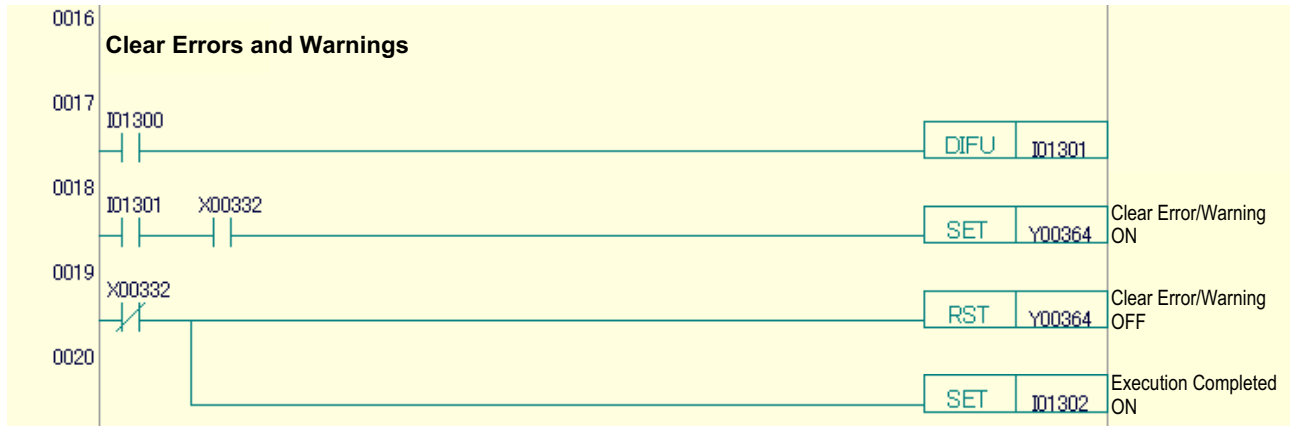**Table 5.19　Relays for Clearing Errors and Warnings**

Output Relay No.	Signal Name	Description	Relation with Other Relays
Y□□□64	Clear Error/warning	Request to clear all errors and warnings	Turn off this relay after confirming that X□□□32 has turned off.

Input Relay No.	Signal Name	Description	Relation with Other Relays
X□□□32	Error/Warning Detected	Turns on when an error or warning is detected by the module or any axis.	Turning on Y□□□64 to clear all errors and warnings turns off this relay if errors and warnings are successfully cleared.

Note:　In the table, "□□□" denotes the slot number of the FA-M3 unit where the module is mounted.

■ Example for Clearing Errors and Warnings

● Sample program

This sample program clears all errors and warnings for the positioning module mounted in slot 3.

```
0016
        Clear Errors and Warnings

0017
        I01300                                              DIFU    I01301
         ┤├

0018
        I01301   X00332                                     SET     Y00364    Clear Error/Warning
         ┤├       ┤├                                                          ON

0019
        X00332                                              RST     Y00364    Clear Error/Warning
         ┤/├                                                                  OFF

0020
                  └─────────────────────                    SET     I01302    Execution Completed
                                                                              ON
```

5.7 Executing Interpolation Movement Commands

When an interpolation movement command is executed from an axis, the positioning module sends a MECHATROLINK-II INTERPOLATE ($34) command to the external equipment corresponding to the axis number (1 to 15).

Only interpolation movement can be executed while an interpolation movement is in progress. Other MECHATROLINK-II commands cannot be transmitted during interpolation movement. Therefore, always confirm that an interpolation movement initiated by an interpolation movement command has completed execution by checking that the Positioning Completed input relay has turned on before sending the next MECHATROLINK-II command.

If an alarm such as a communication error is encountered on an axis involved in interpolation movement, the positioning module automatically sends a SV_OFF ($32) command to all axes to turn off servo for all axes.

■ Procedure for Executing Interpolation Movement Command

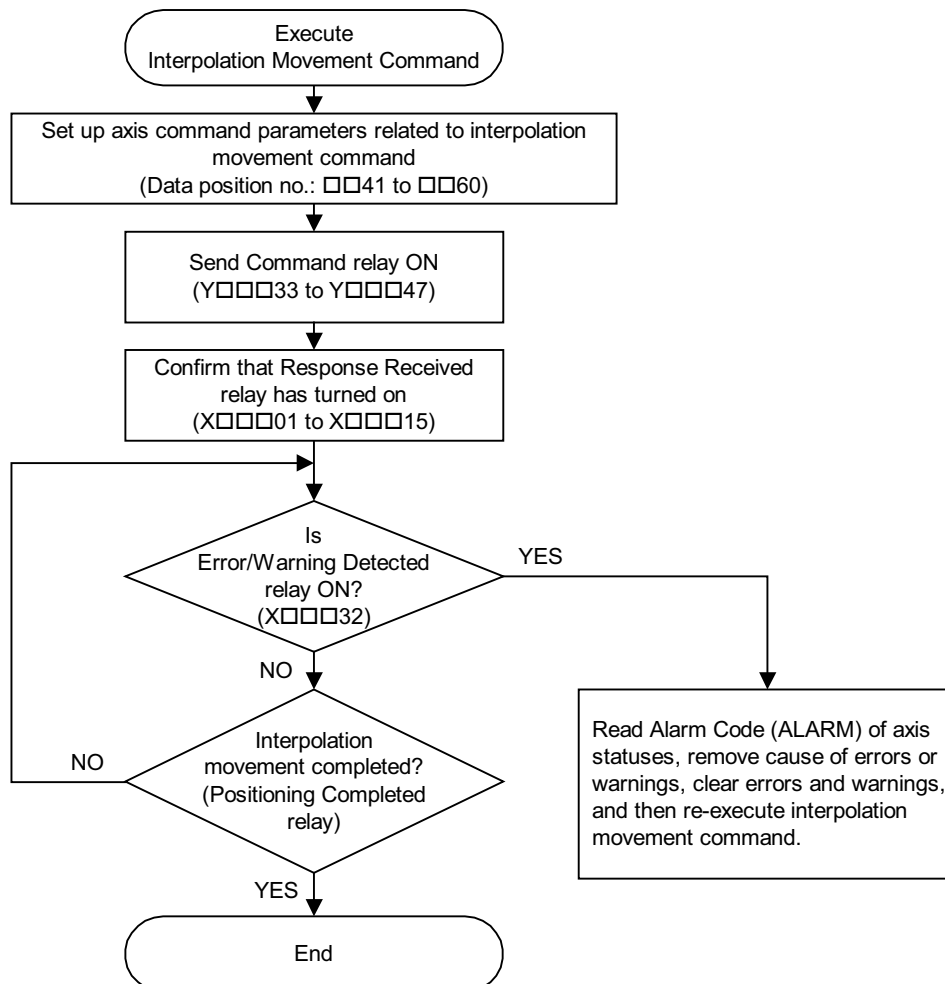### ● Procedure for executing interpolation movement command

Figure 5.5   Procedure for Executing Interpolation Movement Command

● **Acceptance conditions for interpolation movement commands**

- MECHATROLINK-II communication is in progress.

- Send Command relay is OFF.

- Response Received relay is OFF.

- Error/Warning Detected relay is OFF.

- Servo is ON

- Axes are in Positioning Completed state if the interpolation movement command is the Start Positioning command ($0100).

An interpolation movement command is ignored if any of the above conditions is not true.

● **Writing parameters for interpolation movement commands**

Axis command parameters for an interpolation movement command can be written to the module using WRITE instructions in a ladder program.

For details on the required parameters of each interpolation movement commands, see Subsection 5.7.1, "Parameters and Statuses of Interpolation Movement Commands".

● **Send Command relay**

Turning on the Send Command relay of an axis after writing interpolation movement command parameter values executes the interpolation movement command. The Response Received relay of the axis turns on thereafter.

Confirm that the Response Received relay has turned on before turning off the Send Command relay. Turning off the Send Command relay for an axis also turns off the corresponding Response Received relay.

Table 5.20   Relays for Sending Commands

Output Relay No.	Signal Name	Description	Relation with Other Relays
Y□□□33	AX1 Send Command	Request to send MECHATROLINK-II command for axis 1.	Turn off this relay after confirming that X□□□01 has turned on.
Y□□□34	AX2 Send Command	Request to send MECHATROLINK-II command for axis 2	Turn off this relay after confirming that X□□□02 has turned on.
Y□□□35	AX3 Send Command	Request to send MECHATROLINK-II command for axis 3	Turn off this relay after confirming that X□□□03 has turned on.
Y□□□36	AX4 Send Command	Request to send MECHATROLINK-II command for axis 4	Turn off this relay after confirming that X□□□04 has turned on.
Y□□□37	AX5 Send Command	Request to send MECHATROLINK-II command for axis 5	Turn off this relay after confirming that X□□□05 has turned on.
Y□□□38	AX6 Send Command	Request to send MECHATROLINK-II command for axis 6	Turn off this relay after confirming that X□□□06 has turned on.
Y□□□39	AX7 Send Command	Request to send MECHATROLINK-II command for axis 7	Turn off this relay after confirming that X□□□07 has turned on.
Y□□□40	AX8 Send Command	Request to send MECHATROLINK-II command for axis 8	Turn off this relay after confirming that X□□□08 has turned on.
Y□□□41	AX9 Send Command	Request to send MECHATROLINK-II command for axis 9	Turn off this relay after confirming that X□□□09 has turned on.
Y□□□42	AX10 Send Command	Request to send MECHATROLINK-II command for axis 10	Turn off this relay after confirming that X□□□10 has turned on.
Y□□□43	AX11 Send Command	Request to send MECHATROLINK-II command for axis 11	Turn off this relay after confirming that X□□□11 has turned on.
Y□□□44	AX12 Send Command	Request to send MECHATROLINK-II command for axis 12	Turn off this relay after confirming that X□□□12 has turned on.
Y□□□45	AX13 Send Command	Request to send MECHATROLINK-II command for axis 13	Turn off this relay after confirming that X□□□13 has turned on.
Y□□□46	AX14 Send Command	Request to send MECHATROLINK-II command for axis 14	Turn off this relay after confirming that X□□□14 has turned on.
Y□□□47	AX15 Send Command	Request to send MECHATROLINK-II command for axis 15	Turn off this relay after confirming that X□□□15 has turned on.

Input Relay No.	Signal Name	Description	Relation with Other Relays
X□□□01	AX1 Response Received	Turns on when a MECHATROLINK-II response for axis 1 is received.	Turning off Y□□□33 also turns off this relay.
X□□□02	AX2 Response Received	Turns on when a MECHATROLINK-II response for axis 2 is received.	Turning off Y□□□34 also turns off this relay.
X□□□03	AX3 Response Received	Turns on when a MECHATROLINK-II response for axis 3 is received.	Turning off Y□□□35 also turns off this relay.
X□□□04	AX4 Response Received	Turns on when a MECHATROLINK-II response for axis 4 is received.	Turning off Y□□□36 also turns off this relay.
X□□□05	AX5 Response Received	Turns on when a MECHATROLINK-II response for axis 5 is received.	Turning off Y□□□37 also turns off this relay.
X□□□06	AX6 Response Received	Turns on when a MECHATROLINK-II response for axis 6 is received.	Turning off Y□□□38 also turns off this relay.
X□□□07	AX7 Response Received	Turns on when a MECHATROLINK-II response for axis 7 is received.	Turning off Y□□□39 also turns off this relay.
X□□□08	AX8 Response Received	Turns on when a MECHATROLINK-II response for axis 8 is received.	Turning off Y□□□40 also turns off this relay.
X□□□09	AX9 Response Received	Turns on when a MECHATROLINK-II response for axis 9 is received.	Turning off Y□□□41 also turns off this relay.
X□□□10	AX10 Response Received	Turns on when a MECHATROLINK-II response for axis 10 is received.	Turning off Y□□□42 also turns off this relay.
X□□□11	AX11 Response Received	Turns on when a MECHATROLINK-II response for axis 11 is received.	Turning off Y□□□43 also turns off this relay.
X□□□12	AX12 Response Received	Turns on when a MECHATROLINK-II response for axis 12 is received.	Turning off Y□□□44 also turns off this relay.
X□□□13	AX13 Response Received	Turns on when a MECHATROLINK-II response for axis 13 is received.	Turning off Y□□□45 also turns off this relay.
X□□□14	AX14 Response Received	Turns on when a MECHATROLINK-II response for axis 14 is received.	Turning off Y□□□46 also turns off this relay.
X□□□15	AX15 Response Received	Turns on when a MECHATROLINK-II response for axis 15 is received.	Turning off Y□□□47 also turns off this relay.

Note: In the table, "□□□" denotes the slot number of the FA-M3 unit where the module is mounted.

● **Checking Completion of Interpolation Movement Command Execution**

Interpolation movement commands (Start positioning ($0100), Decelerate & stop ($0200), Stop immediately ($0300), Change speed ($0400) and Change target position ($0500)) continue execution even after the Response Received relay turns on.

You can check the completion of these interpolation movement commands by reading the following relays and statuses from a ladder program and checking the values of the relevant status bits.

- Positioning Completed relay (X□□□17 to X□□□31)
- Error/Warning Detected relay (X□□□32)
- Alarm Code (ALARM), Status (STATUS) and Interpolation Status of axis statuses
- Various axis bit pattern statuses of common statuses

■ Example for Executing Interpolation Movement Command

● Procedure

(1) Specify the command code and required parameter values of the interpolation movement command in data position numbers □□01 to □□60.

(2) Turn on the Send Command relay (Y□□□33 to Y□□□47).

(3) Confirm that the Response Received relay (X□□□01 to X□□□15) has turned on.

(4) Confirm that positioning has completed by checking the Positioning Completed relay and statuses as required for each command.
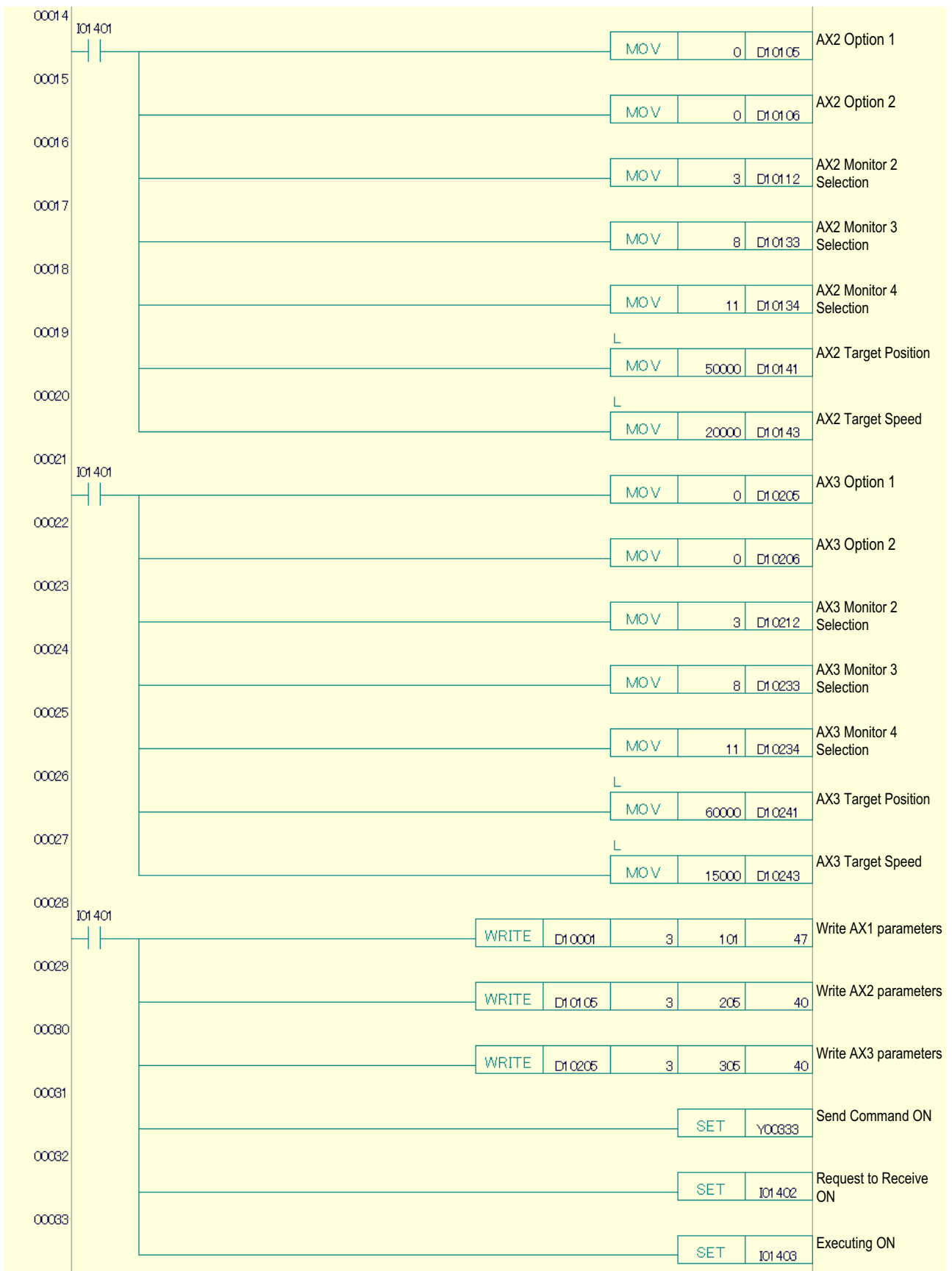
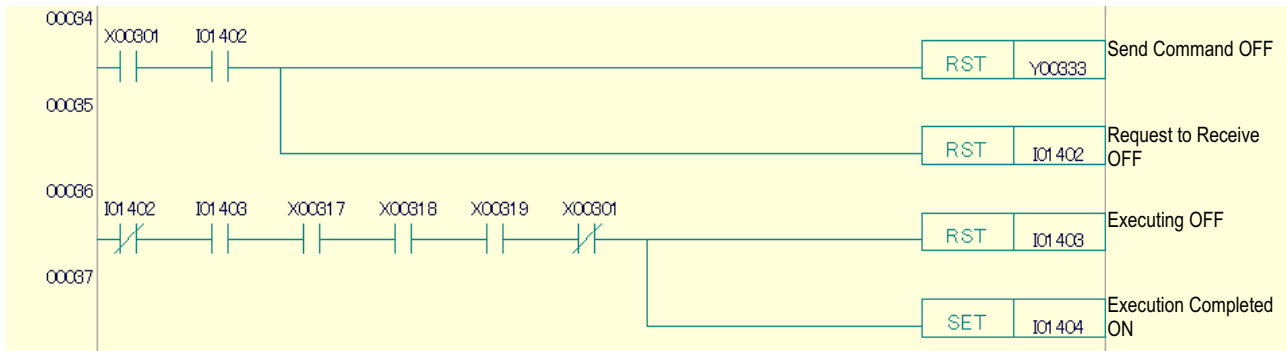## ● Sample Program for Executing Start Positioning Command

This sample program issues a Start Positioning command ($0100) to the positioning module mounted in slot 3 specifying axis 1 as reference axis and axes 2 and 3 as interpolation axes.

After issuing the command, it confirms completion of the command execution by checking that the Positioning Completed relay has turned on.

Rung	Instruction				Comment
00014	I01401 ─┤├─	MOV	0	D10105	AX2 Option 1
00015		MOV	0	D10106	AX2 Option 2
00016		MOV	3	D10112	AX2 Monitor 2 Selection
00017		MOV	8	D10133	AX2 Monitor 3 Selection
00018		MOV	11	D10134	AX2 Monitor 4 Selection
00019		L MOV	50000	D10141	AX2 Target Position
00020		L MOV	20000	D10143	AX2 Target Speed
00021	I01401 ─┤├─	MOV	0	D10205	AX3 Option 1
00022		MOV	0	D10206	AX3 Option 2
00023		MOV	3	D10212	AX3 Monitor 2 Selection
00024		MOV	8	D10233	AX3 Monitor 3 Selection
00025		MOV	11	D10234	AX3 Monitor 4 Selection
00026		L MOV	60000	D10241	AX3 Target Position
00027		L MOV	15000	D10243	AX3 Target Speed
00028	I01401 ─┤├─	WRITE D10001	3	101 47	Write AX1 parameters
00029		WRITE D10105	3	205 40	Write AX2 parameters
00030		WRITE D10205	3	305 40	Write AX3 parameters
00031		SET	Y00333		Send Command ON
00032		SET	I01402		Request to Receive ON
00033		SET	I01403		Executing ON

```
00034
       X00301   I01402                                    ┌─────┬───────┐   Send Command OFF
00035 ──┤├──────┤├────┬──────────────────────────────────│ RST │ Y00333│
                      │                                    └─────┴───────┘
                      │                                   ┌─────┬───────┐   Request to Receive
                      └──────────────────────────────────│ RST │ I01402│   OFF
                                                          └─────┴───────┘
00036
       I01402  I01403  X00317  X00318  X00319  X00301     ┌─────┬───────┐   Executing OFF
00037 ──┤/├────┤├──────┤├──────┤├──────┤├──────┤/├──┬─────│ RST │ I01403│
                                                    │      └─────┴───────┘
                                                    │     ┌─────┬───────┐   Execution Completed
                                                    └─────│ SET │ I01404│   ON
                                                          └─────┴───────┘
```

● **Sample program for executing Decelerate & Stop command**

This sample program issues a Decelerate & Stop command ($0200) from axis 1 to the positioning module mounted in slot 3 to decelerate and stop axes 1, 2 and 3 while an interpolation movement is in progress with axis 1 as reference axis and axes 2 and 3 as interpolation axes.

After issuing the command, it confirms completion of the command execution by checking that the Positioning Completed relay has turned on.
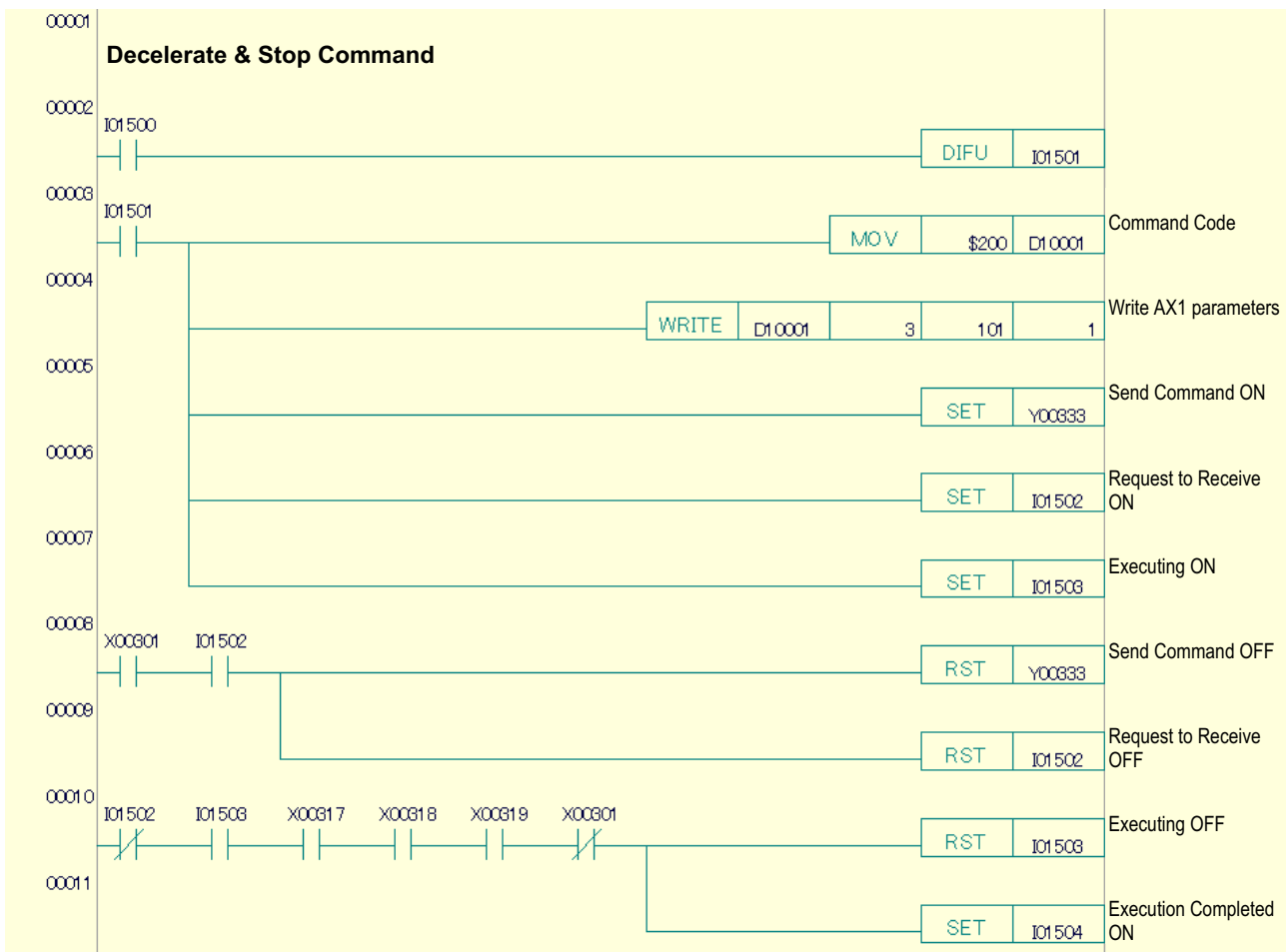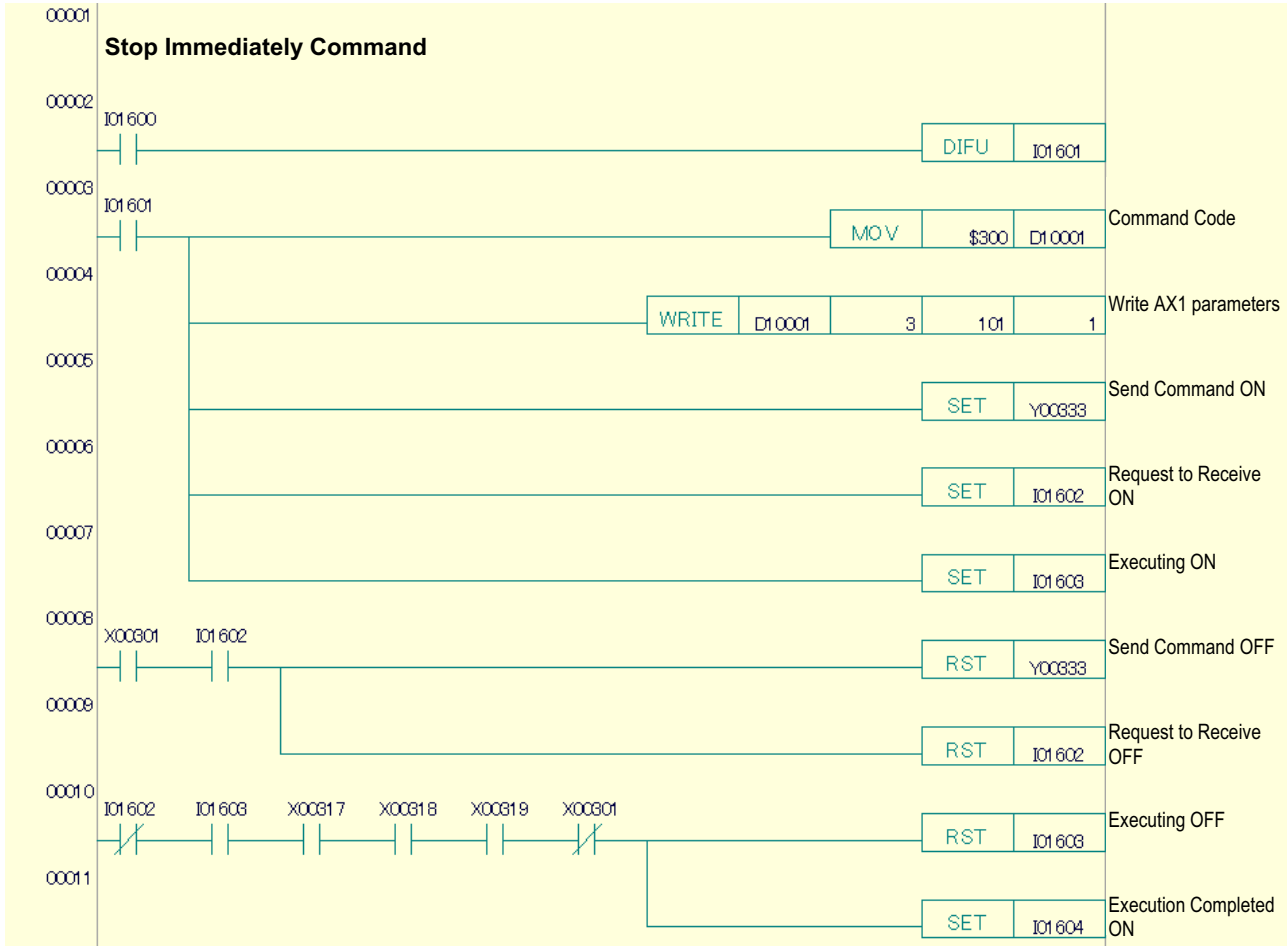
```
00001
       **Decelerate & Stop Command**

00002
       I01500                                             ┌──────┬───────┐
     ──┤├───────────────────────────────────────────────│ DIFU │ I01501│
                                                          └──────┴───────┘
00003
       I01501                                 ┌─────┬──────┬───────┐   Command Code
     ──┤├──────┬────────────────────────────│ MOV │ $200 │ D10001│
              │                               └─────┴──────┴───────┘
00004
              │              ┌───────┬───────┬────┬─────┬────┐   Write AX1 parameters
              ├──────────────│ WRITE │ D10001│ 3  │ 101 │ 1  │
              │              └───────┴───────┴────┴─────┴────┘
00005
              │                                   ┌─────┬───────┐   Send Command ON
              ├──────────────────────────────────│ SET │ Y00333│
              │                                   └─────┴───────┘
00006
              │                                   ┌─────┬───────┐   Request to Receive
              ├──────────────────────────────────│ SET │ I01502│   ON
              │                                   └─────┴───────┘
00007
              │                                   ┌─────┬───────┐   Executing ON
              └──────────────────────────────────│ SET │ I01503│
                                                  └─────┴───────┘
00008
       X00301  I01502                             ┌─────┬───────┐   Send Command OFF
     ──┤├──────┤├────┬──────────────────────────│ RST │ Y00333│
                     │                             └─────┴───────┘
00009
                     │                             ┌─────┬───────┐   Request to Receive
                     └────────────────────────────│ RST │ I01502│   OFF
                                                   └─────┴───────┘
00010
       I01502  I01503  X00317  X00318  X00319  X00301   ┌─────┬───────┐   Executing OFF
     ──┤/├────┤├──────┤├──────┤├──────┤├──────┤/├──┬───│ RST │ I01503│
                                                   │    └─────┴───────┘
00011
                                                   │    ┌─────┬───────┐   Execution Completed
                                                   └────│ SET │ I01504│   ON
                                                        └─────┴───────┘
```

● **Sample program for executing Stop Immediately command**

This sample program issues a Stop Immediately command ($0300) from axis 1 to the positioning module mounted in slot 3 to stop the movement of axes 1, 2 and 3 immediately while an interpolation movement is in progress with axis 1 as reference axis and axes 2 and 3 as interpolation axes.
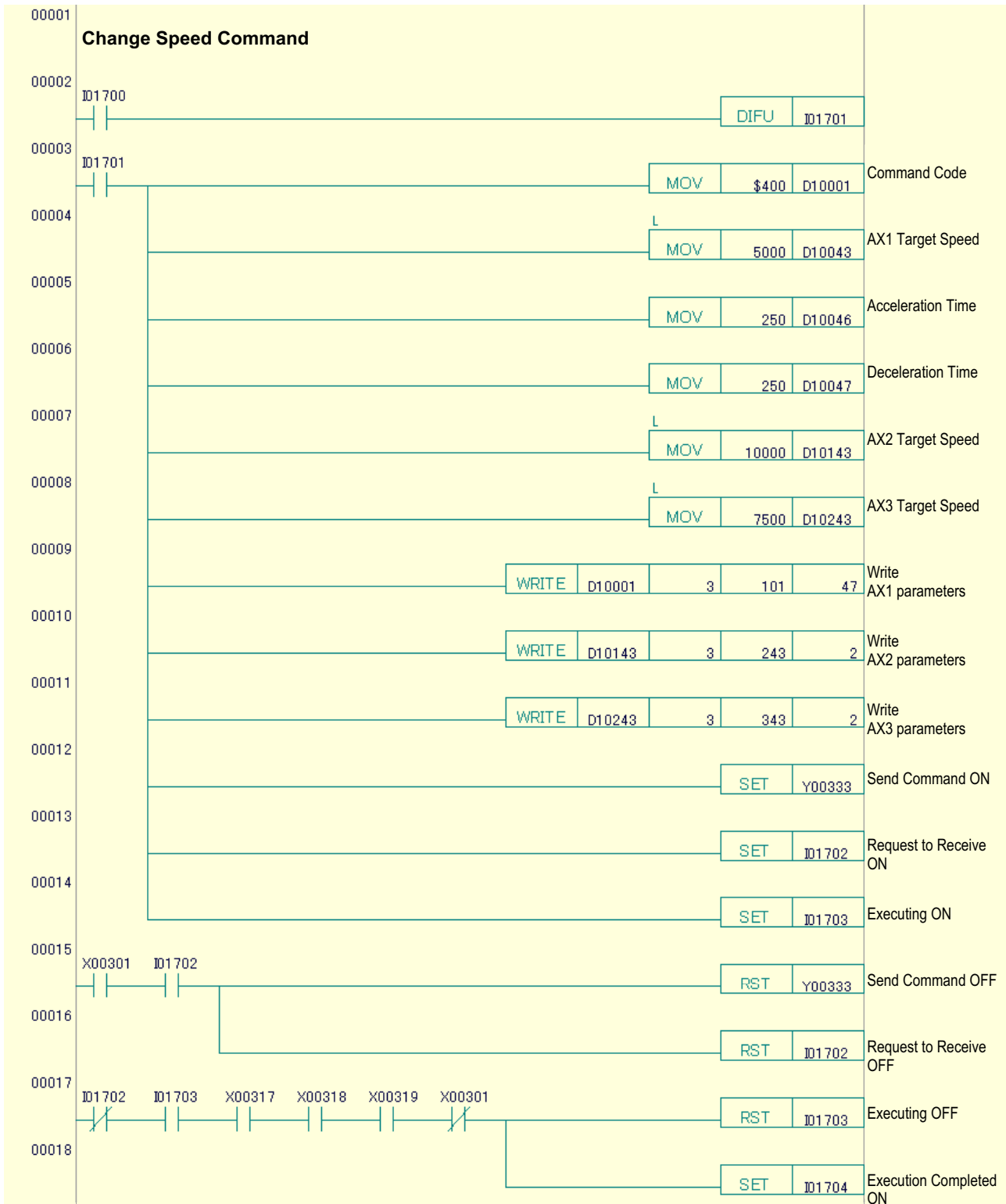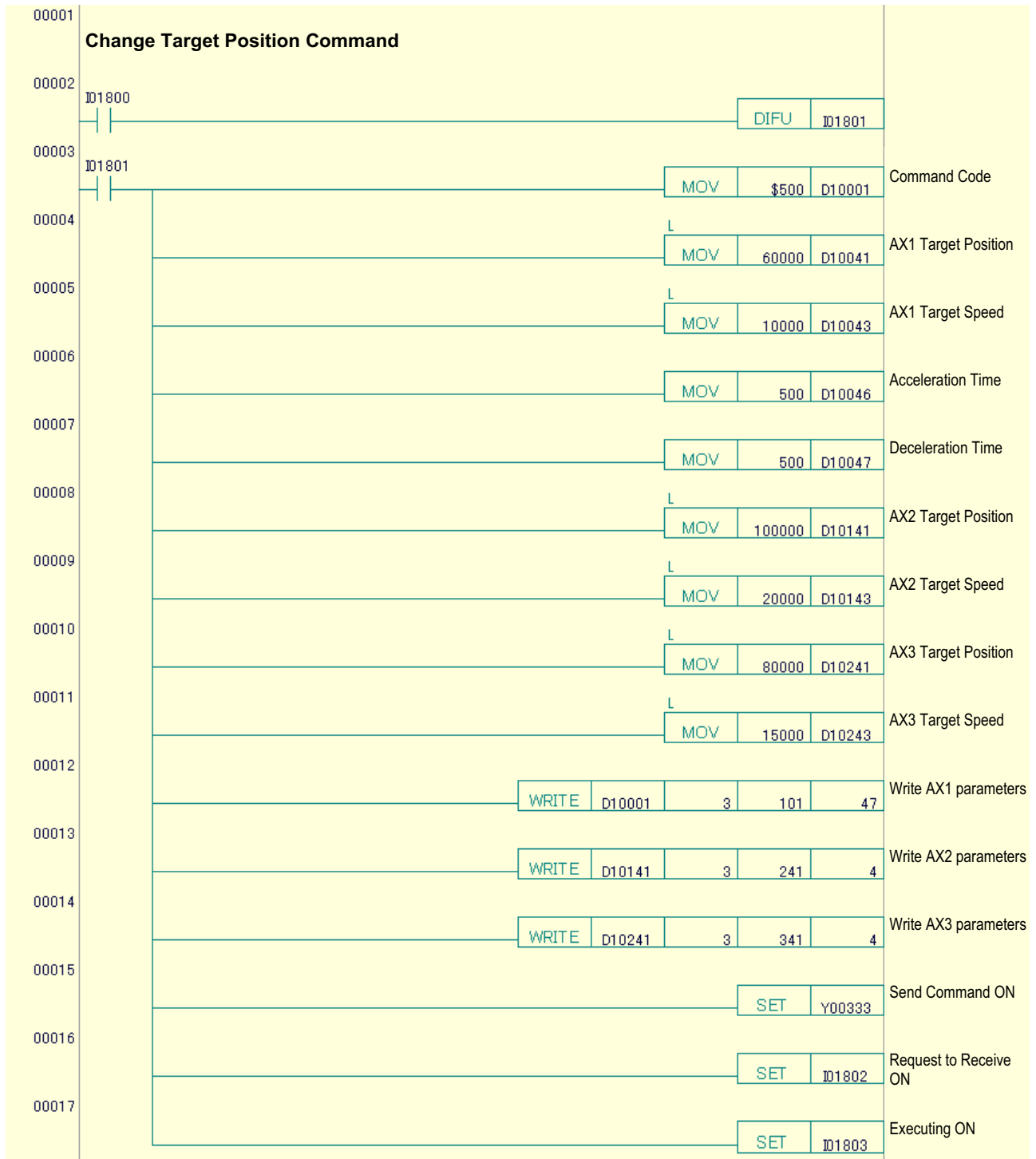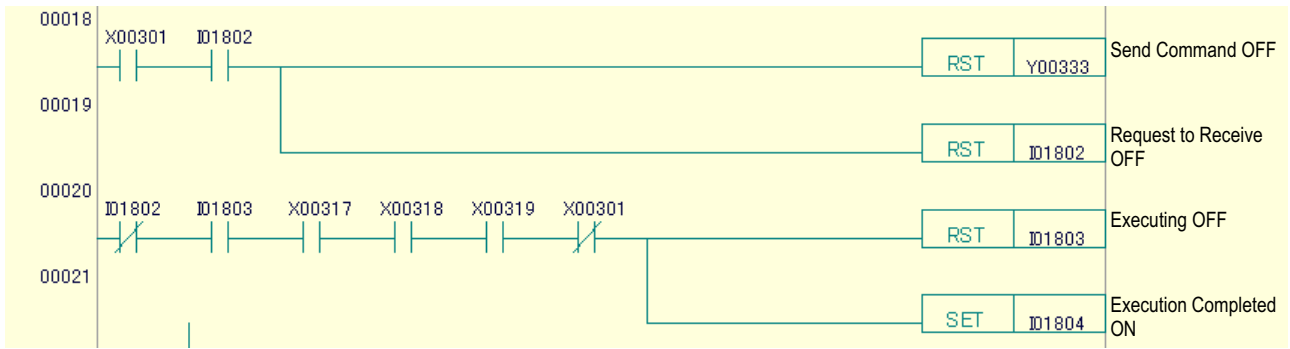
After issuing the command, it confirms completion of the command execution by checking that the Positioning Completed relay has turned on.

```
00001
        Stop Immediately Command

00002
        I01600
        ┤├                                                  DIFU    I01601

00003
        I01601
        ┤├                                           MOV    $300    D10001   Command Code

00004
                                          WRITE   D10001     3      101      1   Write AX1 parameters

00005
                                                             SET    Y00333   Send Command ON

00006
                                                             SET    I01602   Request to Receive
                                                                             ON

00007
                                                             SET    I01603   Executing ON

00008
        X00301  I01602
        ┤├      ┤├                                          RST    Y00333   Send Command OFF

00009
                                                             RST    I01602   Request to Receive
                                                                             OFF

00010
        I01602  I01603  X00317  X00318  X00319  X00301
        ┤╱├     ┤├      ┤├      ┤├      ┤├      ┤╱├         RST    I01603   Executing OFF

00011
                                                             SET    I01604   Execution Completed
                                                                             ON
```

● **Sample program for executing Change Speed command**

This sample program issues a Change Speed command ($0400) to the positioning module mounted in slot 3 to change the speeds of axes 1, 2 and 3 while an interpolation movement is in progress with axis 1 as reference axis and axes 2 and 3 as interpolation axes.

After issuing the command, it confirms completion of the command execution by checking that the Positioning Completed relay has turned on.

● **Sample program for executing Change Target Position command**

This sample program issues a Change Target Position command ($0500) to the positioning module mounted in slot 3 to change the target positions of axes 1, 2 and 3 while an interpolation movement is in progress with axis 1 as reference axis and axes 2 and 3 as interpolation axes.

After issuing the command, it confirms completion of the command execution by checking that the Positioning Completed relay has turned on.

```
00001
         Change Target Position Command

00002
     I01800
     ──┤├──────────────────────────────────────────────── DIFU │ I01801

00003
     I01801
     ──┤├──────────────────────────────────────── MOV │ $500   │ D10001    Command Code

00004                                                      L
          ──────────────────────────────────────── MOV │ 60000  │ D10041    AX1 Target Position

00005                                                      L
          ──────────────────────────────────────── MOV │ 10000  │ D10043    AX1 Target Speed

00006
          ──────────────────────────────────────── MOV │ 500    │ D10046    Acceleration Time

00007
          ──────────────────────────────────────── MOV │ 500    │ D10047    Deceleration Time

00008                                                      L
          ──────────────────────────────────────── MOV │ 100000 │ D10141    AX2 Target Position

00009                                                      L
          ──────────────────────────────────────── MOV │ 20000  │ D10143    AX2 Target Speed

00010                                                      L
          ──────────────────────────────────────── MOV │ 80000  │ D10241    AX3 Target Position

00011                                                      L
          ──────────────────────────────────────── MOV │ 15000  │ D10243    AX3 Target Speed

00012
          ──────────────────────── WRITE │ D10001 │ 3 │ 101 │ 47            Write AX1 parameters

00013
          ──────────────────────── WRITE │ D10141 │ 3 │ 241 │ 4             Write AX2 parameters

00014
          ──────────────────────── WRITE │ D10241 │ 3 │ 341 │ 4             Write AX3 parameters

00015
          ──────────────────────────────────────── SET │ Y00333             Send Command ON

00016
          ──────────────────────────────────────── SET │ I01802             Request to Receive ON

00017
          ──────────────────────────────────────── SET │ I01803             Executing ON
```

5.7.1 Parameters and Statuses of Interpolation Movement Commands

The following tables list the required command parameters, as well as the response parameters and statuses that may be returned for each interpolation movement command.

Throughout an interpolation movement initiated by an interpolation movement command, the positioning module automatically sends MECHATROLINK-II INTERPOLATE commands ($34) to constantly update the status values.

In the table, "□□" denotes an axis number (01 to 15).

● **Command parameters**

Data Position Number	Data Name	Start Positioning	Decelerate & Stop	Stop Immediately	Change Speed	Change Target Position
□□01	Command Code (COMMAND)	0100	0200	0300	0400	0500
□□02 / □□03	(system reserved)					
□□04	Latch Signal (LT_SGNL)					
□□05	Option 1 (OPTION1)	◎				△
□□06	Option 2 (OPTION2)	◎				△
□□07 / □□08	Target Position (TPOS)					
□□09 / □□10	Target Speed (TSPD)					
□□11	(system reserved)					
□□12	Monitor 2 Selection (MOD_SEL)	◎				△
□□33	Monitor 3 Selection (MOD_SEL)	◎				△
□□34	Monitor 4 Selection (MOD_SEL)	◎				△
□□41 / □□42	Target Position (for interpolation movement commands)	◎				◎
□□43 / □□44	Target Speed (for interpolation movement commands)	◎			◎	◎
□□45	Interpolation Axes (for interpolation movement commands)	○				△
□□46	Acceleration Time (for interpolation movement commands)	○			○	○
□□47	Deceleration Time (for interpolation movement commands)	○			○	○

◎:   This parameter must be specified for the reference axis, as well as each interpolation axis.

○:   This parameter must be specified only for the reference axis.

△:   This parameter must be specified only if the command is executed in Positioning Completed state.

● **Statuses**

Data Position Number	Data Name	Start Positioning	Decelerate & Stop	Stop Immediately	Change Speed	Change Target Position
□□81	Alarm Code (ALARM)	○	○	○	○	○
□□82	Status (STATUS)	○	○	○	○	○
□□83 / □□84	Monitor 1 (MONITOR1)	○	○	○	○	○
□□85 / □□86	Monitor 2 (MONITOR2)	○	○	○	○	○
□□87	I/O Signal Monitor (I/O)	○	○	○	○	○
□□88	(system reserved)					
□□89 / □□90	Counter Latched Position (LPOS)					
□□91 / □□92	Monitor 3 (MONITOR3)	○	○	○	○	○
□□93 / □□94	Monitor 4 (MONITOR4)	○	○	○	○	○
□□95	Substatus (SUBSTATUS)	○	○	○	○	○
□□96	Interpolation Status	○	○	○	○	○
□□97 / □□98	Remaining Travel Status	○	○	○	○	○
1601 to 1700	Common statuses	○	○	○	○	○

6. Accessing the Module

6.1 Accessing from Sequence CPU

The following instructions can be used for accessing the module from a sequence CPU using a ladder sequence program. For more information on each instruction, see "Sequence CPU Modules — Instructions" (IM34M6P12-03E).

● **Reading and Writing Parameters and Statuses**

Reading and writing must be performed using word-based instructions. Long word based instructions cannot be used.

- **Special Module Read Instruction (READ Instruction)**

READ	SL	n1	D	k

SL: number of slot where the module is installed
n1: data position number for the first word of data to be read
D: first device for storing the read data
k: number of words of data to be read

- **Special Module Write Instruction (WRITE Instruction)**

WRITE	S	SL	n2	k

S: first device storing the write data
SL: number of slot where the module is installed
n2: first data position number for writing
k: number of words of data to be written

- **Special Module High-Speed Read Instruction (HRD Instruction)**

HRD	SL	n1	D	k

SL: number of slot where the module is installed
n1: data position number for the first word of data to be read
D: first device for storing the read data
k: number of words of data to be read

- **Special Module High-Speed Write Instruction (HWR Instruction)**

HWR	S	SL	n2	k

S: first device for storing the write data
SL: number of slot where the module is installed
n2: first data position number for writing
k: number of words of data to be written

● **Interrupt Handling**

All input relays (X□□□01 to X□□□32) of the module can be used in interrupt processing. A rising edge in an interrupt input triggers execution of an interrupt program sandwiched between an INTP instruction and an IRET instruction.

INTP	S

IRET
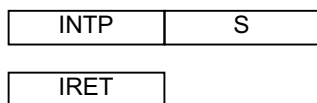
S: input relay raising interrupt

6.2　Accessing from BASIC CPU

The following instructions can be used for accessing the module from a BASIC CPU. For details of each instruction, see "Basic CPU Modules and YM-BASIC/FA Programming Language" (IM 34M6Q22-01E).

Function	Statement Format	Description
Declare use of module	`ASSIGN NC93=SL` SL　　　: slot number	Declares use of a module or CPU module.
Read parameter or status	`ENTER SL,n NOFORMAT;I` SL　　　: slot number n　　　 : data position number I　　　 : Name of integer or integer array variable for storing read data	Reads the parameter or status at a data position number (n) of the module installed in a slot (SL), and stores it in a variable (I).
Write parameter	`OUTPUT SL,n NOFORMAT;I` SL　　　: slot number n　　　 : data position number I　　　 : Name of integer or integer array variable storing write data	Overwrites the parameter at a data position number (n) of the module installed in a slot (SL) with the value stored in a variable (I).
Read input relays [*1]	`STATUS SL,n;P` SL　　　: slot number n　　　 : data position no. (101 or 102) P　　　 : Name of integer variable for storing read data	Reads the status of input relays of a module that is installed in a slot (SL), and stores it in a variable (P).
Write output relays [*2]	`CONTROL SL,n;P,M` SL　　　: slot number n　　　 : data position no. (101 or 102) P　　　 : output data M　　　 : mask pattern	Overwrites output relays of a module installed in a slot (SL) with a value stored in a variable (P). The mask pattern (M) allows writing only to selected output relays.

Declare interrupt	`ON INT SL,nn GOSUB {label}`
	`ON INT SL,nn CALL {subprogram}`
	`ON INT SL,nn GOTO {label}`
	SL　　　: slot number
	nn　　　: input relay no.
		Declares branch destination for handling interrupt request from the CPU module.

Clear interrupt declaration	`OFF INT SL,nn` SL　　　: slot number nn　　　: input relay no.	Clears an ON INT statement.

*1:　101 and 102 refer to input relays having data position numbers (X□□□01 to X□□□16) and (X□□□17 to X□□□32) respectively.

*2:　101 and 102 refer to output relays having data position numbers (Y□□□33 to Y□□□48) and (Y□□□49 to Y□□□64) respectively.

● How To Handle 2-Word Data

Before writing long word parameter data to the positioning module, you need to convert it into two words of integer data. Similarly, after reading a two-word parameter from the positioning module into two integer variables, you may need to convert it into long word data. A sample program for these conversions is shown below.

　　LDAT　　　 : long-word integer variable to be converted

　　IDD, IDU : integer variables for storing the data after conversion (low order/high order)

```
100 IDD=VAL("$"+RIGHT$(LHEX$(LDAT),4))
110 IDU=VAL("$"+LEFT$(LHEX$(LDAT),4))
```

　　ISD,ISU　 : Integer variables storing the two words read (low order/high order)

　　LST　　　　 : long-word integer variable after conversion

```
100 LST=VAL(HEX$(ISU)+HEX$(ISD))
```

Blank Page

7. Errors and Troubleshooting

This chapter describes how to troubleshoot problems involving the positioning module. The description assumes that the FA-M3 is powered on and the module is correctly mounted.

7.1 Troubleshooting Flowchart

The flowcharts below show how to troubleshoot problems when using the positioning module for different scenarios.
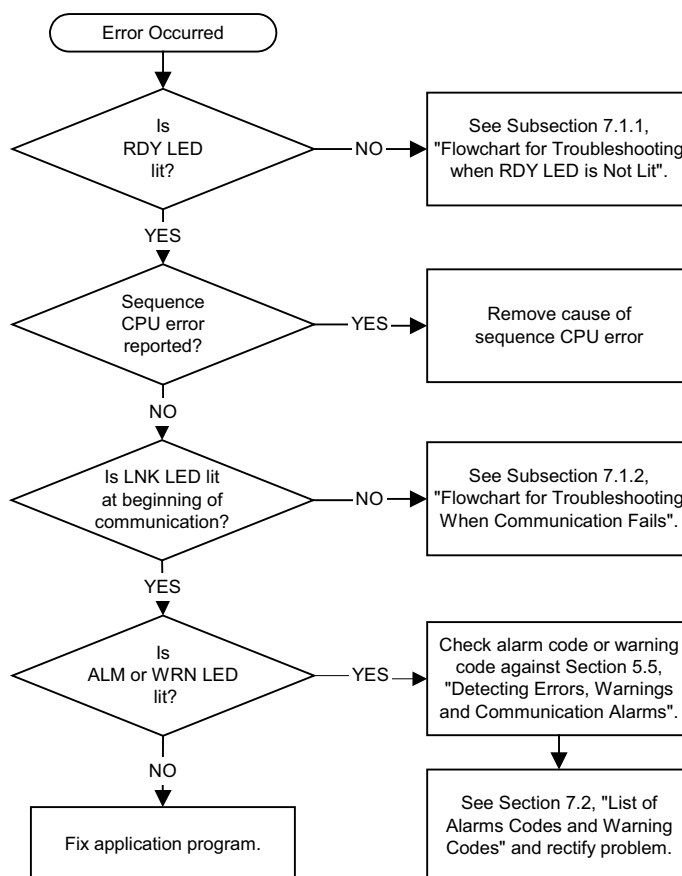
Figure 7.1   Troubleshooting Flowchart
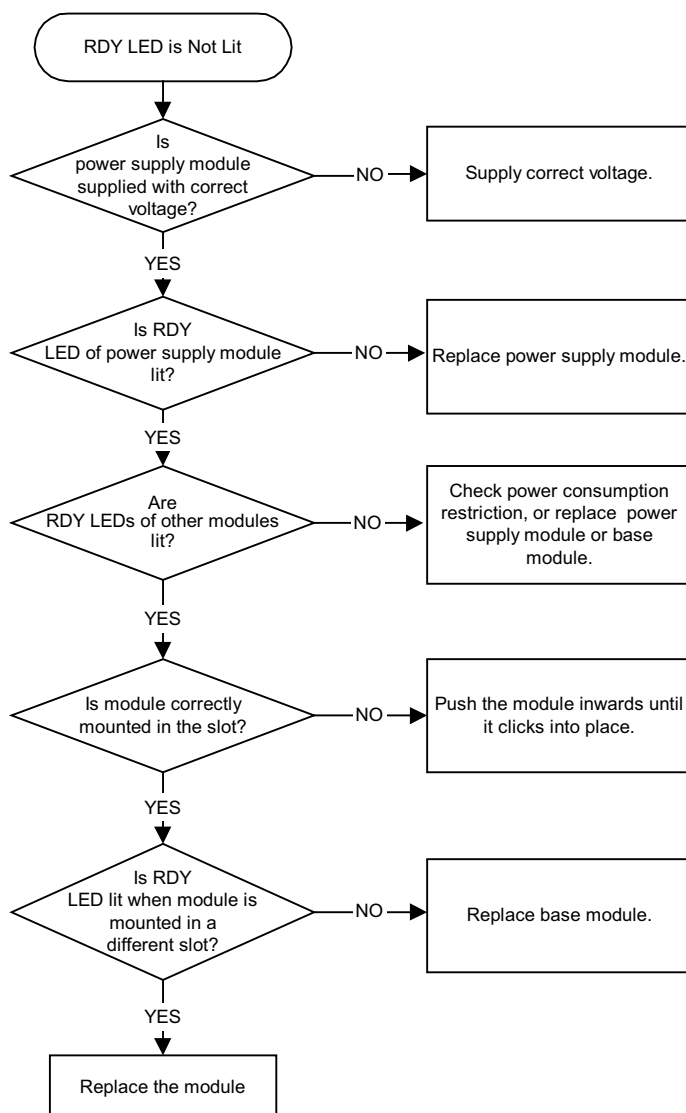
7.1.1 Flowchart for Troubleshooting When RDY LED is Not Lit

Figure 7.2   Flowchart for Troubleshooting When RDY LED is Not Lit

7.1.2 Flowchart for Troubleshooting When Communication Fails
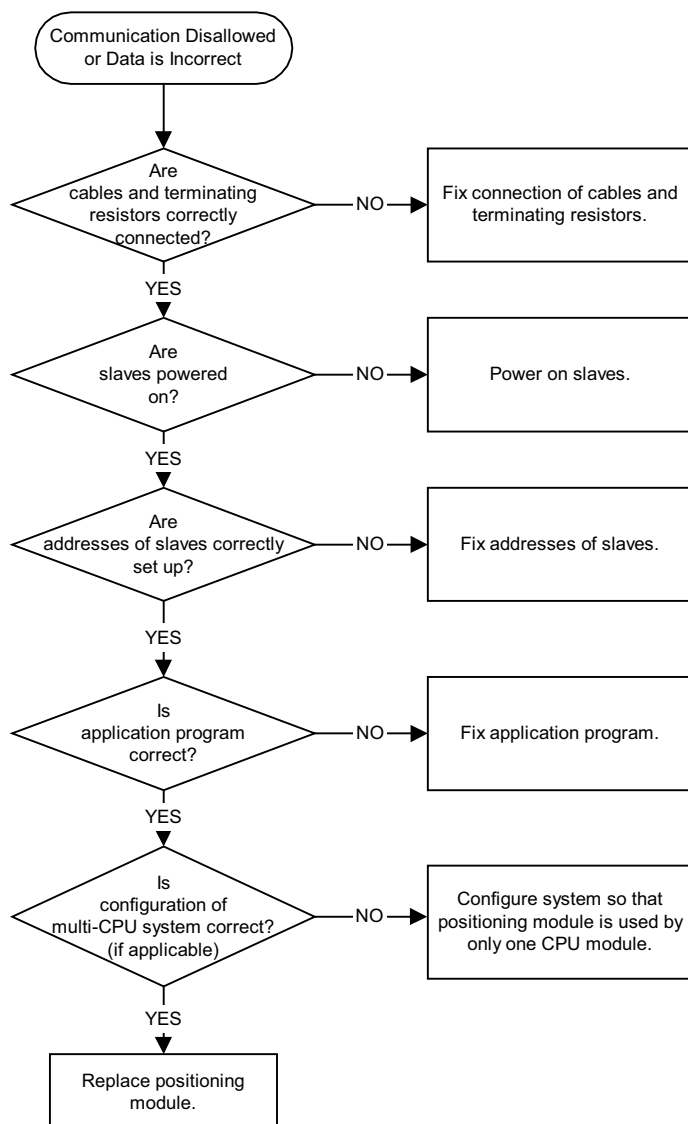
Figure 7.3   Flowchart for Troubleshooting When Communication Fails

7.2 List of Alarm Codes and Warning Codes

7.2.1 Module Alarms

Table 7.1   List of Module Alarm Codes

Alarm Code (Hex.)	Alarm Name	Possible Causes and Description	Troubleshooting
$80E6	Communication error	MECHATROLINK-II communication error was detected for two consecutive cycles. - Bad contact of cables or connector - Operation error due to noise	- Check connector wiring. - Check communication parameter values. - Adopt measures against noise.
$80E5	Watchdog timer error	MECHATROLINK-II synchronization error - WDT data mismatch	Update WDT data during each communication cycle. (This error should normally not happen.)
$8095	Command timeout error	MECHATROLINK-II command timeout error - No response received after transmitting a command for about 10 seconds.	- Check status of external equipment. - Make sure no unsupported command is sent.
$8101	Parameter setup error	A parameter value specified for an interpolation movement command is out of range.	- Correct invalid parameter value.
$8102	Motion axis error	An interpolation movement command was executed against a moving axis. A Change Speed command or Change Target Position command was executed for an axis while target position change was in progress.	Wait for positioning to complete before restarting positioning. Wait for target position change movement to complete before re-executing Change Speed command or Change Target Position command.

7.2.2 External Equipment Communication Alarms or Warnings

The table below lists common communication alarm codes and warning codes.

For details of other equipment-specific alarm codes and warning codes, refer to the user's manual of the external equipment.

Table 7.2   List of MECHATROLINK-II Communication Alarm Codes

Alarm Code (Hex.)	Alarm Name	Possible Causes and Description	Troubleshooting
$00E5	WDT error	MECHATROLINK-II synchronization error - WDT data mismatch	Update WDT data at each communication cycle. (This error should normally not happen.)
$00E6	Communication error	MECHATROLINK-II communication error was detected for two consecutive cycles. - Bad contact of cables or connector - Operation error due to noise	- Check connector wiring. - Adopt measures against noise.

Table 7.3   List of MECHATROLINK-II Communication Warning Codes

Alarm Code (Hex.)	Alarm Name	Possible Causes and Description	Troubleshooting
$0094	Data setup warning	Value specified for MECHATROLINK-II communication is out of range.	Fix specified value.
$0095	Command warning	- Some acceptance condition of a transmitted command is not satisfied. - Transmitted command is not supported.	- Ensure that all acceptance conditions for a transmitted command are satisfied. For details on the acceptance conditions, see the description of each command. - Make sure that no unsupported command is sent.
$0096	Communication warning	MECHATROLINK-II communication error (first instance) - Bad cable or connector contact - Operation error due to noise	- Check connector wiring. - Adopt measures against noise.

⚠ CAUTION

When the positioning module is notified of an alarm or warning that has been detected by an external machine, it does not handle the error automatically by, say, issuing a Decelerate & Stop, Stop Immediately or Servo Off command. Such error handling should be included in a user application program as required.

FA-M3
Positioning Module
(with MECHATROLINK-II Interface)

IM 34M6H60-02E   1st Edition

Index

Blank Page

Revision Information

Document Name : Positioning Modules (with MECHATROLINK-II Support)
Document No. : IM 34M6H60-02E

Edition	Date	Revised Item
1st	1 July 2005	New publication

Blank Page